

Corporate Social Responsibility in Complex system Based on Sustainable Development

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Abstract:

In recent years, sustainable development and the commitment of companies to social responsibility have been emphasized as a new concern for various industries. Considering this issue, for the first time, this study conducted a systematic review of the development of social responsibility from the perspective of industrial sustainable development (SD). To be more precise, this study investigated Corporate Social Responsibility (CSR) with regard to the SD indicators in the mining industry. To do so, all articles published in this field from the beginning until the end of 2023 were extracted from the Scopus database through a detailed screening process. An evaluation of the selected papers in terms of CSR with respect to the indicators of SD revealed six major research themes: 1) the role of CSR in mining communities, 2) the role of CSR in mining companies, 3) the role of CSR in environmental control around mines, 4) the impact of CSR on stakeholders, 5) planning in the field of CSR in mining communities, and 6) CSR/sustainability reporting. All of these research themes are found to be directly associated with SD indicators (i.e., social, economic, and environmental indicators). At the end of the paper, research gaps in this area are introduced for further studies.

Keywords: Mining industry, Corporate Social Responsibility (CSR), Sustainable development, Systematic review

1- Introduction

Due to the phenomenon of globalization in recent years, the world community has adopted a new attitude toward business markets and companies, which thoroughly differs from the attitude prevalent in conventional business and traditional methods of doing business. Owing to these new modifications, there have been massive arguments among experts in this field. These arguments have disclosed that companies, particularly multinational companies and mega-companies, earn their profits without paying attention to environmental and social issues [1]. Experts in this field have reached a consensus that the performance of companies should be coordinated and regulated based on the new conditions (earning profit and income by addressing environmental and social concerns).

These points highlight that sustainable development (SD) is at the hub of these arguments. SD is referred to as development that satisfies the needs of today's community without compromising the ability of the proceeding generations to satisfy their needs [2-4]. Three basic principles in the notion of SD are as follows: a) the development concept (social and economic development with regard to ecological restrictions and the minimization of environmental damage), b) the concept of needs (the fair distribution of and equal access to resources and opportunities to improve the quality of life of all human beings), and c) the concept of proceeding generations and economic prosperity (the possibility of the long-term use of resources by companies to ensure the provision of reasonable living standards for both the present and the next generation) [5].

From another standpoint, these three principles are scientifically associated with another basic concept called corporate social responsibility (CSR). Among the countless definitions of CSR, the most attractive one is the definition provided by Porter and Kramer in 2002. This definition centers on how business prospects and the environment are positively correlated by considering geographical, social,

and cultural contexts. Hence, CSR is closely related to codes of conduct, respect for ethical principles, welfare and quality of life, and collaboration of all stakeholders in selecting and carrying out effective measures in a company. However, the purpose of CSR varies from one country to another. In this study, the literature review section elucidates differences in these CSR purposes.

In one of the articles undertaken in the field of CSR, the researchers have concluded that large and particularly multinational companies are more subjected to scrutiny concerning social and environmental issues; therefore, these companies usually pay more attention to these issues than other companies [6]. As the large-scale exploitation of mineral resources has huge social and environmental impacts, the mining industry is one of the sectors that have substantially attracted the public's attention and have been subject to the public's judgment; as a result, the concept of CSR is of crucial importance in the area of mining. Mining is one of the most influential elements in the economy and employment of a mining country. Nonetheless, it brings about (positive and negative) social and environmental consequences at the local and global levels. SD thus has a very critical role in this industry. Through mining, valuable natural reserves and resources are extracted from the earth, which is a threat to the environment and consequently endangers human life [7, 8]. For this reason, the managers of mining companies are often put under legal and local pressure to observe CSR. These pressures have compelled mining managers to incorporate CSR into their strategic management planning and take high levels of social responsibility (SR) in the nations where they work as miners (especially around the mining area). One of the main challenges of miners in relation to CSR is to prove that their mining activities contribute to the well-being of the communities around the mine and future generations without reducing their quality of life [9]. Therefore, for the continuation of mining activities, it is essential to prepare regular and continuous CSR reports and form dynamic relationships between the surrounding communities and the mining stakeholders so as to establish and maintain the trust of these communities.

Although CSR is one of the most critical factors in the mining industry, little research has been undertaken in this area, and studies on this subject matter are somewhat scarce. CSR is scientifically guided by prominent scholars such as Borial and Henri [10, 11]. The most important research topics in this field are stakeholder collaboration, CSR reporting, sustainability performance, relationships between mining companies and communities, and CSR in specific geographical areas. Given that these studies have often been conducted sporadically and there is a lack of articles in this field, especially with regard to SD indicators, it is quite necessary to collect and analyze the undertaken studies systematically. Thus, in this paper, it is attempted to conduct a systematic study on the field of CSR in the mining industry with regard to SD.

One of the most important novelties of this study is that in addition to taking constructive environmental measures to enhance SD, the mining industry should take more serious measures to promote SR in order to positively manage the effects of mining operations on the surrounding communities. In this way, this industry can prove that it pursues a sustainable activity and places a high value on all the indicators of SD. Large and multinational companies generally own plenty of mines. Hence, it is the responsibility of these companies to overcome these challenges by adopting appropriate, integrated, precise, and transparent CSR strategies according to the host country's legal system and policies.

Another novelty of this study is to review this subject matter systematically, which can be stimulating for the academic community. This systematic study identifies the most prominent concerns in the field of CSR in mining with regard to SD indicators and provides a clear picture of the latest findings in this field by analyzing the previously published articles. The analysis of the published articles also reveals The interaction between the mining sector and the local community as a main stakeholder for the survival of mining companies. Preparing CSR or sustainability reports for stakeholders in a transparent, accurate, clear, and integrated manner is generally an effective way to positively respond to the concerns of the surrounding community and the expectations of stakeholders in the mining area and move this industry and the surrounding community toward more sustainability.

This systematic study is organized into five general sections. Section 1 provides an introduction to CSR and discusses the novelty of this research. In Section 2, the concept of CSR is explained in detail from the perspectives of theorists and experts in this field. Moreover, a brief literature review of the role of CSR in mines is provided with respect to the SD indicators. Section 3 addresses the method of conducting the research. In this section, the framework and procedure of data collection in the field under investigation are fully described. Section 4 centers on the descriptive and cluster analyses of the data. At the end of this section, the most important results obtained from these analyses are discussed. Finally, the conclusion is provided in Section 5.

