Research article

Environmental sustainability disclosures in annual reports of mining companies listed on the Australian Stock Exchange (ASX)

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ABSTRACT

Mining companies use environmental sustainability reporting to inform their stakeholders about their position in relation to environmental sustainability. This paper explores how these companies include topics related to the environment and its protection in their annual reports. The 100 largest mining companies listed on the Australian Stock Exchange (ASX) were included in the research sample, using market capitalisation as the size indicator. The investigation was performed by means of quantitative and qualitative content analysis of annual reports to identify relevant keyword occurrences. Results revealed that topics related to protection of the environment, emissions, carbon footprint, and climate change are addressed in companies' annual reports. In line with research in other industries, this study confirmed that the intensity of communication about these topics varies with company size. A new methodology was developed to assess the extent to which mining companies inform the stakeholders about their environmental protection initiatives and to address the limited applicability of the GRI G3 disclosure checklist for sustainability reporting, thereby enhancing the theory of social licence to operate.

1. Introduction

Mining operations can contribute to negative externalities such as erosion, sinkholes, loss of biodiversity, global warming or the contamination of soil, groundwater, and surface water (Ali et al., 2018; Bebbington and Williams, 2008; Ossa-Moreno et al., 2018; Ponce and Mcclintock, 2014). With the growing awareness of the importance of environmental sustainability, environmental deterioration is becoming a global concern (Borghesi et al., 2015; De Marchi, 2012; Horvathova and Davidova, 2011). Nexus thinking – integrated thinking about resilience, sustainability management and governance, reporting practices, and their interconnections – is increasingly important to address sustainability challenges (Dahlmann and Bullock, 2020). The world is becoming more sensitive to social and environmental issues (Toscano and Grieve, 2020) resulting in higher expectations that businesses should fulfil their role to protect the environment. Transformation of products, processes and approaches to reduce businesses' environmental impact and resource use is widely encouraged (Kemp, 2010). Companies are also compelled to take action and publish sustainability reports to demonstrate their commitment towards achieving the Sustainable Development Goals – SDGs (UNDP, 2021).

In this social climate, the mining industry faces several challenges. Firstly, there is a need for the industry to transform and reduce the environmental impact of its operations (Carvalho, 2017; Dubinski, 2013). Secondly, due to pressure from the society and regulators, mining companies are looking for ways to inform their stakeholders about their environmental protection initiatives (Franks et al., 2014; Lodhia et al., 2020; Owen and Kemp, 2013). This pressure on mining companies is especially eminent in Australia, where perceptions of greed and environmental damage exist in the public's mind (Toscano and Grieve, 2020). Therefore, environmental sustainability reporting can be considered fundamental for building functional company-community relationships and assisting with the creation and maintenance of the social licence to operate. Topics such as social licence to operate and the importance of engaging in a company-community dialogue are prominent in the literature (Karakaya and Nuur, 2018).

Annual reports are widely used as a tool for sustaining stakeholder relationships (Plotnikova, Shilovskaya, Strubalin V, & Muravleva V, 2020). They also contain messages and results that are considered important and highly relevant by companies' management. Therefore, annual reports are regarded as a tool for companies to express their views on environmental issues (Ahmad and Hossain, 2015) and therefore

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ideally suited to communicate messages related to environmental consciousness to mining companies' stakeholders and to influence their perceptions (van der Plank et al., 2016). Researchers investigated the level of environmental disclosures, which varied across countries and industries (Abdullah et al., 2020; Welbeck et al., 2017). Companies are integrating environmental disclosures into their annual reports, while some also publish separate sustainability reports (Kuzey and Uyar, 2017; Myskova and Hajek, 2018).

Research suggests that the intensity of environmental sustainability reporting depends on the industry (Braam et al., 2016; Legendre and Coderre, 2013; Skouloudis et al., 2014; Welbeck et al., 2017) and company size (Karaman et al., 2018; Legendre and Coderre, 2013; Liu and Anbumozhi, 2009; Reverte, 2009; Welbeck et al., 2017). This paper investigates whether and how company size influences that way it reports about environmental matters in the mining industry. The Global Reporting Initiative (GRI) is widely used for sustainability reporting (Sampong et al., 2018). Researchers identified potential issues with using GRI for sustainability reporting (Deegan, 2017). This paper focuses on addressing these issues by adjusting the keyword list to reflect the reporting of environmental sustainability topics more accurately.

Four research questions were formulated to investigate how the mining companies use their annual reports to communicate with their stakeholders about their environment protection initiatives.

RQ1: How can we address the limitations of using the GRI keyword list for the purpose of content analysis?

RQ2: How many times are keywords related to environmental matters mentioned in the annual reports of mining companies and what is the density of these keyword mentions?

RQ3: What notable differences exist between companies regarding the reporting of environmental matters in their annual reports?

RQ4: How does company size influence the level of reporting of environmental matters of Australian Stock Exchange (ASX) listed mining companies?

The formulation of RQ4 was informed by previous research suggesting the positive impact of company size on sustainability-related information disclosure (Karaman et al., 2018; Legendre and Coderre, 2013; Liu and Anbumozhi, 2009; Reverte, 2009; Welbeck et al., 2017). To answer RQ4, the following null and alternative hypotheses were defined:

H_0: Company size does not affect the level of environmentally related communications in annual reports of ASX listed mining companies.

H_1: Significant differences exist in the level of environmentally related communications in annual reports of ASX listed mining companies in relation to their size.

2. Theoretical background

Throughout the years mining activities provided most of the materials accumulated in the technosphere to produce infrastructure such as buildings, machines, tools, etc. that support the world's population (Carvalho, 2017). Thus, the mining industry has played a crucial role in the dynamic global economic growth (Dubinski, 2013).

2.1. The mining industry in Australia

Australia is prominent in the global mining industry and the world's top two mining companies have deep Australian roots (Powell, 2020). BHP, with its headquarters in Melbourne, is the largest mining company in the world, and employs more than 72,000 people worldwide, mainly in Australia and America (Powell, 2020). A total of 625 companies in the Metals & Mining category are listed on the ASX (Listcorp, 2020), with six Australian companies ranking amongst the top 50 mining companies in the world (Powell, 2020).

Mining has made, and continues to make, a substantial contribution to the Australian economy (Moffat et al., 2018). In FY2017 (the 2017 financial year from July 2016 to June 2017), mining accounted for six percent of Australia's GDP, making it the fourth largest contributor to the Australian economy (Minerals Council of Australia, 2017). In FY2017, resources exports were at a record high of 198 billion AUD and accounted for 54 percent of Australia's total export revenues (Minerals Council of Australia, 2017). In the fourth quarter of 2019, the contribution of the mining industry to Australia's GDP was 42,615 billion AUD (Trading Economics, 2020).

The economic contribution of mining positively affects other production and services sectors as well, such as retail and wholesale trade, construction, agriculture, and information and telecommunications (Bashar, 2015). Mining is absolutely crucial for some of Australia's regions: In Pilbara (Western Australia), it contributes to 88 percent of the total regional activity; 63 percent in the Bowen-Surat region (Queensland), and 34 percent in the Hunter region (NSW) (Minerals Council of Australia, 2017). Two established mining methods (open cut mining and underground mining) and two emerging methods (in situ leach mining and hydraulic fracturing) are used in Australia, each having different impacts on the environment (Lacey et al., 2019).

