Ecological Resilience of Industrial Companies in the Republic of Sakha (Yakutia): the impact of external shocks

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Abstract: The article examines the trends of the influence of external shocks in 2020 and 2022 on the formation of a new environmental industrial policy in Russia. Special attention is paid to the Republic of Sakha (Yakutia), the largest subject of the Arctic zone of Russia and a region with a high share of influence on the economy of mining and energy supply organizations. The empirical basis of the study is the statistical data of the relevant ministries and departments of the Government of the Republic of Sakha (Yakutia). The results of a survey of the heads of 12 companies of the republic aimed at studying the environmental maturity of enterprises are also analyzed. The study showed the impact of the pandemic and international economic sanctions on the transformation of the environmental policy of industrial enterprises in the context of modernization of environmental industrial policy in the Russian Federation. The study describes the main directions of the impact of external shocks on the ecological and economic sphere of the region and carried out diagnostics of enterprises according to two parameters – the level of environmental maturity and the scale of adaptation of environmental management to external shocks. The findings may be of interest to politicians at the national and regional levels, as well as business

1`INTRODUCTION

In the context of the incessant external shocks of recent years, faced by society as a whole and individual economic systems, the attention of researchers and practitioners is drawn to the problems of crisis management and ensuring resilience development (Smith, 2006, Zakharov et al, 2022).

It is assumed that future external threats cannot be predicted and assessed, therefore, during periods of exacerbation of crises, an important condition for the survival of economic systems is to increase their internal resilience potential. At the same time, organizations are increasingly involved in the paradigm of sustainable development, which requires management to constantly harmonize their economic priorities of business with the socio-environmental interests of society (Budanov I.A., Terentyev N.E., 2017). Therefore, the ecological sustainability of the organization becomes an inseparable factor of its long-term work. The question of interest is how does a company provide organizational adaptation of its business model in order to unsure its ecological resilience during external crisis.

The transition to more environmentally friendly and efficient production methods requires updating the production base, environmental modernization In terms of strategy scholars understand the ecological sustainability of an organization as its ability to show high ecological indicators while maintaining and increasing the volumes of production and sales of products, works and services, by the complete consumption of natural resources, enhancing its

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efficient use and ensuring the environmental safety of its activities in the conditions of negative external effects (Tumin et al., 2011, pp. 80-85, Chkhutiashvili, 2017, Lepikhina, 2014).

Ensuring the ecological sustainability of an organization presupposes that it reaches a certain **level of maturity of business processes** and characterizes how full and consistentl the organization has implemented processes and best practices in the field of environmental industry policy, contributing to the achievement of its development goals. The mechanism for determining the environmental maturity of an organization can be based on standard models of sustainability - maturity) of companies' business processes by diagnosing the presence of the environmental management characteristics in the functional elements of the organizational system, including strategic management, quality management, knowledge and competence, finance. The diagnostics characterizes not only the availability of environmental policy, but also readiness for its effective implementation in the territories of company's presence.The second important sign of an organization's sustainability is its **adaptability**, the qualitative state of the system, which characterizes its ability to organize the process of management and planning of production and business processes in order to achieve the goals of environmental policy in conditions of uncertainty. Thus, the first characteristic describes the qualitative characteristics of the organization's business processes, the second - the qualitative characteristics of the management system in interaction with the external environment.

It should be noted that the discourse of "ecological modernization" suggests that environmental problems can be internalized by political, economic and social institutions and that the sustainability of institutions can be preserved (Muis, Ichwan, et. al., 2023). For transforming economies, in particular, Russia, such harmonization assumes an active role (Zamyatina M., Fesenko R., 2017; Volosatova A.A. et al., 2023; Bobylev, S.N., 2021) and even a "monopoly opportunity" to launch environmental modernization (Lanshina T. A., 2022) on the part of the state, since such a transformation has a national scale and goes beyond the competence of an individual business.

In recent years, significant efforts have been made in Russia to carry out environmental modernization of the corporate sector within the framework of environmental and industrial policy by the forces of two regulators – the Ministry of Natural Resources and the Ministry of Industry and Trade, which were expressed, among other things, in tightening environmental control and stimulating the introduction of environmentally efficient technologies. Despite the fact that the goal-setting systems and priorities of these structures are different, the general focus of these regulators on rational environmental management is obvious.

According to a number of researches, the COVID-19 pandemic, an extremely complex global crisis that included many problems – from health, economics to politics and public communications, did not create a qualitatively new crisis, but highlighted various crises for the general public and the global audience as a whole – economic, social, political, environmental, etc., which existed previously (Simons, 2021). The unevenness of the economic consequences of the pandemic in countries and regions is noted, due to the structure of the economy and the degree of involvement of the state in the process of economic recovery from the crisis.

The impact of the pandemic on the environmental agenda was manifested in a slight decrease in the attention of enterprises to the problems of greening production (investments in resource and energy conservation). Despite the fact that Russian enterprises incorporate the UN SDG in their activities, environmental risks were not of high importance for enterprises, and a formalized environmental management system was implemented by a fifth of enterprises (Kuvalin, D.B. et al., 2022). State regulatory measures that force enterprises to increase energy efficiency, the degree of greening of production and socio-environmental corporate responsibility are ineffective, and comprehensive measures that stimulate investment in the modernization of production assets are not enough. The impact of sanctions on Russian industrial enterprises (Kuvalin, D.B. et al., 2023) is very significant and manifests itself in specific problems, the solution of which is possible by the predominance of active methods of adaptation to sanctions restrictions over passive ones. In particular, the researches note such problems as (in descending order): difficulties in obtaining imported raw materials and components, rising prices, increasing general uncertainty in the economy, rising import prices, shortage of labor resources.

High ecological sustainability requires additional costs to ensure the implementation of ecological modernization, at the same time, a decrease in income, a decrease in revenue, an increase in production costs of enterprises due to sanctions pressure also limit the ability of enterprises to carry it out. Unfortunately, we came to the pandemic and subsequent sanctions with rather contradictory legislation in this area, a poorly developed sector of financing environmental modernization and incomplete reforms. In this regard, enterprises need targeted support from the state, fixed at the institutional level, a number of measures of state support for enterprises to increase their sustainability have already been implemented.

2 METHODS

The study uses a systematic approach and methods of structural, statistical and comparative analysis. The empirical basis of the study consists of statistical materials, materials of relevant ministries and departments of the Government of the Sakha Republic, data from international databases.

The results of a survey of the heads of 12 enterprises operating in the Republic of Sakha (Yakutia) in the field of extraction and transportation of natural gas, gas condensate and oil, production and distribution of electricity, gas and water, extraction of solid minerals (precious metals and stones), coal and anthracite and geological exploration, geophysical and geochemical works are analyzed in the field of subsoil exploration, information about which is publicly available. The survey was conducted from February 2023 to May 2023.