2- Concept of CSR and its relationship with SD

CSR has received much more attention in all industries in recent years [12]. In general, CSR refers to the commitment of a business/company to improving sustainable economic development and providing a higher quality of life for its subsidiaries, workers' families, local communities, and society [13]. CSR addresses volunteering, ethics, legality, and economics, and its variables alter depending on the type of business. Communities expect organizations and companies to take this responsibility and guarantee their social commitment to all stakeholders. The companies' capacity to respond to this responsibility varies from "doing nothing" to "doing a lot" and is determined by their strategy and the way it is implemented [14]. Carroll contends that CSR has a bright future as it makes it possible to mitigate citizens' concerns about the relationship between business and community [15]. Organizations should certainly continue to establish their economic values with all their power while respecting social values. It is required to share the values established by companies, and this value sharing goes beyond CSR [16, 17]. Providing the best definition for CSR, Porter describes CSR as a suitable and reciprocal interaction between business prospects and the environment, taking into account the activities' physical location.

Some researchers in the field of CSR argue that this concept should be investigated heterogeneously. It means that businesses should adapt themselves to the specific conditions of the country in which they operate. The CSR solutions in less developed countries should differ from those in more developed countries. Therefore, some experts in this field criticize the homogenization of CSR in the whole world [18]. They declare that globalization has changed business environments. To tackle this issue, multinational companies should devise their strategies for SR with regard to various aspects of the host country [19]. This is a challenging and complicated process because these companies should consider the economic, legal, social, environmental, ethical, and cultural aspects of the host countries in their strategy plans to promote SR [20].

Generally, the strategies designed from the perspective of CSR in multinational companies are based on the internal process of companies, norms, procedures, regulations, knowledge, and the environment [21]. As economic drivers at the national and international levels, these companies play a decisive role in CSR growth in both industrialized and underdeveloped nations [22]. Exploring the relationship between international companies and CSR has indicated that voluntary environmental management techniques among nations with various laws and regulations are generally more consistent with the laws and regulations of the host countries. In this way, CSR measures taken by international companies strengthen the legitimacy of these companies and improve relationships among stakeholders [23]. To implement policies in line with SR, it is required for companies to conduct negotiations with all stakeholders. These negotiations create values that go beyond the interests of shareholders. The implementation of SR policies is quite complicated since companies should adapt their policies to the local policies in order to gain more legitimacy [24]. Therefore, the implementation of CSR policies in multinational and international companies is quite strategic. Numerous of these businesses are based in underdeveloped nations, where social considerations are crucial. Thus, They are essential to the growth of these situational factors [25].

International companies, by and large, are capable of controlling and changing the economic, environmental, and social dimensions as the major pillars of SD because they operate in different markets, which allows them to simultaneously exhibit their SR-related actions in different parts of the world [26]. Nonetheless, unlike local companies, these companies face countless challenges posed by NGOs, governments, and global pressure groups in host countries [27].

The discussion and review of SR in the area of mining are of critical importance because the impacts of this industry on the economic, environmental, and social indicators are evident. To handle these effects, mine managers should devise fundamental plans in line with SR and incorporate them into their strategic and operational management practices. These measures and practices certainly offer short-term, mid-term, and long-term benefits for mines [28].

Considering the huge role of mining communities in CSR, the Council of Mines and Metals (ICMM) has declared its intention to assist SD, which has brought about changes in mineral markets, governments, and inter-sector cooperation. These changes have raised the commitment of the mining sector to SR and the implementation of activities in line with SD [28]. From a historical point of view, mining is one of the industries that have always destroyed the environment and are considered unstable. If mining companies, in addition to focusing on revenue generation, take positions based on ethics, environmental conservation, and social justice, many concerns of the opponents of this industry can be rectified.

One study has argued that mine owners should be socially responsible toward other stakeholders [29]. The studies conducted on SD in mining have primarily explored environmental sustainability. In contrast, based on the principles of SD, if one of the SD indicators is unsustainable, the industry is practically unstable from the viewpoint of SD [30]. Fortunately, an increase in studies on global concerns and the greater attention of communities to the mining industry has caused researchers to attend more to the social dimensions of mining. Suppose mine owners implement proper methods of strategic mining management and simultaneously address social, economic, and environmental issues. In that case, it can be expected that in the future, with the interaction of three indicators of SD, this industry's social issues, as well as its environmental and financial issues, will be addressed [31].

As mentioned in Section 1, research in the field of CSR in mining with regard to SD indicators is very scarce. Therefore, it is essential to conduct a systematic review that functions as a guide and reveals the research orientation of this area, the most important themes, the leading scholars, the best articles, and the latest research in this field for those who are interested in this area. To bridge this research gap, this paper undertook a systematic review in the field of CSR in mining with regard to SD indicators in order to respond to these challenges.

3- Procedure of systematic review

The present study, as a systematic review, has attempted to identify, assess, and construe studies in the field of CSR with respect to SD indicators in the mining industry. According to Rowley and Slack [32], concepts, experiences, and theories are examined and organized to make it easier to identify, evaluate, and analyze studies on a certain topic. Valuable reviews in systematic articles comprise the critical reporting, evaluation, analysis, and synthesis of what has been published in a particular field. Review articles generally pursue two major goals [33]: 1) summarizing current research to identify patterns and themes; 2) identifying the theoretical background of the subject being studied and advancing the creation of theories.

In this study, the framework proposed by Tranfield was used to develop the process of the research method [34]. This systematic article has three major phases: 1) the collection and review of relevant articles, 2) development (the synthesis of the data obtained from reviewing the extracted articles), and 3) analyzing the results, finding possible relationships between the results, and finally announcing the results.

The first phase, i.e., the search process of collecting the data and finding articles in the field of CSR with respect to the indicators of SD within the mining sector, is briefly described. Then, the way the procedure for data analysis was performed is explained.

3-1- Search process for extracting relevant articles

Given the significance of using a suitable strategy to extract articles, determining the search terms (keywords) is of great importance [35]. The procedure for extracting the pertinent articles, which was carried out on December 10, 2023, is as follows:

- The articles reviewed in this research were collected from the Scopus database, which is one of the largest online scientific databases. The search was carried out without using the chronological filter. The collected resources include scientific articles, chapter books, and books written in English.
- Considering the purpose of this study, The investigation was carried out in the titles, abstracts, and keywords of all SCOPUS publications using the keywords "mining" and "social responsibility". Based on these search terms, about 600 articles were identified.
- In the second stage of the screening, as an error occurred in the word search and the articles related to "data mining" and "determining" were also included, the screening was performed with more precise restrictions. Given that this study examined CSR in mining with regard to SD, the keywords related to SD were also used to limit the search results. The limiting keywords in the second stage of screening included: "Corporate social responsibility" or "CSR", "mining industry", and "SD". Using these limiting search terms, the number of articles extracted from the Scopus database reached 101.

