Thesis for MSc degree in Environment and Natural Resources

Trends in the sustainability reporting:
A case study of European mining industry

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This thesis is equivalent to 60 ECTS towards a MSc degree in Environment and Natural Resources from the Faculty of Business Administration at the School of Social Sciences, University of Iceland.

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Preface

This thesis is equivalent to 60 ECTS towards a MSc degree in Environment and Natural Resources from the Faculty of Business Administration at the University of Iceland. The project was conducted under the guidance of Lára Jóhannsdóttir, Professor in Environmental and Natural Resources at the School of Business Administration, and Nina María Saviolidis, PhD candidate at the Faculty of Business Administration.

When enrolling into the Environment and Natural Resources Programme, I already had a vision of combining my previous education as a master’s in mining engineering and this Programme in future work. As my knowledge about sustainable development increased, the vision became clearer. The state of our planet is degrading, climate change and social inequalities are increasing and mining industry in its nature contributes to it. Working in the field of business was not something that I had mind at the beginning of my studies, however writing a summary of a paper for one of the classes about corporate social responsibility motivated me to study the further the impacts of mining industry. Moreover, my special motivation was teaching of my supervisor Lara, who inspired me to explore completely new field to me of corporate responsibility and write this thesis.

I would like to thank my both supervisors, Lara and Nina, for their advices and suggestions, for believing in my research and encouraging me through the whole research process. As the thesis research was intensive and time consuming, I want to express the greatest gratitude to my partner Vedran for being a pillar of support during my thesis research by giving me time to work and feedback on my writing. The final acknowledgment goes to my dear parents and sisters for being moral support and help throughout the whole period of my education at the University of Iceland. I dedicate my thesis work to my dog Bena, as she was always laying by my side during the thesis research.
Abstract

Mining is at odds with sustainable development due to the environmental impacts, and social conflicts, but it also provides economic benefits to communities and secures minerals necessary for low-carbon technology. The European mining industry is important for its economy in providing minerals required for sustainable development and by offering employment. Few studies have been conducted on the European mining sector, its contribution to Sustainable Development Goals (SDGs), and sustainability reporting. The aim of this multiple case study is to examine the efforts of European mining companies to mitigate negative impacts caused by their operations, and their contribution to the SDGs by analysing, comparing and critically evaluating their sustainability reports for the 2016-2018 period. Mining companies report on core subjects of corporate governance, employees, the environment, stakeholders and community engagement, occupational health and safety, product stewardship and economic performance. The progress is observed in community relations and health, and safety, while environmental issues like carbon and air emissions, water and energy usage increased for most companies. Furthermore, there is a lack of improvement in gender diversity, renewable energy, and waste recycling. The comparison between the reports was limited by different materiality topics, use of different key performance indicators and non-uniform measuring units. All analysed companies mentioned SDGs in the reports, however the reports miss comprehensive explanation of the mining contribution to the SDGs. European mining companies act under pressures from international initiatives and industry associations, European Union and governments, stakeholders, and partnerships. This study addresses a significant gap in the existing literature on the European context of sustainable development and SDGs relevant for the academia, policymakers and other stakeholders impacted by mining operations and adds a new theoretical knowledge on the external drivers for CSR activities based on the institutional theory.

Keywords: mining, Europe, sustainability reporting, sustainable development goals, content analysis, institutional theory
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## Abbreviations

