

## MODELING AND ANALYSIS OF NATURAL RESOURCE UTILIZATION IN THE EXTRACTION INDUSTRY: APPROACHES AND PRACTICES

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In the context of ongoing depletion of global natural resource reserves, solving the problem of organizing proper control over their availability and efficient use becomes crucial. Control is also necessary to address important tasks related to the reproduction of used resources and restoration of land plots to their natural state. Such control should be carried out both by state and local authorities and by the economic entities engaged in extraction and processing of natural resources. The article highlights methods of control and analytical techniques in the field of extraction and processing of natural resources. The authors emphasize the importance of using economic-mathematical and logical methods, and distinguish between methods of factual and documentary control. They draw attention to the analytical interpretation of actions and events and discuss various approaches to analysis, such as SWOT and PEST, to take into account political, economic, social, and technological aspects of the external environment. The application of these methods can increase the efficiency of management processes in the extraction and processing of natural resources, contributing to the sustainable development of enterprises in this industry. The article also discusses PEST analysis for considering political, economic, social, and technological factors. Conducting PEST analysis allows for a deep understanding of the external environment in which the company operates by: identifying potential threats and opportunities; preparing for potential changes in the external environment, enabling the company to better prepare for them; developing strategies and making decisions aimed at maximizing opportunities and minimizing threats; identifying competitive advantages that can be used to attract customers or markets; monitoring the external environment and timely responding to changes.

**Keywords:** control, analysis, extraction industry, natural resources, economic-mathematical methods, PEST analysis.

### МОДЕЛЮВАННЯ ТА АНАЛІЗ ВИКОРИСТАННЯ ПРИРОДНИХ РЕСУРСІВ У ВИДОБУВНІЙ ГАЛУЗІ: ПІДХОДИ ТА ПРАКТИКИ

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В умовах постійного виснаження світових запасів природних ресурсів вирішення проблеми організації належного контролю за їх наявністю та ефективним використанням набуває вирішального значення. Контроль також необхідний для вирішення важливих завдань, пов'язаних з відтворенням використаних ресурсів та відновленням земельних ділянок до їх природного стану. Такий контроль має здійснюватися як органами державної влади та місцевого самоврядування, так і суб'єктами господарювання, які займаються видобутком та переробкою природних ресурсів. У статті висвітлено методи контролю та аналітичні прийоми у сфері видобування та переробки природних ресурсів. Автори наголошують на важливості використання економіко-математичних та логічних методів, розрізняють методи фактичного та документального контролю. Вони звертають увагу на аналітичну інтерпретацію дій і подій та обговорюють різні підходи до аналізу, такі як SWOT і PEST, для врахування політичних, економічних, соціальних і технологічних аспектів зовнішнього середовища. Застосування цих методів може підвищити ефективність управлінських процесів у видобутку та переробці природних ресурсів, сприяючи сталому розвитку підприємств цієї галузі. У статті також розглядається PEST-аналіз для врахування політичних, економічних, соціальних і технологічних факторів. Проведення PEST-аналізу дозволяє глибоко зрозуміти зовнішнє середовище, в якому працює компанія, шляхом: виявлення потенційних загроз і можливостей; підготовки до потенційних змін у зовнішньому середовищі, що дозволяє компанії краще підготуватися до них; розробки стратегій і прийняття рішень, спрямованих на максимізацію можливостей і мінімізацію загроз; виявлення конкурентних переваг, які можуть бути використані для залучення клієнтів або ринків; моніторингу зовнішнього середовища і своєчасного реагування на зміни.

**Ключові слова:** контроль, аналіз, видобувна галузь, природні ресурси, економіко-математичні методи, PEST-аналіз.

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## INTRODUCTION

Growing societal concern regarding environmental issues such as pollution and depletion of natural resources necessitates the refinement of management methods to ensure the sustainability of natural ecosystems. Natural resources are a key factor in the economic development of many countries, thus effective resource utilization is crucial for ensuring economic stability and competitiveness. The rapid advancement of technologies in the extraction and processing of natural resources demands constant updating of management methods and approaches to leverage new opportunities and minimize environmental impact. Changes in climate conditions may affect the availability and quality of natural resources, posing a threat to the stability of raw material supply for extraction industries. Increasing instability in global political and economic spheres creates the need for the study and development of management strategies to adapt to changes in the external environment. Research on this topic is essential for developing effective resource management strategies and ensuring sustainable development in the extraction industry.