3-3- Data analysis and accuracy

After the identification of the relevant articles (n=101), data analysis was performed in two stages. First, the descriptive review of the research on corporate social responsibility in the mining industry with regard to SD indicators was carried out. This analysis included the annual distribution of the articles in this field, the distribution based on the titles, the distribution based on the names of the authors, and the distribution based on the geographical focus of the research. The extracted papers were thoroughly examined in the following stage in order to address the study's primary goal. VOS-viewer software was utilized to determine the mainstreams and carry out a more thorough examination.

Although the analysis was performed systematically, it was based on human analysis and subject to bias. To avoid this issue as much as possible, following the recommendations of several researchers [34, 36, 37], all stages of data analysis were undertaken by four researchers who were experts in the fields of CSR, mining, and SD. Furthermore, to ensure the validity of the findings, all the obtained results were publicly presented in the mid-term, mostly through talks that were delivered orally, to experts in the fields of mining, SD, and/or CSR. These experts were allowed to offer their suggestions for improving the quality of the overall results.

4- A review of mining industry studies

In this section, the results of the systematic assessment of the extracted articles in the field of CSR and mining with regard to SD indicators are provided.

4-1- Descriptive analysis

Among the 101 extracted articles in this field, the first article, entitled "Mining companies' role in SD: The 'why' and 'how' of corporate social responsibility from a business perspective," was published by Hamman in the *Development Southern Africa* journal in 2003 [38]. This article had 436 citations at the time of undertaking the present study. The journal in which Hamman's article was published is among the top 25% of journals (Q1), with an impact factor of 4.1 in 2022. Husnah and Fahlevi published the most recent article in this field in the *Uncertain Supply Chain Management* journal [39]. Figure 1

illustrates the publication trend of articles in the field of CSR in mining with respect to SD indicators up to December 10, 2023.

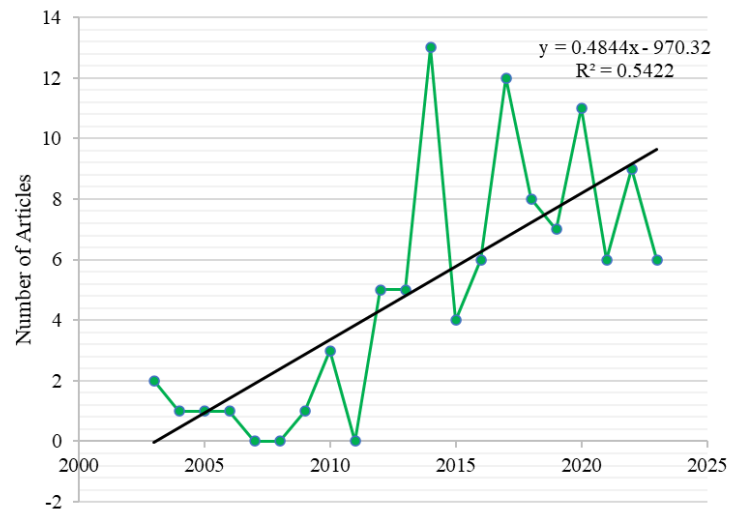


Figure 1. Publication trend of publications about CSR in mining in relation to SD indicators

As illustrated in Figure 1, the greatest number of articles in the field of CSR in mining with respect to SD indicators were published in 2014, 2018, and 2020. In general, there is a significant upward trend in the publication of articles in this field. It is predicted that the growing trend of publishing articles in this field will continue by training researchers and increasing their knowledge about this field, as well as building a CSR culture within the mining industry.

Regarding the publication of articles in terms of the countries, the review of the extracted articles demonstrates that researchers in 40 countries focus on CSR in mining from the perspective of SD indicators. The ranking of countries based on the number of published articles shows that England (12%), Australia (10.4%), and Canada (8.8%) are the leading countries in this research field. Table 1 outlines the rankings of nations based on the number of publications published in the field of mining CSR in relation to SD metrics.

Table 1. Percentage of articles published in different countries

Countries	Percentage of publication
United Kingdom	12
Australia	10.4
Canada	8.8
Poland	7.2
India	5.6
South Africa	5.6
Indonesia	4.8
United states	4.8
Spain	4
Portugal	3.2
Sweden	3.2
France	2.4
Other countries	28

One of the most interesting findings is that most of the countries in Table 1 are either the countries with many mineral resources (such as Australia and Canada) or developed countries that place a high value

on environmental and social issues (such as England and Spain). Another intriguing finding is the absence of countries with huge reserves of natural resources, such as Russia, Iran, and China, in the list. The total share of these three countries is only 2.4% (Table 1). Given the huge natural resources and the high capacity of these mineral resources, as well as the direct impact of the mining industry on the economy, community, and environment of these countries, it is required to take research on these dimensions and issues more seriously in these countries.

As for the number of published articles per author, researchers with the highest number of published articles in this field are included in Table 2. The findings show that two researchers, each with four studies in the field of CSR in mining with respect to SD indicators, are from Sweden and Australia. Dr. Ranängen is a professor at Luleå University, Sweden. This prominent scholar in this field received his doctorate from the same university in 2015 in the field of environmental management. He has been teaching at this university as an Associate Professor since 2020. Dr. Ranängen’s research areas of interest primarily revolve around SD, environmental management, and CSR [40].

International scholar Deanna Kemp works at the University of Queensland in Australia.. Now, he works as a professor at this university. His research mainly centers on the social aspects of mining. Recently, he was chosen to lead Cambridge University's Centre for Social Responsibility in Mining (CSRSM). In addition to plenty of academic achievements, he has been very active in industrial environments and has cooperated with many top mining companies in the world like Broken Hill Propriety Company (BHP) [41].

