

THE CONCEPT OF ACCOUNTING AND REPORTING ON THE EXPLORATION AND ASSESSMENT OF MINERAL RESERVES IN THE CONDITIONS OF THE FORMATION OF A CIRCULAR ECONOMY

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Abstract

Systematized information on exploration and evaluation of mineral reserves and their extraction, which is published in the reports of leading mining enterprises of Ukraine. Stakeholder groups have been identified that have certain information needs regarding the activities of mineral resource exploration and evaluation enterprises. The conducted studies proved that information is not sufficiently fully disclosed in the reporting of entities that conduct exploration and evaluation of mineral reserves and their extraction. Therefore, the prospect of future scientific research on this subject is the development of the format of the accounting report on the results of exploration and evaluation of mineral reserves in accordance with the information needs of a wide range of interested parties. It was determined that the inconsistency and ambiguity of the formulations of Ukrainian and international standards, primarily in the context of the identification and accounting methods of exploration and evaluation assets, proved the expediency of streamlining the classification of assets in order to separate exploration and evaluation assets from other types of assets used in exploration and evaluation of reserves of mineral resources. The proposed author's concept of the accounting and reporting representation of exploration and evaluation of mineral reserves, taking into account the information needs of various groups of stakeholders, which will contribute to the efficiency of the activities of enterprises in the exploration and evaluation of mineral reserves.

Keywords: *Natural resources, information, environment, minerals, Ukrainian accounting standards (UAS), stakeholders, International Accounting Standards (IAS), circular economy.*

JEL Codes: *G18, H00, P43, P47, F10, F36.*

Introduction

The accelerated globalization process, the development of the scientific and technological revolution, a significant increase in the number of the population, the volume of production and, accordingly, waste, create the need to study the problem of the relationship between society and nature, including natural resources. The problems of hunger, pollution of rivers and seas, suffocating harmful air in the world's industrial centers, deforestation, the disappearance of hundreds of species of plants and animals, the irrational use of natural resources, the threat of

climatic anomalies, erosion and complete depletion of soils have become extremely urgent, both in Ukraine and in the world in connection with this, the need to introduce new solutions in the field of circular economy, which would help in solving these problems, is increasing, the need to introduce and adapt circular business models to the activities of domestic enterprises is becoming more urgent. So, for example, in many countries they began to develop ecological plans for the introduction of new effective ecological technologies both in everyday life and in

production activities. With their help, you can ensure the rational use of available resources.

The limitation of natural resources and the negative impact on the environment of the processes and consequences of their extraction are increasingly actualizing society's information requests, both regarding the volumes of extraction and explored reserves of these resources, and regarding the efficiency of their use. This problem is made even more acute by the declaration by the Constitution of Ukraine that subsoil and natural resources belong to the property rights of the Ukrainian people.

Public interest in this issue points to the importance of tools for objective information management of extraction and consumption of natural resources at both the micro and macro levels. The main source of relevant information, regardless of the level of management, is the accounting system of business entities engaged in the extraction, processing and consumption of natural resources. However, the activity of mining enterprises is quite specific, it has number of features that are not characteristic of other types of economic activity, which, together with a high level of public interest, forms additional criteria for public disclosure of information, and therefore the methodology of its accounting.

The proposed concept of accounting and reporting presentation of exploration and assessment of mineral reserves, taking into account the information needs of stakeholders, will allow to increase the efficiency of enterprises.

Literature review

The problems of accounting for the processes of exploration and extraction of natural resources and the display of information about them in accounting were studied by such Ukrainian and foreign scientists as Zatoka T.V., Chizhevska L.V. (2021), Krupka Y.D., Porokhnavevts Y.A. (2019), Savchuk T.V. (2009), Chuchuk Yu.V (2017), Pegg S. (2003) et al. The subject of their research mostly covered the division of mineral exploration and extraction activities into stages, recognition and evaluation of individual accounting objects. Considerable attention of scientists is paid to the methods of

capitalization of exploration costs and estimation of mineral reserves, as well as to the problems of accounting for a specific type of accounting objects - exploration and evaluation assets, which arise in the implementation of only this type of activity. The scientists based their research on the relevant accounting standards - IFRS 6 "Exploration and evaluation of mineral reserves" and National regulation (standard) of accounting 33 (UAS 33) "Expenses for the exploration of mineral reserves".

In all the studied scientific works, the complexity of the researched topic is emphasized, which is evidenced in particular by the results of the development of the corresponding international standard of financial reporting. According to T.V. Savchuk (2009), when developing the corresponding IFRS, the publisher (first the Committee on IFRS, and later the Council on IFRS) assumed that "a comprehensive standard will be adopted, which will reveal the accounting procedure for all the main areas of activity of enterprises in this industry. But the goal was not achieved, so work on it continues. Instead, a standard was adopted that considers only a part of the operations, and therefore is, as it were, an intermediate stage before the adoption of a full standard that considers a small part of the operations of mining enterprises". This argument, as well as the accounting problems described below, which arise already at the stage of identification of accounting objects in the process of exploration and evaluation of mineral reserves, testify to the relevance of scientific research on the specified problem.

The problems of the methodology and accounting methods of mining activities are primarily related to its technological complexity, long duration, high levels of capital intensity and uncertainty and risks regarding obtaining economic benefits. In fact, this type of activity is project-based and includes elements of both operational and investment activities. That's why scientists studying this problem have divided the design activity of mineral extraction into successive elements, homogeneous in terms of technological and economic essence. In particular, Krupka Y.D. and Porokhnavevts Ya.A. (2019) distinguish six stages of the process of natural

resource extraction and processing of minerals, which are combined into three stages (Table 1).