To study the level of environmental maturity of an enterprise, it was proposed to answer questions describing the presence and complexity of the system of environmental management of the enterprise. The existence of an appropriate management system presupposes the existence of internal regulatory documents, procedures, in accordance with Federal Law No. 7-FZ of 10.01.2002 "On Environmental Protection", the complexity of such a system is determined by the presence of the most significant environmental indicators, relevant modernization goals related to improving productivity and reducing negative environmental impact, appropriate actions, measures and resources and ensures the fulfillment of the set goals. In addition to the mandatory norms and requirements for environmental protection provided for by federal legislation, enterprises can assume the requirements of regional legislation related to work in the Arctic, as well as voluntary obligations of enterprises in the region of presence aimed at adapting to climate change, compensation for damage to the habitats of indigenous peoples and others (see Table 1).

To study the **adaptation of an enterprise** to external conditions, it was proposed to answer questions describing the organization's assessment of changes in market operating conditions associated with external shocks (pandemic and sanctions) and the reaction to adapt the existing environmental management system to the changes in market operating conditions (see Table 2).

Table 1: Indicators for the typology of organizations by the level of environmental maturity.

Management system	Indicators describing the qualitative state of the environmental management system in the organization	Low	Average	High
1	*2*	*3*	*4*	*5*
Environmental management	Mandatory documents have been adopted (the program of industrial environmental control at facilities of categories I-III), plans of measures for environmental protection	+	+	+
	Voluntary documents have been adopted (sustainable development strategy, ethnological expertise, agreement on socio-economic cooperation)	-	-	+
	Making strategic and investment decisions on environmental protection issues falls within the competence of strategic management	-	-	+
	Qualitative goal setting (goals, objectives, activities and projects in conjunction with specific measurable indicators)			
	Environmental management is integrated into the internal management system, certified, including according to ISO 14000 standard.	-	+	+
Environmental knowledge and innovations	Human resources (availability of a dedicated unit for solving environmental problems).	-	+	+
	The presence of significant (from 2 to 20% of revenue) investment costs attributed to environmental and the tendency to increase their conservation	-	+	+

Management system	Indicators describing the qualitative state of the environmental management system in the organization	Low	Average	High
1	*2*	*3*	*4*	*5*
Resource security	Availability of implemented / planned projects for the implementation of BAT.			
	Availability of human resources (availability of a dedicated unit for solving environmental problems, project teams)			
	Availability of financial resources. The organization has activities in the field of environmental protection with sources of financing for both current and investment costs	-	+/-	+
Focus on environmental task control	The quality of execution of the environmental budget. Planned environmental protection documents are being executed	50-75%	80-100%	100%
	The organization shows a high interest in solving environmental problems in conjunction with the issues of improving the efficiency of its core activities	-	-	+

Compiled by the authors

Table 2: Indicators for the typology of organizations by the nature of adaptation to external shocks.

Management system	Indicators describing the qualitative state of the environmental management system in the organization	No reaction	Formally described	Clearly and reasonably
1	*2*	*3*	*4*	*5*
Analysis of risks and market conditions of operation	A reasonable assessment of the impact of the pandemic on the organization's activities is given	+/-	+/-	+
	A reasonable assessment of the impact of sanctions on the organization's activities is given.	+/-	+/-	+
Response of the environmental management system	Adaptive goal setting (accelerated or vice versa, delayed implementation of goals and objectives, as well as revision of goal setting)	-	+/-	+
	Adaptive execution of goals (cost reduction, time reduction, synchronization of goals and objectives, increased resource availability and other reactions)	-	+/-	+
	Initiation of external changes (formulation of reasonable proposals in the revision of measures of state regulation and state support).	-	-	+

Compiled by the authorsAs a result, a **typology of organizations is proposed on two grounds** – according to the current level of environmental maturity and the adaptation of the company's environmental policy to external macro-level shocks. Respondent organizations are divided into the following types: with a relatively high, medium and relatively low level of environmental maturity, and by the presence of adaptation plans: a relatively clear vision, a fuzzy vision, no adaptation plans.

3 RESULTS

3.1`Modern environmental industrial policy of Russia

The urgent tasks of modern environmental policy in relation to industry should include the rationality of environmental management, environmental protection and environmental safety. To achieve them, such tools are used as environmental protection standardization; the general and special requirements establishment in economic and other activities implementation; the environmental impact assessment and environmental expertise organization; state monitoring and control (supervision).The legislation provides for special requirements in the field of environmental protection in the implementation of economic and other activities that have or may have a direct or indirect negative impact on the environment. Depending on the type of activity, the requirements are established by industry regulatory legal acts. In relation to planned economic and other activities that may have a direct or indirect impact on the environment, an environmental impact assessment is carried out, closely related to environmental expertise carried out in accordance with the Federal Law of November 23, 1995. No. 174-FZ "On Environmental Expertise".

From the point of view of the development of social and environmental responsibility of industrial enterprises, in addition to state environmental monitoring and control (supervision), designed to monitor compliance with environmental protection legislation, the main mechanism for environmental protection is industrial environmental control. It allows economic entities to organize and ensure the independent implementation of measures for environmental protection, rational use and restoration of natural resources, as well as verification of compliance with environmental requirements.

In accordance with Article 67 of Federal Law No. 7-FZ of January 10, 2002 "On Environmental Protection", the program of industrial environmental control is developed and approved by economic entities operating at facilities of I, II and III categories. If it is impossible to comply with the standards of permissible emissions, standards of permissible discharges by economic entities operating at facilities of II and III categories, for the period of gradual achievement of the standards of permissible emissions, standards of permissible discharges, an environmental protection action plan is developed and approved. The environmental protection action plan includes a list of measures to reduce negative environmental impact, the timing of their implementation, the amount and sources of funding, and a list of officials responsible for their implementation. Similarly, economic entities operating at Category I facilities are required to develop and approve a program to improve environmental efficiency.

In addition to the mandatory requirements stipulated by the legislation, business entities voluntarily implement an environmental management system in their activities and are certified in accordance with national standards, depending on the field of activity. The industry-wide national standard of the Russian Federation GOST R ISO 14001-2016 "Environmental management systems. Requirements with guidance for use" (approved by the Order of the Federal Agency for Technical Regulation and Metrology dated April 29, 2016 No. 285-st).

The Arctic regions of Russia are characterized by a high level of pollution of natural environments due to the activismof the extractive industry and the heat supply sector, which, coupled with negative climatic conditions, affects health and life expectancy in the north. The regulatory framework of the Russian Federation in the field of environmental protection of the Arctic is represented by a large number of regulatory legal acts; the country has adopted documents prescribing provisions to ensure the environmental safety of the Arctic zone. However, most of the documents are declarative or programmatic in nature, which excludes the application of sanctions for non-fulfillment, poor-quality, incomplete implementation of planned activities (Veselova, D., 2022).

