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Article

Global mining in the 21st century: An overview

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Abstract: At present, states and entire regions that possess significant reserves of sought-after minerals have great potential to maintain and even improve their socio-economic position in the foreseeable future. Since the beginning of 2000, the increase in mining volumes of minerals has been more than 50%; however, more than half of all extracted raw materials fall to only five leading countries: China, the USA, the Russian Federation, Australia, and India. This article presents the results of the analysis of the global structure of mineral production by type and geographic region. The article provides an in-depth analysis of the world's leading mining companies, identifying the key players in the industry. A comprehensive overview of each company's performance, including key financial indicators and production statistics, is presented. The main environmental risks as a result of the continued increase in the global scale of mining have been identified. The prospects for the development of the mining sector are shown. The results of the study can be used by the scientific community as an information source.

Keywords: mining sector; mining volumes; mineral resources; scale of mining; mining companies; environmental issues

1. Introduction

The insatiable thirst for technological advancement and societal progress has propelled the global mining industry to unprecedented levels of activity. Since the early 2000s, mineral extraction has skyrocketed by over 50%, driven by the ever-growing demand for raw materials [1,2]. This surge has been fueled by the rapid expansion of emerging technologies such as electric vehicles, renewable energy systems, and advanced electronics, all of which require a steady supply of minerals like lithium, cobalt, and rare earth elements. However, this surge in production masks a significant geographical disparity, with a handful of dominant players like China, the USA, and Australia extracting a disproportionate share of global resources [3].

China, for instance, not only leads in the extraction of rare earth elements, essential for various high-tech applications but also dominates the processing and refining stages, controlling nearly 80% of the global supply chain. In contrast, countries in Africa and South America, despite being rich in mineral resources, often face challenges such as political instability, a lack of infrastructure, and investment, which hinder their ability to fully capitalize on these assets. Furthermore, the environmental and social impacts of mining have become increasingly prominent, with local communities and ecosystems bearing the brunt of the industry's expansion. This has led to a growing emphasis on sustainable mining practices and stricter regulations, aimed at mitigating the adverse effects while ensuring that the industry can continue to meet global demand. As the world moves towards a greener future,

the mining industry is at a crossroads, balancing the need for increased production with the imperative of sustainability.

While the general scale of extraction is known, a thorough understanding of the current mining landscape is crucial. This study delves deeper, providing a short overview across four key areas:

- Global extraction scale—A detailed analysis of the current worldwide extraction volumes and trends in mineral production;
- Leading mining companies—An in-depth exploration of the world's largest mining companies, highlighting their key roles and performance metrics;
- Environmental Impact—A critical examination of the main environmental risks associated with the expanding scale of mining operations.

Significance of the study

The global mining industry plays a crucial role in shaping the following:

- Understanding the economic impact—This research sheds light on the distribution of mineral wealth and its impact on global economic development. By identifying the leading producers and analyzing production trends, the study allows resource-rich countries to formulate informed strategies for maximizing the economic benefits of their mineral reserves. Additionally, it helps assess the contribution of mining to global supply chains and infrastructure development;
- Navigating environmental challenges—The significant rise in mining activity necessitates a focus on environmental responsibility. This study serves as a platform to identify and analyze the environmental risks associated with large-scale mining operations. By highlighting these challenges, it encourages the development and implementation of sustainable mining practices that minimize environmental impact;
- Informing future strategies—This study offers valuable insights for stakeholders like policymakers, investors, and industry leaders. By analyzing the performance of leading mining companies and future industry prospects, the research helps inform strategic decision-making. This includes policy development for sustainable resource management, investment opportunities in the mining sector, and strategies for technological advancements in mining techniques;
- Bridging the knowledge gap—The comprehensive analysis of the global mining industry provided by this study contributes to a deeper understanding of this complex sector. It serves as a valuable resource for the scientific community, researchers, and anyone interested in gaining insights into the present and future of the global mining landscape.

Thus, the purpose of this research is to conduct a retrospective evaluation of global volumes of mineral extraction, identify leading countries and major mining companies, and analyze the potential environmental consequences of the annual increase in extraction volumes.