The aim is to investigate and disclose the methods, models, and analytical approaches used in the extraction and processing of natural resources, analyze current trends in resource utilization, evaluate the effectiveness of these processes, and study the impact of various factors (political, economic, social, technological, etc.) on resource extraction and utilization.

The following approaches were used in the research:

- Analytical approach, involving the study of existing literature, analysis and comparison of various models and methods, and selection of the most suitable ones for addressing specific tasks.
- Modeling and statistical analysis, utilizing mathematical models and statistical methods for forecasting and analyzing natural resource utilization, as well as determining optimal management strategies.
- Systems analysis, providing a comprehensive approach to studying the problem, considering the interrelationships between different aspects of resource utilization and their impact on society and the environment.

## ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

In the context of the modern extraction industry, where dynamics and uncertainty of the external environment are widely accepted, timely and objective assessment of phenomena, processes, and trends may be complicated by the lack of necessary reliable information. Therefore, enterprise managers should limit the spectrum of external factors they consider and give preference to those that have the greatest impact on performance outcomes. For successful operation and development in such conditions, enterprises must be prepared to adapt to changes and actively shape their future.

Analyzing external environmental factors is an important tool for forecasting opportunities and developing action strategies in unforeseen circumstances. Addressing these issues requires the development of appropriate procedures, methods, actions, and decisions for strategic management and environmental analysis. This allows companies to turn threats into opportunities, which is critical in unpredictable conditions. However, it is worth noting that theories and methods of strategic management, developed for stable economies, may not fully correspond to the conditions of post-socialist countries, such as environmental instability and insufficient information base. Therefore, it is necessary to adapt these approaches to the specific conditions of the extraction industry, considering its specificity and challenges.

To effectively manage the process of exploration, extraction, and processing of natural resources, a system of control methods and analytical techniques is required. Currently, there are no clear and universal rules regarding the methods and procedures of internal control. The results of control significantly influence the use of various control methods. Internal control methods often include analytical tools and calculations, but the principles of their disclosure have a similar approach. For

example, Professor Usach B. F. divides control methods into general scientific ones, such as analysis, synthesis, induction, deduction, modeling, and specific ones, such as inventory, economic analysis, and expertise [7].

R. Kostyrko defines control methods, including analysis and synthesis, induction and deduction, analogy and modeling, abstraction and systems analysis, which help focus on exploring cause-and-effect relationships in the economic potential of an enterprise [3]. N. Vygovska emphasizes that conducting control at an enterprise is impossible without the application of analytical procedures, which also hold significant importance for financial management [8]. T. Kamenska and O. Redko believe that control actions should encompass not only data collection and processing but also analysis, comparison of actual results with planned indicators, identification of deviations, and development of measures to achieve objectives [2]. L. Hutsalenko, V. Deriy, and M. Kotsupatriy underline the importance of analytical techniques such as techno-economic calculations, comparisons, relative and absolute values, and data grouping [1]. O. Skasko highlights the analytical function among the functions of the internal audit department [6].

In economic literature, various methods of grouping analysis methods and analytical procedures, as well as their utilization in control actions, have been elucidated. Specifically, Ye. Mnykh identifies methods such as modeling, logical and graphical methods, methods of comprehensive evaluation, econometric methods, methods of financial calculations, and expert assessment [4]. H. Savitska justifies diverse analysis methods, including logical information processing methods, deterministic and stochastic factor analysis, and optimization of economic tasks [5].