Table 2. Researchers with the greatest quantity of publications in the field of CSR in mining with respect to SD indicators

Author	No. of articles	Reference
Ranängen	4	[42-45]
Kemp D	4	[46-49]
Woźniak J.	3	[50-52]
Dashwood	3	[53-55]
Yakovleva, N.	3	[56-58]

On the whole, at the time of conducting this research, the 101 extracted articles published in this field were cited 4753 times. 38.34% of citations belong to the articles published in England. Australia is ranked second with 22.93%. The number of citations given to the extracted articles by different countries is demonstrated in Table 3.

Table 3. Number of citations by country

Countries	Percentage of citations
United Kingdom	34.38
Australia	22.93
Canada	9.32
New Zealand	4.02
Poland	3.7
United States	3.3
Denmark	3.11
Argentina	2.71
Switzerland	2.12
Other countries	14.4

As indicated in Table 3, the articles published by English, Australian, and Canadian researchers have received more attention than those published by researchers from other countries. Table 3 also reveals

that the readers of the articles published by these researchers in the field of CSR in mining with respect to the indicators of SD have shown an acceptable level of satisfaction with the articles. Table 4 reports the most important journals publishing articles related to CSR in mining with respect to SD indicators.

Table 4. Journal publications

Journals	No. of publications	% of total publications
Resources Policy	18	17.8
Journal of Cleaner Production	9	8.9
CSR, Sustainability, Ethics and Governance	8	7.9
Corporate Social Responsibility and Environmental Management	5	5
Sustainability (Switzerland)	5	5
Extractive Industries and Society	4	4
Journal of Mines, Metals and Fuels	2	2
Development Southern Africa	2	2
Other journals or conferences	48	47.6

In Table 5, among 101 articles published up to December 10, 2023, 10 articles with the most citations are introduced.

Table 5. Most cited articles in the area under study (top 10 articles)

Article title	No. citations	Reference
Corporate social responsibility in the mining industry: Exploring trends in social and environmental disclosure.	614	[56]
Social license and mining: A critical perspective.	464	[48]
Corporate social responsibility and the mining industry: conflicts and constructs.	281	[59]
Development on whose terms?: CSR discourse and social realities in Papua New Guinea's extractive industries sector.	191	[60]
Maintaining the legitimacy of a contested practice: How the minerals industry understands its 'social license to operate'.	174	[61]
Mining companies' role in SD: The 'why' and 'how' of corporate social responsibility from a business perspective.	161	[38]
Community relations and mining: Core to business but not "core business".	158	[47]
Evaluating the drivers of corporate social responsibility in the mining industry with multi-criteria approach: A multi-stakeholder perspective.	148	[62]
The rise of global corporate social responsibility: Mining and the spread of global norms.	133	[53]
Corporate social responsibility in the mining industry: Perspectives from stakeholder groups in Argentina.	125	[57]

Finally, Table 6 reports the articles published from 2022 to 2023. Certainly, some of these articles have much value. Since these articles have been published in the last 18 months and research in the field of CSR in mining with respect to SD indicators is somewhat scarce, it is possible that in the current descriptive analysis and outputs, not much attention has been devoted to them. Therefore, these articles are provided in a separate table 6.

Table 6. paper published in the field of study in 2022 and 2023

Year	Article title	Reference
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2023	Sustainability and profitability efficiencies: the moderating role of corporate social responsibility.	[63]
	CSR and Labor Policies in the South African Mining Industry.	[64]
	Corporate Social Responsibility and the Challenges of the Regulatory Environment in the Tanzanian Mining Sector.	[65]
	Creating shared value strategies to reach the United Nations SD goals: Evidence from the mining industry.	[66]
	Community-centred approach for assessing social sustainability in mining regions: A case study of Chingola district, Zambia.	[67]
	How do corporate social responsibility and sustainable development goals shape financial performance in Indonesia's mining industry?	[39]
2022	Beyond the social license to operate: The whole system approaches for a socially responsible mining industry.	[68]
	When social movements close institutional voids: Triggers, processes, and consequences for multinational enterprises.	[58]
	Issues of corporate social responsibility in the mining industry: The case of China.	[69]
	Corporate vs. Corporate foundation as a support tool in the area of social responsibility strategy–Polish mining case.	[50]
	SLO in CSR perspective-A comparative case study from Poland (2018–2020).	[51]
	Achieving sustainable corporate social responsibility outcomes: a multiple case study in the south african mining industry.	[70]
	Mapping the literature on social responsibility and stakeholders' pressures in the mining industry.	[71]
	The operationalization of Corporate Social Responsibility (CSR) in a mining context.	[72]
Corporate Social Responsibility Index for Mine Sites.	[73]	

4-2-Cluster analysis

As shown in Figure 2, the VOS-viewer analysis reveals five distinct clusters. Figure 2 depicts the co-citation network of the articles obtained from the analysis. Co-citation means how many times two research papers are cited together in the given articles. By examining different clusters in co-citations, the research origins are identified, which facilitates the identification of the major research themes in a given field.

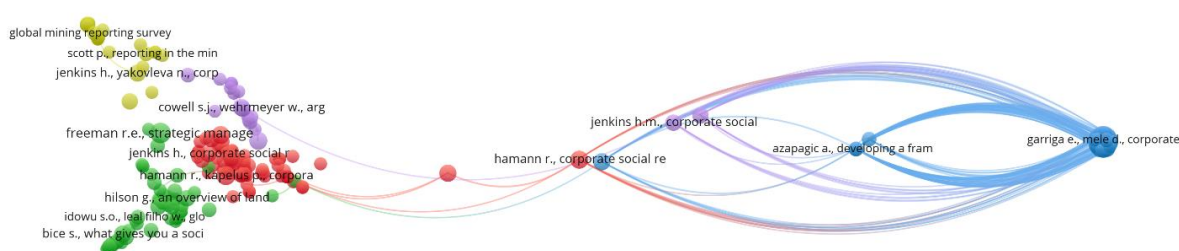


Figure 2. Co-citation network of extracted articles

Five main clusters are observed in the co-citation network (Figure 2). The analysis shows that these five CSR clusters in mining with regard to SD generally consist of I) the social responsibility of mining territory, II) strategic management in accordance with social responsibility in mining companies, III) responsible behavior of mining companies toward the environment, IV) stakeholders' interests created by measures taken in line with SR in mines, and V) the evaluation of practical measures carried out by mining companies or the provision of practical solutions to different challenges and problems for the improved mining CSR implementation in relation to the SD indicators.