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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>BC</strong></td>
<td>Before Christ</td>
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<tr>
<td><strong>GMI</strong></td>
<td>Global Mining Initiative</td>
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<tr>
<td><strong>ICMM</strong></td>
<td>International Council on Mining and Metals</td>
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<td><strong>GRI</strong></td>
<td>Global Reporting Initiative</td>
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<td><strong>SDGs</strong></td>
<td>Sustainable Development Goals</td>
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<td><strong>EU</strong></td>
<td>European Union</td>
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<tr>
<td><strong>CDP</strong></td>
<td>Carbon Disclosure Project</td>
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<td><strong>CSR</strong></td>
<td>Corporate Social Responsibility</td>
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<tr>
<td><strong>UN</strong></td>
<td>United Nations</td>
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<tr>
<td><strong>UNGC</strong></td>
<td>United Nations Global Compact</td>
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<tr>
<td><strong>COP</strong></td>
<td>Communication on Progress</td>
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<tr>
<td><strong>NGO</strong></td>
<td>Nongovernmental organisation</td>
</tr>
<tr>
<td><strong>GHG</strong></td>
<td>Greenhouse gas emissions</td>
</tr>
<tr>
<td><strong>SO₂</strong></td>
<td>Sulphur dioxide</td>
</tr>
<tr>
<td><strong>NOₓ</strong></td>
<td>Nitrogen oxides</td>
</tr>
<tr>
<td><strong>CO₂</strong></td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td><strong>IUCN</strong></td>
<td>International Union for Conservation of Nature</td>
</tr>
<tr>
<td><strong>REACH</strong></td>
<td>Regulation, evaluation, and authorisation of chemicals</td>
</tr>
<tr>
<td><strong>LCA</strong></td>
<td>Life cycle assessment</td>
</tr>
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1 Introduction

Mining is one of the oldest documented human activities, and it has advanced the economic, cultural, and technical development of societies and countries throughout human history (Hartman & Mutmansky, 2002). Mining is defined as the process of exploiting minerals such as metallic ore, non-metallic ore, and fossil fuels from the Earth’s crust (Kozan & Shi-Qiang, 2011). Mining activities also include five phases in the life cycle of a mine: prospecting and exploration of the potential mine site, development, exploitation and processing, and a final phase of closure and reclamation of the mine (Hartman & Mutmansky, 2002). Prospecting is the first phase and it includes the exploration of ores or other valuable minerals. Second phase, exploration determines the size of a mineral deposit through a range of measurements, followed by the mine development, which relates to the third phase of opening a mineral deposit for excavation. The fourth phase is exploitation, the recovery of valuable minerals from the Earth, which are then processed into a higher-quality product. The fifth phase of the mine operation is the process of closing the mine and the reclamation of the disturbed land (Hartman & Mutmansky, 2002). It is necessary to emphasise that the production of petroleum and natural gas has progressed into a separate industry and will not be the research area for this thesis.

The first civilizations in human history used minerals for weapons, tools and utensils, ornaments and decorations, and currency. Many historical eras are identified by minerals such as the Stone and the Bronze Age in prehistory, the Iron Age in the middle ages, the Steel Age lead by the Industrial Revolution, and the Nuclear Age in more recent history (Harman & Mutmansky, 2002). Evidently, mining and minerals played a vital role in human history from the development of the first civilizations. According to UNESCO, the Ngwenya mine in Swaziland, dated around 43,000 before Christ (BC), is one of the oldest known mining operation sites globally (UNESCO, 2008). In Europe, mining and quarrying the stone has a very long tradition dating to the Neolithic era with extraction sites found in Portugal, Sicily, south of Russia and north of Norway (Weissgerber, 1980; Lech, 1995).
Today, the transition towards a low-carbon future based on the Paris Agreement, indicates a potentially increased demand for certain minerals needed for low-carbon technologies, meaning that the extractive industry has an essential role to play in reaching sustainable development (CCSI et al., 2016). Additionally, mining contributes to sustainable development through the economic dimension by providing revenues to countries, driving economic growth, creating jobs, and infrastructural development (CCSI et al, 2016). The World Commission on Environment and Development in the so-called Brundtland Report defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, 1987, p 8). The Brundtland report (1987) highlighted the three essential pillars of sustainable development - environmental protection, economic growth, and social equity.

Mining is often considered to be in conflict with sustainability due to its use of non-renewable natural resources and its significant impact on the environment (Parameswaran, 2016). Environmental and social issues such as pollution, negative impact on biodiversity, the displacement of people, and loss of natural resources have often caused conflicts between mining companies and local communities (UNDP, 2018). Such a conflict in Europe occurred in 2010 when the red mud from an alumina refining plant in Ajka, Hungary flooded surrounding villages. It resulted in killing of ten people, injuring dozens, and causing an ecological disaster (Guardian, 2010). The vast area was polluted from the toxic sludge, and many residents had to move elsewhere. The court acquitted the accused employees, and no one was held responsible for this catastrophic accident (Guardian, 2016).

