

The Efficiency Assessment of State Environmental Safety in Russian Industrial Regions

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ABSTRACT

The rapid development of society has not only positive effects. Anthropogenic impact on the ecosystems of the planet often leads to destructive and irreversible consequences. The COVID-19 pandemic, which swept the whole world in 2020, once again demonstrates the need to find a balance between humans and nature. Conservation of the environment is one of the key tasks not only of governments that formulate environmental policies, but also of supranational organizations. A lot of the world's research is aimed at demonstrating the quantitative harm caused by industrial pollution through metamathematical calculations. They prove that air and water pollution leads to irreversible consequences for human health: an increase in respiratory diseases, an increase in mortality from malignant tumors. Of course, in the long term, such consequences will affect the economic indicators of the state's development. That is why management in the field of ensuring environmental safety in a modern state is one of the key branches of management. Environmental safety is the permissible level of the impact of external factors, which ensures the state of protection of the planet's ecosystem and basic human interests from the negative impact of industrial activities, emergencies of various kinds and their consequences.

Keywords: public administration, environmental safety, industrial regions

1. INTRODUCTION

The importance of the environment and issues of its preservation have been of interest to foreign authors for a long time. Someone seeks to understand the scientific component of sustainable development, to invent new resources and environmentally friendly methods of their use. And for someone it is important to understand what effective resource management (human, natural, man-made) should be in order to minimize the harm done to the environment.

The relationship between environmental policy and the quality of life of the population was examined by Ryan Bosworth, Trudy Ann Cameron, J.R. DeShazoc in Demand for environmental policies to improve health: Evaluating community-level policy scenarios. This work assesses the need for state environmental policy to improve public health[1]. The authors revealed the dependence of mortality and health indicators on the amount of resources spent on the implementation of environmental policy.

Sustainable development issues are indeed key in the modern world. Economic growth, good living conditions and the protection of the natural environment are important for both citizens and the state. This opinion is shared by the authors of the article "Dissemination of Environmental Information and its Effects on Stakeholders' Decision-Making: A Comparative Study between Swedish and Polish Municipalities" Anna Cregård and Iwona Sobis. This article focuses on environmental sustainability [2]. It examines the place of municipalities in protecting the natural environment and disseminating information about it among stakeholders. This study shows that the dissemination of environmental information has a positive impact on decision-making by internal stakeholders. In both countries, municipal authorities are following EU guidelines, which leads to innovative work and increased environmental awareness among municipal authorities, residents and other stakeholders. Improvement of the natural environment is perceived by the authors as a necessity for the future. However, especially large municipalities face challenges as the production and dissemination of environmental information is time-consuming. In the long term, however,

it is planned to have a positive impact on the local environmental protection.

Another important aspect in the implementation of the concept of sustainable development is the analysis of corporate social responsibility of companies and its compliance with the environmental policy of the region. Because only effective interaction of state institutions and corporations, which have a huge impact on the quality of the environment, can ensure environmental safety. This topic is touched upon in the works of such authors as: "What companies do not disclose about their environmental policy and what institutional pressures may do to respect" Mitzi Isabel Cubill-Montilla, Purificación Galind-Villardón, Ana Belén Nieto-Librero, María Purificación Vicente Galindo, Isabel María García-Sánchez; "The role of business strategy and CEO compensation structure in driving corporate social responsibility: Linkage towards a sustainable development perspective" Chih Wei Peng [3,4].

The need to combine market mechanisms and a strong regulatory framework in the area of environmental safety is extremely important. This topic was raised by the authors of the article "UN environmental policy: Non-State Actors, trends, and the regulatory role of the state" Joseph S. Weiss, Zhu Dajian, Maria Amélia Enríquez, Peter H. May, Elimar Pinheiro do Nascimento, Walter A. Pengue, Stanislav Shmelev[5]. The article discusses possible mechanisms of interaction between the UN, civil society organizations and transnational corporations (TNCs) in the implementation of environmental policy. Strengthening national government competencies and enforcement capacity, as well as binding UN agreements, are essential for effective market incentives that can be leveraged by business and civil society initiatives. If civil society organizations unite, they will be able to implement the necessary environmental policy on an equal footing with TNCs [6,7,8,9,10].