The temporal mapping of keyword clustering obtained from VOS-viewer demonstrates that in the past few years, CSR studies have altered their conventional approach, and the issue of CSR in mining with regard to SD has gained legitimacy. Furthermore, the requirement of social certificates for starting mining operations has become a hot research topic (Figure 4).

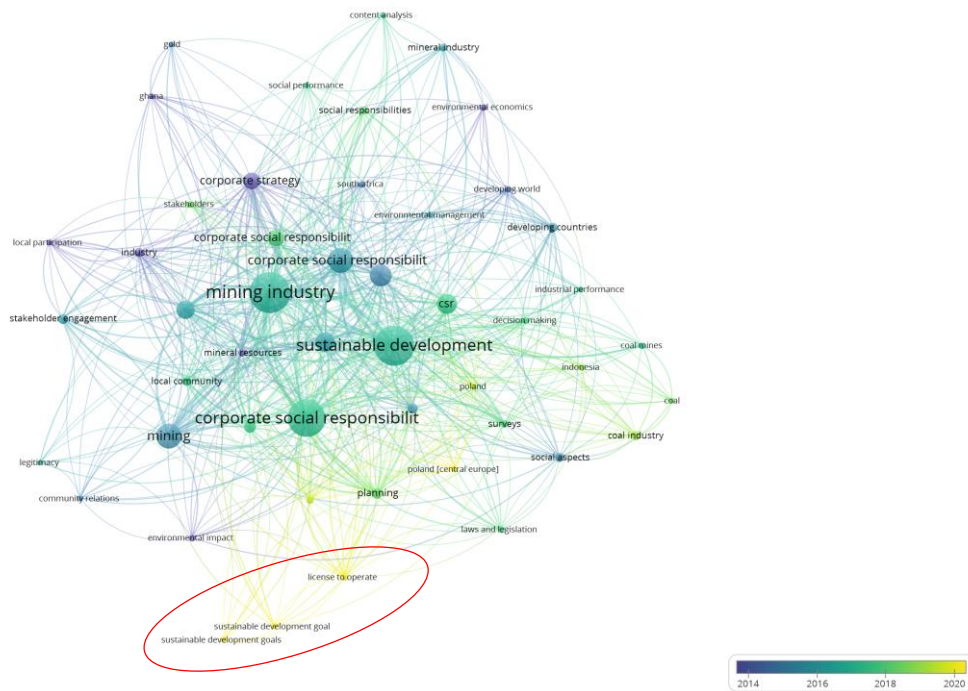


Figure 4. Keyword clusters by time

To further investigate the reviewed articles and apply more restrictions, the researchers themselves evaluated the same keywords to detect the focal themes of CSR research in mining with regard to SD indicators. The data were analyzed through VOS-viewer software, and Figure 5 presents the findings. As observed in Figure 5, all the achieved results are in good agreement with those provided in Figure 3 and Table 7, which confirms the validity of the results summarized in Table 7.

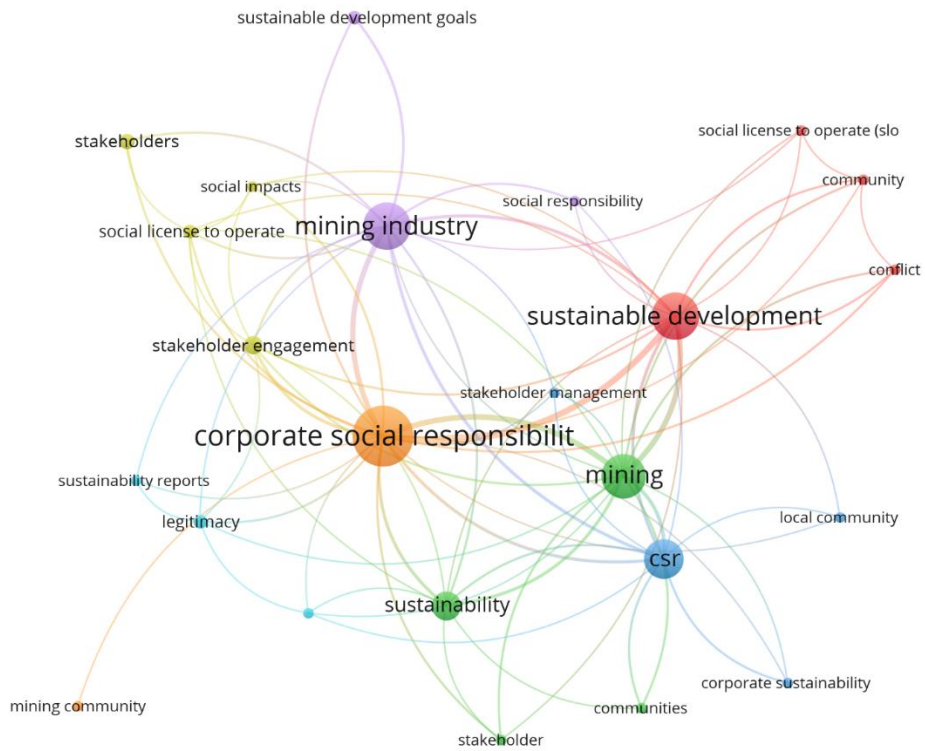


Figure 5. Analysis of keywords by researchers

The bibliographic coupling analysis network is displayed in Figure 6. Bibliographic coupling refers to the number of citations an article in a specific theme gives to previous articles published in the same theme. Through bibliographic coupling, it is possible to find out who the researchers in so many mining CSR fields in relation to SD indicators are and what articles are related to a specific research theme. Based on the bibliographic coupling analysis network (Figure 6), six main clusters are identified.