Due to these negative impacts, the mining industry has been under intensified pressure from stakeholders e.g., civil society and non-profit organisations, over the last few decades (Kapelus, 2002). Moreover, the impact has intensified due to the rising demand for materials, increased production, and ore grades decline (Mason et al. 2011), causing higher waste rock production and greenhouse gas emissions per tonne of product (Mudd, 2007a). As a result, the mining industry begun to develop strategies to address sustainable development. In the late 1990s, the nine world largest mining companies founded the Global Mining Initiative (GMI), which carried out multi-stakeholder consultations and a research process over two years which resulted in an agenda for
change (ICMM, 2019a). The outcome of the GMI was the establishment of a new industry association, the International Council on Mining and Metals (ICMM), and the mining industry’s best practice framework for the concept of sustainable development (Fonseca, 2010). The ICMM’s main goal is to be a stimulant for change on concerns linking mining and sustainability. Members of the ICMM are 22 of the world’s largest mining companies and 34 mining and commodity associations, including three companies that have operation sites in Europe (ICMM, 2019b).

The most widespread approach to communicate on the progress toward sustainable development is the issuing of annual sustainability reports by which companies report on their non-financial part of their business, including environment and social impact, and corporate governance. The Global Reporting Initiative (GRI) Standards are the most commonly used framework in the mining industry where in 2011 95% of the 102 mining companies publishing reports used the GRI (Fonseca et al., 2014). The GRI framework became the GRI Standards in 2016. UN Global Compact is one of the most commonly used frameworks on human rights, labour standards, environment and anti-corruption, including the mining sector (Un Global Compact, n.d. a). The ICMM Principles and the Sustainable Development Goals (SDGs) have also been widely used in the mining industry as guidance for writing a sustainability report.

1.1 The European mining industry
The European mining industry is an important part of its economy. It has almost self-sufficient production of industrial minerals and aggregates for European requirements (Euromines, n.d.; European Commission, n.d. a). The EU is a major international producer of many industrial minerals like magnesite, kaolin, and potash, and the biggest producer of extracted gypsum in the world with 25 % share of total world production (European Commission, n.d. a). Likewise, Europe produces one-third of the global natural stone (European Commission, n.d. b). Even though the European Union (EU) produces metals like iron, chromium, copper, lead, and zinc, it greatly depends on import of metals. EU’s production of metals is only about 3% of world production (European Commission, 2008), while EU countries consume around 30% of the global metal production (Nurmi & Molnar, 2014). The EU extracts only 1.7 % nickel, 2 % iron ore, 5 % copper, 8.5% zinc and 2% bauxite of the world’s production (European Commission, 2007). For the EU’s to be
competitive it is important to have consistent and undistorted access to raw materials and change towards a resource-efficient economy and sustainable development. According to the European Commission (2008), around 30 million jobs depend on raw material accessibility in the European Union.

Beside ICMM, there are several European mining industry associations. One of them is Euromines, representative of the European metals and minerals mining industry, with the main goal to promote the extractive industry as a contributor to sustainable development in Europe (Euromines, n.d. a). One more association that acts for non-ferrous metals producers and recyclers in Europe called Eurometaux, supports sustainable production, utilization, and recycling of non-ferrous metals in Europe (Eurometaux, n.d. a). A representative for industrial minerals is the organization IMA-Europe, which promotes topics such as health and safety, environmental protection, product safety, and the significance of industrial minerals for society (IMA Europe, n.d. a).