2. METHODOLOGY

One of the methods for assessing the effectiveness of public administration in the field of ensuring environmental safety is the use of a list of performance indicators calculated according to the formulas presented in Table 1

So, these indicators are indicators of the effectiveness of public administration in the field of ensuring environmental safety. The financial growth index reflects the ratio of investments in environmental activities and the total number of investments in the region, i.e. demonstrates the degree of development and priority of financing this area. The structural and professional index demonstrates the level of employment in the field of ensuring environmental safety, i.e. the amount of human resources, one way or another, implementing environmental policy. The index of the location of environmental services and departments in the region shows what part of the total number of enterprises is occupied by services involved in ensuring environmental safety. The indicators for the industrial regions of the Russian Federation are presented in table 2.

Table 1 Economic indicators for assessing the effectiveness of environmental safety management in the region

Index	Calculation model	Model Description
Growth index of the volume of financial resources invested in the environment in the region for the year	$I_k = \frac{P_k(t)}{V_k(t)}$	The ratio of the volume of financial resources invested in ensuring environmental safety in the t-th year to the total volume of investments
The structural and professional index of the development of environmental activities in the region	$Ck = \frac{q_{\text{ээК}}}{q_B}$	The ratio of the population employed in the field of ensuring environmental safety to the total number of employed population
Index of location of environmental services and departments in the region	$I_p = \frac{N_B}{N_{\text{эК}}}$	The ratio of the total number of enterprises in the region to the number of environmental services

The analysis of this index shows that the growth in the volume of funds invested in the ecology of the region for the year is observed in the Lipetsk region, the Sverdlovsk region and the Republic of Tatarstan. In other regions, there is a reduction in financial resources spent on the environment. A particularly sharp decline is observed in the Krasnoyarsk Territory: in 2018, environmental costs decreased three times compared to the previous year. The next step is to consider the structural and professional index of the development of the ecological activity of the regions. (table 3)

Table 2 Calculations of the growth index of the volume of financial resources invested in the ecology of the region for 2017-2018

	2017	2018
Growth index of the volume of financial resources invested in the ecology of the region for the year		
Lipetsk region	1,55%	1,64%
Altai region	1,36%	0,90%
Krasnoyarsk region	2,36%	0,66%
Chelyabinsk region	0,30%	0,29%
Sverdlovsk region	1,16%	1,46%
Republic of Tatarstan	0,57%	0,65%

Table 3 Calculations of the structural and professional index of the development of environmental activities in the regions in 2017-2018.

	2017	2018
The structural and professional index of the development of environmental activities in the region		
Lipetsk region	1,29%	1,45%
Altai region	0,96%	0,94%
Krasnoyarsk region	0,92%	0,90%
Chelyabinsk region	1,07%	1,03%
Sverdlovsk region	0,90%	0,87%
Republic of Tatarstan	1,12%	1,12%

The analysis of this index indicates the presence of a positive development trend in the Lipetsk region and the Republic of Tatarstan. The rest of the regions show negative dynamics. This fact may be a consequence of several reasons: first, insufficient development of the structure of interconnected services and departments to ensure environmental safety; secondly, the unpopularity of activities in the field of environmental safety (environmental education, expertise, public and legal activities).

3. RESULTS

To form a complete picture reflecting the effectiveness of public administration not only in ensuring environmental safety, but also in ensuring a high standard of living in the studied regions, we present the calculations of the coefficients of the level of survival and the standard of living of the population.

The coefficient of the population's survival rate characterizes the conditions of survival that have developed as a result of the activities of state authorities and operate in a particular territory. This indicator is defined as the ratio of the number of those born on the territory of the state, for a certain period, to the number of deaths to the ratio of the number of those born in the previous period to the number of citizens who died during the same period. If this ratio is greater than 1, then in a specific territory the activities of state authorities gave a positive result. (table 4)

It can be seen from the data in the table that none of the studied regions has a coefficient equal to or greater than one. At the same time, the situation in the regions is unstable, there are regions with a positive trend - Altai Territory, the Republic of Tatarstan. In other regions, over the past three years, this coefficient has decreased, which indicates a deterioration in the socio-economic situation in general and environmental safety in particular.

Table 4 Survival rate of the population in the industrial regions of the Russian Federation in 2017-2019.