Table 1. Stages and stages of the process of natural resource extraction and processing of minerals

Stage No.	The name of the stage	Stage No.	The name of the stage
I	Preparation for the implementation of the mineral extraction and processing project (acquisition (lease) of a land plot, its survey and obtaining a permit for exploration of mineral reserves)	1	Registration of land plots and the necessary rights for their use, conducting search and reconnaissance works and preparation of places and means for extracting minerals
II	Search and intelligence works		
III	Preparation for mining		
IV	Extraction of minerals	2	Direct extraction and processing of minerals
V	Processing of mined reserves of minerals		
VI	Completion of the mining project (restoration of the soil cover, provision of social and environmental safety in places of resource extraction, etc.)	3	Organization of works after completion of extraction and closure of projects with liquidation or conservation of deposits, mines, wells, land reclamation

**Source: compiled by the authors.*

In fact, only the second stage (IV and V stages) fully meets the criteria of operational activity and, according to Krupka Ya.D. and Y.A. Porohnavets (2019), only at this stage “there is a possibility of observing the accounting principle of matching income and expenses”. At the second stage, there are practically no specific problems with the organization or methodology of accounting of economic processes and operations.

In order to cover the costs associated with the completion of mineral extraction projects (stage 3, stage VI), scientists quite logically suggest forming special reserves (provisions) at the previous stage of projects. That is, for the accounting of economic transactions at this stage, there are no significant problems of a methodological or methodical nature. On the other hand, at the first stage of the natural resource extraction process, a lot of problematic issues arise from accounting methods and methodology, especially in relation to the second stage of this process - prospecting and exploration work. It is at this stage that the subjects of extractive activity bear significant amounts of expenses, despite the uncertainty regarding the possible receipt of economic benefits in the future to compensate them. The relevant standards of accounting and financial

reporting at the international and national levels are aimed at solving the methodological and methodical problems of accounting at the stage of prospecting work - International Financial Reporting Standard 6 (IFRS 6) “Exploration and evaluation of mineral reserves” and National regulation (standard) of accounting 33 “Costs for exploration of reserves” mineral resources.

These standards provide for the capitalization of costs for exploration and evaluation of mineral reserves, as a result of which they either recognize a special type of intangible assets - assets from the exploration of mineral reserves (in IFRS 6 - exploration and evaluation assets) or write off these costs as expenses of the period. However, the methodological approaches to the accounting of these costs and assets provided by the standards have certain differences (Table 2), which grouped by authors based.

Despite the fact that both standards are devoted to a rather narrow area of accounting and the technological process of extraction and consumption of natural resources, their provisions are still not unambiguous. Considerable confusion exists primarily in the definition and classification of exploration and evaluation assets (mineral resource exploration assets). According to IFRS 6, exploration and evaluation assets are

exploration and evaluation expenditures that are recognized as assets in accordance with the entity's accounting policy. At the same time (2004), Clause 16 of this standard indicates that "some exploration and evaluation assets are treated as intangible assets (for example, drilling rights), while others are tangible assets (for example, vehicles and drilling rigs)" (2018). On the other hand, clauses 1 and 2 of Chapter III UAS 33 provide that non-current material assets purchased (received) by the enterprise (in particular, special vehicles, drilling equipment) for the performance of work on the exploration of mineral reserves are recognized as assets in accordance with the UAS 7 "Fixed assets", and "intangible assets (in particular, licenses and other special permits)" for the same purposes - according to UAS 8 "Intangible assets". The question naturally arises: how to recognize non-current assets that are used in prospecting and exploration work - as fixed assets and intangible assets or as exploration and evaluation assets?

Objectives

The purpose of the article is to study and improve the conceptual provisions of the presentation in the accounting and reporting system of information on exploration and evaluation of mineral reserves and its results, taking into account the interests of a wide range of interested parties.

Methods

The research was conducted using general scientific and special methods of

scientific knowledge: comparison, analysis, generalization, analogy, classification. Scientific searches are based on the results of research by Ukrainian and foreign scientists in the subject area of knowledge of accounting and reporting of the activities of enterprises engaged in exploration, evaluation and extraction of minerals, as well as the theory of stakeholders and the concept of physical economy.

Results

The mineral industry includes the extraction, processing and sale of minerals and metals. The main directions include the production of oil, natural gas, coal, iron, gold, copper and other metals. Recently, there has been an integration of new technologies, such as artificial intelligence and nanotechnology, to increase the efficiency of mining and processing. Increased attention to environmental standards and sustainable development due to the impact of mining activities on the environment. Let's consider the state of development of the mineral industry in the world. We can summarize information about minerals in the world for the period from 2015 to 2024 according to several main parameters: volume of production, volume of reserves, market prices, as well as geographical distribution. Below are the key aspects with data for some of the most important minerals. The volume of oil production in the world for the period from 2015-2024 is shown in Figure 1.

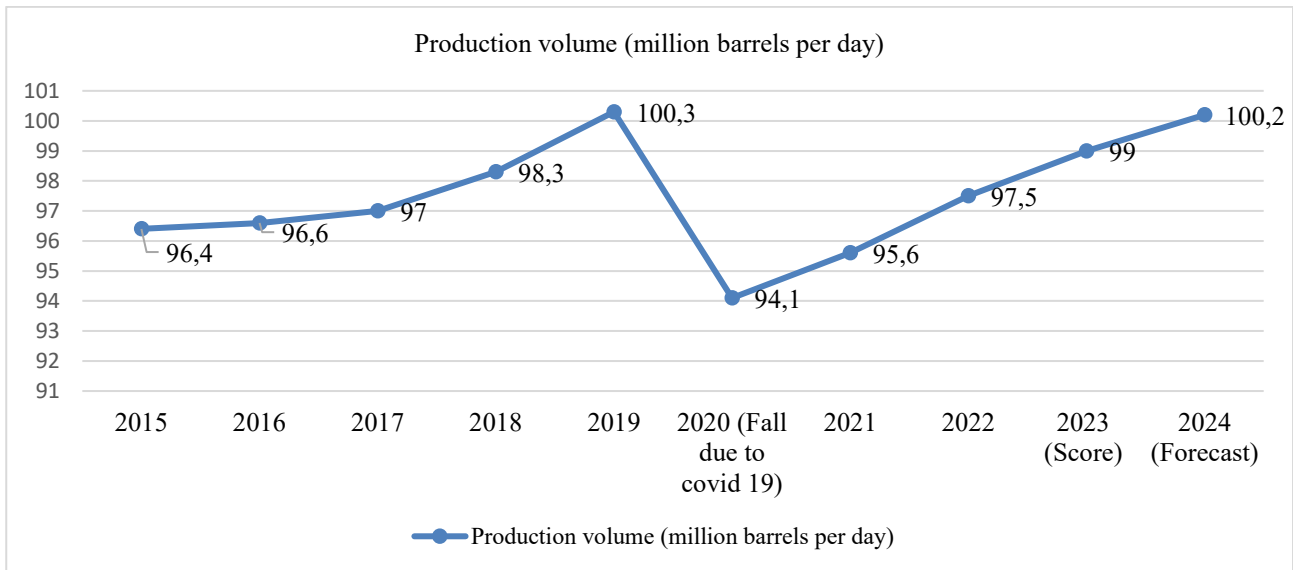


Figure 1. The volume of oil production in the world for the period from 2015 to 2024