1.2 The European Union and sustainable development
For almost 20 years, since issuing the EU Sustainable development strategy in 2001, sustainable development has been one of the main goals of the European Union (European Commission, 2001). The long-term vision is to secure a prosperous society, a better and healthier environment, which offer a better life quality for current and future generations (European Commission, 2001). The European Union has strongly committed to implementing the 2030 Agenda and the Sustainable Development Goals in its strategy and incorporate them in all internal and external policies (European Commission, n.d. c). The Agenda 2030 shift towards low-carbon, efficient use of resources, and circular economy promotes social wellbeing, equality, and inclusion (United Nations, n.d).

A roadmap with actions for the European Union's sustainable economy is the EU's Green Deal developed in 2019 by European Commission. The strategy aims to implement the Agenda 2030 through the resource-efficiency and implementation of circular economy, biodiversity conservation, and reducing pollution (European Commission, 2019). The main objective for the EU is to become climate neutral by 2050. To achieve the goal actions are required, such as investments in environmentally-friendly technologies, innovations, cleaner transport, decarbonization of the energy sector,
energy-efficient buildings, preserving and restoring biodiversity, and international partnerships to improve global environmental standards (European Commission, 2019). Certain minerals are essential to the technologies required for the success of Europe's Green Deal and transition to climate-neutral Europe; consequently, the European mining industry as a supplier of those minerals will play a significant role (EIT Raw Materials, 2020).

The European Commission adopted another sustainability initiative called the Raw Material Initiative, which aim is assuring sustainable raw material supply globally and within the EU and securing efficient use of raw materials, together with the recycling of secondary raw materials (European Commission, 2008). Critical metals like cobalt, platinum, rare earths, and titanium are crucial in the advancement of sustainable technologies. However, they present a high supply risk as the EU is greatly dependent on their imports (European Commission, 2008). Therefore, The Raw Material Initiative enhances resource efficiency, recycling, and reuse, not only due to the material scarcity and import dependence but also due to energy savings in the production of the secondary raw materials compared to primary raw materials (European Commission, 2008).

The European Union Directive 2014/95/EU (ref) as regards disclosure of non-financial and diversity information by certain large undertakings and groups obligates companies with 500 and more employees to report annually on non-financial matter from 2018 onwards regarding the data from 2017 (European Commission, 2014). They must publish reports on the implemented policies linked with the environment, social concerns, human rights, anti-corruption and bribery, and diversity on company Boards. Prior to the 2018 legislation, the European Commission (2017) issued non-mandatory guidance on non-financial reporting in which it is suggested to use some of the international, EU-based or national frameworks for reporting, such as the Carbon Disclosure Project (CDP), the Global Reporting Initiative, ISO 26000 of the International Organization for Standardization, the UN Global Compact and the SDGs (European Commission, 2017). The main purpose is to increase transparency, and over time it will lead to, according to the European Commission, more resilient companies with better performance, together with increased trust among stakeholders, especially investors and consumers (European Commission, 2017). Instead of detailed and in-depth reports, companies are obligated to release relevant, useful information regarding their performance and the impact of their
activities. The disclosure of relevant information is flexible and can be in the form of a separate report. This kind of non-financial disclosure is considered as a crucial component to enable sustainable finance. Through the increased transparency Directive aims to contribute towards the Sustainable Development Goals and the Paris Agreement (European Commission, 2017).

1.3 Research questions and aims

Not many scholars have studied the mining industry in Europe regarding sustainable development, SDGs and sustainability reporting (Endl et al., 2019). The studies carried out have mainly focused on the Nordic countries (Ranangen & Zobel, 2014; Ranangen & Lindman 2018); therefore, there is a significant gap in the research of the impacts and practices related to the sustainability of the European mining sector. The study aims to examine the sustainability activities of the mining companies that operate in Europe by carrying out a content analysis of their sustainability reports. The thesis is based on these four research questions:

1. How committed are mining companies in Europe in preventing or mitigating the impacts caused by their operations?
2. What efforts the mining companies in Europe take to contribute to sustainable development and implement sustainable development goals into their reports?
3. How comparable are the reports of the companies evaluated by this research?
4. What are the external drivers for mining companies in Europe to implement CSR practices?