2. Materials and methods

In order to conduct a comprehensive overview of the current state of the global mining industry, various sources of information were utilized, including industry

reports, academic articles, government statistics, and online databases. The following methods were used to gather and analyze the data:

- Literature Review: A thorough review of academic literature was conducted to gather information on the current trends and developments in the mining industry. Keywords such as "global mining industry", "mining trends", and "mining production statistics" were used to search for relevant articles in academic databases such as Elsevier, Scopus, and Google Scholar.
- Industry Reports: Industry reports from organizations such as the World Mining Congress, the International Council on Mining and Metals, and the United States Geological Survey were consulted to obtain data on the production, consumption, and trade of minerals and other raw materials.
- Government Statistics: National and international government statistics were collected from sources such as the World Bank, the United Nations, and the US Bureau of Labor Statistics to obtain information on the economic impact of the mining industry and to track the growth of the industry over time.
- Online Databases: Online databases such as Companiesmarketcap, Investing.com, Mining Intelligence, Mining Technology, and Mining Journal were consulted to gather data on the top mining companies, production capacities, and exploration activities.

The data was analyzed and presented in the form of tables, charts, and graphs to provide a comprehensive overview of the current state of the global mining industry. The information was then synthesized and summarized to provide a clear and concise overview of the key trends and developments in the industry.

This research provides a comprehensive overview of the current state of the global mining industry and offers insights into the key trends and developments shaping the industry. The findings of this study will be useful for policymakers, industry stakeholders, and researchers in understanding the current state of the mining industry and in making informed decisions about the future of the industry.

3. Results and discussions

3.1. General information on a global scale of extraction of minerals

The consumption of minerals and other raw materials has been an integral part of human civilization, driving technological advancements and economic growth. Over the past 100 years, the rate of consumption of minerals has increased significantly, reflecting the growing demand for mineral resources from a rapidly expanding global population and increased industrialization.

During the 20th century, the global population grew from approximately 1.6 billion people in 1900 to 8 billion people in 2022. This significant increase in population has driven the demand for minerals and other raw materials, as well as the need for increased production capacities to meet this demand. Additionally, the rise of industrialization and technological advancements has also led to an increase in the demand for minerals and other raw materials, as these materials are used in the production of a wide range of goods and services.

One of the most notable trends in the consumption of minerals over the past 100

years has been the increasing demand for metals such as iron, aluminum, and copper. These metals are used in a wide range of applications, including construction, transportation, and electronics. The increasing demand for these metals has driven the expansion of mining operations, leading to increased production and consumption of these minerals.

Another notable trend has been the increasing consumption of minerals such as rare earth elements, which are used in a wide range of high-tech applications, including electronics, renewable energy systems, and military equipment. The increasing demand for these minerals has driven the expansion of mining operations, particularly in countries with significant deposits of these minerals.

Thus, according to the data from the annual analytical report World Mining Data [4], a total of 17.2 billion tons of minerals were extracted in 2020, which is 5.89 billion tons more than at the beginning of the 21st century. The production volume dynamics for these 20 years can be traced by the types of minerals in **Table 1**.

Table 1. Global structure of mineral production and dynamics of its change in the period from 2000 to 2020 [4].

Type of minerals	Volume of mineral extraction, million tons					Change in production dynamics from 2000 to 2020, %
	2000	2005	2010	2015	2020	
Iron and ferroalloys	627.28	858.62	1224.03	1494.89	1567.41	149.8
Non-ferrous metals	50.00	60.53	74.87	96.19	104.56	109.1
Precious metals	0.021	0.023	0.026	0.031	0.029	38.09
Non-metallic minerals	539.43	656.65	712.67	790.28	781.51	44.8
Mineral fuels	10,105.16	12,229.18	13,827.77	14,833.65	14,774.45	46.2
Total	11,321.89	13,805.00	15,839.37	17,215.04	17,227.96	52.1

The annual increase in the growth rate of mining is linked to both the development of technologies and equipment in general [5,6], and to the increase in demand for certain types of raw materials for the transition to new environmentally friendly energy sources [7–11].

The steady growth of the global mining industry has been continuing for more than a decade, however, it has not been uniform in all regions. As of 2020, more than half of the minerals were extracted in the Asian region –59.8%, followed by North America –15.4%, Oceania –7.3%, Europe –6.8%, South America –5.5%, and the African region –5.2% (**Table 2**) [4,12,13].

