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Research of the Efficiency of Mining and Metallurgical Enterprises Based on the Environmental, Social, and Governance Risk Rating in the Context of Digital Transformation

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Abstract. In recent years, there has been a significant increase in interest in the low-carbon, "greener" economies from investors and the public sector. To assess companies' compliance in terms of Environmental, Social, and Governance (ESG) criteria, Rating Agencies have developed ESG risk ratings, which allow for determining the effectiveness of enterprises in terms of ESG. The article is intended to research the efficiency of mining and metallurgical enterprises based on compilations of ESG risk ratings of leading international Rating Agencies. The authors briefly described the most recognized global ESG rating methodologies and compared the top 5 ESG ratings. The results of the qualitative assessment of ESG ratings formed this top-5 list. The current situation in the formation of rating ratings was described. In accordance to open data sources, the ratings of mining and metallurgical enterprises were collected, then ranged (based on an expert assessment) and highlighted the divergence of ESG ratings with explanations of these discrepancies. This study revealed a significant correlation between ESG ratings of leading Rating Agencies and assessed the efficiency of mining and metallurgical enterprises based on compilations of these ratings. Based on the graphical analysis, there is a correlation between the ESG ratings of the different Rating Agencies since when the enterprises are ranked from the best to the worst, the graph has a distinct direction of values from the lower left corner to the upper right corner.

Keywords: Ecological risk; ESG rating; Mining and metallurgical enterprise; Sustainability; Vertical integration

1. Introduction

In modern conditions, digital transformation impacts the activities on the activities of mining and metallurgical enterprises. It helps to identify previously unnoticed relationships, which increases the efficiency of comparing parameters. The main advantage of companies that actively use modern technologies is the efficiency and reasonableness of their business decisions, considering risks. Thanks to the development of digital technologies, it has become possible to analyze big data in real-time, produce machine learning and apply the potential of Artificial Intelligence (Pishchalkina et al., 2021; Segura-Salazar & Tavares, 2018). Moreover, data collection from industrial sensors and controls, more accurate accounting of resource consumption, and big-data creation allow enterprises

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to develop complex configuration models, models of greenhouse gas emissions, and other negative impact models.

Due to the growing interest in responsible investments in line with sustainable development, there is an exceptionally active process of creating and calculating Environmental, Social, and Governance (ESG) ratings (Danilov et al., 2021). ESG investing has also recently garnered interest from the public sector, which has expressed support for ways to help transition financial systems toward low-carbon, "greener" economies (OECD, 2020). The development of the ESG criteria system has contributed to the creation of ESG-Related investment products formed the public perception of companies and the ways of annual reports and ESG disclosure. ESG standards allow an investor and other stakeholders to consider non-financial factors and more accurately determine which companies need to be financed in the long term (Giese et al., 2021; Hübel & Scholz, 2020; IMF, 2019).

The ESG rating refers to non-credit ratings and represents the opinion of rating Companies regarding the compliance of the current practice and strategy of the rated Entity with the goals of sustainable development, including environmental protection and restoration, social responsibility, and the development of corporate governance to achieve these goals. In the process of assigning an ESG rating, the rating Agency takes into account the assessment of the risks of the rated Entity in the fields of ecology, social development, and corporate governance, takes into account compliance with international standards and the specifics of national regulation (NCR, 2022).

The works (Ovechkin, 2021; Friede et al., 2015) assess the positive impact of ESG on the financial success of companies, which is stable over a long period. Other studies (Filbeck et al., 2019; Brogi & Lagasio, 2018; Forcadell & Aracil, 2017; Dellaportas et al., 2012) describe that firms should disclose information about their activities in the field of sustainability, as this can increase their reputation and, as a result, the value of such firms. In addition, some researchers (Sassen et al., 2016; Salama et al., 2011) claim that firms with a high level of ESG are characterized by less financial risk. In this paradigm, the presence of an ESG-related risk premium is due to the fact that a high risk of performance characterizes companies with low ESG levels.

The mining and metallurgical industry are key sectors of the modern global economy (Korneeva, 2016). It incorporates enterprises engaged in the extraction, enrichment, and processing of ferrous and non-ferrous ores and is a type of heavy industry that poses a negative impact on the environment. Such impact may cause reputational damage to this type of enterprise if their management does not take swift and preventive counter-actions (Blinova et al., 2022; Rybak et al., 2021). In addition, the metallurgical industry is now influenced by some downward trends, including high depreciation of fixed assets, strict environmental requirements for products, an insufficient supply of the domestic market, and high production costs of metals.