Survival rate ratio	2017	2018	2019
Lipetsk region	0,91	0,97	0,90
Altai region	0,89	0,91	0,92
Krasnoyarsk region	0,90	0,93	0,91
Chelyabinsk region	0,90	0,94	0,91
Sverdlovsk region	0,94	0,93	0,93
Republic of Tatarstan	0,88	0,95	0,96

One of the latest innovations in the analysis of the effectiveness of public administration in the field of ensuring environmental safety was the decree adopted by the Government of the Russian Federation on July 17, 2019 "On the approval of methods for calculating indicators for assessing the effectiveness of the activities of senior officials (heads of the highest executive bodies of state power) of the constituent entities of the Russian Federation and the activities of bodies executive power of the constituent entities of the Russian Federation, as well as the recognition as invalid of certain acts of the Government of the Russian Federation. This resolution approved the methodology for calculating the indicator "Environmental quality", which is calculated as the average value of the coefficients in three important areas, reflecting the level of negative impact on the environment in the territory of the subject of the Russian Federation.

The formula for calculating this indicator is as follows:

$$Eq = \frac{1}{K_{atm} + K_{bod} + K_{otx}} \times 100\% \quad (1)$$

where K_{atm} - air pollution factor;

K_{bod} - coefficient of water quality;

K_{otx} - coefficient of the quality of work with waste.

Moreover, each indicator is calculated according to the following formulas:

$$K_{atm} = \frac{\frac{V_{a_t} + SO_{2_t} + NO_{2_t} + CO_t + \text{ЛОС}_t + NH_3_t}{V_{a_{t-1}} + SO_{2_{t-1}} + NO_{2_{t-1}} + CO_{t-1} + \text{ЛОС}_{t-1} + NH_{3_{t-1}}}}{6} \quad (2)$$

where V_a - is the total volume of emissions of air pollutants from stationary and mobile sources on the territory of a constituent entity of the Russian Federation;

SO_2 – is the volume of sulfur dioxide emissions;

NO₂ – is the amount of nitrogen dioxide emissions;
 CO – s the amount of carbon monoxide emissions;
 ЛОС – the volume of emissions of volatile organic compounds;
 NH₃ – is the amount of ammonia emissions.

Based on this methodology, the indicator "Environmental quality" was calculated for the Chelyabinsk region for 2018. (table 5).

This indicator "Environmental quality" for the Chelyabinsk region is lower than the normatively established one: it should be higher than 1. This suggests that there are growth zones, which should be paid close attention: in this case, it is waste management, since this indicator calculated for an increase and low enough for the area.

Thus, based on the analysis of the effectiveness of the activities of public authorities in general and the analysis of the effectiveness of ensuring environmental safety in particular, it can be concluded that the regions under study are developing at a sufficiently high level. However, with regard to the effectiveness of ensuring environmental safety, the regions lack infrastructure: in particular, the low index of placement of environmental services and departments demonstrates the inadequacy of organizations of this specialization, more funds must be invested in financing environmental safety, the provision of employees in this area is also insufficient and needs in the increase. It should be noted that among all performance indicators, the leadership of the Republic of Tatarstan is observed, which has shown moderate growth over the past years.

Table 5 Calculation data for the indicator "Environmental quality" for the Chelyabinsk region in 2018

Indicator	Value
$K_{\text{атм}} = \frac{V_{a_t} + \frac{SO_{2_t}}{6} + \frac{NO_{2_t}}{6} + \frac{CO_t}{6} + \frac{ЛОС_t}{6} + \frac{NH_{3_t}}{6}}{V_{a_{t-1}} + \frac{SO_{2_{t-1}}}{6} + \frac{NO_{2_{t-1}}}{6} + \frac{CO_{t-1}}{6} + \frac{ЛОС_{t-1}}{6} + \frac{NH_{3_{t-1}}}{6}}$	1,08
$K_{\text{вод}} = \frac{V_{B_{t-1}}}{V_{B_t}}$	1,07
$K_{\text{отх}} = \frac{K_c + \frac{Д\text{оу}_t}{2}}{Д\text{оу}_p}$	0,69
$Eq = \frac{1}{K_{\text{атм}} + K_{\text{вод}} + K_{\text{отх}}} \times 100\%$	89,53

4. DISCUSSIONS

During the analysis of the theoretical foundations of public administration in the field of environmental safety, it was

revealed that the system is developed at a sufficiently high level: it is structured, there is an organized regulatory framework and organizational and economic elements are developed. However, after considering the foreign experience in implementing the policy in the field of ensuring environmental safety, as well as analyzing the current situation in the industrial regions of the Russian Federation, several problems were identified.