Table 2. Structure of mineral production by region and dynamics of its change in the period from 2000 to 2020 [4].

Region	Volume of mineral extraction, million tons					Change in production dynamics from 2000 to 2020, %
	2000	2005	2010	2015	2020	
Africa	765.73	944.54	1009.67	940.17	891.82	16.4
Asia	5051.12	7069.40	8921.79	9820.60	10303.43	103.9
Europe	1755.97	1749.87	1621.73	1487.18	1174.17	–33.1
South America	908.63	1068.29	1128.72	1196.13	956.91	5.3
North America	2324.94	2343.74	2355.46	2632.65	2652.40	14.1
Oceania	515.49	629.11	801.95	1138.20	1249.27	142.3
Total	11,321.88	13,804.95	15,839.32	17,214.93	17,228.00	52.1

3.2. Regional distribution and influence in the global mining sector

When analyzing the scale of global mining, it is important to note that the huge statistical weight of the Asian region is provided by China, which is the world leader in the extraction of 32 different types of mineral raw materials, and also provides 43.0% of the total extraction of all minerals in the region [14].

Similarly, Australia, the United States, Russia, India, Canada, Brazil, Chile, South Africa, etc. have an impact on their regions. The presence of a large mineral resource potential and, as a result, the location of world-class research institutions in these countries in the field of profile studies, allow the mining industry to develop at a fast pace. The government policy in the field of natural resources is favorable to the investment of foreign assets, and advanced achievements in science and technology are used in the development of deposits [15–19].

The African region has enormous potential in terms of mineral exploration and extraction. The continent is home to many of the world's mineral reserves: diamonds, vanadium, manganese, copper, phosphates, platinum, uranium, cobalt, gold, etc. Investors are eager to enter new markets, especially in developing countries, which offer new investment opportunities for leading mining companies. In this context, the African mining industry offers unprecedented opportunities for both local and international investors.

The European mining industry has long traditions and is today one of the most modern and innovative industrial sectors on the continent. Europe is rich in natural resources, however, the supply of minerals on the territory of its states from other regions continues to play a decisive role in the European economy and society, as it has been for centuries.

South America continues to remain an important jurisdiction for investments in the mining industry. The region boasts rich strategic natural resources and has been the target of a large number of direct foreign investments in the geology exploration sector in recent years.

Figure 1 shows the leading countries in mineral production for the 2020 calendar year and information about the largest mining companies in the world.

Thus, it has been demonstrated that the mining industry plays an important economic role in the structure of many countries. The produced products, both in the form of raw materials and finished products, can be competitive in the external markets and bring a significant portion of export revenue.

However, in addition to the economic benefits to nations and the development of world science and technology in general (creation of new electronic devices, instruments, machines, etc.), the global expansion of mining is also characterized by obvious environmental problems. For example, the construction and operation of mining facilities can lead to such long-term consequences as the loss of flora and fauna habitat, changes in the shape of the relief, changes in the soil profile, or changes in surface and subsurface drainage [20–22]. All this makes it necessary to regulate the mining industry in each individual region.