**Source: developed by the authors.*

Oil prices have experienced significant fluctuations since 2015 due to various global factors, including economic trends, political decisions and unforeseen events.

The beginning of the period was characterized by a sharp drop in oil prices. In January 2015, the price of Brent oil fell to around \$50 per barrel, which was a significant drop compared to previous years. The main reasons included an oversupply in the global market and OPEC's decision not to cut production. At the end of 2016, OPEC countries agreed to cut production, which contributed to the start of price growth. Prices continued to rise, reaching a peak in October 2018 at the level of \$86 per barrel. However, prices fell again at the end of the year due to concerns about oversupply and slowing global economic growth.

The COVID-19 pandemic has led to an unprecedented drop in oil demand. In April, WTI oil prices even turned negative (-\$37 per barrel) due to limited storage capacity. Brent fluctuated between \$20-40 per barrel for most of the year.

In 2021, the recovery of the world economy contributed to the growth of oil prices. By the end of the year, Brent rose to over \$70 per barrel. It began with a significant increase in prices due to geopolitical tensions and conflicts, reaching the level of more than \$100 per barrel. The war in Ukraine and sanctions against Russia put additional pressure on prices. Despite stabilizing in the second half of 2022, prices remain high due to supply constraints and ongoing economic uncertainties. Prices range from \$80-100 per barrel. The dynamics of oil price changes are shown in Figure 2.

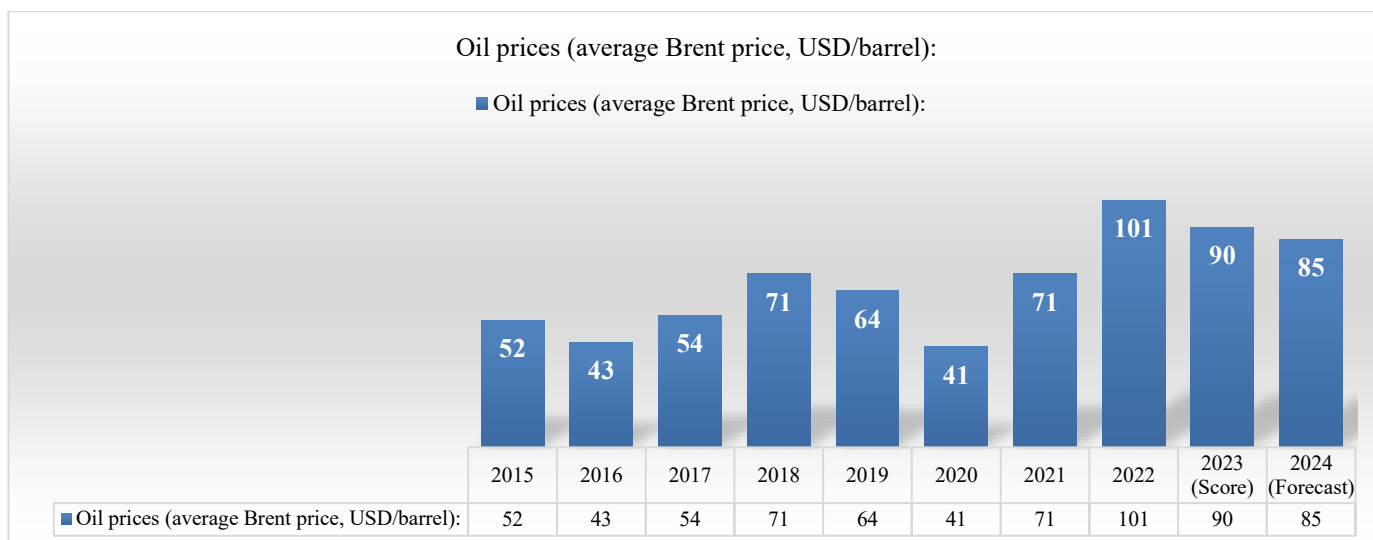


Figure 2. Dynamics of oil price changes in the world from 2015 to 2024 (average price, USD/barrel)

**Source: developed by the authors.*

Thanks to the technology of hydraulic fracturing (fracking), the production of natural gas in the United States has increased, making the country one of the largest producers in the world. Russia is a producer of natural gas, in particular supplying gas to Europe through gas pipelines. And Qatar is the largest exporter of liquefied natural gas (LNG) in the world, allowing it to supply gas to distant markets.

During the period from 2015 to 2024, coal production underwent various changes, a consequence of the transition to more ecological sources of energy (solar, wind energy, etc.) and a decrease in the demand for coal. In addition, coal mining is accompanied by a significant negative impact on the environment, which led to a decrease in mining in many regions, which is associated with the popularization of the circular economy.

China is the largest importer of iron ore as the country continues to develop its infrastructure and steel industry.

However, Australia and Brazil remain the leading producers of iron ore, thanks to large deposits and developed infrastructure, and iron ore prices fluctuate depending on global supply and demand, political factors and changes in production. Many countries invest in renewable energy sources, which affects the production of traditional energy carriers. Strengthening environmental standards and international agreements, such as the Paris Agreement, help reduce emissions and transition to cleaner technologies.