The outcome of this analysis will uncover missing knowledge in the literature on the contribution of the European mining sector to sustainable development, but as well point out weaknesses of sustainability strategies presented in the reports. It will provide a new insight to the implementation of Sustainable Development Goals of the mining companies in Europe and it can serve as a base for policymakers related to sustainable development and the EU Green Deal. By determining the comparability and flaws between the reports, this thesis contributes to the improvement of comparability and standardisation of sustainability reports. Determining the main pressures which influence
mining companies in Europe to progress on CSR activities adds new theoretical knowledge to the CSR and institutional theory.

1.4 Thesis framework

This thesis is divided into six chapters. In the first chapter the concept of sustainable development and mining, including their interactions, are explained. It also includes a brief review of the European mining industry and the European Union's commitment to sustainable development. The Chapter 1 is finalized by presenting the objective and research questions for the thesis. The Chapter 2, literature review, gives an overview of institutional theory, the sustainable development, and the mining industry, particularly the European mining industry. It also includes explanation of sustainability reporting and frameworks like GRI Standards, UN Global Compact, Sustainable Development Goals, and ICMM Principles. The literature review process, data collection, and content analysis of the sustainability reports are described in Chapter 3 Research methods. Main findings regarding the mitigation of the impacts of mining operations, implementation of sustainable development, and SDGs in the sustainable reports are presented in Chapter 4 Results. Following the results, the Chapter 5 will deliver the research contribution to the subject of sustainable development in the mining industry of Europe, together with the limitations of the study. The Chapter 6 includes the conclusion with the academic and practical implications of the thesis.
2 Literature review

The Chapter 2 Literature review explains the relations between sustainable development and the mining industry through an overview of academic papers which were studying this area. In the section 2.1 theoretical framework of institutional theory is explained, followed by the section 2.3 where the terms of sustainable mining, sustainability issues of mining, and previous research on sustainability reporting are described. Section 2.3 narrows down the explanation to previous studies of the sustainable topics and European mining industry. Sustainability reporting and summary of sustainable reporting frameworks used in the analysed reports are included in the Section 2.4.

2.1 Institutional theory

Corporate social responsibility (CSR) defines the incorporation of social and environmental issues in a company’s business (Dahlsrud, 2008). It supports the concept of company’s responsibility not only towards the shareholders, but also towards other stakeholders like employees, local communities and society which should be regularly informed on company’s activities related to human rights, social and environmental subjects (Hamann, 2003). In order to present their progress, companies are influenced by certain drivers.

The institutional theory explains the pressures organisations experience, forcing them to adopt social and institutional norms and rules for the purpose of increasing legitimacy to maintain access to resources. Due to those pressures organisations within the same organisation field become more similar to another (DiMaggio & Powell, 1983). Legitimacy characterizes the adopted sustainable actions observed as appropriate by stakeholders (DiMaggio & Powell, 1983). The company’s strategies and decisions are motivated by external social, political, and economic pressures (Jennings & Zandbergen, 1995). This theory can clarify how changes in social norms, technological improvements, and regulations influence choices related to sustainable behaviours and environmental management (Ball & Craig, 2010; Brown et al., 2006). The concept that describes the process of homogenisation is called isomorphism, and according to DiMaggio and Powell (1983), it can be categorised as coercive (regulatory), mimetic (competitive), and normative (market) isomorphism. Coercive isomorphism occurs due to the pressure from
external factors like a shareholder or employee influence, and government policy to change an organisation’s institutional practices (Deegan, 2009). An example of this pressure are policies or taxes on companies to reduce their business's environmental impact (Seuring & Muller, 2008). Mimetic isomorphism is a process of an organisation trying to imitate or copy other organisation’s practices, often to gain a competitive advantage regarding the legitimacy. Implementing CSR reporting is an example of innovative practices that help maintain corporate legitimacy (Susith & Stewart, 2014). Normative isomorphism relates to the pressures to adopt particular institutional practices rising from common values, usually from customers on suppliers to comply with environmental and social standards (Deegan, 2009; Seuring & Muller, 2008). Increased use of GRI Standards for sustainability disclosure by companies worldwide (KPMG, 2017) seen as the right thing to do is an illustration of normative isomorphism (De Villers & Alexander, 2014). According to Ball & Craig (2010), normative pressures force businesses to become more environmentally aware. Organisations adopt institutional practices through these isomorphic processes (Dillard et al., 2004), including voluntary CSR activities and disclosures (Deegan, 2009). The institutional theory takes a broad view in explaining why an organisation adopts a particular structure or reporting practice. Companies whose core business is associated with the higher environmental impact, like the mining industry, are expected to act responsibly in the way they conduct their business, while the pressures to act responsibly for companies with a lesser environmental impact are lower (Gardberg & Fombrun, 2006). Therefore, the institutional theory will be used in this research to explain the reasons for the changes in sustainability reports among mining companies.