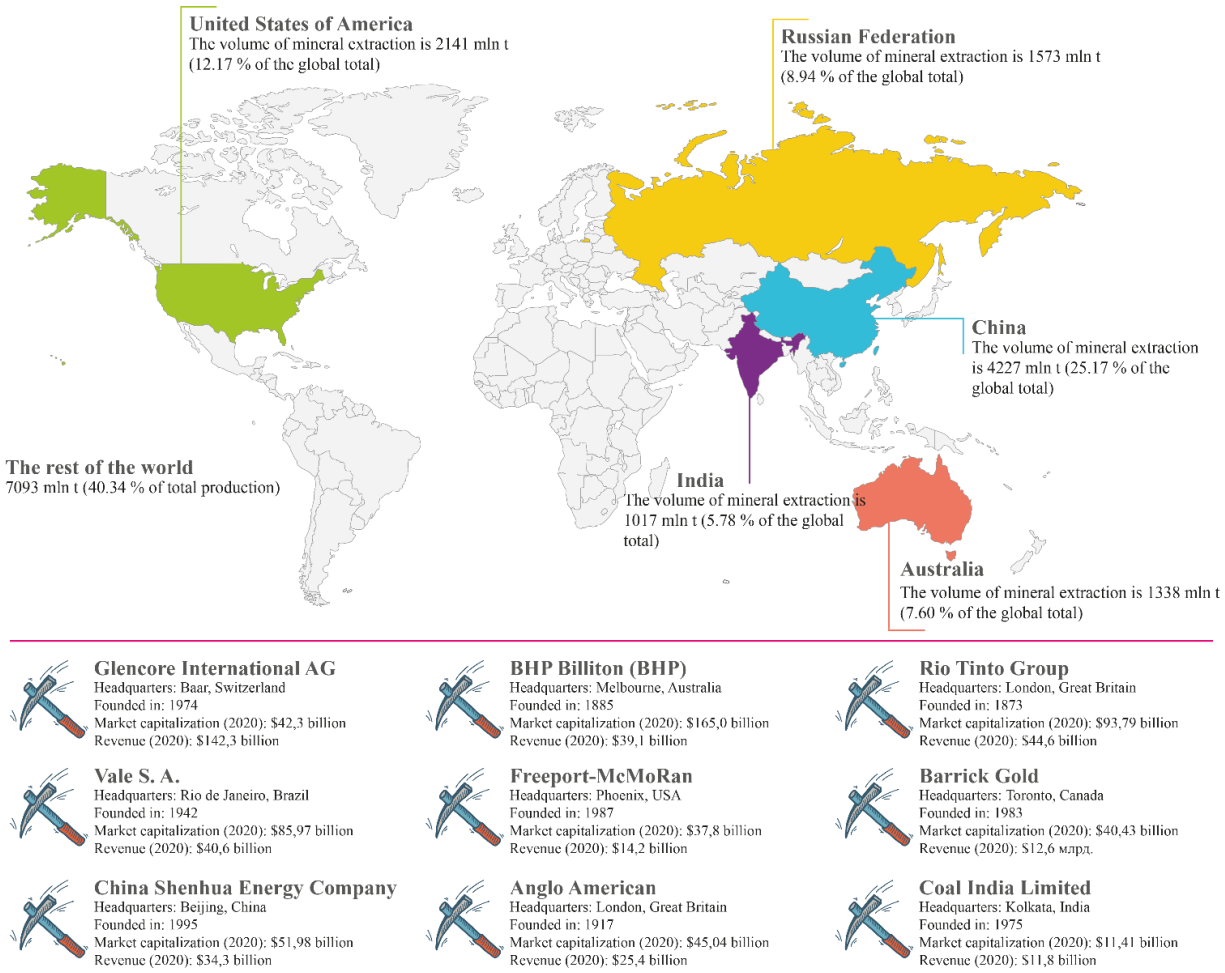

Figure 1. World leaders in the extraction of minerals (for 2020) and the largest mining companies.

3.3. Key facts about largest mining companies in the world

Large mining companies play a crucial role in the mining sector, accounting for a significant portion of global mineral and resource extraction. With their extensive experience, expertise, and financial resources, these companies are capable of executing large-scale mining operations that would be challenging for smaller firms to undertake.

The mining sector is capital-intensive, and large mining companies are typically better equipped to manage the high costs associated with exploration, development, and production. They also have access to advanced technology and equipment, which enhances efficiency and productivity.

Furthermore, large mining companies are often involved in multiple stages of the mining process, from exploration to production and refining. This comprehensive involvement allows them to maintain greater control over the entire value chain, thereby reducing the risk of supply chain disruptions.

Many large mining companies also have a strong global presence, enabling them to respond more effectively to market demands and fluctuations. Their financial strength allows them to invest in research and development, leading to new and improved mining methods and technologies.

Additionally, large mining companies can have a significant impact on local

communities and the environment. While some companies have made efforts to minimize their environmental footprint and improve their social and environmental responsibility, concerns remain about the potential negative consequences of large-scale mining, such as environmental degradation and social displacement. It is crucial for these companies to be held accountable for their actions to ensure sustainable and responsible mining practices.

Given the above, key information on the world's largest mining companies will be presented below.