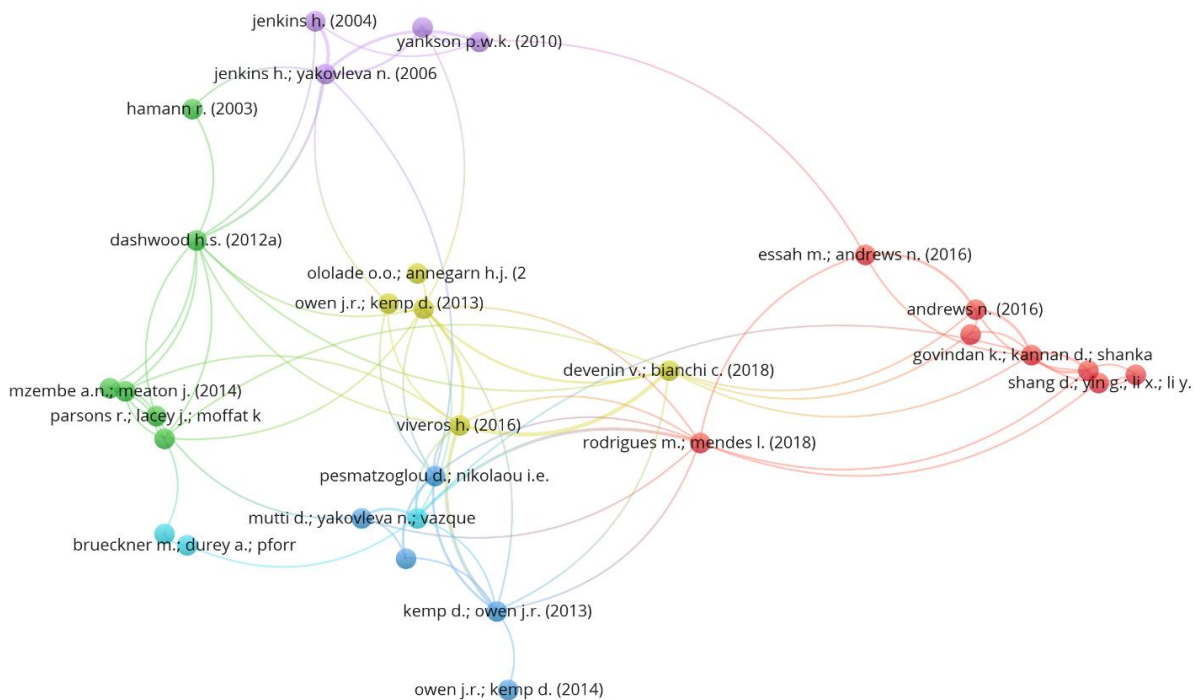


Figure 6. Bibliographic coupling cluster of reviewed articles

Considering Figure 6, the cluster of articles in specialized themes of CSR in mining with respect to SD indicators are reported in Table 8.

Table 8. Articles published in each cluster of bibliographic coupling

Cluster No.	References
1	[62, 74-80]
2	[38, 53, 61, 81, 82]
3	[47, 49, 57, 83]
4	[48, 84-87]
5	[56, 59, 60, 88]
6	[43, 89, 90]

Regarding the author and scientific institution partnership cluster analysis at the international level, no remarkable finding was achieved. It seems that researchers in this research area have cited each other's articles but have never been inclined to collaborate in doing research in the mining industry's CSR field and have chosen to carry it out on their own. Only five scientific centers have cooperated in this field in Australia.

4-3- Results of descriptive, cluster, and literature analyses in the field under study

The results obtained from the descriptive and cluster analyses presented in the previous sections can be divided into eight major categories (Table 9).

Table 9. The most important results obtained from descriptive and cluster analyses

No.	Main results
1	Effects of mining on SD indicators considering CSR
2	Intrinsic factors of sustainability in the mining industry considering CSR
3	Impact of communities around mining area on mining
4	Management of stakeholders' expectations
5	CSR strategies and social responsibility reports
6	Legitimacy of sustainability reports and heterogeneity of content
7	Standardization for report preparation, monitoring, and evaluation
8	Role of governments

In what follows, each of the categories presented in Table 9 is discussed.

4-3-1- Effects of mining on SD indicators considering CSR

The mining industry, operating in different communities (developed, developing, and underdeveloped countries), faces serious social and environmental challenges. Among these challenges are the non-acceptance of mining projects by the indigenous people of the region, the lack of skilled labor, environmental pollution around the mining area, and noise pollution [91]. According to some researchers, a large part of these concerns and challenges in the mining industry can be eliminated or their effects can be reduced through SR practices [92]. Dougherty and Olsen also support this assertion. These researchers have pointed out that since the early 1990s, the mining industries have grown a strong sense of responsibility for CSR in their surrounding communities. Greater attention to CSR has been an effective strategy for the survival of these mining companies in these communities and has caused economic and social synergies in mining areas. Mining, as the main supplier of raw materials for industries, has a special place in job creation and economy and has not only social and environmental impacts but also local and global effects [9, 93].

4-3-2- Intrinsic factors of sustainability in the mining industry considering CSR

As mentioned before [9], environmental pollution is one of the inherent consequences of mining. With the advent of the industrial revolution and technological progress [94-96], the need for raw materials has been raised so drastically that mining companies have had to carry out many more mining operations, which has raised public concerns about the environmental damage caused by these operations, particularly since the 21st century. Therefore, the major and inherent challenge of mining is to prove that its activities are in keeping with the ideas of SD (i.e., addressing the needs and well-being of the present generation while keeping an optimistic future to ensure that the requirements of future generations are met) [97]. Consequently, mining should devise its strategies in such a way that it can respond to public concerns and attain social satisfaction without interfering with mining activities [98].

Based on what was stated, building a healthy partnership between SD and the mining sector is a difficult problem because valuable natural resources are limited and non-renewable, which causes some concerns about meeting the needs of future generations [9]. These concerns can be resolved by making management decisions in line with SR. As argued by some researchers [99, 100], when management measures are devised, implemented, and expanded so meticulously that they are performed on a voluntary basis and go beyond mandatory laws and regulations, it is possible to increase mining sustainability and create competitive advantages for mining companies. Therefore, it is of paramount importance for mining companies to implement an extended environmental and social plan that can consistently help decrease environmental conflicts and produce information for the next generations [101, 102]. It means that the mining industry should be open to criticisms concerning SD indicators and be aware of its contribution to global sustainability [103]. These arguments show that attention to the community is one of the most critical dimensions of SD indicators from the perspective of mining companies. Mining companies have substantially invested in this area so that they balance socio-economic dimensions and consequently provide sustainable economic growth for themselves and the mining communities [82]. Finally, the legitimacy of SR measures has been introduced as a crucial factor [104], and mining companies should meet what stakeholders consider as their CSR obligation or commitment. Today, regarding their commitment to CSR, mining companies have come to the understanding that their activities should be consistent with the principles of global sustainability as much as possible [31, 85].