In recent years, the State has made significant efforts to carry out environmental modernization. Ecology in 2018 was identified as a strategic priority of the country's development, institutional conditions began to form, first of all, the use of the best available technologies and tools to stimulate their implementation, reforms are being carried out and environmental regulation systems are being transformed, in particular, in the forest sector, the sphere of MSW management, a discussion is underway about the transition to a progressive fiscal policy in conjunction with environmental payments (HSE, 2021). Since 2017, an environmental fee has been introduced, paid by manufacturers and importers of goods subject to recycling, in 2022, the norm of "greening" environmental fines has been introduced.

Increased attention from the state to environmental issues was also reflected in the tightening of environmental control; for example, in 2020, for the first time in the history of Russia, the amount of damage caused by NOVATEK holding as a result of an environmental disaster in connection with a large-scale spill of petroleum products in Norilsk, according to Rosprirodnadzor, amounted to 2.1 billion US dollars. Naturally, these efforts led to an increase in environmental protection costs; in 2017-2021, current and operational environmental costs increased by 2 times due to an increase in corporate costs, and the share of government funding in the structure of environmental costs decreased to 35%. The costs of operating expenses had increased, and capital expenditures did not exceed a quarter of total environmental costs in 2022. This is due to the fact that the financial sources of environmental modernization are limited and are at the stage of formation; "green" banking is practically absent. In the presence of all the tools for organizing environmental investment, in fact, the sectors of the economy require complex transformations related to technological modernization and, including environmental, for competitive development in the conditions of the "green" agenda. In 2021, the Government of the Russian Federation approved national criteria for sustainable development projects, including green development, and requirements for the verification system of sustainable development financing instruments, and prepared a green investment standard in conjunction with the register of the best available technologies.

3.2 The impact of external conditions on the ecological and economic sphere in Russia

The pandemic, according to researchers (Jayaraman K., 2020, Rodygina N., 2020), disproportionately significantly affected the economies of developing countries and led to a deepening economic downturn due to falling commodity prices, disruptions in supply chains and insufficient measures of economic policy. In Russia, the economic downturn in 2020 amounted to 2.7% of GNP, in 2021 the economy grew by 5.6%, and in 2021-2022 Russia reached relatively high rates of recovery growth. However, since the second quarter of 2023 and in 2023, Russia has been experiencing a structural crisis due to **sanctions** from about 50 countries; in general, GDP decreased by 2.1% in 2022 (Frenkel, A. et al., 2023). In 2023, the volume of Russian exports decreased relative to 2022, an increase in inflation is recorded, the federal budget deficit (which in October 2023 was offset by an increase in oil and gas revenues) and an increase in the size of the state debt of the Russian Federation. Thus, the public debt deficit by the end of 2022 amounted to 3.3 trillion rubles (2.1% of GNP), in 2023 it is estimated at 1.6 billion rubles (or 1% of GNP), the amount of domestic public debt as of 01.10.2023 amounted to 20,377 billion rubles, which poses threats to the exhaustion of the National Welfare Fund and, accordingly, financial and economic stability. According to a number of experts, in 2022-2026, Russia is facing a systemic transformation, a structural restructuring of the economy that "guarantees technological and financial sovereignty" (Frenkel, A. et al., 2023) and the formation of an economy with mobilization features (Vinislav, 2022, Shkodinsky S.V. et al., 2023).

The study (Romanova, O.A., Ponomareva, A.O., 2021) conducted for the regions of Russia showed that industrial regions suffered less from the impact of COVID-19 than service-type regions; the combination of the predominance of industrial production in the structure of the regional economy and the increased influence of the state on economic processes provided, according to the authors, a quick way out of the crisis caused by the pandemic. At the same time, during the COVID crisis, environmental and public safety issues came to the forefront of public demand in Russia, along with problems in the sphere of labor and employment of the population (Torkunov, 2021). In contrast to the pandemic crisis, which turned out to be short, according to N. Zubarevich, the influence of the industry factor and the degree of involvement in the global economy of the regions on the depth and intensity of crisis phenomena in the regions has become more significant. At the same time, the regions of the Far East (with the exception of Sakhalin) are going through the crisis of 2022-2023 more mildly due to their orientation to Asian markets, especially to the markets of China (Zubarevich, N. 2022).

The implementation of the state environmental industrial policy in conditions of high instability and structural transformation of the economy significantly complicates the achievement of a balance between the desire for economic stability and the need to ensure ecological sustainability and security.

An analysis of the development of legislation in the field of environmental protection for 2022-2023 shows that the state environmental policy of the Russian Federation reacts to external changes rather restrainedly, taking balanced and targeted measures of both a laxative and tightening nature, and also does not abandon the previously introduced regulatory mechanisms, extending the timing of a full-fledged transition of environmental reforms by 1-2 years.

The Strategy of Environmental Safety of the Russian Federation for the period up to 2025, approved by Decree of the President of the Russian Federation No. 176 of April 19, 2017, when identifying the main challenges and threats to the state of environmental safety, identifies the threat of restricting access to foreign environmentally friendly innovative technologies, materials and equipment in the context of a containment policy against the Russian Federation.

Suspense of the previously instated regulatory mechanisms is a characteristic feature of the state environmental policy reaction on the economic instability. In particular, the deadlines of industrial emissions accounting systems digitalization, imposed on the industries, has been suspended, as well as the use of the increased coefficient rates to calculate the negative environment impact fees paid by industrial companies. Additionally, under the conditions of sanctions pressure, the subsurface users have been granted relief from the waste management policy implementation. The state waste policy, being reformatted during recent years, has performed a number of novelties, aimed to restrict the waste management rules for the industries. Thus, a number of amendments have been adopted that allow industries to use Vth hazard category wastes of subsoil industries, IVth and Vth hazard categories wastes of ferrous metal production, coal burning Vth hazard class wastes and phosphogypsum Vth hazard class wastes in the elimination of mining cites and other facilities related to the mineral resources, and in the land reclamation. In order to stimulate companies to take measures to reduce negative environment impact, zero coefficient rate is applied in the industrial wastes disposal fees, if a company extracts minerals and useful components from these wastes; no wasted disposal fees are imposed on companies in case of disposal of subsoil wastes recognized to be overburden and host flammable rocks, which are subject to use in accordance with the Law of the Russian Federation dated February 21, 1992 N 2395-I "On Subsoil", except in cases where such rocks are recognized as production and consumption waste.