The division of analysis methods into formalized and informal aids in a clearer understanding of information processing methods and determining the analytical toolkit for conducting research. In carrying out control actions in the field of extraction and processing of natural resources, computational-analytical procedures based on various economic analysis methods are utilized. These methods include traditional ways of comparing actual performance with normative and planned indicators, as well as grouping of works and expenses by various parameters. Factor analysis is an essential tool for identifying reserves to enhance the efficiency of deposit exploitation and well drilling, as it allows assessing the impact of various factors on the extraction and processing of raw materials.

## RESULTS OF THE STUDY

In light of the continual depletion of global natural resources, effective control over their availability and economic utilization becomes an extremely important task. Control is also necessary for ensuring the replenishment of depleted resources and restoring land plots to their natural state. This control should be exercised both by government and local authorities and by the economic entities engaged in the extraction and processing of natural resources.

Various accounting and reporting financial and non-financial information on extracted and processed resources are used in the process of economic control. To enhance information provision, a new reporting format has been introduced in accordance with legislative changes. State and public control systems are crucial, especially in the field of extraction and processing of minerals, to ensure efficient resource use while adhering to environmental and social norms.

The formation of an internal economic control system for individual projects of extraction and processing of minerals involves several stages. Firstly, it is necessary to identify factors influencing the successful implementation of the project and establish potential systemic and non-systemic risks. Each project must be evaluated for its effectiveness before its launch, comparing expected revenues and other benefits with capital and current costs.

Additionally, significant restrictions imposed by the state on the extraction, processing, and export of natural resources for their efficient use should be taken into account. Another aspect of state control to be considered in organizing internal control in an enterprise is monitoring compliance with

environmental standards and rules to reduce negative impacts on the natural environment and/or restore it after completion of extraction works, etc.

In modern conditions, econometric methods can be widely used for implementing control measures at extraction enterprises and for analyzing the industry as a whole. Among them, formalized approaches based on linear programming and correlation analysis, as well as econometric methods and fuzzy logic techniques, can be distinguished.

The method of correlation and regression analysis is applied to establish relationships between various factors of the investigated object, such as volumes of extracted minerals and natural conditions or equipment performance. Linear and dynamic programming methods can identify "bottlenecks" and optimize extraction conditions with limited resources. The balance method can be used to measure the balance between production and consumption of products, particularly in the context of natural resource constraints.

Additionally, game theory methods, queuing theory, and inventory optimization can be utilized to address control tasks. Despite this, informal methods such as expert assessments also hold significant importance. They rely on professional experience and experts' intuition and can assist in making timely managerial decisions considering external and internal factors.

The importance of this approach lies in the fact that a considerable number of external factors can influence the processes of exploration, extraction, and processing of natural resources, as well as the opening and closing of deposits. These factors can be caused by both natural conditions (climate, geological conditions, etc.) and socio-economic factors (legislation, environmental and social requirements, competition, etc.). It is also important to consider the internal strengths and threats of the enterprise.

Situation analysis methods such as SWOT analysis, SNW analysis, and PEST analysis are effective tools for considering these factors. SWOT analysis identifies the strengths and weaknesses of the enterprise/industry, as well as opportunities and threats from the external environment. SNW analysis expands this approach by considering mid-market factors, while PEST analysis examines political, economic, social, and technological aspects of the external environment.

Using these methods allows enterprises/industries to understand their strengths, weaknesses, potential opportunities, and threats. This helps in making management decisions based on objective situation analysis, maximizing advantages, and minimizing risks.

Let's delve further into PEST analysis. It is a long-term planning tool used to assess the impact of environmental factors on the business. The methodology is employed to study the market during the launch of a new product, evaluate major trends for the next 3-5 years, and identify potential risks and growth opportunities. The abbreviation is formed by four English words (see figure 1):



Figure 1. Meaning of PEST Analysis.

Source: created by the authors

The analysis was conducted by Professor Francis Aguilar of Harvard University. In 1967, this tool was developed to scan the macro environment (external factors affecting business) and was named ETPS. Later, for ease of pronunciation, the name was changed to PEST. Sometimes the method is referred to as STEP analysis - the essence of the instrument remains unchanged despite changes in the sequence of factors.