4-3-3- Impact of communities around mining area on mining

Mining companies should establish proper relationships with the communities around the mining area. To put it in other terms, mining companies should try to comprehend the perspectives of these communities and reach mutual understanding with them by creating consistent two-way communication and negotiations [46]. To do so, mining companies should consider the geographical location of the mining area and its local and cultural characteristics in their strategies in order to mitigate the concerns of the nearby towns surrounding the mining region and thus gain their local and social legitimacy for mining activities [105]. Companies can invest in tangible and intangible assets (building schools, creating infrastructure, training people, creating health centers, etc.) to obtain the necessary local and social legitimacy for mining operations [106]. One can ascertain the efficacy of these expenditures by the amount of economic and social development in the areas around mining. Generally, it is required to understand that mining operations have systematic effects on the environment and society, and they should be addressed systematically and incorporated into strategies [107].

Furthermore, the cultural and linguistic differences of international mining companies pose certain challenges in mining areas. These companies should find a common language with the surrounding communities in order to gain higher local and social legitimacy [108]. By giving communities symbolic power in CSR management, mining companies can gain their trust. As a result, local communities believe that mining companies are committed to their SR measures [92, 109]. It is substantially important for mining communities to perceive that the mining industries' operations in their region improve their quality of life and generate economic prosperity for them [110].

4-3-4- Managing the expectations of stakeholders

Effectively handling the expectations of stakeholders is essential for companies and communities to have fruitful collaborations [59, 107, 111] since the value created by mining companies is simultaneously shared with shareholders and other stakeholders [112]. However, reaching these shared values is highly dependent on all shareholders and stakeholders and is achieved with the cooperation of all stakeholders [113]. Therefore, The development of long-term, sustainable values for stakeholders should be encouraged by all mining corporations, so as to be allowed to gain a sustainable competitive advantage for mining operations, value creation, and survival in the mining area. Moreover, some researchers claim that human and labor rights are an integral part of SR [114, 115].

4-3-5- CSR strategies and social responsibility reports

Nowadays, most mining companies, especially in developed countries, are required to prepare reports in line with SR. These reports are generally accessible to the public under the title of "CSR report" or "Sustainability report" [116]. By preparing these reports according to local communities' and stakeholders' expectations, big mining corporations can meet these expectations. In these reports, all the activities of mining companies carried out in line with SR, the economic indicator, the environmental indicator, and, in general, SD are included [10]. The measures these companies have planned to take in the future are also mentioned. These reports are usually provided once per season as quarterly reports and once per year as annual comprehensive reports and are made available to the public. The publication of these reports can help raise the legitimacy of mining corporations on a local and worldwide scale while fulfilling stakeholder requirements [53].

4-3-6- The legitimacy of sustainability reporting and the diversity of information

After examining the reports supplied by the ICMM, Fonseca came to the conclusion that they had always been verified and scrutinized [117]. However, some researchers contend that these reports require more detailed inspection and control [118]. In effect, the accuracy, integrity, control, and transparency of the information presented in these reports are still much lower than expected due to the lack of information and models for systematic comparison [116]. Owing to an increase in criticism about mining operations by environmental and social activists, ICMM emerged in 2001 as the representative of 20 mining companies and more than 30 national, regional, and global mining associations. To increase the mining sector's contribution to SD, ICMM has developed the SD Framework (SDF) for its member companies. In this framework, the importance of topics including social and economic concerns, risk management, health and safety, environmental preservation, respect for human rights, customs, and values, and ethical corporate practices are emphasized. In addition, ICMM compels its member companies to prepare detailed reports based on the Global Reporting Initiative (GRI) guidelines. The ICMM SD framework emphasizes how the mining sector adheres to SD principles [53].

4-3-7- Standardization for report preparation, monitoring, and evaluation

Stringency in CSR reporting by using standardized regulations probably makes mining companies adopt more appropriate SR practices [119]. Although the growing use of rigorous standards, such as Global Reporting Initiative (GRI) standards, has fostered relative optimism about the accuracy and transparency of CSR/sustainability reporting, Boiral argues that CSR reports prepared by companies based on the GRI standards should be monitored and issued by external auditors. Villiers and Alexander review the GRI reports, stating that a clearer and more efficient design for the Global Sustainability Standards Board (GSSB) might be achieved [11, 120]. Boiral contends that sustainability reports issued by companies are not reliable because they are possibly prepared to cover the real problems of these companies. Therefore, to ensure the validity of these reports, it is essential to have external auditors evaluate and monitor them [121, 122].

4-3-8- Role of governments

Mining organizations ought to abide by national legislation in which they operate in order to satisfy the interested parties and promote their legitimacy in the mining area [123]. The strategic analysis of CSR strategies adopted in mining companies has demonstrated that the effectiveness of the CSR measures of mining companies is directly determined by the similarities of laws and regulations in mining companies with those in the country in which they operate [9, 124].

Figure 7 provides the main issues discussed in this section and underlines the fact that mining companies entail reconsidering their perspectives, missions, and strategy values to overcome the challenges that push them away from sustainability agendas. It indicates that by adopting a proper CSR approach, sustainability can be realized, and mining companies can gain the necessary legitimacy from the government and community to continue their operations, thereby ensuring the continuation of long and sustainable mining operations. Eventually, these measures would pave the way for these mining communities to move in the path of sustainability progressively.

5- Conclusion

Research in the area of corporate social responsibility has revealed that CSR indirectly affects the economic and environmental indicators; however, these impacts are less than the influence of CSR on the social indicator. Mining companies have not generally obtained significant achievements in implementing social and environmental obligations, which deviates them from SD. In many nations, the mining sector is economically significant., notably in developing and impoverished areas; as a result, not much attention is devoted to the damaging consequences that mining operations in this sector have on the surrounding population and the environment. Given the abovementioned points, Social and environmental activists constantly put pressure on mining organizations to keep this business consistent with SD. One of the effective solutions to tackling environmental and social concerns and improving SD in this industry is to develop and implement policies in line with SR without noticeably jeopardizing the economy of mining companies.