3.3 Ecological and economic problems of the Republic of Sakha (Yakutia)

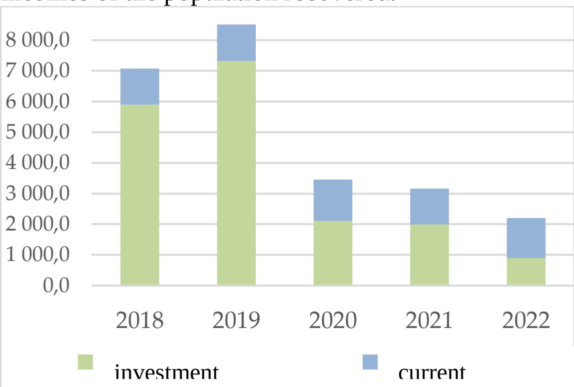
The Republic of Sakha (Yakutia) is an industrial region in the North-East of Russia, with a developed mining sector that forms 59.6% of the gross value added of the region's economy. Yakutia ranks first in Russia in terms of territory area, is the leader in the production of diamonds, coal, gold, oil, natural gas, antimony, and is among the 20 regions of the Russian Federation in terms of GRP produced. The extractive industry forms 59% of the gross value added, electricity, steam and water production – 3.4% (Table 3).

Table 3: Macroeconomic indicators of the Republic of Sakha (Yakutia) in 2018-2023.

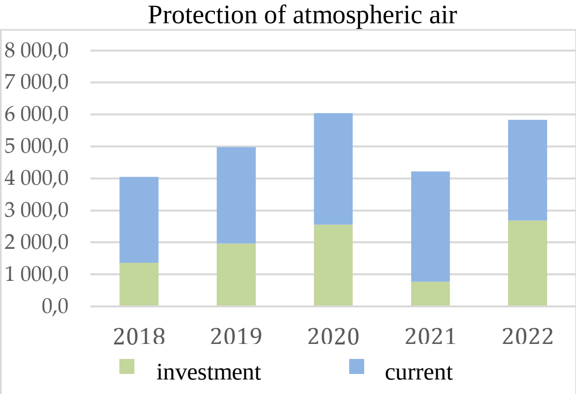
Indicators	2018	2019	2020	2021	2022	2023
1	*3*	*4*	*5*	*6*	*7*	*8*
Population, at the beginning of the year, thousand people.	964.3	967.0	972.0	982.0	997.8	997.7*
GRP per capita, thousand rubles	1 166.8	1 266.3	1 160.4	1 636.7	1 950 .2	2048.7 *
GRP, volume index in constant prices, as % of the previous	103.9	104.0	90.7	116.0	104.4	102.9*
Environmental protection costs						
billion rubles	20.67	20.23	17.56	19.46	24.56	-
including investment	*9.76*	*6.2*	*4.2*	*4.8*	*8.4*	
in % to GRP	1.8	1.6	1.7	1.2	1.2	-

* Assessment of the Ministry of Economy of the Republic of Sakha (Yakutia), 01.09.2023
Source: Sakha (Yakutia)stat, Ministry of Economy of the Republic of Sakha (Yakutia).

The pandemic significantly affected the economy of the Republic of Sakha (Yakutia) in 2020, the gross regional product decreased by 9.3% by 2019 in constant prices (Table. 3); the volume of investments in fixed assets fell by 40.5%, construction works – by 42.3%, retail trade, passenger turnover, and the volume of paid services decreased under restrictive measures. Excess mortality in the republic in 2020 amounted to 1.34 thousand people or 117.7% compared to 2019, of which more than half (50.2%) officially from COVID19 (Torkunov, 2021), in general, the mortality rate in the region is lower than the national average (1.74%) and amounted to 1.67%. In 2021, the region's economy entered recovery growth at a rapid pace, the dynamics of industrial production, the volume of investments, and real incomes of the population recovered.



Protection of atmospheric air



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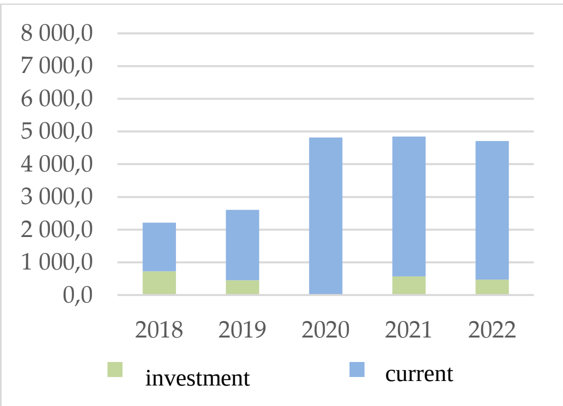
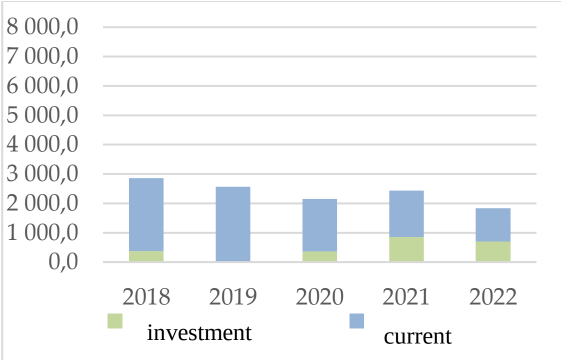


Waste management



Protection of land, surface and groundwater

Figure 1: Current and investment costs for environmental protection in the areas of environmental protection in the Republic of Sakha (Yakutia) in 2017-2022. Source: Sakha (Yakutia) stat, 2023.

According to preliminary estimates, the gross regional product for 2022 of the Republic of Sakha (Yakutia) amounted to 1,936.5 billion rubles, or 104.4% by 2021, in 2023 - 2,048.1 billion rubles. In general, in the republic in 2022-2023, there is an outstripping growth of industrial production in the mining sector and production volumes in natural terms for coal, oil, gas, precious metals; the industrial production index was 117.8% in 2021, 111.4% in 2022, and by the end of 2023 it is estimated to be 103.8% (in Russia, respectively, 104.8%, 100.8% and 100.2%).

The volume of environmental protection costs increased in the republic during the specified period, but it did not reach the pre-nominal values relative to the GRP produced (Table 3). Budget expenditures do not exceed 5% of the total cost of the environmental protection, the main amount of costs falls on enterprises. The structure of costs is dominated by current ones, for the period 2019-2022 the volume of investment costs has significantly decreased due to investments in environmental modernization aimed at protecting atmospheric air. There is a slight increase in the costs of waste management (Table 3, Fig.1).

More than half of the territory of Yakutia belongs to the Arctic zone of Russia, where the main mineral reserves are located, mainly in the form of hydrocarbons — oil and gas, rare earth metals. Since industrial development of the Arctic has been conducted for a long time without taking into account environmental consequences, one of the main tasks, in addition to preserving natural ecosystems and adapting to climate change, is the **elimination of accumulated harm** (Zukerman V.A., Goryachevskaya E.S., 2022).