At the same time, the mining industry is under immense pressure from the public, local communities, and the investors to take the environmental and social impact of their operations more seriously. The Juukan Gorge disaster, where Rio Tinto destroyed two ancient Aboriginal rock shelters in May 2020, added fuel to the fire. Jean-Sebastian Jacques, Rio Tinto's chief executive officer said, 'our industry is one of the least trusted on the planet' (Toscano and Grieve, 2020). It is more important than ever for Australian mining companies to minimise their negative environmental impact and contribution to dangerous climate change (Barker, 2008) and to actively engage in company-community dialogues via environmental disclosures.

2.2. Social licence to operate

Not surprisingly, mining is among the human activities with widest environmental and social impacts (Carvalho, 2017). Although mining projects are diverse and may have different ecological footprints (Carvalho, 2017), there is a need for sustainable development in the industry of mining mineral resources (Dubinski, 2013). This has been transformed into a push towards better understanding and managing the territory developed in large-scale mining (Devenin and Bianchi, 2019). Companies are adopting corporate environmental ethics, integrating environmental awareness into decision-making inside and outside the enterprise, and further formalising green beliefs and ethics through the development of environmental policies (Chang, 2011). As such, they attach importance to environmentally friendly production processes and technologies (Guo et al., 2020).

Societal expectations about the environmental, social, and cultural 'performance' of industries involved in the development, use or management of natural resources have changed over recent decades (Edwards et al., 2019). Communities have increased expectations regarding the benefits they receive from the presence of such industries, along with assurances that the industry is properly regulated (Prno, 2013). Companies are aware of their close ties with local and wider communities and the importance of these relationships for the feasibility of their projects (Axon, 2020). Generating trust in the mining industry and its operators is an important driver of social acceptance in mining (Moffat et al., 2018; Moffat and Zhang, 2014).

Companies are seeking legitimacy through disclosing information related to their environmental protection initiatives, by engaging in the dialogue with stakeholders (Lodhia et al., 2020). The role of long-term relationships with various stakeholder groups has been widely discussed in the communication, PR, CSR, marketing and management literature (Lock, 2019). These six sub-dividable market domains cover all major stakeholder groups: i) customer markets; ii) referral markets; iii) influencer markets; iv) employee markets; v) supplier markets; vi) internal markets (Christopher, Martin Ballantyne, Payne, & Chartered Institute of Marketing, 1991). Stakeholder theory posits two views: i) moral view, suggesting that those impacted by an organisation's

operations have a right to be informed and to demand certain standards of performance; ii) strategic view, recognising that stakeholders can provide benefits to the organisation, such as legitimisation and social license to operate, risk management, and learning (Brower & Mahajan, 2013; Herremans et al., 2016). Informing stakeholders of values, status quo, actions, and plans related to companies' commitments towards environmental protection initiatives and sustainability are crucial for beneficial relationships (Oh et al., 2020). It forms part of an attempt to articulate the many ways in which companies are responding to societal and community expectations (Franks et al., 2014).

Mining companies require legal licence to operate, however, social licence should not be underestimated (Moffat and Zhang, 2014; Owen and Kemp, 2013; Wright and Bice, 2017), as external stakeholders have various legal, political, and social avenues to impose costs on focal firms (Franks et al., 2014). The concept of social licence to operate (hereafter referred to as 'SLO') has been widely accepted by the industry as an essential indication of sector's successful efforts to reach out to stakeholders, both global and local (Franks et al., 2014; Frantal, 2016; Lacey et al., 2017; Matlaba, Mota, Maneschy, & dos Santos, 2017). SLO refers to the ongoing acceptance of a company or industry's standard business practices and operating procedures by all stakeholders, including its employees, and the general public (Kenton, 2020). The company-community dialogue contributes to building relationships and leads to social acceptance of mining developments (Mercer-Mapstone et al., 2018).

2.3. Environmental sustainability reporting

Sustainability reporting, i.e. the reporting of issues related to the environment and sustainability of operations, can contribute to a perceived level of satisfying the requirements of the SLO (Franks et al., 2014). Such reporting also forms part of a company's Corporate Social Responsibility (CSR) commitments (Banks, 2006; Jaderna and Prikrylova, 2018) and builds business-community engagement (Narula et al., 2019). Through increased awareness and transparency, sustainability reporting can also assist in limiting stakeholder mobilisation, thus managing the risk of a negative effect on the target company (de Bakker, den Hond, King and Weber, 2013; Dorobantu et al., 2017; Haviernikova and Kordos, 2019). While the amount of sustainability reporting is growing worldwide, a low percentage of companies systematically disclose their sustainability related activities (Habek and Wolniak, 2015), which are also expected to be published as separate sustainability reports (Karaman et al., 2018).

There are three dimensions of sustainability reporting, namely economic development, social development, and environment protection (Pelikanova, 2019). The latter is the focus of this study. Corporate environmental sustainability reporting ('CESR'), also referred to as corporate environmental reporting, environmental sustainability reporting (ESR) or environmental disclosure (Berthelot et al., 2003) has been directly linked to the SLO, responding to stakeholders requiring companies to minimise their negative impact on the environment (Cerin, 2002; Haviernikova and Kordos, 2019). In line with legitimacy and stakeholder theories, public disclosure of the information pertaining to environmental performance (Matsumura et al., 2013) reduces the idiosyncratic risk companies face (Tzouvanas et al., 2020).

Transparent reporting of environmental information mitigates information asymmetries and helps create an informative network within society, which is crucial for dealing with climate change (Aggarwal and Dow, 2012; Tzouvanas et al., 2020). Research confirms the importance of the quality of environmental disclosures, which is manifested in their accessibility, transparency, and reliability (Syrotenko et al., 2021). Disclosure of environmental information reflects the companies' transparency and responsibility toward the environment, and can increase the confidence in these companies (Dinca et al., 2019). Evidence reveals that stakeholder-oriented governance mechanisms lead to more transparent environmental disclosure and higher environmental performance (Mallin

et al., 2013). Arena et al. (2015) empirically proved that transparent environmental disclosures is used to reveal superior environmental performance because of the greater societal pressure regarding environmental issues.

Environmental sustainability disclosures, often in report forms, represent a way to consult and influence stakeholders (Manetti, 2011) and contribute to stakeholder dialogue and engagement (Hess, 2007; Scherer and Palazzo, 2011). Trust has been shown to be a key element of SLO (Moffat and Zhang, 2014). Public acceptance of a company or industry's development activities is linked to public trust and confidence in their ability to 'do the right thing' (Morrison, 2014). Media reports have the power to influence public perception of mining. It was confirmed that trust towards the natural resource sector at the government, industry, and community nexus is mediated by media (Edwards et al., 2019). Media and public debate have also been confirmed to contribute to the formation of legitimacy (and fragility) of the SLO (Lyytimaki and Peltonen, 2016). Websites (Provasnek et al., 2018) or social media (Lodhia et al., 2020) are also used for sustainability reporting, contributing to stakeholder engagement and affirming the legitimacy of businesses.

An annual report is a primary document through which companies communicate details of their activities, financial results and strategies to shareholders and other stakeholders (CPA Australia Ltd., 2019). Other stakeholders include investors, employees, customers, donors, business journalists and many others (Venngage, 2021), all of whom form their perceptions and further influence the general public and communities. Annual reports represent the most credible type of external communication (Petera et al., 2019). There are some compulsory parts of annual reports of Australian ASX listed companies, which are required by statutory and regulatory requirements articulated in the Corporations Act 2001 and Australian Securities Exchange (ASX) Listing Rules. These include the directors' report, the corporate governance statement, the financial report, and the auditor's report on the financial and remuneration reports (CPA Australia Ltd, 2019).