These trends show how global economics and politics affect the extraction of key natural resources. More information on the production of these minerals in the period from 2015 to 2024 is displayed in Table 2.

Table 2. The volume of mineral extraction in the world for the period from 2015 to 2024

Minerals/ Indicators Year	Natural Gas		Coal		Iron ore	
	Production volume (billion cubic meters)	Natural gas prices (average price in Europe, USD/1000 cubic meters)	Production volume (million tonnes)	Coal prices (USD/tonne)	Production volume (million tonnes)	Iron ore prices (USD/tonne)
1	2	3	4	5	6	7
2015	3,600	260	7,864	60	2,280	56
2016	3,653	200	7,463	67	2,330	58
2017	3,768	225	7,728	84	2,420	71
2018	3,867	280	7,811	107	2,500	69
2019	3,988	220	7,906	77	2,450	93
2020	3,760	150	7,200	59	2,400	108
2021	3,850	240	7,800	177	2,460	160
2022	4,000	900	8,000	400	2,500	120
2023 Score	4,100	500	7,900	250	2,520	110
2024 Forecast	4,200	400	7,800	220	2,540	100

**Source: developed by the authors.*

This data shows the general trends in the production and prices of key minerals in recent years. Figures for 2023 and 2024 are estimates and projections based on current trends and expert expectations.

Gold production from 2015 to 2024 was marked by various trends and factors that affected the global production of this precious metal (Figure 3). Between 2015 and 2019, gold production steadily increased, reaching a peak in 2019. This was due to high demand for gold from investors and the jewelry industry. After 2019, there was a slight decline in gold production, partly due to the impact of the COVID-19 pandemic, which caused work to stop at some mines and reduced investment in new projects. From 2021, gold production began to recover as economic activity resumed and gold prices remained high.

China remains the world's largest gold producer, although its output has declined slightly since 2015 due to a decline in high-grade resources and environmental constraints. Australia has increased gold production due to

large reserves and technological improvements in the mining industry. The US remains a significant producer of gold, with the main deposits in the states of Nevada and Alaska. Canada has shown steady growth in gold production thanks to new discoveries and development of deposits. High gold prices contributed to the growth of investments in the mining industry and the opening of new mines. Growing environmental demands are affecting gold mining as companies must adhere to stricter regulations. Political stability and a favorable investment climate in key producing countries have a positive effect on gold production. Demand for gold is expected to remain stable, particularly from investors and the jewelry industry. New technologies and mining methods, including automation and environmentally friendly technologies, can increase the efficiency of gold mining. Potential geopolitical tensions could affect gold production and supply. Overall, gold production from 2015 to 2024 is characterized by gradual growth, temporary downturns due to global events such as the pandemic, and stable demand for this precious metal.

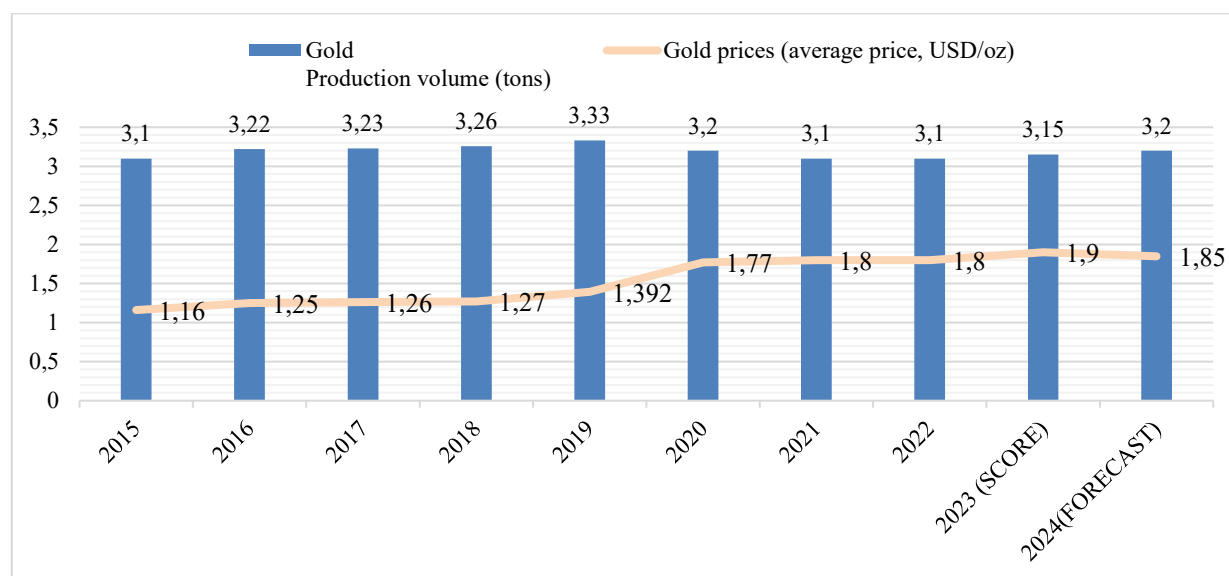


Figure 3. Dynamics of gold production and average value from 2015 to 2024

**Source: developed by the authors.*

Overall, gold production from 2015 to 2024 is characterized by gradual growth, temporary downturns due to global events such as the pandemic, and stable demand for this precious metal.

Ukraine has significant reserves of titanium ores, which make up about 1,12% of world reserves. According to estimates by the US Geological Survey, these reserves amount to 8,4 million tons, of which 5,9 million tons are ilmenite and 2,5 million tons are rutile. At the same time, according to the United Mining and Chemical Company (UMC), Ukraine has about 20% of the world's titanium ore reserves, and the volume of balance reserves for 2022 is estimated at 40,2 million cubic meters (MMC). The main producers of titanium ores in Ukraine are the United Mining and Chemical Company, which extracts ore at the Vilnohirskiy and Irshansky combines, as well as the companies “Velta”, “Valky-Ilmenit” and “Mizhrichensky mining and processing plant”. The military actions significantly affected the industry, in particular, reduced production volumes and led to the restructuring of logistics chains (MGK).

