Implementation of environmental principles of sustainable development in the mining region

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Abstract. The extractive regions are experiencing both the economic problems associated with the depletion of the resource base and the relative development of other industries, as well as the environmental problems caused by the depletion of the bowels and the use of backward equipment. On the path of sustainable development, it is essential to envisage areas that can improve efficiency. The authors of the article highlighted two main areas: management and innovation. The first area is implemented by two approaches: authoritarian governance and multi-stakeholders' initiatives (MSI). MSI is more effective, but at the same time only possible if there are developed and interested initiative participants. It allows us to discuss key issues together, as well as increases the degree of cooperation of companies in the regions. Voluntary initiatives have been made possible by increased attention to environmental issues and the transition to green mining. On the part of innovation, the authors note the importance of supporting them, as new technologies not only improve efficiency, but also reduce emissions and improve safety of working conditions. Encouraging innovation is possible both on the part of the companies themselves, which should be targeted assistance from the authorities, and through the mechanism of innovative vouchers, which result in practical and economically feasible technologies.

1 Introduction

Mining has a dual impact on the achievement of sustainable development goals. On the one hand, it is an important source of income for budgets that can be directed to the development of subsidized industries (agriculture, construction), but at the same time it is associated with serious problems of sustainable development (soil depletion, low living standards of workers, environmental problems). The increase in the degree of mineral processing directly determines the environmental burden on the resource base of the extractive regions, as it allows to create added value in the laboratory without involving new subsoil sites.

Coal is an important resource that supports the economic development of many mining regions. However, it is important to understand that coal mining can lead to serious environmental disasters, as happened in some mining areas. So, in February 2020, a gas

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explosion occurred at the Pir Ismail coal mine in the Marwaarh district of the Balochistan province of Balochistan, killing eight people. In April 2020, the Datong Coal Mine Group mine in China collapsed due to a rock collapse, leaving 13 miners under the rubble. Earlier on March 6, methane was released at the Vorkutinskaya mine in Komi, northern Russia. Two people were killed. In this regard, when focusing on the development of the mining industry in the regions, it is imperative to focus on observing the environmental principles of sustainable development.

The largest coal region in Russia is the Kemerovo region. Kuzbass coal reserves amount to 690 billion tons (fig.1) of low-grain coals with a sulphur content of 0.1-0.5% and are represented by all known brands and technological signs of coking and energy coals in the world.

Fig. 1. The biggest coal mining centers in Russia. Source: composed by the authors.

Currently, coal exports to Japan, Great Britain, and Turkey are actively practiced, and export to Finland is established. Supply volumes are increasing rapidly. Russia's permanent coal-buying partners are the Netherlands, Korea and China, but the number of products supplied is declining. Exports to Asia have been increasing recently. Active consumers of Kuzbass coal in the domestic market are residents of Western Siberia, the Urals, the European part of Russia.

Coal mining is carried out both underground and more progressive - open and hydraulic ways. The production is about 210 million tons per year.

The coal industry is key for the residents of the region, mining is carried out at 167 mines. However, the contribution of the coal industry to sustainable development goals is small, as:

- There is a high incidence of respiratory problems in the region caused by the work of coal plants;
- High density of mines leads to the emergence of karst failures and to the high depletion of minerals, low level of their replacement (the ratio of stock growth to production for the year) [1];
- The industry's contribution to the region's GRP and regional budget revenues is about 50%, which hinders the development of other industries, the cooperation of companies in the field of ecology and economy is poorly developed [2,3].

These difficulties can be overcome through a coherent policy that takes into account the goals of sustainable development. As part of this work, the mechanisms for the implementation of this policy, as well as approaches to its formation, will be defined. To that end, the authors conducted a literary review of the sources and identified two key approaches to sustainable development policy at the regional level.

2 Materials and Methods

Mining, in particular coal, should be based on the following environmental principles:

- 1) Exploring resources. Careful use of resources is impossible without reliable information about their volume, quality, without predicting the consequences of their removal from natural sites and the possibility of replacing them with others;
- 2) Natural Resource Monitoring Organization. The need to conduct environmental checks for emissions, reliability of mine structures;
- 3) Improving technologies for extracting, transporting and processing resources to maximize their use. Designing, building new ones, and upgrading existing facilities to reduce the use of natural resources. Using alternative energy sources;
- 4) Constant search for the latest environmental technologies with mandatory environmental examination;
- 5) Reducing waste production - wastewater, emissions and solid waste [3-10].

The latter two principles cannot be achieved without research and development, which should be carried out by scientific centers in the regions on the basis of a government order or through an innovative voucher mechanism. The voucher mechanism provides that companies develop a technical task and send it to a scientific organization, which independently conducts a competition for the best developments, as well as monitors compliance with the technical task.

Sustainable development goals cannot be achieved without environmentally responsible activities by companies. The term environmental responsibility is relatively new, the author's series includes it as part of corporate social responsibility (the term CSR was introduced in 1953 by the American scientist G. Bowen in the monograph «Social Responsibility of a Businessman»). Van den Brink et al. sees the company's responsibility as «managing social, environmental and/or economic sustainability» [11].

F. Sauer and M. Hiete believe that the term responsible mining is often preferable to the term sustainable mining, as responsibility is an important motivating factor that comes from within the company [12].

Achieving environmentally responsible mining is possible in two ways: management and innovation. There are two approaches on the part of management - on authoritarian or voluntary basis. According to the common and widely accepted approach, the public authorities play an active role, and the later approach is based on voluntary initiatives involving several stakeholders (Multi-stake initiatives) [13,14].