The non-compulsory reporting supports good corporate governance and is normally reflected in reports from the chairman and the chief executive of the company. This second part often contains the CSR report or the sustainability report (CPA Australia Ltd, 2019), and is therefore ideal for communicating messages related to environmental consciousness to companies' stakeholders (van der Plank et al., 2016). Annual reports are therefore used for disclosure of information related to environmental sustainability (Petera et al., 2019), with companies reporting on the development of environmental sustainability activities and results achieved (Myskova and Hajek, 2018). Previous research showed that the level of disclosure of environmentally-related information in annual reports varied, based on the environmental sensitivity of companies (Welbeck et al., 2017) and across countries (Abdullah et al., 2020).

3. Methodology

3.1. Research paradigm and approach

An interpretive research paradigm was deployed to investigate environmental sustainability reporting of mining companies via their annual reports. Although interpretive research tends to rely heavily on qualitative data, quantitative data are often gathered to add precision and clearer understanding of the studied area. Interpretive data collection can be done through documentation. Both external and internal documents (e.g. annual reports), may be used to provide insight into the phenomenon of interest.

Researchers have been using content analysis to investigate the purposes, messages, and effects of communication content, by quantifying the occurrence of certain words, phrases, topics or concepts in a physical or electronic document. This method is useful to gain insights into complex social and communicational trends and patterns. The goals of content analysis include finding correlations and patterns in the

communication of concepts, understanding the intentions of an individual, group or institution, identifying propaganda and bias in communication, revealing variations in communication in different contexts and/or analysing the consequences of communication content, such as the flow of information or audience responses.

In this study, content analysis was selected as the method for analysing the contents, context, and connotation within the annual reports of selected mining companies. In line with suggestions by Krippendorf (2013), the text was systematically evaluated to make replicable and valid inferences to the contexts of their use. Content analysis can be both quantitative, i.e. focused on counting and measuring, and qualitative, i.e. focused on interpreting and understanding (Miklosik et al., 2019). Both approaches were used in this study, with words, themes, and concepts categorised or "coded" within the texts and the results analysed (Kim and Kuljis, 2010).

In the interpretive paradigm, researchers are considered part of the social phenomenon, and their specific role and involvement in the research process therefore have to be clearly described (Kim and Kuljis, 2010). In this study, the researchers searched for keywords related to the environment and its protection in the annual reports to induce assumptions about the existence and level of communication about protection of the environmental to stakeholders of mining companies. Its purpose was to identify when a relevant keyword is mentioned, as this reflects the companies' commitment towards environmental sustainability issues. Such commitment will be clearly visible in their environmental policies, response to regulations, creation of committees, creating environmental risk plans, responding to environmental hazards et cetera.

The content analysis was conducted in five steps. In the first step, the content that will be analysed was selected: the medium (electronic documents), the genre (annual reports), and the criteria for inclusion (the most recent annual report) were chosen. The second step was to define units of analysis (keywords relevant to environmental sustainability reporting) that will be used for coding. In the third step, the rules for coding were developed to ensure that all texts are coded consistently (to clearly define what will and will not be included). In the fourth step, the researchers recorded all relevant keyword occurrences in the document sample. In the fifth step, statistical analysis was used to confirm correlation between company size and the intensity of environmental sustainability communications.

3.2. Contextually relevant topics

Content related to environmental and sustainability topics were identified by searching for relevant keywords. The selected topics were closely aligned to literature on the environmental aspects of the SLO. The selection of topics started with assessing the 13 environmental information indicator words listed in the GRI G3 disclosure checklist (Welbeck et al., 2017), namely *material, energy, water, biodiversity, emissions, effluent, waste, product, services, compliance, transport, supplier environmental assessment,* and *environmental grievance mechanism.* Topic-specific standards in the latest version of GRI Standards (GRI, 2020) are also based on these keywords. Eight of these indicator words were excluded before the data collection because the qualitative analysis revealed that they are too general, i.e. mostly not closely related to environmentally related topics. These are *material, energy, water, effluent, product, services, compliance,* and *transport.*

During the process of data collection and testing, two other indicator words were ruled out. One of the reasons was that they rarely occurred in the annual reports or not occurred at all. The second reason was that the qualitative analysis revealed that they were mainly used in a different context than environmental initiatives and is therefore not useful for quantitative analysis. These words are *biodiversity* and *waste.* When assessing the last two words in the original GRI G3 disclosure checklist, namely *environmental assessment,* and *environmental grievance mechanism,* it became apparent that the word *environment* is also used in different, often relevant contexts. Thus, these two keywords were replaced by one more general keyword, namely *environment.* In the process of studying the annual reports, other relevant topics that were not included in the GRI G3 disclosure checklist were also analysed and assessed. Four main keywords were finally selected for the purpose of this analysis. Details of the keywords that were considered and reasons for their inclusion or exclusion are listed in Table 1.

3.3. Research sample

Choosing an effective and efficient sampling size may prevent considerable unnecessary effort when analysing an enormous amount of data (Kim and Kuljis, 2010). Purposive sampling was selected for the content analysis. Of the 625 companies listed in the category, the

Table 1. Selection of topics for the content analysis.

Topics	Status	Reasoning
Emissions	Included	Although not so frequent, almost all mentions were directly related to the environmental impacts of mining operations. The most frequent contexts were carbon emissions, CO_2 emissions and similar.
Environment	Included	The most frequently mentioned keyword, although some keyword occurrences were not related to environmental impacts. Thus, each mention needed to be carefully evaluated, to exclude unrelated contexts, such as work environment, operational environment, supply environment, regulatory environment business & economic environment and similar.
Climate	Included	Most mentions were highly relevant to the studied context; some of the mentions were excluded as they were used in a different context, e.g. of the current economic or business climate.
Footprint	Included	Some of the mentions were relevant and closely related to the carbon and environmental footprint of mining operations, while others were linked to factory footprint, operations footprint and alike.
Biodiversity	Excluded	Minimum number of mentions and thus, irrelevant for detailed analysis.
Sustainability	Excluded	This area was, along with environment, originally considered as very relevant and matching the purpose of the study. There were hundreds of mentions of related keywords in annual reports. However, the contextual analysis revealed that most mentions were not directly related to environmental sustainability. Some of them referred to economic & business sustainability of operations or partnerships, while others could not be easily excluded, because they were only used in the general context of corporate sustainability (Vetrakova et al., 2018). The term sustainability was often used without a clear connotation, in line with its broader definition (Maj, 2018).
Protection	Excluded	This keyword was expected to cover topics such as protection of natural resources. However, more than half of the keywords mentioned were not related to the subject area, while the others overlap with occurrences that had already been counted (terms such as protecting the environment, environment protection, environmental protection etc.).
Nature	Excluded	In most cases, related keywords were used in a general context referring to the nature of operations, processes, etc.
Resources		Not included, as most of the keyword mentions were not related to issues of conserving/protection of natural resources, but to general information about availability of resources (incl. financial, human etc.)
Planet	Excluded	This keyword was very rarely mentioned (almost not at all).
Conservation	Excluded	Similarly, associated keywords occur very rarely.

companies with the largest market capitalisation as per 11 May 2020 were selected. The sample consisted of 100 mining companies that are listed in the Metals & Mining category on the Australian Stock Exchange (ASX) (Listcorp, 2020). Market capitalisation is often related to company size, apart from sales or total asset figures (Chen, 2020). By considering the market capitalisation, the researchers were able to include major market players that publish comprehensive annual reports to inform their stakeholders.