An extremely important problem in the Arctic is the management of **industrial waste**, which accumulates in huge quantities in places of concentration of industrial facilities for the extraction and processing of minerals, and when they enter the soil in quantities exceeding the maximum permissible norm, they lead to their accumulation in living organisms and to loss of soil fertility. The main volume of negative impact on the environment falls on enterprises engaged in mining, providing electric energy, gas and steam.

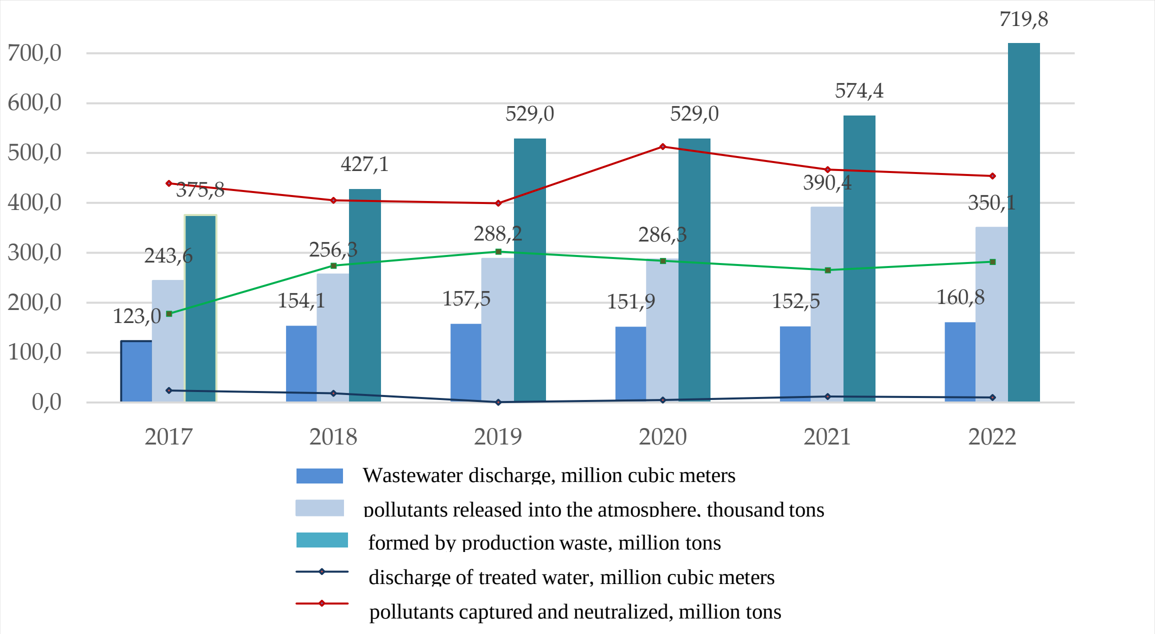


Figure 2: Environmental impact indicators of industry in the Republic of Sakha (Yakutia) in 2017-2022. Source: Sakha (Yakutia) stat, 2023.The volume of emissions of pollutants and greenhouse gases into the atmospheric air is determined by the activities of water and heat supply, oil production enterprises - 93% of industrial emissions tracked by statistics (Gavrilyeva, T, et al. 2020), water pollution is more than 70% caused by solid mineral extraction, water and heat supply enterprises and waste generation.

In 2016-2022, in the republic in the whole, there is an increase in the volume of wastewater discharge that does not meet the standards of purification, emissions of pollutants into the atmosphere. There is a significant increase in the formation of production waste due to the activities of industrial enterprises (diamond mining, gold mining, coal mining, etc.), in 2017-2022 the volume of annual waste generation increased 3 times, the volume of disposal – 2 times (Fig.2), the relationship between the value of GRP and the formation of production and consumption waste.

4 DISCUSSION OF STUDY RESULTS

4.2 Ecological maturity of enterprises in the extractive and energy sectors of the economy

Environmental management. The environmental management system is aimed at improving the environmental performance of a company striving to manage its responsibility in the field of ecology on a systematic basis, ensuring its ecological sustainability, allowing business entities to demonstrate their commitment to environmental standards and can be an important factor in ensuring long-term sustainability.

The presence of an environmental management system was announced by organizations engaged in energy supply, diamond mining, oil and natural gas extraction and transportation – 50% of respondents. These companies have implemented an environmental management system certified according to ISO14001, and regulatory documents, in addition to mandatory requirements in the field of the environment, contain goals on voluntary commitments of the organization, plans for additional activities in environmentally sensitive areas of the Arctic, including ethnological expertise, implementation of agreements on socio-economic cooperation between the organization and local communities (9%), measures to support biodiversity (27.3%) and adaptation to climate change (9%).

Half of the surveyed organizations have adopted a medium-term strategy, every fourth has a program in the field of environmental policy with an approved budget; the remaining 25% of organizations do not – have developed and adopted documents in the field of environmental protection.

Environmental knowledge. From the point of view of the current level of effectiveness, the following estimates have been obtained on the achievement of the goals of the development of the company's environmental management systems:

– "ensuring the rational use of natural resources at all stages of production activity" – 66%;

– "openness and transparency of information on environmental protection activities" – 54.5%;

– "implementation of the program for the processing of industrial waste" – 36.4%;

– "measures to reduce energy consumption have been implemented" – 36.4%;

– "the policy of interaction with the indigenous peoples of the North has been implemented" – 27.3% of respondents.