Glencore International AG, now known as Glencore, is a multinational mining company that is headquartered in Baar, Switzerland. Here are some key facts about the company:

1) Origin and Evolution: Glencore was originally founded as Marc Rich & Co. AG in 1974, named after its founder, Marc Rich. In 1993, the company rebranded as Glencore International AG.
2) Diversified Business: Glencore operates in several areas, including mining, refining, smelting, and trading of metals and minerals. The company also has significant business interests in oil and agricultural products.
3) Global Reach: With operations in over 50 countries, Glencore is one of the world's largest diversified natural resource companies. It has a significant presence in regions such as Europe, North America, South America, Africa, and Australia.
4) Major Miner: Glencore is one of the largest producers of copper, cobalt, and nickel, and has significant reserves of zinc, lead, and tin. The company is also one of the largest coal producers in the world.
5) Environmental Concerns: Glencore's mining operations have faced criticism over environmental and human rights concerns. The company has taken steps to address these issues and has committed to reducing its carbon footprint and reducing its impact on local communities and ecosystems.
6) Philanthropic Efforts: Glencore is involved in various philanthropic efforts and initiatives, including supporting education and health programs in the communities where it operates. The company also supports the development of renewable energy and sustainability initiatives.
7) Financial Performance: Despite the challenges faced by the global mining industry, Glencore has consistently delivered strong financial results. The company has a solid balance sheet and a track record of profitability, making it a key player in the global mining sector.

Vale S.A. is one of the largest mining companies in the world. It was founded in 1942 in Brazil and is now headquartered in Rio de Janeiro, Brazil. The company specializes in the production of iron ore, nickel, and other metals. Some interesting key facts about Vale S.A. include:

1) Vale S.A. is the largest iron ore producer in the world, producing over 300 million metric tons of iron ore annually.
2) The company operates in over 30 countries worldwide and has a diverse range of mining activities, including open-pit mining, underground mining, and processing operations.

3) Vale S.A. has a significant presence in the Asia-Pacific region, with operations and offices in countries such as China, India, South Korea, and Australia.
4) The company has made significant investments in technology and innovation, with a focus on sustainability and environmental responsibility. This includes initiatives such as reducing greenhouse gas emissions, increasing the use of renewable energy sources, and improving water management practices.
5) Vale S.A. has faced significant challenges and controversies, including a tailings dam collapse in Brazil in 2019 that caused widespread environmental damage and loss of life. The company has since taken steps to improve its dam safety and emergency response measures and has faced significant fines and legal action as a result of the disaster.

Overall, Vale S.A. is a major player in the global mining industry, with a strong focus on sustainability and innovation, and a commitment to responsible resource development.

BHP Billiton is a global mining company with headquarters in Melbourne, Australia, and London, UK. Here are some key facts:

1) Origin and History: BHP Billiton was formed in 2001 through a merger of two mining giants: BHP (Broken Hill Proprietary Company) and Billiton. BHP was established in 1885 in Broken Hill, Australia, and Billiton was founded in 1860 in the Netherlands.
2) Size and Reach: BHP Billiton is one of the largest mining companies in the world, with operations in over 25 countries across five continents. It is a dual-listed company, with shares traded on both the Australian and London Stock Exchanges.
3) Product Range: BHP Billiton's primary focus is on the production of commodities such as iron ore, coal, copper, nickel, and oil and gas. The company also produces other minerals and metals such as bauxite, silver, lead, and zinc.
4) Environmental Responsibility: BHP Billiton takes environmental sustainability seriously and has implemented various initiatives to reduce its carbon footprint, such as investing in renewable energy sources and reducing its water usage.
5) Community Involvement: BHP Billiton is committed to supporting local communities where it operates, and has established various programs to promote education, health, and community development.
6) Health and Safety: BHP Billiton places great emphasis on the health and safety of its employees and has implemented various programs to prevent workplace accidents and injuries.
7) Financial Performance: BHP Billiton has consistently delivered strong financial performance over the years, reporting high levels of revenue and profits. The company has a robust balance sheet, with low levels of debt and a strong credit rating.

In conclusion, BHP Billiton is a large, global mining company with a strong history, a diverse product range, and a commitment to environmental sustainability and community involvement. Its financial performance has been strong, making it a significant player in the mining industry.