In some cases, the methodology is supplemented with other factors that are significant for a particular enterprise. For example, SLEPT - in addition to analyzing the legal field (Legal); PESTEL - environmental conditions (Ecological) and legal relations (Legal) are added to the list for analysis; PESTELI - industry (Industry) to which the business belongs is studied; LONGPEST - factors related to the local (Local), national (National), and global (Global) levels are added to the general set of factors; STEEPLE - the study includes legal (Legal), ecological (Ecological), and ethical (Ethical) fields.

Conducting a PEST analysis allows for a deep understanding of the external environment in which the enterprise or industry operates. Here are some specific benefits of conducting a PEST analysis:

- Identification of potential threats and opportunities - analyzing political, economic, social, and technological factors helps identify possible risks and opportunities for the enterprise or industry. These could be changes in legislation, economic downturns or growth, demographic trends, technological breakthroughs, etc.

- Preparation for changes - knowledge of potential changes in the external environment allows the enterprise or industry to better prepare for them. For example, if a change in legislation is anticipated, the enterprise can develop adaptation strategies in advance.

- Development of strategies and decision-making - the results of the analysis assist in formulating strategies and making decisions aimed at maximizing opportunities and minimizing threats. For example, if social trends indicate an increasing demand for environmentally friendly products, the enterprise can focus on their production.

- Identification of competitive advantages - analysis helps identify the competitive advantages of the enterprise or industry that can be used to attract customers or markets.

- Monitoring of the external environment - PEST analysis is not a one-time activity. It helps the enterprise or industry continuously monitor changes in the external environment and respond to them in a timely manner.

PEST analysis is an important tool for strategic management and decision-making, allowing enterprises to adapt to changes in the external environment and leverage opportunities for success. During PEST analysis, relevant factors that are key to the enterprise/industry are evaluated.

The characteristics of factors assessed during PEST analysis are presented in Table 1.

Table 1. Characteristics of factors, components for study, and questions considered during PEST analysis

<i>Politics</i>		
Political factor takes into account all aspects of the political environment that can influence the success of a company's business.	<i>In PEST analysis, the following aspects are studied:</i> - Stability of the political situation in the country and region, dynamics of changes in government and possible consequences of these changes for business. - Global political situation (cooperation, international disputes, sanctions, incentives). - Global political situation (cooperation, international disputes, sanctions, incentives). - Domestic state and tax policies.	<i>Questions that need to be addressed through analysis:</i> - When will the next elections for local, regional, or national government bodies take place, and how might this change regional or state policies? - Could any anticipated legislative or tax changes affect the company's operations positively or negatively? - How does the state approach corporate policy, corporate social responsibility, environmental issues, consumer protection legislation; and could this affect the company?