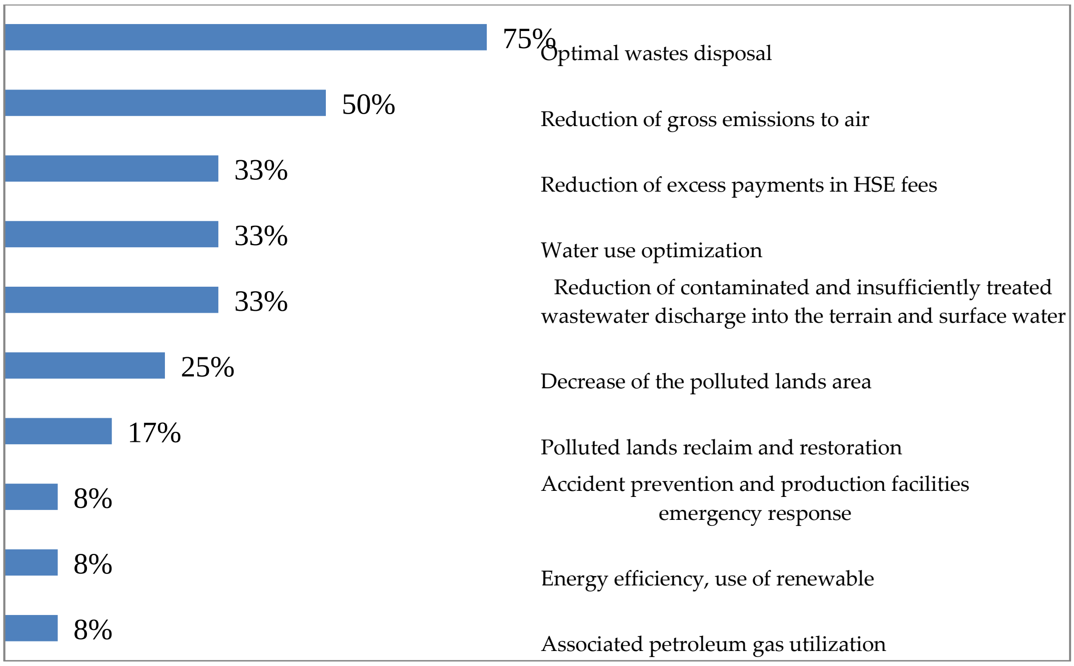


Figure 3: Target directions of environmental policy of organizations.

The target areas and priorities of corporate strategies for rational subsoil use and environmental protection have sectoral and territorial specifics. At the same time, 75% of respondents indicate the goal of optimal utilization of industrial waste, 50% – reduction of gross emissions of pollutants into the atmosphere, which is objectively related to the problem of waste growth and tightening of the regulatory framework in the field of waste management and air pollution.

Further, priority is given to such areas as reduction of excess payments in the total amount of fees for negative environment impact, optimization of water consumption and reduction of wastewater disposal into surface reservoirs of polluted waters (33.3%) (Fig. 3).

Resources and focus on achieving environmental objectives. Most often, responsibility for the implementation of an organization's environmental policy is divided between management levels; in 42% of organizations, responsibility for the implementation of an enterprise's environmental policy is in the area of responsibility of the general director, 17% – his deputy, chief engineer.

Most organizations have a dedicated staff unit responsible for the development and implementation of measures in the field of environmental protection; in some cases, the functions in the field of environmental protection are combined with the functions of occupational safety and industrial sanitation. Three of the surveyed organizations engaged in geological exploration and extraction of precious metals indicated that these functions are assigned to individual specialists as part of other structural divisions.

Environmental strategies and programs of industrial companies are mainly characterized by the completeness of the directions (goals) of corporate environmental policy; companies indicate a variety of measures, including mandatory measures and payments in accordance with the legislation of the Russian Federation, and others. At the same time, the budget of software programs for enterprises differs and is determined by a number of factors, including the stage of the enterprise life cycle. There are companies with a high share of environmental investment costs in the structure of capital expenditures: the enterprises Kolmar JSC, Almazy Anabara JSC, Sakhaenergo JSC, according to the data obtained, account for from 8 to 30% of investment costs. Thus, the costs of environmental modernization in 2020-2022 amounted to from 20 to 40% of the capital costs of the company Sakhaenergo JSC, which during this period implemented projects for the modernization and construction of power plants in the Arctic regions, 6-30% of the capital costs of Kolmar JSC, implementing the investment project of coal mining Denisovsky and Inaglinsky coal mines using the best available technologies in terms of environmental impact, and 0.3% of the costs of Vilyuyskaya HPP JSC.

The execution of the environmental budget is noted at a high level (80-100% of the planned volumes), with the exception of two companies – SUE Housing and Communal Services of the Republic of Sakha (Yakutia), where the actual execution of the environmental budget in recent years was 50-75% of the planned and Zapadnaya Gold Mining Company (more than 100%).

4.3 Assessment of the impact of external conditions on environmental programs

Risks and market conditions of functioning. In the context of the 2020 pandemic and subsequent sanctions restrictions of 2022-2023, enterprises of the Republic of Sakha (Yakutia) faced a shortage in commodity and financial markets and, accordingly, a rapid increase in prices for industrial goods and services, primarily fuel (Fig.4), a decrease in revenue due to falling prices on commodity export markets, tightening requirements for the organization of labor during the lockdown period.

In 2020, 2022 and in the first half of 2023, a deterioration in the financial results of the republic's organizations in the production and energy supply sectors is recorded.

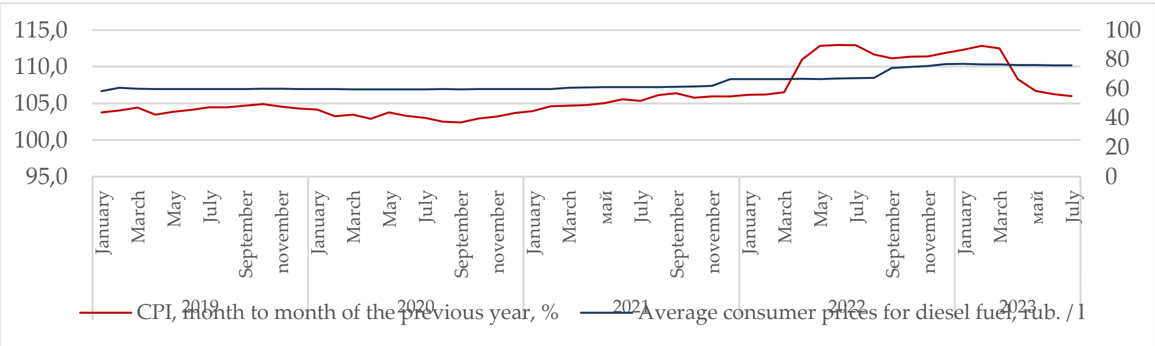


Figure 4: Dynamics of consumer price index values (right axis) and average diesel fuel prices (left axis) in the Republic of Sakha (Yakutia) in 2019-2023. Source: Sakha (Yakutia) stat, 2023.