Freeport-McMoRan is one of the world's largest mining companies, primarily focused on the exploration, extraction, production, and sale of copper, gold, and

molybdenum. The company was formed in 1987 through the merger of Freeport Minerals and McMoRan Oil & Gas. Here are some interesting facts about Freeport-McMoRan:

1) Diversified operations: Freeport-McMoRan operates mines in North and South America, including the Grasberg mine in Indonesia, which is one of the largest gold and copper mines in the world.
2) Size and scale: Freeport-McMoRan is a major player in the global mining industry, with a market capitalization of over $30 billion and over 40,000 employees worldwide.
3) Sustainability efforts: Freeport-McMoRan is committed to sustainable mining practices and has implemented several initiatives aimed at reducing its environmental impact, including water conservation and energy efficiency measures.
4) Community involvement: The company has a strong focus on community engagement and works closely with local communities to support economic development and improve living standards.
5) Financial performance: Freeport-McMoRan has consistently delivered strong financial results, with robust revenue and earnings growth in recent years.

Overall, Freeport-McMoRan's commitment to sustainability, its diverse operations, and its financial performance make it a significant player in the global mining industry.

Barrick Gold is a Canadian mining company that is one of the largest gold mining companies in the world. The company was founded in 1983 and is headquartered in Toronto, Canada. Some interesting facts about Barrick Gold include:

1) Size and scale: Barrick Gold is one of the largest gold producers in the world, with a market capitalization of over $30 billion and operations in North America, South America, Africa, and Australia.
2) Significant production: Barrick Gold has produced more than 160 million ounces of gold and is one of the largest gold producers in the world.
3) Strategic acquisitions: Over the years, Barrick Gold has made several strategic acquisitions, including the acquisition of Homestake Mining Company in 2001, which helped the company become one of the largest gold producers in the world.
4) Focus on sustainability: Barrick Gold is committed to sustainable mining practices, and has a number of initiatives in place to minimize its impact on the environment, including a water management program and a tailings management program.
5) Community engagement: Barrick Gold places a strong emphasis on community engagement, and has a number of programs in place to support the communities in which it operates, including education initiatives, health programs, and economic development initiatives.
6) Responsible gold production: Barrick Gold is committed to responsible gold production, and is a signatory to the United Nations Global Compact, which is a voluntary initiative aimed at promoting responsible corporate citizenship.
7) Innovative technology: Barrick Gold is known for its innovative use of technology in the mining industry, including the use of autonomous trucks and drills, and the implementation of advanced analytics to optimize its operations.

China Shenhua Energy Company is one of the largest coal-mining companies in the world and is headquartered in Beijing, China. The company was established in 1995 and is a subsidiary of the state-owned China National United Fuel Company. Here are some interesting facts about China Shenhua Energy Company:

1) Coal production: China Shenhua Energy Company is the largest coal producer in China and one of the largest coal producers in the world. The company produces both thermal and coking coal.
2) Size and scale: The company operates several large-scale coal mines across China, and also has significant operations in Australia and Mongolia.
3) Diversification: In addition to its core coal-mining operations, China Shenhua Energy Company has diversified into several other business segments, including electricity generation, railway transportation, port operations, and coal-to-chemicals.
4) Environmental initiatives: China Shenhua Energy Company has made a commitment to sustainable development, and has implemented several initiatives aimed at reducing its environmental impact. For example, the company has invested in renewable energy and has also undertaken a number of reforestation projects.
5) Financial performance: Despite a challenging economic environment, China Shenhua Energy Company has consistently performed well financially, making it one of the largest and most successful mining companies in the world.

Overall, China Shenhua Energy Company is a major player in the global mining industry, and its continued success is a testament to its commitment to sustainable development and responsible business practices.

Anglo-American is a global mining company that was established in 1917. The company is headquartered in London, Great Britain, and is listed on the London and Johannesburg stock exchanges. Here are some key facts about Anglo American:

1) Diversified Portfolio: Anglo American is a diversified mining company that operates across a wide range of commodities, including platinum, copper, diamonds, nickel, iron ore, and metallurgical coal.
2) Global Presence: The company operates in over 20 countries around the world, including South Africa, Chile, Brazil, Peru, and Australia.
3) Sustainable Mining Practices: Anglo American is committed to sustainable mining practices and has implemented a number of initiatives to reduce its environmental impact, including the use of renewable energy sources and reducing greenhouse gas emissions.
4) Community Investment: The company has a strong focus on community investment and works with local communities to support development and improve living standards.
5) Innovation: Anglo American invests heavily in innovation and research and development, in areas such as automation, artificial intelligence, and digital technologies, to improve its operations and reduce costs.
6) Leading Company in the Mining Industry: Anglo American is widely considered one of the leading companies in the mining industry, known for its strong financial performance, commitment to sustainability, and focus on innovation.