Initially, the first 100 companies with the largest market capitalisation were analysed. However, three companies were excluded from the sample as their core operations were not directly related to mining and two companies were excluded because their annual reports were not available. The next five companies, according to their market capitalisation, were subsequently added to the sample to achieve the target sample size, namely *n = 100*. The mining companies that were included in the sample are listed in Appendix A.

There were vast differences in company size within the research sample. The market capitalisation of the largest company (BHP Group Limited) was higher than the total of 96 companies ranked No. 5 to 100. BHP was also more than a thousand times bigger than Kingsgate Consolidated Limited, No. 100 in the list. The headquarters of most of the mining companies are based in Australia. They operate in various regions, with main operations in Asia-Pacific, Africa, and the Americas.

3.4. Data collection and analysis

The most recently published annual report of each company was used for the content analysis. The reports were available on the Listcorp website (Listcorp, 2020) and, in most cases, they contained data for FY2019 (financial year 2019, from July 2018 to June 2019). Older reports were analysed in three cases where the FY2019 reports were not available.

The total number of occurrences of related keywords was recorded. For example, for the 'Environment' keyword, these also included variants such as 'environment' and 'environmental'. The context of each keyword was carefully analysed, and the occurrence was either categorised as related or unrelated to the area of study. This approach was also followed for the other three keywords included in the analysis.

The total number of keyword mentions, both related and unrelated to the study area, was recorded for each keyword. Descriptive statistics was used to describe the status quo, to identify the differences between companies, and to characterise the results. Correlation analysis was applied to determine whether there are significant differences between companies with different market capitalisation, regarding the level of communication about environmentally related topics.

4. Results

4.1. Relevant keyword mentions

Some of the 100 annual reports analysed were quite long, while others were more succinct; the number of pages ranged from 23 to 320. Details regarding annual reports that were analysed, are depicted in Table 2.

Table 2. Annual reports analysed.

Characteristics	
Total number of reports (research sample)	100
Total number of pages	9941
Maximum number of pages per report	320
Minimum number of pages per report	23
Average number of pages (mean) per report	99.41
Median	90

Within the total number of relevant mentions recorded (3,844), there were notable differences between the number of mentions of the four examined keywords, with the first one (environment) containing most mentions. Details are shown in Table 3.

4.2. Differences in environmental sustainability reporting

There were notable differences between mining companies regarding their communication about these topics. Table 4 shows the key characteristics with the distribution of data and illustrates the variations.

Examining the number of keyword mentions in relation to the size of the annual report (number of its pages) can reveal the intensity with which companies communicate about topics related to environment matters. Density of relevant mentions was calculated for each annual report as the number of relevant mentions divided by number of pages. Details are shown in Table 5.

Tables 4 and 5 suggest significant differences between the keyword mentions of mining companies. These are further illustrated by showcasing the 5 companies with the most and least relevant keyword mentions. The data from Table 6 show that a gap exists between companies at the top and bottom of this list, with BGP Group Limited leading the list with 508 relevant keyword mentions, whereas companies at the bottom of the list having only two mentions per report.

Differences in the keyword density, i.e. the ratio between the number of mentions and the length of each annual report, also reveals the emphasis that these companies put on communicating topics related to environmental issues to their stakeholders. Zimplats Holding has the highest density with more than 2 keyword mentions per document page (keywords density 2.279), which translates to almost 228 mentions per 100 annual report pages. The company at the bottom of this list (Tietto Minerals Limited) mentioned relevant keywords less than 3 times per 100 (keyword density 0.024). Details are listed in Table 7.

Table 3. Overview of collected data per keyword.

Keyword	All mentions	Relevant mentions	Average relevance to the subject matter
Environment	3142	2636	83.9%
Climate	588	561	95.4%
Emissions	604	601	99.5%
Footprint	106	46	43.4%
Total	4400	3844	86.6%

Table 4. Relevant keyword mentions per annual report.

Relevant keyword mentions	Value
Maximum	508
Minimum	2
Median	14.500
Mean	38.440
Std deviation (σ)	69.385

Table 5. Density of relevant keyword mentions, relative to annual report's size.

Density characteristics	Value
Median	0.163
Average	0.387
Maximum	2.279
Minimum	0.024
Std deviation (σ)	0.348

Table 6. Companies at the top and bottom in relation to relevant keyword mentions.

Company	Relevant mentions	Rank by market capitalisation
Top 5		
BHP Group Limited	508	1
Rio Tinto	382	3
Zimplats Holdings	237	22
Evolution Mining	145	6
Cardinal Resources	128	58
Bottom 5		
Tietto Minerals Limited	2	74
Champion Iron	2	25
American Pacific Borates Limited	3	98
AustSino Resources Group	3	89
Jervois Mining	3	73

Table 7. Top and bottom five companies related to keyword density.

Company	Keyword density	Rank by market capitalisation
Top 5		
Zimplats Holdings	2.279	22
BHP Group Limited	1.586	1
Rio Tinto	1.248	3
Gold Road Resources	1.036	17
Evolution Mining	0.929	6
Bottom 5		
Tietto Minerals Limited	0.024	74
Jervois Mining	0.038	73
AVZ Minerals Limited	0.043	67
AustSino Resources Group	0.048	89
Bellevue Gold Limited	0.048	42

4.3. Company size and the intensity of communications

Finally, the analysis aimed to determine whether the intensity of communication about environmentally related issues changes with the size of the company. To achieve this, the Pearson correlation coefficient was calculated between the two variables of continuous data, namely market capitalisation and total mentions. The $r = 0.792$ revealed a strong positive correlation between these sets of values. With the $p < 0.01$, the correlation coefficient is statistically significant. Results of the calculations are shown in Table 8.

5. Discussion

For this study, a methodology has been developed to assess the extent to which mining companies inform the stakeholders about their environmental protection initiatives and to address the limited applicability of the GRI G3 disclosure checklist for sustainability reporting. Topic-specific standards in the latest version of GRI Standards (GRI, 2020)

Table 8. Relationship between company size and number of relevant keywords mentioned.

Statistic	Value
r	0.792
N	100
T statistic	12.844
Degrees of Freedom	98
p value	9.96E-23

are also based on these keywords. Eight indicator words were excluded from the final keyword list because the qualitative analysis revealed that they are too general, i.e. mostly not closely related to environmental matters. Two indicator words - *supplier environmental assessment* and *environmental grievance mechanism* - were merged into one to enable capturing more of the mentions that are relevant to environment protection initiatives. The final keyword list was created, containing the keywords *emissions*; *environment*; *climate*; and *footprint*. By omitting some keywords from the original GRI list and replacing two keywords that were too specific with one more general term, the issues with usability of GRI keywords for evaluation of sustainability reporting (Deegan 2017) were addressed (RQ1).

The results of the study reveal that mining companies use their annual reports to communicate about issues related to the environment to their stakeholders. The analysis of 9,941 pages of top 100 mining companies listed on the Australian Stock Exchange (ASX) revealed that there were 3,844 relevant mentions in the reports that relate to one of the four examined areas, namely environment, climate, emissions, and carbon footprint. The average keyword density was 0.387, meaning that on average, relevant keywords were mentioned 38.7 times per 100 annual report pages (RQ2). The keyword density indicates, on a communication level, how seriously the ASX listed mining companies take their environmental protection initiatives. This finding can also be used to identify trends by comparing the current and future average keyword density.