Continuation of Table 1

	<ul style="list-style-type: none"> <li>- Degree of government influence on the industry.</li> <li>- Presence of legislative relaxations, subsidies, or support.</li> <li>- Nuances of interstate agreements.</li> <li>- Level of corruption and effectiveness of law enforcement agencies, which can influence the business climate and opportunities for corrupt practices.</li> </ul>	<ul style="list-style-type: none"> <li>- To what extent is property law and the rule of law developed in the country, how prevalent is corruption, organized crime, and how could this affect the company?</li> </ul>
<b>Economics</b>		
<p>Economic factors in PEST analysis are an important aspect of assessing a company's business environment.</p>	<p><i>In PEST analysis, the following factors are studied:</i></p> <ul style="list-style-type: none"> <li>- Level of inflation, GDP dynamics;</li> <li>- Interest rates and exchange rate fluctuations;</li> <li>- Dynamics of population income and unemployment;</li> <li>- Dynamics of adjacent markets; current level of competition;</li> <li>- Opportunities for tax breaks or special industry programs;</li> <li>- Level of competition.</li> </ul>	<p><i>Questions to be addressed through analysis:</i></p> <ul style="list-style-type: none"> <li>- How do changes in oil, gas, or other extracted resource prices affect your company's profits?</li> <li>- What technological and innovation trends impact the cost and efficiency of resource extraction?</li> <li>- How do changes in the regulatory environment, such as tax rates or environmental regulations, affect your operations and profitability?</li> <li>- How can economic instability in the region affect risks for your business?</li> <li>- What opportunities for economic growth may arise from the development of new markets or technologies?</li> </ul>
<b>Socio-culture</b>		
<p>Social and cultural factors are important for the extractive industry due to their influence on workforce productivity, occupational safety, consumer preferences, and lifestyle.</p>	<p><i>During PEST analysis, the following factors are examined:</i></p> <ul style="list-style-type: none"> <li>- standard of living and population habits,</li> <li>- demographic criteria,</li> <li>- level of education and workforce productivity,</li> <li>- social needs of the population,</li> <li>- religious beliefs.</li> </ul>	<p><i>Questions that need to be answered through analysis:</i></p> <ul style="list-style-type: none"> <li>- How does the standard of living affect the demand for extracted products? Can changes in consumer habits affect the development strategy of your company?</li> <li>- What demographic changes could affect the workforce in your industry?</li> <li>- How does the level of education affect the qualifications of workers in your industry?</li> <li>- Can changes in workforce productivity affect the efficiency of extraction?</li> <li>- How can social needs affect the development of your business?</li> <li>- Can changes in environmental standards affect the method of extraction?</li> <li>- How do religious beliefs affect attitudes towards extraction projects and adherence to ethical standards?</li> </ul>
<b>Technology</b>		
<p>Technological factors have a significant impact on the extraction industry due to their ability to improve extraction efficiency, reduce costs, and enhance safety.</p>	<p><i>In PEST analysis, the following technological factors are studied:</i></p> <ul style="list-style-type: none"> <li>- Innovative technologies</li> <li>- Patent legislation</li> <li>- Research and development costs</li> <li>- Potential technological changes</li> <li>- Competitors' advantages</li> </ul>	<p><i>Questions to be answered through analysis:</i></p> <ul style="list-style-type: none"> <li>- What new technologies are available for use in the extraction industry?</li> <li>- How can they improve extraction, processing, and transportation processes?</li> <li>- What is known about patent legislation regulating technology use in your industry?</li> <li>- What are the research and development costs within your industry?</li> <li>- Are significant technological changes anticipated that could impact your industry in the near future?</li> <li>- What technological innovations are being utilized by your competitors?</li> </ul>

Source: created by the authors

The main goal of PEST analysis is long-term strategic planning for the enterprise. The forecasting period is typically 3-5 years with annual adjustments.

Conducting a PEST analysis requires a significant amount of data collection and processing. First, it is necessary to identify factors from each direction, focusing on those that affect the company's activities and income. Each organization will have its own list of these factors. Then, data about these factors are gathered. Various sources such as reports, market research, specialized literature, and media are used to collect primary information.

An important step is to assess the level of impact. For this, a scale from 1 to 3 points is used, where:

- 1 - the impact is minor and has almost no effect on the business results;
- 2 - it matters only in the case of significant changes;
- 3 - even slight fluctuations will significantly affect the enterprise.

These assessments are made by experts based on a thorough analysis of each factor.

Additionally, possible changes are identified using a scale from 1 to 5, with expert assessments also assigned. For example, to assess the political situation in a country:

- stable political situation without major changes - 1;
- the political situation may change in the future - 2;
- certain signs of instability or tension, but without serious threats - 3;
- significant political turbulence or conflicts, but without progressing to a crisis situation - 4;
- crisis or highly unstable political situation (war), threat of social conflicts or political crises - 5.

It is important not only to assess the moment but also to forecast its state in the coming years. It is desirable to formulate the main trends, both positive and negative, for the next few years. This approach will help develop a company's development plan and identify the most important factors and potential risks.