Ukraine has the potential for significant investment in the titanium industry, as strategic titanium reserves could attract investors, especially amid declining supplies from Russia. According to Oleh Ustenko, the economic

adviser to the President of Ukraine, the development of these resources can increase global stability and provide additional protection from Russia's military actions against Ukraine have significantly affected the titanium industry, in particular the mining of ores containing titanium and the production of titanium products. In 2022, the volume of exports of ores containing titanium decreased by more than 40%. In addition, sanctions and the return of titanium assets to state ownership may cause a redistribution of the market. In 2022, the export of ores containing titanium decreased by 41,8% to 322,1 thousand tons. The turnover of exporters decreased by 19,6% to \$130,1 million. We will remind that in 2021 Ukraine increased titanium exports by 3% to 553,000 tons, which brought in \$161.9 million (+17%). According to the US Geological Survey, as of 2021, Ukrainian ilmenite accounted for about 5% of world production of ores used for titanium production. The main export destinations were the Czech Republic (47,9% of deliveries in monetary terms), the USA (11,9%) and Romania (9,7%). The regional structure of titanium exports from Ukraine has changed significantly compared to 2021, when the main buyers were Mexico (21,2%), China (18,2%) and the Czech Republic (14,1%). The main producers of titanium in Ukraine during the war:

– Zaporizhzhya Titanium-Magnesium Plant (ZTMK) – manufacturer of spongy titanium.

– Sumikhimprom – a producer of titanium dioxide.

– Velta suspended the construction of a factory for the production of titanium products in the city of Novomoskovsk, Dnipropetrovsk region, and focused on moving production facilities to a safer location.

It should be noted that the startup Beholder, which is engaged in the development of neural networks for the search for minerals, received an investment in the amount of \$940,000 from the European fund InnoEnergy, which specializes in the energy industry. Funds Rockstart and STRT Ventures also participated in this financing round. This information was confirmed by the company's co-founder Daniil Lubkin in a message to Forbes. Beholder uses neural networks to improve the process of mineral discovery, which could significantly change the way we explore and use natural resources. The received investment will help the startup expand its activities and implement the latest technologies in the field of mineral extraction.

Ukrainian space startup Beholder won the main prize of €600,000 at the Latitude59 international conference. Beholder, a Ukrainian SpaceTech startup that uses neural networks for mineral resource exploration and is working on a specialized hub for geologists, won the final pitching competition at the Latitude59 startup conference in Tallinn.

Founded in 2021 by Andrii Sevrjukiv (CEO/CTO), Sergey Lubkin (CMO/CFO) and Daniil Lubkin (COO), Beholder is a neural network complex that helps in mineral exploration. In addition, the team is developing a specialized portal for geologists called Beholder Hub.

In March 2023, Beholder entered the top 50 at the 4YFN Awards. In autumn 2023, the startup became one of the semi-finalists of IT Arena 2023. Beholder is already registered in Estonia. In 2021, the startup received its first investment of €150,000, and since then the

founding team has also made additional investments in the project. In March 2024, Beholder raised \$940,000 in investment from European fund InnoEnergy, focusing on energy.

In addition, neural networks and other artificial intelligence techniques are becoming increasingly popular in the field of mineral exploration. Here are some of the famous and innovative neural networks and technologies used for this purpose:

1. Minerva Intelligence uses artificial intelligence to analyze geological data and create models that help in the search for new mineral deposits. Their tools can automatically find similar geological structures by comparing them to known deposits. Minerva Intelligence Based in Vancouver, Minerva Intelligence offers AI-driven solutions for mineral exploration, including their TARGET software. TARGET helps in generating exploration targets by identifying geological similarities to known mineral deposits using cognitive AI. Minerva's approach involves compiling and standardizing large geological datasets and applying knowledge engineering to make predictions that are explainable and actionable. Their technology has been successfully implemented in projects in Brazil and the Yukon (GoGeomatics).

GoldSpot Discoveries uses machine learning to analyze geological and geophysical data to identify promising areas for mineral exploration. The company specializes in forecasting the location of gold deposits. (Canadian Mining Journal)

Earth AI offers a mineral exploration platform that uses artificial intelligence to analyze geological data and maps. Their technology helps discover new deposits with high precision and efficiency.

Corescan uses neural networks to analyze cores obtained during drilling. Their systems can automatically identify different types of rocks and minerals, helping geologists make more accurate predictions.

Geolumina specializes in the use of artificial intelligence to analyze aerial photographs and satellite images for the purpose of prospecting for minerals. Their algorithms can

determine signs of mineral resources based on spectral analysis.

DataCloud uses machine learning and big data to optimize drilling and mining processes. Their solutions help to improve the accuracy and efficiency of work, reducing costs and risks.

DeepSeeker develops technologies that use neural networks to analyze geophysical data such as seismic and gravity measurements. Their tools help identify underground structures where mineral deposits may be located.

These companies and their technologies demonstrate how neural networks can be effectively applied to mineral prospecting and exploration, giving geologists new tools for data analysis and decision making.

Analysis of the public financial statements of Ukrainian mining companies shows that exploration and evaluation assets can be presented in the balance sheet as part of fixed assets (JSC “Ukrgezvydobuvannya” (2020), intangible assets (PJSC “Poltava GZK” (2020)) or as a separate

item in assets of the balance sheet (PJSC “Ukrnafta” (2020), JSC “Ukrgezvydobuvannya” (2020). This argument also indicates that the indicated problem has not only theoretical but also practical significance. If you organize the accounting policy of the enterprise, focusing exclusively on Ukrainian accounting standards, then the problem of recognition and classification of assets from the exploration of mineral reserves disappears, because Ukrainian Accounting standard 33 clearly defines: the main means used to perform work on the exploration of mineral reserves minerals are recognized as fixed assets, intangible assets for the same purposes are intangible assets, and expenses for the exploration of mineral reserves are assets from the exploration of mineral reserves, with their subsequent transfer to the composition of intangible assets after confirmation of the technical feasibility or economic feasibility of further extraction of these minerals.