And metal products, a high level of concentration in production, and underdevelopment of the system of small and medium-sized enterprises (Pishchalkina, 2021). For example, such companies as Anglo American (Anglo American, 2021), Glencore Plc (Glencore, 2021), Vale S.A. (Vale, 2021), China Hongqiao (China Hongqiao, 2021), Norilsk Nickel (Nornickel, 2021), RUSAL (RUSAL, 2021), EVRAZ (EVRAZ, 2021), Severstal (Severstal, 2021) are largely diversified. And vertically integrated enterprises that sell commodities and precious metals on the world markets. Companies that occupy the best positions at the industry-specific ESG ratings have competitive advantages due to compliance with international environmental, social and corporate governance requirements. Therefore, metallurgical enterprises are presented in international ESG ratings, and these values can be found in such Rating Agencies as Sustainalytics

(Morningstar), Vigeo-Eiris (Moody's), RobecoSAM (S&P Global), CDP (CDP Worldwide), MSCI (Morgan Stanley Capital International), ISS (Institutional Shareholder Services Inc.) and etc. Since 2018 and until currently, there have been more than 600 ESG ratings and rankings existing globally, and the number of ESG frameworks and standards, rankings, and ratings continues to grow (SustainAbility, 2020).

The study aims to research the efficiency of mining and metallurgical enterprises based on compilations of ESG risk ratings of leading international Rating Agencies. To achieve this goal the following objectives are attained in the article: (1) describe the essence and relevance of ESG risk rating; (2) determine and characterize the most reliable and in-demand ESG rating methodologies recognized by the international community; (3) make an expert assessment and range ESG ratings of the enterprises under consideration; (4) highlight the divergence of ESG ratings and explain the reasons for the discrepancies.

2. Methods

This article focuses on the importance of ESG ratings, analysis of methodologies recognized by the international community, and their divergences. In addition, we considered the ability of mining and metallurgical companies to use an ESG-driven approach to managing their sustainable development.

Data were collected through Rating Agencies databases, sustainability reports, and non-financial statements (CDP, 2022; MSCI, 2022; S&P Global, 2020; OECD, 2020; Sustainalytics, 2018) of 8 mining and metallurgical companies. The authors conducted research using comparative analysis (identifying the features of the existing ESG ratings and identifying the most reliable) and an expert analytical method for comparing ratings of mining and metallurgical enterprises of different Rating Agencies. The expert analytical technique applied in this study complies with the three-step analysis: (1) form the scale of normalization ratings; (2) range of the companies' ESG ratings; (3) illustrate the extent of divergence between the different Rating Agencies.

The scale of normalization ratings is necessary to bring the assessments of various Rating Agencies to a single assessment (Table 1). Normalization allows hiding the inversion of the rating scale such as Sustainalytics to exclude incorrect interpretation of meaning ESG ratings.

Table 1 Normalized numerical scale for dependent variable

Scoring	S&P	CDP	Sustainalytics	MSCI
5	100-80	A:A-	0-10	AAA:AA
4	80-60	B:B-	10-20	A
3	60-40	C:C-	20-30	BBB
2	40-20	D:D-	30-40	BB
1	20-0	F	40+	B:CCC

After normalization of the numerical scales of ESG ratings, a graph was constructed reflecting the discrepancy between the ratings of different Rating Agencies, allowing visualization deviations of values.

3. Results and Discussion

3.1. Overview of international ESG risk ratings

Events and problems are significant for the ESG assessment in cases where they may have a significant negative impact on the organization's operating activities, cash flows, legal or regulatory responsibilities. Its access to capital, reputation, or relationships with

key stakeholders and society as a whole–directly or through the value chain. As a rule, to assess ESG risks, the materiality of events or problems related to ESG factors is analyzed, considering their likely impact on the financial activities of the organization, including the potential impact of external environmental and social factors (Koroleva et al., 2020).

There are several reasons for using ESG ratings: provide information or data material to investment performance; supplement the organization's other research on corporate ESG risk or performance; provide credible and quality source of information on corporate ESG performance; Entity derives reputational benefit from using ESG ratings; growing demand by key stakeholders to use ESG ratings; required by organization to integrate ESG ratings into investment analysis and decision-making (SustainAbility, 2020).