Potential changes are evaluated. At this stage, a score is calculated to show the significance of the factor and the need for its monitoring. This is done using the following formula:

$$\text{Factor score} = \text{Impact of the factor} \div \text{sum of impacts} \times \text{average expert assessment}$$

Using PEST analysis, let's analyze the impact of external factors on the extractive industry as a whole. The results of the factor assessment calculations are presented in Table 2.

Table 2. Example assessment of political, economic, socio-cultural, and technological factors for the enterprise

Content of the factor	The influence of the factor	Expert evaluation					Average score	Score with adjustment for significance
		1	2	3	4	5		
1	2	3	4	5	6	7	8	9
<b>Politics</b>								
Political situation in the country	3	5	5	5	4	5	4,8	0,6
International relations	3	5	5	5	4	4	4,6	0,6
Tax policy	3	5	5	4	5	4	4,6	0,6
Legal environment	2	4	4	3	3	3	3,4	0,4
Trends in industry regulation	2	4	4	3	4	4	3,8	0,4
<b>Economics</b>								
Inflation rate and GDP dynamics	2	3	3	4	4	3	3,4	0,4

Continuation of Table 2

1	2	3	4	5	6	7	8	9
Dynamics of population income and unemployment	3	4	4	4	3	4	3,8	0,6
Dynamics of adjacent markets	3	4	4	4	4	4	4	0,6
Current level of competition	3	4	4	4	4	4	4	0,6
<b>Socio-culture</b>								
Standard of living and population habits	3	4	4	5	3	4	4	0,6
Demographic criteria	2	2	3	3	2	3	2,6	0,4
Level of education and workforce productivity	1	1	1	1	1	2	1,2	0,2
Social needs of the population	3	3	4	4	4	5	4	0,6
Religious beliefs	1	1	1	1	1	1	1	0,2
<b>Technology</b>								
Innovative technologies	2	4	3	3	3	5	3,6	0,4
Patent legislation	1	2	2	3	3	3	2,6	0,2
Research and development costs	2	4	3	3	4	3	3,4	0,4
Potential technological changes	3	5	5	4	5	4	4,6	0,6
Competitors' advantages	2	3	4	4	3	4	3,6	0,4

Source: created by the authors

After calculating the evaluation, the data was translated into matrix form. Factors are arranged in descending order based on the calculations performed. The higher the calculated indicator, the more attention it requires (Table 3).

Table 3. Matrix of Results

<b>Politics</b>		<b>Economics</b>	
Factor	Value	Factor	Value
Political situation in the country	0,6	Discount rate and exchange rate change	0,6
International relations	0,6	Dynamics of population incomes and unemployment	0,6
Tax policy	0,6	Dynamics of adjacent markets	0,6
Legal environment	0,4	Current level of competition	0,6
Trends in industry regulation	0,4	Inflation rate and GDP dynamics	0,4
<b>Socio-culture</b>		<b>Technology</b>	
Factor	Value	Factor	Value
Standard of living and population habits	0,6	Potential technological changes	0,6
Social needs of the population	0,6	Innovative technologies	0,4
Demographic criteria	0,4	Research and development costs	0,4
Level of education and workforce productivity	0,2	Competitors' advantages	0,4
Religious beliefs	0,2	Patent legislation	0,2

Source: created by the authors

The most important factors (those with the greatest significance) have been studied in more detail (Table 4), followed by the development of measures to mitigate their negative impact.

Table 4. Analysis of potential issues regarding key factors and options for their resolution.