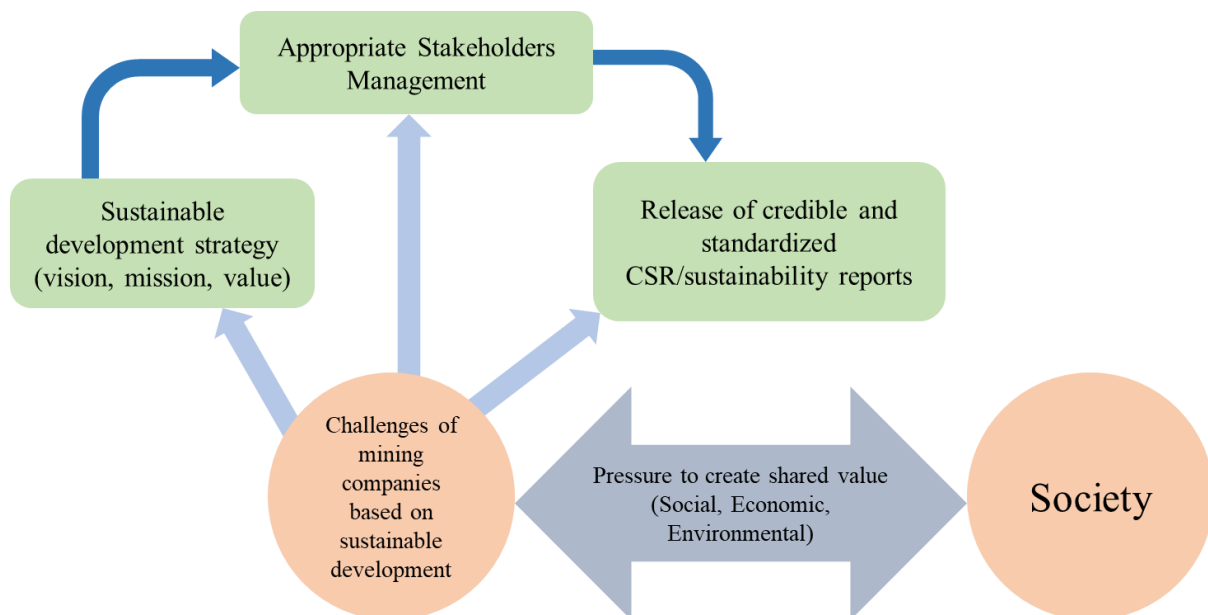


Figure 7. Sustainability challenges from a CSR perspective in the mining industry

As an example, mining companies can invest in expanding infrastructure for local communities and promoting the level of life quality and well-being of the residents of the mining area (the social indicator of SD). Adopting responsible environmental strategic policies that address the concerns of environmental activists and international institutions can also improve the image and legitimacy of mining companies. However, this industry faces various obstacles, including cultural and language

problems, and usually comes into conflict with its stakeholders in the mining area. To deal with these problems, the concepts of SD should be developed over time, and companies are required to achieve equilibrium between SD's social, environmental, and economic metrics. Today, in European countries, some mineral resources are left intact because the host countries impose legal requirements like environmental and social requirements on the investing companies, which makes the exploitation of these mines uneconomical for them.

In order to overcome mining challenges, maintain the dynamic internal and external environment of companies, and make them give priority to SR and consider it an indispensable part of their management planning, it seems necessary to form a different business perspective within the mining sector. Therefore, in the prospect among mining corporates, the business model should not only focus on the economic dimension but also should be based on the entire value chain. In this prospect, Information technology, research, and development should be prioritized, and human resource management should be proactive and motivation-based. Moreover, it should be a top priority to work closely with all stakeholders involved. To promote SD, mining companies should provide a safe work environment, support new technologies, and convincingly meet the community's expectations in environmental and energy management. Given the pressure of stakeholders, mining companies are highly sensitive to environmental and social concerns. Under such conditions, due to the opposition of the stakeholders to overseas involvement in the mining industry, negative environmental effects, the export of raw minerals without creating added value from these resources in the host country, and other concerns of the stakeholders, mining companies are expected to resolve these concerns by actively involving in social and environmental issues and establishing close communication with their stakeholders.

This research, as a comprehensive, methodical study of the literature on CSR in mining with regard to SD, offers valuable information to the mining industry. Providing a future vision, this research, which discusses some theoretical and practical concepts, gives a better insight into CSR and SD for academics, mining companies, and mining professionals. It also paves the way for those who would like to conduct studies on CSR with regard to SD in the mining field. This research contributes to the area of sustainability in the mining industry as it analyzes the articles published in the field of CSR in mining with respect to SD indicators. The data analysis also reveals the gaps in this area and introduces possible research topics for those interested in this field. As for SR in the mining industry, it is found that much attention needs to be devoted to the interaction of businesses with stakeholders, particularly local communities. The results suggest that mining companies should establish constructive communication with the government and local communities and adopt responsible behavior toward environmental and social issues.

As evident in this research, the studies conducted in this field are very scarce, and in general, replicated studies in this area are very limited. Hence, the issue of CSR in mining with regard to the SD indicators, especially the environmental and social indicators, as well as the relationship between mining companies and stakeholders are suitable areas for upcoming studies in this area. The findings of this research show that although certain progress has been made in adopting strategic practices in line with SD to minimize environmental and social issues, some concerns remain about the current assessment methods. The results have also disclosed that the process of assessing sustainability and reporting on CSR and sustainability is developing slowly and needs more attention. Within the mining sector, the leading companies in the field of CSR are more aware of the problems associated with SD and attempt to adjust to the principles of SD by implementing strategies in line with SR. However, many companies, especially in developing and underdeveloped countries, do not incorporate these principles into their plans. Today, the integration of CSR into management strategies is considered essential for the creation and effective execution of mining projects and the balance between economic priorities and environmental and social concerns. Another important finding is that nowadays, regulatory emphasis on the increasing demand for benefit sharing from resource extraction is growing; therefore, the strategies of mining companies to mitigate such pressures would be substantially effective. Social

legitimacy, environmental challenges, The involvement of mining corporates in reducing the impacts of this industry on climate change, and challenges related to labor safety, supply chain management, and distribution channels are among other highly significant issues within the mining industry's CSR field. These pressures can help mining companies align more with SD principles. Since industries are remarkably dependent regarding water resources, the water issue is often a subject of dispute between industries and communities. It puts the mining industry under increasing pressure for sustainable management, especially with regard to climate change and population growth. Therefore, It is expected that mining businesses to make investments in creative ideas in line with SD in the future. To assist in meeting the demands of the present and future generations, it is required to conduct more international research on this topic in order to comprehend better the worldwide trend of studies and measures taken in this field.

Finally, the focus of the extracted articles is basically on SR and its effects on SD in mining companies. A necessity exists to expand studies in this area and explore the role of other stakeholders who are essential to the sustainability of mines and SD indicators.

Declaration of generative AI and AI-assisted technologies in the writing process:

During the preparation of this work, the Mahdi Pouresmaieli used ChatGPT and Grammarly to improve their writing and grammar. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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