Factors determining ESG rating quality include several criteria: quality of methodology; disclosure of methodology; experience or competence of the research team; credibility of data sources; corporate and stakeholder involvement in the evaluation process; common usage by investors and stakeholders; focus on relevant or material issues (S&P Global, 2020).

According to the results of the qualitative assessment of existing ESG ratings by the agency Rate the Raters 2020 Report (SustainAbility, 2020), the number of respondents from experts and investors who rated the quality of ratings as high or very high in percentage proportion is shown in Figure 1.

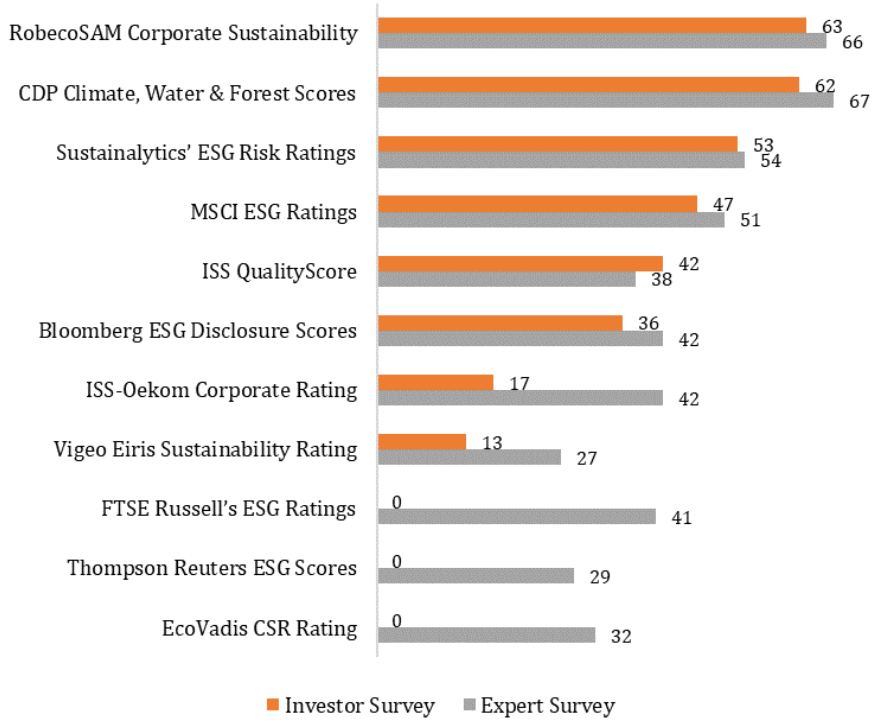

Figure 1 Qualitative assessment of ESG ratings, %

The ratings presented in Figure 1 have one thing in common–they are all based on three issues: Environmental, Social and Governance Indicators. The main difference between the ratings is that each Agency independently determines the methodology of ESG risk ratings. Moreover, the work (Berg et al., 2019) describes that decision-makers receive «noisy» information from Rating Agencies. The ambiguity around ESG ratings represents a challenge for decision-makers trying to contribute to an environmentally sustainable and socially just economy. On the other hand, using and subscribing to more than one ESG rating has tangible benefits for investors (SustainAbility, 2020). Subscribing to multiple can help

stakeholders and investors to fill the gaps if one rating provides more data on a given sector or geographic region or if one rating has a smaller coverage than another.

The authors selected the top-5 ESG ratings for further consideration and comparison of features (see Figure 1). The analysis of these ratings is based on the wide literature sources, such as the original sources of the methodologies presented by the Rating Agencies themselves (MSCI, 2022; CDP, 2022; Framework ESG, 2021; S&P Global, 2020; Sustainalytics, 2018; Dorfleitner, 2015) and the detailed information was presented in Table 2.