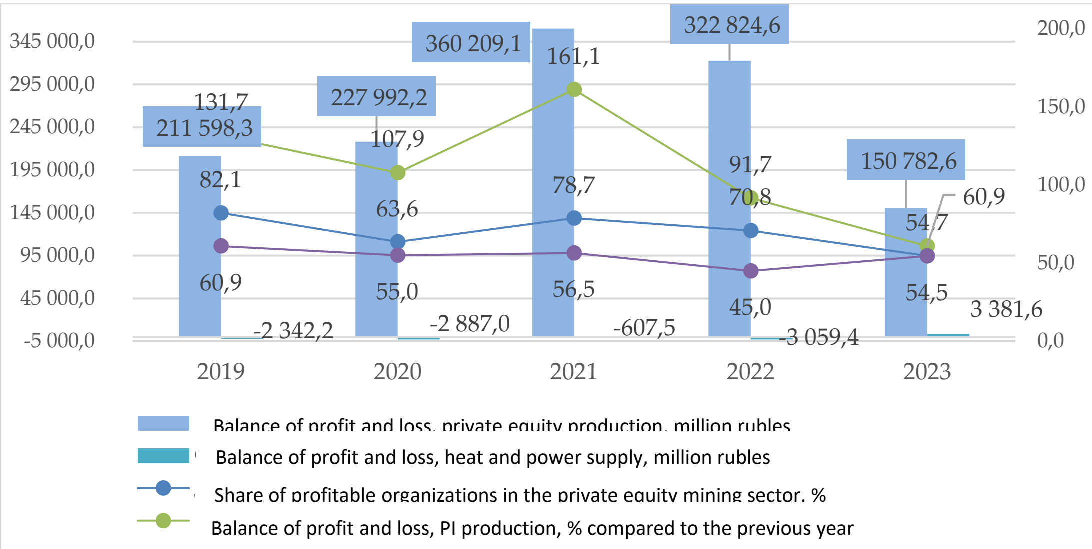


Figure 5: Financial result of the activities of organizations by types of economic activity mining and provision of electric energy, gas and steam; air conditioning in the Republic of Sakha (Yakutia) in 2019.

1st half of 2023.During these years, the share of profitable enterprises decreased, the amount of losses increased: in the first half of 2021 and 2022, the balance of profits and losses of enterprises in the field of mining amounted to 360.2 and 322.8 billion, respectively, then for 6 months of 2023 – 150.8 billion, the share of unprofitable companies increased from 30.8% in 2022 to 45.3%, and in the field of providing electric energy, gas and steam, the balance of profits and losses amounted to -607.5 million rubles in 2021, -3059.4 million rubles in 2022, and the share of profitable companies - 45% (Fig.5). In 2022, there is an increase in income taxes and mineral extraction taxes, due to an increase in production volumes, while the negative VAT balance is growing, which indicates a decrease in sales. The expected reaction of enterprises to the increase in costs is a reduction in investment programs, exploration volumes, and more active use of the rotation shift method (for example, the decision of Polyus Aldan JSC to transfer workers to the village of Nizhny Kuranakh on a rotation basis is known), and reduction of environmental programs.

The majority of organizations surveyed (63.6%) indicated that the COVID-19 pandemic had an impact on the company's environmental agenda. The exception was 3 organizations in the field of gold mining and hydraulic power, whose environmental policy was not affected by the external shock of 2019-2020 in connection with quarantine measures; of these three, two companies indicated that external shocks caused by sanctions pressure also did not affect the environmental policy of the organization. The degree of impact of the pandemic, according to the responses, turned out to be not very significant, and the nature of the impact is an increase in current expenses related to sanitary and epidemiological requirements and ensuring the safety of working conditions.

More than 72.7% of the companies that took part in the survey believe that economic sanctions have an impact on the company's activities in the field of ecology, while energy supply organizations note that the degree of influence is insignificant, mining companies indicate a significant impact. Among the main difficulties are difficulties with the import of equipment and the rise in the cost of raw materials, components and technologies.

The reaction of the management system.

As a response of the environmental management system to COVID-19, 27.3% indicated – the objectives of the environmental policy were revised. The current and investment costs for environmental protection have significantly decreased only in organizations engaged in diamond mining (due to a partial shutdown of production), while at enterprises engaged in the extraction of ores and sands of precious metals and geological exploration, current environmental costs have increased by 10%.

As a reaction of the environmental management system to sanctions, 100% of the surveyed organizations indicated a slight reduction in spending on environmental protection programs in 2022-2023, including through the curtailment and postponement of individual projects and activities to a later date - 18.2%, and 9% due to the adjustment of environmental policy goals, 18% - by reducing deadlines and 18% - by reducing the costs of individual projects. The deadlines for the implementation of the planned environmental measures at some enterprises have been shifted due to the need for time for forced import substitution. The reduction in the budget of the environmental strategy was noted in enterprises engaged in coal mining, production and distribution of electricity, gas and water, while state-owned enterprises did not note significant changes in the budgets of 2023. Some respondents noted that the reduction of the budgets of organizations for environmental protection in 2020-2022 is not related to sanctions, in particular, they note the lack of relationship between sanctions and the environmental situation in the regions of presence, as difficulties existed even before their introduction.

Structural transformations in the field of environmental policy management of organizations are not related to external shocks. The survey showed that in the next 2-3 years, 41.7% of the surveyed industrial companies planned to maintain the existing organizational structure in the field of environmental policy. The same number of companies were going to strengthen the organizational and staff security of the company for the implementation of the shaped plans of the environmental program or strategy. The remaining 16.7% of companies found it difficult to assess changes in personnel policy in the field of environmental policy implementation.

Among the enterprises in which the strategy was adopted, but there was no environmental policy implementation program with an approved budget, 2/3 of the surveyed companies planned to strengthen the staffing and personnel policy of the company in the near future. All companies that had already adopted and implemented an environmental policy program with a budget wanted to keep the personnel policy at the same level. 25% of companies in which individual specialists were responsible for the implementation and control of environmental policy would like to open a full-time unit that would deal with environmental issues. Among the companies that already had such a division or department, 60% were going to expand and strengthen it.

Enterprises did not plan to reduce the financing of environmental policy in 2024-2025, half of the respondents expected to increase the budget of the environmental program in their company, 42% – to remain it at the same level. Geological exploration companies expected budget cuts in the environmental strategy in the coming years. Those companies that had adopted an environmental policy program with an approved budget estimated that all measures would necessarily be implemented (66.7%) and possibly with an increase (33.3%), whereas among companies in which there was no document reflecting the company's environmental policy, or only a strategy was adopted, the share of negative assessments increased.

Difficulties in obtaining ***imported technologies***, raw materials and components for the implementation of environmental policy were indicated by energy companies, enterprises producing and transporting oil and gas through pipelines, extracting ore and sand of precious metals, coal and anthracite, engaged in geological exploration in the field of subsoil exploration. The following answers were received to the question of which projects and activities the enterprises had to suspend: "modernization of the car wash complex", "reduction in the utilization of oil sludge and drilling sludge", "scrap metal removal".

Regulatory environment. Regarding the environmental policy in the Republic of Sakha (Yakutia), 91% of the companies participating in the survey expected changes in the plans of control and supervisory measures to maintain the stability of the economy in Russia. More than 36.4% of enterprises would like to be able to extend the deadlines for fulfilling obligations and to receive subsidies. Measures of support from the state to companies affected by sanctions were expected by 18.2% of the surveyed enterprises. The same number of experts pointed out the need to revise and adjust the implementation plans of the Environmental Policy Strategy of the Republic of Sakha (Yakutia).

Most of all, state-owned enterprises hoped for support from the state. The majority of joint-stock companies and limited liability companies unanimously expected changes in the plan of control and supervisory measures.