L. Mancini and S. Sala note the positive role of authority-based governance. This approach was prompted by pressure from trade unions and governments to respond to claims by affected workers and other stakeholders, which led to significant industrial development and improved safety, as well as reduced exposure and risks to the environment and society [15].

Workers of large companies in developed Western countries, where trade unions have strong power, have benefited from this approach. However, in small and medium-sized enterprises, working conditions are often poor, especially in artisanal and small-scale mining [16,17], and miners often do not have the freedom to form trade unions, etc.

Earlier in 2012, H. Shi introduced the concept of green mining [18]. The term refers to responsible mining by mining companies as part of an agreement with their employees and authorities on emissions levels, the goal of the agreement to gradually reduce emissions, otherwise offset negative effects and pay fines. Later, the term formed the basis of the approach of voluntary initiatives, as initially the promotion of green mining came from the authorities that have fiscal purposes.

Further studies were purely applied. Thus, Jixiong et al. modeled the sustainable impact of green mining policies on the coal industry in China, which resulted in a 25% increase in

coal production efficiency through the use of a drainage system that allowed to pump out gas (coal seam methane), improve safety of work and reduce the duration of coal mining and the presence of workers in the mine [19]. Wang et al. highlighted four aspects of green mining: safe mining, efficient mining, economic mining and energy conservation, and low-carbon analysis [20]. Each aspect has its own goals and objectives, its participants and stakeholders, which is important to consider to achieve sustainable subsoil use and ultimately sustainable development of companies and extractive regions.

F. Sauer and M. Hiete introduced a management approach based on voluntary initiatives. The approach is seen as a social innovation, as it allows for discussion of key issues in the field of sustainable and responsible mining in the dialogue mode of stakeholders (companies, employees, authorities, scientific organizations) [12]. Part of the approach is utopian, as it is extremely difficult to take into account the interests of all groups, and equality will not be optimal for Pareto (a situation where it is impossible to improve the situation of any participant in the economic process, while not reducing the well-being of at least one of the others). Since the authority has a coercion mechanism and in the case of rigid policies, this approach is not achievable. A feature of Sauer and Hiete's approach is that they view voluntary initiatives as informal lysing companies from different countries to develop coherent policies for sustainable development.

The next direction for responsible mining is to develop innovations in mining technology. Productivity growth is a major driver of technology development, and the decline in social and environmental impacts is a positive side effect. According to I. Ramdoo: «The digitization of mining enterprises will further improve economic and environmental performance» [21].

3 Results and Discussion

The authors consider it possible to move the approach of voluntary initiatives to the regional level. Initiatives are a valuable addition to the authoritarian management of responsible mining, as they go beyond a particular company, allow for discussion of problems and exchange of experience. However, the initiatives are voluntary and relatively young. This limits their power and requires further research.

With regard to innovation, the low-carbon agenda suggests that fuel as a raw material for producing and generating heat and energy is environmentally friendly. Most of Kuzbass's coal is stone, with less carbon dioxide and other particles (particles) released when they are burned, but coal seam methane mining is promising. Natural gas is found in cracks of coals and migrates through the cleave. Thanks to the activities carried out by Gazprom, in 2010 it was possible to get the first thousand. tons of coal gas. Gazprom has acquired 2 licenses for gas development and production in Kuzbass. In 2014, the Taldin fishery produced 2.8 million cubic meters gas, since the beginning of operation - almost 16 million cubic meters. Gas can be compressed and used as automotive fuel. By 2021, the company plans to enter the shelf of production of 4 billion cubic meters per year. The economic reserves of coal seam methane are estimated at 13,100 billion cubic meters natural gas [22].

The limited financial resources for development require concerted action by the Government in the form of subsidized loans. Another effective mechanism for stimulating renewal and development processes is the formation of clusters [23-24]. The demand of high quality on the part of buyers and measures to improve efficiency on the part of the extractive enterprises themselves will allow to implement the processes of renewal in the extractive industry of the Kemerovo region and switch to clean and environmentally friendly technologies.

It is noteworthy that resident companies do not pay attention to environmental principles. Thus, Kuzbassugol among its competitive advantages allocates compliance with the products

(coal) of world quality standards in the field of calorific value, at the same time pays much less attention to industrial safety and environmental protection. There are 329 mining companies operating in the region that are little coordinated with each other on the best use of the sites provided and the technologies used.

Raspadskaya, the largest company, adopted an updated standard for coal mine development in 2019. The company spends about 100,000. Rub. annually on natural and security activities, but does not pay enough attention to interaction with other companies in the region of presence. This is partly due to the high proportion of borrowings, and wages are heavily arrears.

4 Conclusion

The paper outlines the main areas for achieving sustainable development goals through responsible consumption. The first is to choose the best approach to governance (authoritarian or based on voluntary initiatives). The choice of approach depends on the level of cooperation of companies, the development of the trade union movement, the political strength of the ruling party in the region. For the Kemerovo region, the implementation of managerial influences through discussion of stakeholders is promising. The regional authorities have paved the way for the cooperation of the companies, but further development depends on the initiative of the companies themselves in terms of responsible production.

The second is to develop new technologies that improve the safety of production and reduce the negative impact on the landscape and increase productivity. A promising technology for coal plants in the Kemerovo region is the extraction of coal seam methane. This will allow, first, the use of gas as a more environmentally friendly fuel, and secondly to reduce the likelihood of collapse by pre-draining the reservoirs and pumping gas from cavities.

Advancing green mining and technological innovation will lead to low-carbon development based on coal mining and related industries, and the use of innovative voucher mechanisms will increase the targeting and development efficiency.

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