Table 2 Comparison of the top-5 ESG ratings

Name	Short description	Scoring	Companies scored
RobecoSAM (S&P Global)	The Agency has its own methodology for Corporate Sustainability Assessment (CSA), which is the strictest and most prestigious rating. It is the longest-running sustainability benchmark, assessing the largest global companies on ESG performance	0-100, with 100 – best performance	7 500
CDP Climate, Water & Forest Scores	The Agency is based only on companies' questionnaires and runs a global disclosure system comprised of the world's most comprehensive collection of self-reported environmental data	A to D– (F, if a company is invited and chooses not to respond)	> 9 600
Sustainalytics' ESG Risk Ratings	The Agency is one of the most useful and highest-quality ratings. The rating measures a company's exposure to how well a company manages those risks versus industry-specific ESG risks	0 (negligible) – 100 (severe)	12 000
MSCI ESG Ratings	The Agency uses the leveraging machine learning, Artificial Intelligence (AI), and natural language processing augmented with analysts, MSCI researches and rates companies on a 'scale according to their exposure to industry-material ESG risks and their ability to manage those risks relative to peers	AAA (leader) to CCC (laggard)	9 800
ISS Quality Score	The Agency is an authoritative source of ESG information for corporate investors and measures the scope and depth disclosure. Sector allocation and factor selection reflect leading disclosure frameworks and standards, such as the Sustainability Accounting Standards Board (SASB) standards, the Global Reporting Initiative (GRI) and the Task Force on Climate-related Financial Disclosures (TCFD)	1 to 10 (decile). which 1 – is low risk, 10 – is high risk	4 700

The conducted comparison of ESG ratings showed that the ratings are based on different methodologies in structuring ratings and divergence between scoring approaches. In this regard, the analysis of ESG ratings and related results highlights the difficulties investors face and how these ratings may differ (fundamentally) depending on the rating source. As a result of the analysis, common trends and significant differences in the methodologies for assigning the ESG rating of companies were identified.

3.2. Ranking of mining and metallurgical companies' ESG ratings

Substantially different results from major ESG rating providers (as opposed to credit rating performance) could create market uncertainty among institutional investors, fund managers, and non-qualified investors as to what constitutes a high ESG rated company

(Pyykkö et al., 2021). Suppose the approach to unification of ratings is not changed. In that case, the existing subjectivity in assessments may undermine investor confidence in ESG assessments, the main ESG indices, and portfolios created based on these products. It is necessary to clarify how the factors and indicators of subcategories E, S, and G, their weight and subjective assessment affect the total ESG scores. This will allow users and issuers to understand and compare methodologies and results. Such transparency is especially justified if rating Agencies' assessments continue to differ widely (Alexandrov, 2021; Egorova et al., 2021).

In this study, the authors analyzed and compared the methods and methodologies of calculating ESG ratings that are most relevant and significant for companies providing non-financial reporting on the sustainable development of companies. Based on open sources of information and data from Rating Agencies such as S&P, CDP (Climate change ratings), Sustainalytics and MSCI have collected the values of mining and metallurgical companies' ESG ratings. ISS Quality Score was excluded due to the lack of sufficient data from the selected companies. To compile the final results of ranking ESG ratings for 8 international mining and metallurgical enterprises (Anglo American, 2021; Vale, 2021; Glencore, 2021; Severstal, 2021; EVRAZ, 2021; RUSAL, 2021; Nornickel, 2021; China Hongqiao, 2021), Table 3 was formed.

Companies based on their ratings were grouped into five subgroups, according to those scores, indexes, ratings, and places that they received from Rating Agencies. For each company, a place in the 4 main ESG rating suppliers was determined. Then, a set of occupied places in each rating was determined for each company. According to this set of places, the final position was determined according to the methodology, where the ranking took place from 1st to 8th place. The method involved selecting the number of times the company occupied a certain place in the relevant ratings. The more often a company has ranked higher in the ratings, its final rank will be higher. If the companies scored the same score, the number of the best ratings from such companies was considered.

Table 3 Ranged ratings of mining and metallurgical enterprises for 2021Y

Range	Name	S&P	CDP	Sustainalytics	MSCI
1	Anglo American	78	A-	23	AA
2	Severstal	48	B	31.4	B
3	Vale S.A.	63	A-	39.1	CCC
4	EVRAZ	52	C	38.9	B
5	RUSAL	n/a	A-	30.3	B
6	Glencore Plc.	42	F	36	BBB
7	Norilsk Nickel	44	D	43.9	BB
8	China Hongqiao	19	F	50	B

Thus, the analysis showed that, in general, mining and metallurgical companies do not occupy the highest positions in the ESG ratings as it possible. Increasingly, this is due to the technology of production of metallurgical products, which has a strong impact on the environment and social capital. In addition, the spread of Rating Agencies' values indicates insufficient consistency of assigned ratings. According to the Agency's research (S&P Global, 2021), the mining and metallurgical industry has the most influential ESG factors: waste and pollution (70% of companies affected); climate transition risks (50% of companies affected); social capital (40% of companies affected) and health and safety (40% of companies affected). At the same time, no meaningful concentration of factors emerges for the governance of metals and mining companies. However, governance structures indicate some financial sponsorship, mostly in more stable downstream metals processing and distributing.