A significant factor	Likely changes and impact on the company	Solution options
<b>Politics</b>		
1	2	3
Political situation in the country	Investors and consumers may refrain from making decisions due to uncertainty. This can lead to a decrease in investments and a decline in consumer demand.	Companies may consider the potential consequences of political changes and develop strategies to mitigate risks. Increasing the diversification of product portfolios and markets can help companies reduce the impact of adverse changes in the political environment. - Companies may actively engage with the government and other stakeholders to influence political decisions and regulations. - Companies may seek new ways to adapt to the changing political environment by implementing new technologies, strategic changes in production, and marketing.
International relations	Imposing sanctions or tariff changes may restrict market access or increase export costs. Deteriorating relations with other countries or rising geopolitical tensions may pose risks of production and supply constraints. This could alter the competitive environment and compel companies to reconsider their export and import strategies. It may also affect market and investor confidence.	Companies may explore opportunities to develop new markets and reduce dependency on specific suppliers. Companies may develop strategies to manage currency risk, political risks, and other factors affecting international operations. Companies may seek new ways to adapt to changing conditions in international markets, including the adoption of new technologies and innovative solutions.
Tax policy	The government may introduce changes to tax policies or regulations, affecting the costs and operational conditions of companies. Simplification of tax procedures and reduction of bureaucracy can improve the business environment and attract more investments. Tax incentives may stimulate the development of new technologies or reduce environmental impact.	Companies may seek ways to optimize their tax planning considering new rules and tax rates. Companies may explore opportunities to expand revenues or change strategies to offset any losses associated with new tax changes. Companies may engage with the government and lobby for their interests in the tax policy-making process to protect their interests and ensure favorable business conditions.
<b>Economics</b>		
Key interest rate and exchange rate changes	Increase in the key interest rate and currency exchange rate instability may lead to higher borrowing costs and changes in the cost of imported goods.	Companies may review their financial strategy, seek alternative sources of funding, and consider using local suppliers.
Dynamics of population incomes and unemployment	Rising unemployment and decreasing population income may result in reduced consumer demand and declining sales of goods and services.	Companies may reduce prices, implement discount programs, or review their target market segments.
Dynamics of adjacent markets	Instability in adjacent markets may lead to changes in demand for companies' products and services.	Companies may explore opportunities to develop new markets or change their production strategy.
Current level of competition	Changes in the competitive environment may lead to increased or decreased competition in the industry.	Companies may adjust their pricing policy, improve products and services, or seek new collaboration opportunities.
<b>Socio-culture</b>		
Standard of living and population habits	Production and sales of goods and raw materials may decline.	Companies may review their strategy and product range, focusing on more affordable and necessary market segments. Additionally, promotions and discounts may be introduced to attract customers.

1	2	3
Social needs of the population	Possible change in social needs due to increased demand for security, medical assistance, social support, etc.	Companies may implement corporate social responsibility programs aimed at improving the lives and living conditions of the local population. Special products or services that meet specific social needs may also be created.
<b>Technology</b>		
Potential technological changes	Warfare can stimulate technological innovations in defense, medicine, communications, and other fields requiring new solutions to address challenges associated with military conflict. Changes in the competitive environment, the possibility of new market players emerging, or the need for rapid adaptation to new technologies.	Active monitoring of innovations, attracting talented experts in research and development, or quickly adapting proprietary technologies to meet new market demands.

Source: created by the authors

Therefore, PEST analysis provides a comprehensive assessment of the development strategy for an individual company or industry as a whole. Based on the analysis, key factors can be identified that are most relevant to the company/industry and require further monitoring.

## CONCLUSIONS

For effective management of natural resources in the extractive industry, it is important to apply a comprehensive approach. The use of mathematical models and analytical tools allows for forecasting and optimizing the processes of extraction and processing of natural resources, thereby increasing efficiency and reducing costs. Moreover, increasing attention to environmental issues requires the extractive industry to implement environmentally friendly technologies and management strategies aimed at preserving the natural environment. The development and implementation of natural resource management strategies are essential components of successful enterprise development in the extractive industry, contributing to sustainable development and competitiveness in the market. Rapid changes in the technological, economic, and environmental environment require constant improvement of management methods and adaptation to new conditions, enabling enterprises to remain competitive in the long term.

Analyzing criteria and indicators using PEST analysis will identify potential opportunities for improving the efficiency of extraction enterprises from political, economic, technological, and social perspectives. Additionally, this analysis will contribute to reducing the damage caused to nature by mineral deposit development and improving the environmental conditions in extraction areas.

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