7) Significant Production: In 2020, Anglo-American produced over 5.5 million ounces of platinum, 1.3 million tons of copper, and more than 20 million carats of diamonds.

Coal India Limited (CIL) is a state-owned coal mining company based in India and is the largest coal producer in the world.

1) Founded in 1975, CIL is the largest coal-producing company in India and the largest employer in the Indian coal industry, with over 300,000 employees.
2) CIL produces over 82% of the coal in India and holds a monopoly in the Indian coal sector.
3) The company operates through 81 mining areas spread across eight states in India, including West Bengal, Jharkhand, Odisha, Madhya Pradesh, Chhattisgarh, Telangana, Maharashtra, and Andhra Pradesh.
4) In addition to coal mining, CIL also provides various other services, including consultancy and engineering services for coal and lignite mines, and operates washeries to process coal and produce clean coal.
5) CIL is committed to sustainability and has implemented various measures to minimize its environmental impact, including reforestation and afforestation programs, and measures to reduce greenhouse gas emissions.
6) Despite being a state-owned company, CIL has been listed on the Bombay Stock Exchange and the National Stock Exchange of India since 2010 and is subject to regulation by the Securities and Exchange Board of India.
7) CIL is also involved in various social initiatives, including programs to improve the living conditions of local communities, support for education and health initiatives, and the promotion of local sports and cultural activities.

Having explored the profiles and contributions of major global mining companies, it is evident that these industry giants play a pivotal role in meeting global demand for minerals and resources. However, the expansion of their operations brings with it significant environmental considerations. In the next section, we will delve into the main environmental risks associated with increasing the scale of production, examining the challenges and implications for sustainable mining practices.

3.4. The main environmental risks of increasing the scale of production

The growth of global mining can result in various environmental risks that can have negative impacts on the ecosystem and human health. Some of these risks include [23–29]:

1) Water pollution: The release of toxic chemicals from mining operations into nearby water sources can cause water pollution, which can harm aquatic life and negatively affect the health of local communities that rely on these sources for drinking water.
2) Land degradation: The removal of large amounts of earth and rock during the mining process can result in land degradation, causing soil erosion and decreased biodiversity in the area.
3) Air pollution: Dust and emissions from mining operations can contribute to air pollution, leading to respiratory health problems for local communities and damaging delicate ecosystems.

4) Climate change: The extraction and transportation of minerals and other resources used in the mining process can contribute to greenhouse gas emissions, driving climate change and its associated impacts such as sea level rise and the increased frequency of extreme weather events.
5) Loss of biodiversity: The clearing of large areas of land for mining operations can result in the loss of biodiversity, as well as the displacement of local communities and wildlife.
6) Health risks: Mining operations can expose workers and nearby communities to hazardous chemicals and dust, leading to health problems such as lung diseases and other respiratory issues.

In conclusion, the expansion of mining operations globally brings with it significant environmental risks that cannot be overlooked. It is important for the mining industry to take these environmental risks into account and implement practices to minimize their impacts, such as using cleaner technologies, restoring degraded land, and protecting water sources.

4. Conclusion

As consumption increases, humanity demonstrates a culture of consumption, resulting in the mining industry becoming hostage to growing consumer demands. At the same time, mineral deposits are being depleted. Despite this, the mining industry remains one of the few sectors of the economy that maintains positive growth dynamics, despite the COVID-19 pandemic-related quarantine restrictions.

The mining industry should not be limited to just the extraction sector. Creating favorable economic conditions within each individual region or country can attract new investors, who in turn will develop existing or create new technological chains. The involvement of leading global companies in the processing of metallurgical raw materials will have an even more positive impact on the economic development of the region. However, it is important not to forget about the accompanying risks and problems.

The present study was aimed at demonstrating the overall situation in the global mining industry. At the same time, the analysis conducted provides the opportunity to outline future directions for research in the areas considered.

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