Next, we normalize the ratings of different Agencies received by companies to form the distribution of these values. The scale of normalization is given in Table 1. Normalized ratings for the 8 companies are sorted by average ratings and presented in Figure 2. Each of the 4 rating Agencies is plotted in a different color.

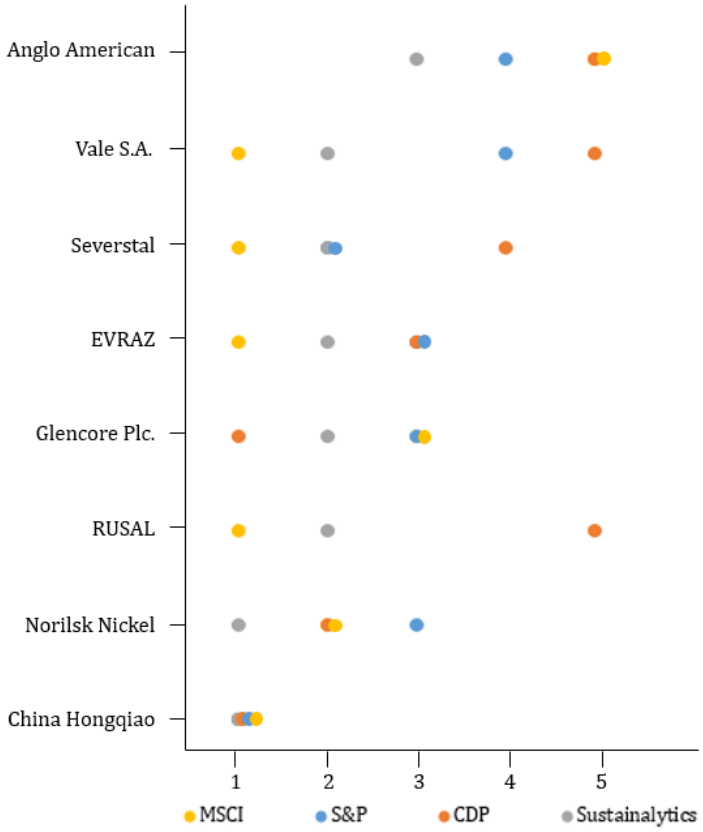

Figure 2 Distribution of normalized ratings

The resulting distribution of normalized value indicates that it is difficult to interpret the assigned ratings due to data outliers, but there is a correlation. Mining and metallurgical companies should carry out work on interaction with rating agencies for more detailed disclosure of information and bringing the assigned ratings to the smallest spread of values. Also, the ratings may differ due to the different risk levels taken into account per the developed methodology of each rating Agency. All these factors testify to the lack of reliability of the ESG ratings (Danilov et al., 2021): (1) discrepancy in measurements (most significant for hard-to-quantify factors such as human rights and product safety); (2) differences in the set of factors taken into account when compiling ratings; (3) "rater effect", when Rating Agencies tend to give high ratings to a company that already has high ratings in other categories. The results obtained to expand the scope of research on the efficiency of mining and metallurgical enterprises based on ESG risk ratings.

4. Conclusions

In general, mining and metallurgical companies negatively impact the environment and the health of people living in industrial areas. However, increasing investor interest in "green" companies leads to strengthening environmental programs and improving the quality of people's lives. The conducted research is based on compilations of ESG risk ratings of leading international Rating Agencies, allowing a more objective assessment of the global vertically integrated mining and metallurgical enterprises. The proposed

approach eliminates methodological differences by normalizing the ratings and bringing the ratings under consideration to a single scoring scale. In any case, there is a correlation between all ratings despite the differences in ratings. In addition, the ranged ratings of mining and metallurgical enterprises made it possible to identify the industry leaders in terms of ESG parameters. The results obtained can be used for further research on the study of the efficiency of mining and metallurgical enterprises based on compilations of ESG risk ratings. Further research is to analyze the specificities of ESG evaluation methodologies of leading international Rating Agencies and determine the most influencing factors on the summary ESG ratings of these companies.

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