Table 3. Differences in the elements of the methods of IFRS 6 and Ukrainian Accounting standard 33 Regarding the Accounting of Assets Recognized as a result of prospecting

Elements of accounting methodology	International Financial Reporting Standard 6	National regulation (standard) of accounting 33
The name of the recognized asset	Exploration and evaluation assets	Mineral resources exploration assets
The type of asset recognized	A tangible or intangible asset	Intangible asset
Types of costs that are included in the cost of a recognized asset	<ul style="list-style-type: none"> – acquisition of exploration rights; – topographic, geological, geochemical and geophysical research; – exploratory drilling; – ditch testing; – taking samples and samples; – activities in connection with the assessment of technical feasibility and commercial feasibility of mineral extraction, etc. 	<ul style="list-style-type: none"> – expenses related to obtaining (acquisition) the right to explore mineral reserves; – expenses for performing topographical, design, geological exploration works, geochemical and geodetic studies; – costs for the construction of exploration, anticipatory production and injection wells and mine exploration; – costs for taking samples and samples; – expenses related to state examination and determination of the volume of mineral reserves.
Valuation model for asset recognition	At cost	At cost
Valuation model after	Cost model and revaluation model	The revaluation model

asset recognition		
Information to be disclosed in reporting	<ul style="list-style-type: none"> – an approach to the accounting policy for exploration and evaluation costs, including the recognition of exploration and evaluation assets; – total amounts of assets, liabilities, income and expenses, and cash flows from operating and investing activities that arise as a result of exploration and evaluation of mineral reserves. 	<ul style="list-style-type: none"> – the amount of assets, liabilities, income and expenses from activities related to the exploration of mineral reserves, indicating the balance at the beginning and end of the reporting year, receipts and disposals for the reporting year; – cash flow from activities related to the exploration of mineral reserves for the reporting year.

**Source: compiled by the authors.*

In contrast, IFRS 6 is less clear in establishing the type of exploration and evaluation assets. Indeed, if we compare the duration of the period of useful use of vehicles and the period of exploration and evaluation of a certain field, it seems illogical to attribute the vehicle to exploration and evaluation assets, since these vehicles can also be used to meet other production and technical needs of the enterprise, in particular, during exploration and exploration works at another deposit. In this context, Savchuk T.V. proposes to classify assets of exploration and estimation of mineral reserves into three groups: 1) fixed assets; 2) intangible assets; 3) expenses for exploration and evaluation of reserves (2009). Such a classification, in our opinion, can be acceptable only for grouping assets by purpose (classification of fixed assets and intangible assets as part of mineral exploration and evaluation assets based on the fact of their use in the relevant production and technological processes), in particular for further calculation of enterprise costs. However,

building the architecture of analytical accounts of non-current assets based on this classification is unfounded.

The above arguments suggest that in order to avoid confusion and properly organize the accounting of mineral exploration and reserve estimation activities, it is advisable to introduce a broader concept that unites different types of assets involved in this activity, for example, assets of exploration and reserve estimation activities mineral resources. These assets include fixed assets (in particular, vehicles) and intangible assets (for example, special permits for the use of subsoil, etc.) that participate in prospecting and exploration work, as well as capitalized exploration and evaluation expenditures (Table 4). The authors based on (2009) propose this classification. The proposed classification makes possible to meaningfully distinguish this special type of exploration and evaluation assets for the purpose of formulating normative regulation and methods of its accounting.

Table 4. Classification of assets of exploration and evaluation of mineral reserves

Types of assets for the exploration and evaluation of mineral reserves	Normative documents that regulate the accounting of the relevant type of assets	Accounts on which records of the relevant types of assets are kept	Examples of types of assets for the exploration and evaluation of mineral reserves
Fixed assets	UAS 7, IAS (International Accounting Standard) 16	10	Vehicles
Intangible assets	UAS 8, IAS (International Accounting Standard) 38	12	Special permit for subsoil use
Exploration and evaluation assets	UAS 33, IFRS 6	15	Capitalized exploration and evaluation expenditures

**Source: compiled by the authors.*

The majority of scientists studied the problems of accounting of mining enterprises from a microeconomic point of view. This accounting paradigm, which is ultimately the basis of the relevant accounting and financial reporting standards (IFRS 6 “Exploration and evaluation of mineral reserves” and National regulation (standard) of accounting 33 “Expenses for the exploration of mineral reserves”), is oriented towards the information provision of achieving goals of the mining enterprise in the coordinates “costs - risks - economic benefits”. In fact, the methodology of accounting and financial reporting of this paradigm is aimed at establishing the status of costs incurred for the implementation of the project for the exploration of mineral reserves, because the high level of uncertainty regarding the receipt of economic benefits from its results provokes a dilemma - to capitalize these costs or to write them off to the financial result in the period of occurrence. At the same time, the need to disclose information in accordance with public interests in this area of the economy is not taken into account by either the paradigm or accounting and reporting standards. According to Chizhevska L.V. and Zatoky T.V. (2021) foreign scientists emphasize the need to change the existing accounting paradigm, namely “the transition from the accounting system of “income from a surprise “to the accounting of common heritage, the application of the principles of sustainable development”.

Krupka Y.D. and Y.A. Porohnavets (2019), researching the problems of accounting and control in the extractive industries, for the

economic mechanism of nature use, allocate tasks not only of an economic, but also of a social and ecological direction, emphasizing that “the economic mechanism of the use of natural resources should be based on the principles of taking into account the possibility of natural complexes withstand anthropogenic loads and ensure the normal functioning of the biosphere and local systems”. At the same time, based on world experience, the authors claim that “economic methods provide more favorable conditions for rational nature management than strict administrative measures. The multifunctional purpose of the economic mechanism for regulating the use of natural resources is manifested through the current system of taxes and payments for the use of natural resources”.

Public interest in the processes and results of exploration and evaluation of mineral reserves can be outlined through the prism of information requests of the main interested parties (stakeholders, groups of economic influence) of the entities that conduct this activity. The system of information support on exploration and evaluation of mineral reserves should be aimed at meeting these information requests.