The first problem of ensuring environmental safety in the industrial regions of the Russian Federation is the deterioration of the situation with morbidity and mortality from specific diseases.

The solution to this problem is also impossible without increasing costs for environmental protection and elimination of accumulated pollution.

For clarity, we present data on the costs of environmental protection in the countries of the world (figure 1).

The sample of countries for this chart was based on nominal GDP in 2018 for a more reliable analysis. All countries, except Spain, have a nominal GDP higher than that of Russia. And, as we can see, all countries, except Germany, have more% of GDP spent on environmental protection than Russia.

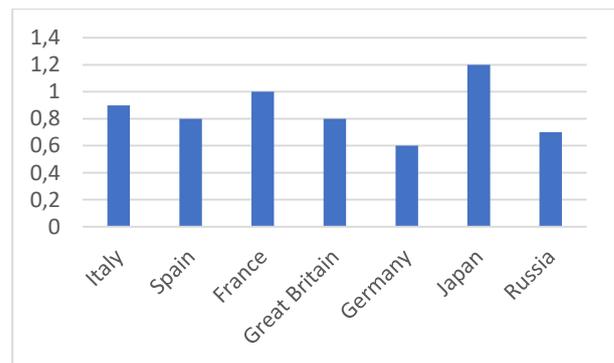


Figure 1 Environmental protection costs, % of GDP

The average value of this indicator for the sample is 0.86%. This suggests that the Russian Federation allocates less funds for environmental protection, not only qualitatively, but also quantitatively, since multiplying the presented value in% by the volume of nominal GDP, we will get an amount less than in other countries represented. ... At the same time, the area of the country plays an important role in assessing financing. In this case, Russia has a disproportionately larger area, and hence large natural resources that need to be protected. Consequently, even more funding is needed to ensure environmental safety. (table 6)

Table 6 Data of calculation of environmental protection costs per 1 km in 2018

	Nominal GDP, trillion USD	Yardage, thousand km ²	Environmental protection costs per 1 km ² (billion USD per 1 km ²)
Italy	2,084	301,3	0,06
Spain	1,419	505,9	0,02
France	2,778	643,8	0,04
Great Britain	2,855	242,4	0,09
Germany	3,948	357,3	0,07
Japan	4,971	377,9	0,16
Russia	1,658	17100	0,0007

The amount of expenditures on environmental protection clearly demonstrates the lack of funding for this area in the Russian Federation. If for the studied countries the average value of this indicator is 0.07, i.e. the cost of environmental protection is 70 million USD per 1 km² per year, while for Russia this figure is 0.0007, which is a hundred times less. Russia spent 0.7 million USD on environmental protection per 1 km² in 2018. Obviously, these data confirm the conclusions about the problem of underfunding of activities to ensure environmental safety.

The next problem is the lack of infrastructure in the system for ensuring environmental safety, namely: a low index of the location of environmental services and departments. It demonstrates the lack of organizations specialized in environmental issues. In addition, more funds must be invested in financing environmental safety, the availability of employees in this area is also insufficient and needs to be increased, which was shown by the consolidated structural and professional index of the development of environmental activities in the regions, calculated in the same part of the analysis.

An increase in the number of environmental organizations and specialists working in the field of ensuring environmental safety will ensure better quality state environmental control. It will become possible to conduct on-site environmental audits as one of the most effective ways to detect violations in the area of exceeding the permissible level of emissions of pollutants into the atmosphere.

5. CONCLUSION

Summing up, it should be noted that ensuring environmental safety is an important task of the state. And it is the state, first of all, that sets the vector for the development of this direction. Public administration in the field of ensuring environmental safety in the Russian

Federation is still young, but has sufficient potential to create an effective system that acts for the benefit of the environment, based on international environmental standards.

The development of the public administration system in the field of ensuring environmental safety in the industrial regions of the Russian Federation is a long process that requires significant investments: financial, material, human. But, of course, it is significant and necessary for the development of the country. The indicated directions of development are only a small part of the changes that can occur and, of course, only by trial and error will it be possible to arrive at the type of system that will balance the interests of society, representatives of industry and the state.

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