As the length of annual reports varied across mining companies, ranging from 23 to 320 pages, so did the number of mentions of topics relevant to the study area. BHP Group Limited, the largest company by market capitalisation, had 508 relevant keyword mentions in its latest annual report, whereas Tietto Minerals Limited and Champion Iron had only two each. The extent of the differences was documented by calculating the standard deviation $\sigma = 69.385$. This confirms that the measured values are quite spread out and on average, the number of keywords mentioned by one mining company differ from the mean value by more than 69 mentions. Similar differences were observed when examining the distribution of keyword density values, with values ranging from 0.024 to 2.279. The company with the lowest keyword density had less than 2.5 relevant keyword mentions in 100 pages of its annual report, while the company with most mentions had almost 228, i.e. almost 95 times more (RQ3).

Further analysis was performed to determine whether the level of communications of environmental sustainability issues was influenced by company size. Results confirmed the existence of strong positive correlation between the size of the company determined by its market capitalisation and the overall number of relevant keywords mentioned. The very low p value $p = 9.96E-23$ ($p < 0.01$) has enabled the rejection of the null hypothesis. Instead, the alternate hypothesis H_1 was accepted, confirming that significant differences exist between the level of environmentally related communications in annual reports of ASX listed mining companies and their size (RQ4). This finding is in line with the previous research performed in different regions and industries (Legendre and Coderre, 2013; Liu and Anbumozhi, 2009; Reverte, 2009; Welbeck et al., 2017).

Qualitative analysis also revealed remarkable differences in the environmental sustainability reporting. For some companies, mentioning environmental hazards and risks is merely a regulatory necessity. They do not display their real commitment towards minimising negative impacts on the environment and climate change, which is in the centre of the Sustainable Development Goals agenda. Most of the companies have medium to high levels of relevant keyword mentions. This means that at the communication level - which was the focus of this study - they seem to take their environmental protection initiatives seriously and are proactive in minimising their negative environmental impact. Selected annual reports featured a separate sustainability section that addresses the issues of the impacts of their activities on the environment and local communities. Some of the companies appointed a separate sustainability or environmental committee to oversee projects, implement policies, and

to address management and report hazards related to the environment. Certain mining companies also publish separate sustainability reports, but the examination of these is outside the scope of this study.

6. Conclusion

It has been confirmed that mining companies registered on the Australian Stock Exchange (ASX) use their annual reports as a means of communicating their commitment towards protection of the environment, through environmental sustainability-related initiatives and projects, to their stakeholders. However, significant differences exist in the extent of this communication, with some companies emphasising their environmental protection initiatives more intensely while others merely mention them. Company size is directly related to the level of this communication, with larger companies addressing the topics studied with much higher intensity (mentions per page) than smaller companies. There have been some exemptions to this rule. For example, Cardinal Resources - the 58th largest company according to its market capitalisation - had the fifth highest frequency of relevant mentions in its FY2019 annual report. High frequency of keyword occurrences that are related to environmental issues confirms that these companies understand the importance of environmental sustainability reporting as part of acquiring and maintaining their SLO.

Although environmental sustainability reporting and environmental sustainability management are not identical activities, they are strongly interconnected and communicating about environment protection initiatives is of paramount importance (Petera et al., 2019). This study introduced and applied a methodology that enables researchers and practitioners to determine the intensity of communications about companies' environmental initiatives. Analysing the annual reports of ASX listed mining companies provides results that indicate the commitment of these organisations towards environmental sustainability and protection of natural resources. This is in line with the integrated thinking about resilience, sustainability management and governance, reporting practices, and their interconnections, which have proven important to address environmental sustainability challenges (Dahlmann and Bullock, 2020).

6.1. Theoretical contribution

The methodology constructed for the purpose of this research supports the measurement of the extent to which the topics related to environmental initiatives and sustainability are communicated with key stakeholders via companies' annual reports. The results further enrich the theory of corporate environmental sustainability reporting by addressing the issues of the limited applicability of GRI guidelines (Deegan, 2017). This adds another dimension to the theory of SLO, enabling the determination and evaluation of communication initiatives of mining companies. Findings of this research also complement the stakeholder theory by providing insights on the use of corporate annual reports for disclosing environmental issues to company stakeholders.

6.2. Managerial impact

Practical implications of the research presented in this study are twofold: 1) it enables the generation of precisely crafted comparison reports. This may prove valuable to regulators, various government and non-government bodies, and activists wanting to evaluate the current status quo and progress in the mining sector; 2) its results can become a benchmark for mining companies that aim to compare themselves with industry leaders in environmental sustainability reporting.

6.3. Limitations of the study

This study has some limitations. Firstly, only annual reports for the last financial year were analysed (FY2019 in most cases). This means that the analysis does not enable the identification of trends over time. Also, the changes in regulations may have influenced the extent of environmental sustainability regulations. Secondly, the results of the quantitative analysis were mostly presented, and the quality of the disclosed information is not extensively discussed. Thirdly, only annual reports were included in the analysis, with other media not considered. Lastly, the results indicate the commitment of companies to environmental sustainability but do not reveal their actual contribution to minimising their harmful environmental impact.

Content analysis also has a few limitations. For example, focusing on words or phrases in isolation may disregard context, nuance, and ambiguous meanings. It can also be subjective, which affects the reliability and validity of the results and conclusions. Furthermore, manually coding large volumes of text is extremely time-consuming, often resulting in limited sample sizes.

6.4. Future research directions

There are several opportunities for future research. Firstly, adding annual reports from previous years to the analysis can help identify trends in environmental sustainability reporting. Secondly, more results of the qualitative analysis can be included, providing insights into the quality of relevant information contained in annual reports. Thirdly, the analysis can be extended by covering other media, such as official company websites, which would extend the scope of monitoring the communication and its potential effects on the SLO. Also, data can be gathered from other countries, enabling researchers to compare the situation in environmental sustainability reporting in various regions. Lastly, shifting the focus towards detailed qualitative analysis of context of the mentions can help determine which part of the environmental sustainability reporting is related to compliance only and to what extent these companies emphasise real implementation of environmentally focused programs and policies.

Declarations

Author contribution statement

Andrej Miklosi: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Nina Evans: Analyzed and interpreted the data; Wrote the paper.

Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Appendix A. List of mining companies included in the study