Summarizing the approaches to the classification of groups of economic influence on the enterprise, proposed by in 2022 and 2003, it is possible to single out the following interested parties of the enterprise in information based on the results of exploration and assessment of mineral reserves, as well as their information needs (Table 5).

Table 5. Enterprise stakeholders and their information needs regarding exploration and evaluation of mineral reserves

Stakeholders of an enterprise engaged in the exploration and evaluation of mineral reserves	The nature of the interests of the interested parties of the enterprise, which conducts the activity of exploration and evaluation of mineral reserves	Information needs of interested parties of the enterprise, which conducts activities of exploration and evaluation of mineral reserves
Management of the enterprise	Economic expediency of mineral extraction activities	Volumes of explored mineral reserves, planned volume of capital investments for their extraction, forecast specific costs for mining, forecasted volume of mining (total and in time)

Current and potential investors (owners, shareholders)	Profitability of investments in the enterprise's capital, its growth potential	Indicators of profitability and value of the enterprise (market capitalization), factors of its growth (among which are the volumes of explored mineral reserves and the economic feasibility of their extraction)
Workers	The possibility of continuous activity, further provision of a place of work and an adequate amount of earnings (its growth)	Volumes of explored reserves of minerals
Creditors	Solvency and creditworthiness of the enterprise	Absolute and relative indicators of liquidity of assets (balance), solvency and creditworthiness
Bodies of state power and regulation	The development potential of the sphere of economic activity related to the extraction and processing of a certain type of natural resources	Volumes of explored mineral reserves, indicators of the economic feasibility of their extraction, the impact of extraction on the environment
Bodies of the state tax service	The potential of tax revenues from the use of subsoil (fees for extracted natural resources)	Volumes of explored mineral reserves, forecast volume of production in time
Local governments	The potential for growth of the revenue part of the local budget at the expense of tax revenues from the use of subsoil (payments for extracted natural resources); growth in the number of jobs in the territorial unit; development of entrepreneurship, in particular related to mineral extraction (mining infrastructure, processing of mined minerals); impact of mineral extraction activities on the comprehensive development of the territory	Volumes of explored mineral reserves, indicators of the economic feasibility of their extraction, the impact of extraction on the environment
Society (in particular, citizens living in the territory directly adjacent to land plots (or located on them) with relevant mineral reserves)	Absence of negative socio-ecological impact of mineral extraction activities on the life of citizens; the possibility of restoration of territories where mineral extraction is pl	Specific territories that may be involved in the extraction of minerals; specific manifestations of the economic, social and environmental impact of mineral extraction activities on the daily life of citizens living in the territory where the relevant reserves are located

**Source: compiled by the authors.*

The vast majority of those indicated in the Table 4 stakeholders of enterprises engaged in exploration and evaluation of mineral reserves have or may have access to sources or channels of information to meet their information needs. It is obvious that in this context there is a certain asymmetry in information provision - only the managers of these enterprises have full access to information sources, and therefore can fully satisfy their information needs. Most of the information needs of investors, owners, shareholders, and creditors can be satisfied by the public financial reporting of enterprises (the

system of international financial reporting standards is aimed at meeting the information needs of these groups of economic influence). State authorities can ensure the satisfaction of their information needs by establishing the obligation to submit certain information with the help of instruments of legislative and imperative influence.

Among the interested parties, society is singled out separately. On the one hand, the representative of society's interests is the government, i.e. bodies of state power and regulation, the tax service, and local self-

government. However, on the other hand, it is worth agreeing with the opinion of Oleksiv I.B. (2003) that “the goals of state authorities and society can both coincide and differ. The latter situation is often observed in Ukraine”. The study of public (financial and non-financial) reporting of the leading mining companies of Ukraine shows that its format does not sufficiently disclose data that could satisfy the information needs of society as an interested party in activities related to the extraction (in particular, exploration and evaluation) of mineral reserves, despite the fact that that Ukraine has undertaken to ensure transparency in the extractive industries. In accordance with the laws of Ukraine “On accounting and financial reporting in Ukraine” (1999) and “On ensuring transparency in the extractive industries” (2018), business entities that carry out activities in the extractive industries or harvest wood are required to annually submit to of the central executive body, which ensures the formation and implementation of state policy in the fuel and energy complex, and to publish on its websites (if available) reports on payments to the state. However, these reports mostly contain information only about the amounts paid to the state or local budgets, mandatory state social and pension insurance funds, as well as other recipients of payments (business entities, at least

50% of whose corporate rights belong to the state or territorial community) taxes, mandatory and other payments directly related to mining activities (2018). Thus, information on the volume of explored and estimated mineral reserves is not subject to mandatory public disclosure and disclosure for public discussion of the expediency of their extraction. Voluntary disclosure of relevant information in the management report or non-financial reporting of economic entities is only a “gesture of goodwill” by the managers of these entities, which most of them do not perform.

In view of the exhaustion of the planet due to the unlimited and uncontrolled extraction of natural resources, the opinion of supporters of the concept of physical economy is correct: “the use of energy accumulated on Earth in the form of living matter, deposits of energy carriers and other minerals is ... impoverishment or even robbery of descendants, and from the point of view of eternity - the self-robbing of humanity, which almost led it to omnicide” (2011). In this context, accountants are assigned the role of advocates of descendants, which morally obliges representatives of the profession to ensure disclosure to society of information on the volumes of explored and estimated mineral reserves.