At the regional level, for the effective implementation of environmental programs of companies, according to experts, first of all it is necessary: to postpone the tightening of regulations, standards and rules in the field of environmental protection and rational use of natural resources (75%); to provide state support to enterprises for the implementation of environmental programs (42%); to reduce the amount of fees for negative environment impact with transparency of regulation.

For state support and regulation in the field of ecology in the region, the following proposals were received from the surveyed companies:

– for life-supporting enterprises, a single republican accredited laboratory center is needed for production control of emissions from sources, at the border of the SPZ, for wastewater discharge;

– at the federal level, a downward revision of the MPC standards for environmental objects such as water and air is needed;

– downward revision of the amount of administrative fines for legal entities or benefits for life-supporting enterprises;

– it is important to ensure a balance between economic development and conservation of the nature of Yakutia with the preservation of its unique, fragile ecosystems. Otherwise, the long-term damage may exceed all the benefits received;

– allocate funds for the removal of scrap metal from the Arctic;

– compensation payments for reforestation.

4.4 Typology of ecological sustainability of enterprises

In general, most of the surveyed organizations are characterized by an average and high level of environmental maturity, the availability of approved documents with a budget allocated for financing environmental protection measures, including current and investment costs; the exception is one company in the field of exploration and extraction of precious metals. The age of the organization and its "origin" have an impact – the older ones and those who are owned by the region have larger goals in the field of ecology and corporate social responsibility, ties with local communities.

Table 4: Typology of enterprises of the Republic of Sakha (Yakutia) mining and energy sectors by the level of environmental maturity and adaptation of environmental policy to external shocks of 2020-2023.

		Low	Average	High
Level of ecological maturity **Influence of external conditions and adaptive management**		formal signs of the presence of a strategic management system: there is no program document, the level of decision-making is specialists, there is no dedicated unit, there is no certification system, mandatory measures, the presence of fines, there is no information about the budget of environmental activities or the budget is insignificant	formal signs: the presence of a strategy, the level of decision-making is high, planned budgets are executed by 80-100%, the amount of financing of environmental programs does not exceed 2% of the company's` revenue, there is a trend to reduce environmental investments. Or the level of impact is minimal and the company is limited to the implementation of mandatory plans	formal signs of maturity of the strategic management system of the environmental impact of the enterprise on the territory of work, mandatory requirements of federal legislation and corporate social responsibility, stable planning and execution of budgets of environmental programs
No influence	No adaptive control	**1 company (gold mining)**		
The impact is negligible	Environmental policy is not adapted to external conditions. Priority is given to the expectation of state support measures	-	**3 company (gold mining / production and distribution of electricity, gas and water)** **2 companies (coal mining / gold mining / geological exploration,**	**4 companies (production and distribution of electricity, gas and water / gold mining / coal mining)** **2 companies (extraction and transportation of natural gas, gas condensate and oil / diamond industry)**

			geophysical and geochemical)	
The influence is explicitly described	Specific measures of adaptation of the environmental policy of the enterprise are described	**1 company (gold mining)** **-**	**3 company (gold mining / production and distribution of electricity, gas and water)** **2 companies (coal mining / gold mining / geological exploration, geophysical and geochemical)**	**4 companies (production and distribution of electricity, gas and water / gold mining / coal mining)** **2 companies (extraction and transportation of natural gas, gas condensate and oil / diamond industry)**

The adaptive response of the companies' environmental management system consists mainly in reducing environmental costs, including investment costs for environmental modernization, embedded in production modernization programs in conditions of reduced availability of investment resources and technologies. The greatest deterioration occurred from a technological point of view, here 63.6% of companies faced difficulties and deterioration of the situation. Despite this, half of the companies have not abandoned their environmental projects and plans, and in the near future they plan to increase environmental spending. The study showed high expectations of all types of industrial companies from the state and the regulatory environment (Table 4).

5 CONCLUSIONS

The current conditions, characterized simultaneously by high instability of the external environment and the need for structural transformation of the economy, significantly complicate the achievement of a balance between the desire for economic stability and the need to ensure ecological sustainability, security and the growing requirements of modern environmental policy of the Russian Federation.

The state environmental policy of the Russian Federation reacts to external changes rather restrainedly, taking balanced and targeted measures of both a laxative and tightening nature, and also does not abandon the previously introduced regulatory mechanisms, extending the time frame for the full transition of environmental reforms by 1-2 years.

In the Republic of Sakha (Yakutia), the costs of environmental protection in the period 2020-2022 increased, but did not reach the pre-nominal values relative to the GRP produced. Budget expenditures do not exceed 5% of the total cost of the environmental protection, the main amount of costs falls on enterprises. The structure of costs is dominated by current ones, for the period 2019-2022 the volume of investment costs significantly decreased due to investments in environmental modernization aimed at protecting atmospheric air, the growth of costs aimed at waste management in connection with the reform of the MSW management system increased slightly, while against the background of accumulated harm in previous years and high economic growth rates the problem of industrial waste management has been escalating in recent years.

An expert survey of industrial companies in the Republic of Sakha (Yakutia) showed that most enterprises highly appreciate their own level of environmental preparedness, 75% have developed strategies or environmental policy programs with an approved budget, 58.3% of companies have full-time special environmental units, which guaranteed the implementation and control of environmental management activities. First of all, the environmental policy of industrial companies is focused on mandatory tasks and measures provided for by the legislation of the country and industry specifics. The attention of Russian enterprises to the issues of resource and energy conservation has somewhat decreased, the priorities are issues related to emission reduction and waste disposal.

In general, the surveyed organizations are characterized by an average and fairly high level of environmental maturity; almost all companies have approved documents in the field of environmental protection with allocated funding for environmental protection measures, including current and investment costs. The exception is 3 employed in the field of geological exploration and the extraction of precious metals. The age of the enterprise and its "origin" affect the level of environmental maturity – older enterprises and so-called local enterprises demonstrate larger-scale environmental development programs and closer ties with the region of presence.

The adaptive response of the environmental management systems of enterprises to the deterioration of external conditions consists in an objective reduction of expenditures for environmental purposes, including investment costs for environmental modernization, embedded in the production modernization programs.

Enterprises are pinning their hopes on the regulatory environment, hoping for the easing of fines for negative environment impact and state support in the implementation of environmental programs and projects. For the effective implementation of environmental programs of companies, it is necessary: to postpone the tightening of regulations, standards and rules in the field of environmental protection and rational use of natural resources; to provide state support to enterprises for the implementation of environmental programs; to reduce the amount of payments for negative environment impact with transparency of regulation. Currently, in the context of the sanctions policy at the level of regions and industries, it is necessary to create strategic plans and programs to ensure environmental safety, as well as to conduct continuous monitoring of key indicators.

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