No.	ASX ID	Code	Company	Market Capitalisation
1	1	ASX:BHP	BHP Group Limited	91.32B
2	2	ASX:FMG	Fortescue Metals Group	35.25B
3	3	ASX:RIO	Rio Tinto	30.26B
4	4	ASX:NCM	Newcrest Mining	22.49B
5	5	ASX:NST	Northern Star Resources	9.5B
6	6	ASX:EVN	Evolution Mining	9.17B
7	7	ASX:S32	South32	9.04B
8	9	ASX:SAR	Saracen Mineral Holdings	4.76B
9	10	ASX:AWC	Alumina	4.55B
10	11	ASX:MIN	Mineral Resources Limited	3.2B
11	12	ASX:ILU	Iluka Resources	3.09B
12	13	ASX:OZL	OZ Minerals	2.82B
13	14	ASX:IGO	Independence Group NL	2.68B
14	15	ASX:RRL	Regis Resources	2.42B
15	16	ASX:SBM	St Barbara Limited	1.84B
16	17	ASX:SLR	Silver Lake Resources	1.72B
17	18	ASX:GOR	Gold Road Resources	1.35B
18	20	ASX:PRU	Perseus Mining	1.24B
19	21	ASX:LYC	Lynas Corporation	1.21B
20	22	ASX:RMS	Ramelius Resources	1.1B
21	23	ASX:CRN	Coronado Global Resources Inc.	1.09B
22	24	ASX:ZIM	Zimplats Holdings	1.06B
23	25	ASX:RSG	Resolute Mining	1.04B
24	26	ASX:WLF	Wolf Minerals	1B
25	27	ASX:CIA	Champion Iron	901.94M
26	28	ASX:WGX	Westgold Resources Limited	847.79M
27	29	ASX:NIC	Nickel Mines Limited	817.22M
28	30	ASX:SFR	Sandfire Resources Limited	751.28M
29	32	ASX:MGX	Mount Gibson Iron	723.55M
30	33	ASX:WAF	West African Resources	713.92M
31	34	ASX:PRN	Perenti Global Limited	687.34M
32	35	ASX:WSA	Western Areas Ltd	583.64M
33	36	ASX:ORE	Orocobre Limited	562.5M
34	37	ASX:JMS	Jupiter Mines Limited	548.52M
35	38	ASX:AQG	Alacer Gold Corp	528.87M
36	39	ASX:MAH	Macmahon Holdings	474.1M
37	40	ASX:PLS	Pilbara Minerals	455.86M
38	41	ASX:ALK	Alkane Resources	449.53M
39	42	ASX:CMM	Capricorn Metals Ltd	439.48M
40	43	ASX:DEG	De Grey Mining	437.85M
41	44	ASX:LEG	Legend Mining	416.87M
42	45	ASX:BGL	Bellevue Gold Limited	409.23M
43	46	ASX:IMD	Imdex Limited	403.58M
44	47	ASX:TBR	Tribune Resources	379.17M
45	48	ASX:CHN	Chalice Gold Mines	343.46M
46	49	ASX:RED	Red 5 Limited	307.05M
47	50	ASX:GXY	Galaxy Resources	305.06M
48	51	ASX:GRR	Grange Resources	271.98M
49	52	ASX:AMI	Aurelia Metals	270.94M
50	53	ASX:OMH	OM Holdings	265.9M
51	54	ASX:CYL	Catalyst Metals	257.09M
52	55	ASX:EMR	Emerald Resources NL	252.07M
53	56	ASX:SPX	Spectrum Metals Limited	230.48M
54	57	ASX:ADT	Adriatic Metals	228.55M
55	58	ASX:BCK	Brockman Mining Ltd	222.7M
56	59	ASX:MCR	Mincor Resources NL	216.26M
57	60	ASX:DCN	Dacian Gold	214.16M
58	61	ASX:CDV	Cardinal Resources	212.51M

(*continued*)

No.	ASX ID	Code	Company	Market Capitalisation
59	62	ASX:INR	ioneer Ltd	209.99M
60	63	ASX:MLD	MACA Limited	203.69M
61	64	ASX:LTR	Liontown Resources	203.28M
62	65	ASX:OGC	OceanaGold Corporation	191.95M
63	66	ASX:PNR	Pantoro Limited	170.51M
64	67	ASX:NCZ	New Century Resources Limited	161.9M
65	68	ASX:MAU	Magnetic Resources NL	158.96M
66	69	ASX:OKU	Oklo Resources	155.86M
67	70	ASX:AVZ	AVZ Minerals Limited	153.24M
68	71	ASX:BSE	Base Resources	152.31M
69	72	ASX:IMA	Image Resources NL	152.05M
70	73	ASX:MML	Medusa Mining	145.46M
71	74	ASX:GGG	Greenland Minerals Limited	136.96M
72	75	ASX:MMI	Metro Mining Limited	136.11M
73	76	ASX:JRV	Jervois Mining	131.66M
74	77	ASX:TIE	Tietto Minerals Limited	131.4M
75	78	ASX:ATU	Atrum Coal Limited	122.6M
76	80	ASX:BCN	Beacon Minerals	117.35M
77	81	ASX:RND	Rand Mining	114.58M
78	82	ASX:AJM	Altura Mining	113.48M
79	83	ASX:NWF	Newfield Resources	110.45M
80	84	ASX:SYR	Syrah Resources	109.86M
81	85	ASX:BDC	Bardoc Gold Limited	108.87M
82	86	ASX:OBM	Ora Banda Mining Ltd	108.65M
83	87	ASX:MRC	Mineral Commodities	107.4M
84	88	ASX:BOE	Boss Resources	104.77M
85	89	ASX:TGM	Theta Gold Mines Limited	101.58M
86	90	ASX:GNG	GR Engineering Services	101.39M
87	92	ASX:BLK	Blackham Resources	99.31M
88	93	ASX:FMS	Flinders Mines	95.83M
89	94	ASX:ABR	American Pacific Borates Limited	95.11M
90	95	ASX:ANS	AustSino Resources Group	94.31M
91	96	ASX:BOC	Bougainville Copper	94.25M
92	97	ASX:SVY	Stavely Minerals	94.07M
93	98	ASX:BRL	Bathurst Resources Limited	94.02M
94	99	ASX:G1A	Galena Mining Limited	93.33M
95	100	ASX:VAN	Vango Mining Limited	93.1M
96	101	ASX:DGO	DGO Gold Limited	92.49M
97	102	ASX:POS	Poseidon Nickel	92.49M
98	103	ASX:AGD	Austral Gold	92.3M
99	104	ASX:PAN	Panoramic Resources	91.58M
100	105	ASX:KCN	Kingsgate Consolidated Limited	90.49M

References

Abdullah, M., Hamzah, N., Ali, M.H., Tseng, M.-L., Brander, M., 2020. The Southeast Asian haze: the quality of environmental disclosures and firm performance. J. Clean. Prod. 246, 118958.

Aggarwal, R., Dow, S., 2012. Corporate governance and business strategies for climate change and environmental mitigation. Eur. J. Finance 18 (3–4), 311–331.

Ahmad, N.N.N., Hossain, D.M., 2015. Climate change and global warming discourses and disclosures in the corporate annual reports: a study on the Malaysian companies. Procedia - Soc. Behav. Sci. 172, 246–253.

Ali, A., Sloane, D.R., Strezov, V., 2018. Assessment of impacts of coal mining in the region of Sydney, Australia on the aquatic environment using macroinvertebrates and chlorophyll as indicators. Int. J. Environ. Res. Publ. Health 15 (7).

Arena, C., Bozzolan, S., Michelon, G., 2015. Environmental reporting: transparency to stakeholders or stakeholder manipulation? An analysis of disclosure tone and the role of the board of directors. Corp. Soc. Responsib. Environ. Manag. 22 (6), 346–361.

Axon, S., 2020. The socio-cultural dimensions of community-based sustainability: implications for transformational change. J. Clean. Prod. 266, 121933.

Banks, G., 2006. Mining, social change and corporate social responsibility: drawing lines in the Papua New Guinea mud. In: Globalisation, Governance and the Pacific Islands, pp. 259–274.

Barker, T., 2008. The economics of avoiding dangerous climate change. An editorial essay on the Stern Review. Clim. Change 89 (3–4), 173–194.

Bashar, O.H.M.N., 2015. The trickle-down effect of the mining boom in Australia: fact or myth? Econ. Rec. 91 (S1), 94–108.

Bebbington, A., Williams, M., 2008. Water and mining conflicts in Peru. Mt. Res. Dev. 28 (3/4), 190–195.

Berthelot, S., Cormier, D., Magnan, M., 2003. Environmental disclosure research: review and synthesis. J. Account. Lit. 22, 1–44.