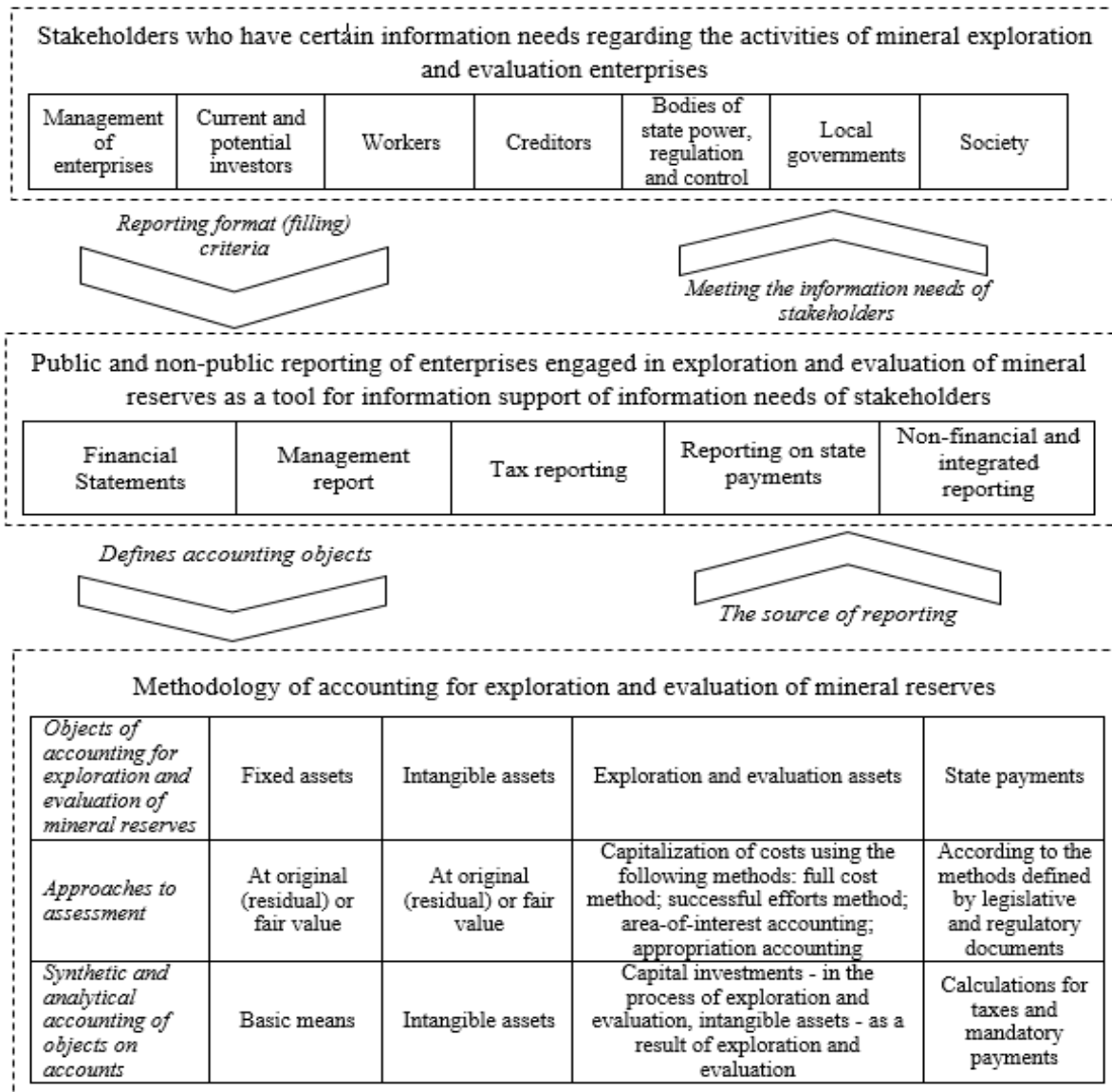


Figure 4. The concept of accounting and reporting representation of the activities of enterprises in exploration and evaluation of mineral reserves

**Source: developed by the authors.*

The concept of accounting and reporting representation of exploration and evaluation of mineral reserves, taking into account the information needs of various groups of stakeholders, shown in Fig. 4, will improve the efficiency of enterprises.

Discussion

The majority of scientists studied the problems of accounting of mining enterprises from a microeconomic point of view. This accounting paradigm, which is ultimately the

basis of the relevant accounting and financial reporting standards (IFRS 6 “Exploration and evaluation of mineral reserves” and NP(S)BO 33 “Expenses for the exploration of mineral reserves”), is oriented towards the information provision of achieving goals of the mining enterprise in the coordinates “costs - risks - economic benefits”. In fact, the methodology of accounting and financial reporting of this paradigm is aimed at establishing the status of costs incurred for the implementation of a project for the exploration of mineral reserves, because

the high level of uncertainty regarding the receipt of economic benefits from its results provokes a dilemma - to capitalize these costs or to write them off to the financial result in the period of occurrence. At the same time, the need to disclose information in accordance with public interests in this area of the economy is not taken into account by either the paradigm or accounting and reporting standards. Therefore, the prospect of future scientific research on this subject is the development of the format of the accounting report on the results of exploration and evaluation of mineral reserves in accordance with the information needs of a wide range of interested parties.

Conclusions

Exploration and evaluation of mineral reserves is a special topological area of accounting, which is why a separate accounting and financial reporting standard is dedicated to it, both at the national and international levels. National regulation (standard) of accounting 33 and IFRS 6. Inconsistency and ambiguity of the wording of individual provisions of these standards, primarily in the context of the identification and accounting methods of exploration and evaluation assets, proved the feasibility of streamlining the classification of assets in order to distinguish exploration and evaluation assets from other types of assets used in exploration and evaluation of mineral reserves.

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The public importance of information based on the results of exploration and evaluation of mineral reserves indicates the expediency of its public disclosure. The conducted studies proved that this information is not sufficiently fully disclosed in the reports of entities that conduct exploration and evaluation of mineral reserves and their extraction. Therefore, the prospect of future scientific research on this subject is the development of the format of the accounting report on the results of exploration and evaluation of mineral reserves in accordance with the information needs of a wide range of interested parties.

The proposed author's concept of accounting and reporting representation of exploration and evaluation of mineral reserves, taking into account the information needs of various groups of stakeholders, which will contribute to the efficiency of the activities of enterprises in exploration and evaluation of mineral reserves.

The mineral industry remains a key sector of the global economy that is constantly adapting to new challenges and technologies. Innovation and environmental responsibility are becoming key aspects of its further development. The industry is expected to become increasingly focused on sustainable development and environmental responsibility, and the growing demand for metals for the production of electric vehicles and renewable energy sources is driving the development of the industry.

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