Borghesi, S., Cainelli, G., Mazzanti, M., 2015. Linking emission trading to environmental innovation: evidence from the Italian manufacturing industry. Res. Pol. 44 (3), 669–683.

Braam, G.J.M., de Weerd, L.U., Hauck, M., Huijbregts, M.A.J., 2016. Determinants of corporate environmental reporting: the importance of environmental performance and assurance. J. Clean. Prod. 129, 724–734.

Brower, J., Mahajan, V., 2013. Driven to Be good: a stakeholder theory perspective on the drivers of corporate social performance. J. Bus. Ethics 117 (2), 313–331.

Carvalho, F.P., 2017. Mining industry and sustainable development: time for change. Food Energy Secur. 6 (2), 61–77.

Cerin, P., 2002. Communication in corporate environmental reports. Corp. Soc. Responsib. Environ. Manag. 9 (1), 46–65.

Chang, C.-H., 2011. The influence of corporate environmental ethics on competitive advantage: the mediation role of green innovation. J. Bus. Ethics 104 (3), 361–370.

Chen, J., 2020. Market Capitalization. https://www.investopedia.com/terms/m/market capitalization.asp. (Accessed 25 February 2020).

Christopher, Martin Ballantyne, D., Payne, A., Chartered Institute of Marketing, 1991. Relationship Marketing: Bringing Quality, Customer Service, and Marketing Together. Butterworth-Heinemann Oxford, Boston.

CPA Australia Ltd, 2019. A Guide to Understanding Annual Reports: Australian Listed Companies.

Dahlmann, F., Bullock, G., 2020. Nexus thinking in business: analysing corporate responses to interconnected global sustainability challenges. Environ. Sci. Pol. 107, 90–98.

de Bakker, F.G.A., den Hond, F., King, B., Weber, K., 2013. Social movements, civil society and Corporations: taking Stock and looking ahead. Organ. Stud. 34 (5–6), 573–593.

De Marchi, V., 2012. Environmental innovation and R&D cooperation: empirical evidence from Spanish manufacturing firms. Res. Pol. 41 (3), 614–623.

Deegan, C., 2017. Twenty five years of social and environmental accounting research within Critical Perspectives of Accounting: hits, misses and ways forward. Crit. Perspect. Account. 43, 65–87.

Devenin, V., Bianchi, C., 2019. Characterizing a mining space: analysis from case studies in Chile and Australia. Resour. Pol. 63.

Dinca, M.S., Madaleno, M., Baba, M.C., Dinca, G., 2019. Environmental information transparency-evidence from Romanian companies. Sustainability 11 (18).

Dorobantu, S., Henisz, W.J., Nartey, L., 2017. Not all sparks light a fire: stakeholder and shareholder reactions to critical events in contested markets. Adm. Sci. Q. 62 (3), 561–597.

Dubinski, J., 2013. Sustainable development of mining mineral resources. J. Sustain. Min. 12 (1), 1–6.

Edwards, P., Fleming, A., Lacey, J., Lester, L., Pinkard, E., Ruckstuhl, K., Williams, T., 2019. Trust, engagement, information and social licence - insights from New Zealand. Environ. Res. Lett. 14 (2).

Franks, D.M., Davis, R., Bebbington, A.J., Ali, S.H., Kemp, D., Scurrah, M., 2014. Conflict translates environmental and social risk into business costs. Proc. Natl. Acad. Sci. Unit. States Am. 111 (21), 7576–7581.

Frantal, B., 2016. Living on coal: mined-out identity, community displacement and forming of anti-coal resistance in the Most region, Czech Republic. Resour. Pol. 49, 385–393.

GRI, 2020. Consolidated Set of GRI Sustainability Reporting Standards 2020. Retrieved from. https://www.globalreporting.org/how-to-use-the-gri-standards/resource-c enter/.

Guo, Y., Wang, L., Yang, Q., 2020. Do corporate environmental ethics influence firms' green practice? The mediating role of green innovation and the moderating role of personal ties. J. Clean. Prod. 266, 122054.

Habek, P., Wolniak, R., 2015. Factors influencing the development of CSR reporting practices: experts' versus preparers' points of view. Inzinerine Ekonomika-Eng. Econ. 26 (5), 560–570.

Haviernikova, K., Kordos, M., 2019. Selected risks perceived by SMEs related to sustainable entrepreneurship in case of engagement into cluster cooperation. Entrepreneurship Sustain. Issue 6 (4), 1680–1693.

Herremans, I.M., Nazari, J.A., Mahmoudian, F., 2016. Stakeholder relationships, engagement, and sustainability reporting. J. Bus. Ethics 138 (3), 417–435.

Hess, D., 2007. Social reporting and new governance regulation: the prospects of achieving corporate accountability through transparency. Bus. Ethics Q. 17 (3), 453–476.

Horvathova, P., Davidova, M., 2011. Operations management as practice of organizations' strategic management in relation to the environment. In: Dan, C. (Ed.), Financial Management and Economics, ICFME 2011, 11. IACSIT Press, Singapore, pp. 8–12.

Jaderna, E., Prikrylova, J., 2018. Green solutions in automotive industry. Market. Sci. Inspirat. 13 (1), 2–11.

Karakaya, E., Nuur, C., 2018. Social sciences and the mining sector: some insights into recent research trends. Resour. Pol. 58 (SI), 257–267.

Karaman, A.S., Kilic, M., Uyar, A., 2018. Sustainability reporting in the aviation industry: worldwide evidence. Sustain. Account. Manag. Policy J. 9 (4), 362–391.

Kemp, R., 2010. Eco-innovation: definition, measurement and open research issues. Econ. Politic. 27 (3), 397–420. Retrieved from. https://www.scopus.com/inward/rec ord.uri?eid=2-s2.0-79551627390&partnerID=40&md5=44843ec4e9e7aa0522 1f543b7039f700.

Kenton, W., 2020. Social License to Operate (SLO). Retrieved April 10, 2020, from. https://www.investopedia.com/terms/s/social-license-slo.asp.

Kim, I., Kuljis, J., 2010. Applying content analysis to web-based content. J. Comput. Inf. Technol. 18 (4), 369–375.

Krippendorf, K., 2013. Content Analysis: an Introduction to its Methodology, third ed. Sage Publications Inc, London.

Kuzey, C., Uyar, A., 2017. Determinants of sustainability reporting and its impact on firm value: evidence from the emerging market of Turkey. J. Clean. Prod. 143, 27–39.

Lacey, J., Carr-Cornish, S., Zhang, A., Eglinton, K., Moffat, K., 2017. The art and science of community relations: procedural fairness at Newmont's Waihi Gold operations, New Zealand. Resour. Pol. 52, 245–254.

Lacey, J., Malakar, Y., McCrea, R., Moffat, K., 2019. Public perceptions of established and emerging mining technologies in Australia. Resour. Pol. 62, 125–135.

Legendre, S., Coderre, F., 2013. Determinants of GRI G3 application levels: the case of the fortune global 500. Corp. Soc. Responsib. Environ. Manag. 20 (3), 182–192.

Listcorp, 2020. ASX Metals & Mining Companies. https://www.listcorp.com/asx/se ctors/materials/materials/metals-mining. (Accessed 30 April 2020).

Liu, X., Anbumozhi, V., 2009. Determinant factors of corporate environmental information disclosure: an empirical study of Chinese listed companies. J. Clean. Prod. 17 (6), 593–600.

Lock, I., 2019. Explicating communicative organization-stakeholder relationships in the digital age: a systematic review and research agenda. Publ. Relat. Rev. 45 (4), 101829.

Lodhia, S., Kaur, A., Stone, G., 2020. The Use of Social media as a Legitimation Tool for Sustainability Reporting A Study of the Top 50 Australian Stock Exchange (ASX) Listed Companies. Meditari Accountancy Research (Early Access).

Lyytimaki, J., Peltonen, L., 2016. Mining through controversies: public perceptions and the legitimacy of a planned gold mine near a tourist destination. Land Use Pol. 54, 479–486.

Maj, J., 2018. Embedding diversity in sustainability reporting. Sustainability 10 (7).

Mallin, C., Michelon, G., Raggi, D., 2013. Monitoring intensity and stakeholders' orientation: how does governance affect social and environmental disclosure? J. Bus. Ethics 114 (1), 29–43.

Manetti, G., 2011. The quality of stakeholder engagement in sustainability reporting: empirical evidence and critical points. Corp. Soc. Responsib. Environ. Manag. 18 (2), 110–122.

Matlaba, V.J., Mota, J.A., Maneschy, M.C., dos Santos, J.F., 2017. Social perception at the onset of a mining development in Eastern Amazonia, Brazil. Resour. Pol. 54, 157–166.

Matsumura, E.M., Prakash, R., Vera-Muñoz, S.C., 2013. Firm-value effects of carbon emissions and carbon disclosures. Account. Rev. 89 (2), 695–724.

Mercer-Mapstone, L., Rifkin, W., Louis, W.R., Moffat, K., 2018. Company-community dialogue builds relationships, fairness, and trust leading to social acceptance of Australian mining developments. J. Clean. Prod. 184, 671–677.

Miklosik, A., Evans, N., Hasprova, M., Lipianska, J., 2019. Reflection of embedded knowledge culture in communications of Australian companies. Knowl. Manag. Res. Pract. 17 (2), 172–181.

Minerals Council of Australia, 2017. Pre-budget Submission 2018-2019. Retrieved from. https://minerals.org.au/sites/default/files/MCAPre-Budget/submission/2018-19.pd f.

Moffat, K., Pert, P., McCrea, R., Boughen, N., Rodriguez, S., Lacey, J., 2018. Australian Attitudes toward Mining: Citizen Survey – 2017 Results.

Moffat, K., Zhang, A., 2014. The paths to social licence to operate: an integrative model explaining community acceptance of mining. Resour. Pol. 39, 61–70.

Morrison, J., 2014. The Social License: How to Keep Your Organization Legitimate. Palgrave Macmillan.

Myskova, R., Hajek, P., 2018. Sustainability and corporate social responsibility in the text of annual reports-the case of the IT services industry. Sustainability 10 (11).

Narula, S.A., Magry, M.A., Mathur, A., 2019. Business-community engagement: a case of mining company in India. Bus. Strat. Develop. 2 (4), 315–331.

Oh, C.H., Shapiro, D., Ho, S.S.H., Shin, J., 2020. Location matters: valuing firm-specific nonmarket risk in the global mining industry. Strat. Manag. J.

Ossa-Moreno, J., McIntyre, N., Ali, S., Smart, J.C.R., Rivera, D., Lall, U., Keir, G., 2018. The hydro-economics of mining. Ecol. Econ. 145, 368–379.

Owen, J.R., Kemp, D., 2013. Social licence and mining: a critical perspective. Resour. Pol. 38 (1), 29–35.

Pelikanova, R.M., 2019. Corporate social responsibility information in annual reports in the EU-A Czech case study. Sustainability 11 (1).

Petera, P., Wagner, J., Paksiova, R., Krehnacova, A., 2019. Sustainability information in annual reports of companies domiciled in the Czech republic and the Slovak republic. Inzinerine Ekonomika-Eng. Econ. 30 (4), 483–495.

Plotnikova, V.V., Shilovskaya, M.S., Strubalin, V.P., Muravleva, V.T., 2020. Connectivity of information between annual and sustainability reports: Russian company's analysis. Qual. Access Success 21 (174), 14–21.

Ponce, A.F., Mcclintock, C., 2014. The explosive combination of inefficient local bureaucracies and mining production: evidence from localized societal protests in Peru. Lat. Am. Polit. Soc. 56 (3), 118–140.

Powell, J., 2020. The 6 Biggest Mining Companies in Australia. https://blog.iseekplant. com.au/blog/6-biggest-mining-companies-australia. (Accessed 28 March 2020).

Prno, J., 2013. An analysis of factors leading to the establishment of a social licence to operate in the mining industry. Resour. Pol. 38 (4), 577–590.

Provasnek, A.K., Schmid, E., Steiner, G., 2018. Stakeholder engagement: Keeping business legitimate in Austria's natural mineral water bottling industry. J. Bus. Ethics 150 (2), 467–484.

Reverte, C., 2009. Determinants of corporate social responsibility disclosure ratings by Spanish listed firms. J. Bus. Ethics 88 (2), 351–366.

Sampong, F., Song, N., Boahene, K.O., Wadie, K.A., 2018. Disclosure of CSR performance and firm value: new evidence from South Africa on the basis of the GRI guidelines for sustainability disclosure. Sustainability 10 (12).

Scherer, A.G., Palazzo, G., 2011. The new political role of business in a globalized world: a review of a new perspective on CSR and its implications for the firm, governance, and democracy. J. Manag. Stud. 48 (4), 899–931.

Skouloudis, A., Jones, N., Malesios, C., Evangelinos, K., 2014. Trends and determinants of corporate non-financial disclosure in Greece. J. Clean. Prod. 68, 174–188.

Syrotenko, N., Pravdiuk, N., Slobodyanik, Y., Holovatska, S., Skrypko, T., 2021. Environmental disclosures in the management report: transparency, responsibility and communication. Indepen. J. Manag. Prod. 12 (3), S187–S204.

Toscano, N., Grieve, C., 2020. Rocked to the core: mining giants. Age 4.

Trading Economics, 2020. Australia GDP from Mining. Retrieved from. https://trading economics.com/australia/gdp-from-mining.

Tzouvanas, P., Kizys, R., Chatziantoniou, I., Sagitova, R., 2020. Environmental disclosure and idiosyncratic risk in the European manufacturing sector. Energy Econ. 87, 104715.

UNDP, 2021. Sustainable Development Goals. Retrieved March 2, 2021, from. https://www.undp.org/content/undp/en/home/sustainable-development-goals.htm.

van der Plank, S., Walsh, B., Behrens, P., 2016. The expected impacts of mining: stakeholder perceptions of a proposed mineral sands mine in rural Australia. Resour. Pol. 48, 129–136.

Venngage, 2021. What is an annual report? Definitions, requirements and examples. Retrieved January 30, 2021, from. https://venngage.com/blog/annual-report/.

Vetrakova, M., Hitka, M., Potkany, M., Lorincova, S., Smerek, L., 2018. Corporate sustainability in the process of employee recruitment through social networks in conditions of Slovak small and medium enterprises. Sustainability 10 (5).

Welbeck, E.E., Owusu, G.M.Y., Bekoe, R.A., Kusi, J.A., 2017. Determinants of environmental disclosures of listed firms in Ghana. Int. J. Corpor. Soc. Respons. 2 (1), 11.

Wright, S., Bice, S., 2017. Beyond social capital: a strategic action fields approach to social licence to operate. Res. Pol. 52, 284–295.