2.2 Sustainable development and the mining industry
Mining is often perceived as oxymoron to sustainable development due to mining’s depletion of non-renewable reserves and major environmental effect (Parameswaran, 2016; Whitmore, 2006). However, the compromise of mining and sustainable development does not include the end of mining, but the rational consumption of limited resources. For Allan (1995) sustainable mining minimizes negative impacts caused by mining activities, and at the same time reduces extraction rates, so that the extraction does not compromise the needs of future generations. An additional explanation of
sustainable mining suggests the implementation of activities in the operations to reduce negative impacts, improve environmental and social performance, support the health and safety of the employees, and addresses the stakeholder’s interest (Gorman & Dzombak, 2018). The same authors propose to assess and improve sustainability in the mining industry where the focus should be moved from the life cycle of the mine to the life cycle of the mineral. The improvement of the sustainable mineral mining is to move the emphasis from a mine life cycle to the rational rates of extraction and consumption of a mineral during the life cycle and preserve reserves and minimize any losses (Gorman & Dzombak, 2018). Azapagic, (2004) states that to contribute to sustainable development, mining companies need to identify stakeholders and key sustainability issues, actions required to tackle these issues, develop sustainability indicators to measure and monitor performance, progress assessment and communication with stakeholders.

Even though mining results in considerable economic gains (Wingard and Vorster, 2001), mining industry has several damaging environmental and social impacts, including non-sustainable land use and health and safety effects (Azapagic, 2004). Key sustainability issues are usually classified as economic, environmental, and social dimensions. In the case of mining economic issues are connected with contribution to gross domestic product, allocation of revenues and capital, investments and added value. The most relevant environmental issues in mining are depletion of non-renewable resources, air emissions, effluents discharges and generation of waste. Issues also include significant energy use and contribution to climate change. Water contamination can also occur due to acid drainage and other toxic components like heavy metals (Azapagic, 2004). Impacts of mining on biodiversity and natural habitat include biodiversity loss, habitat fragmentation, degradation of native vegetation, contamination of water bodies from waste, and land degradation in general (Kitula, 2006; Dobele et al., 2013). According to Azapagic, (2004) the mining industry presents high risks to employees, so occupation health and safety is a specifically important issue for the mining industry. Attracting and retaining high skilled workforce is another big challenge for the industry. However, the shortage of talent is observed as a major issue that businesses around the world confront with (Mcdonnell, 2011; Strack et al., 2007; Johannsdottir et al., 2014). Also, mining encounters equality issues due to the low rate of women employees and their general
benefit from mining activities. Local employment can bring prosperity to communities but as well cause reliance on the mine as a main employer. Some mining companies have been blamed for the abuse of human rights, as paying low wages, the use of child labour and the violating of indigenous rights (Azapagic, 2004).

Consequently, the mining sector has experienced intensified stakeholder pressure in the previous decades (Kapelus, 2002). Moreover, mineral associations like the ICMM and the Mining Association of Canada have mandated sustainability reporting among their members (Fonesca et al., 2010). Thus, sustainability reporting has significantly increased among the mining companies. As reported by the Global Mining Reporting Survey, 40 out of 44 major global mining companies published sustainability reports (KPMG, 2006). In 2017, the GRI database included published reports from 208 large and multinational mining organizations of which 127 organizations used the GRI G4 or cite the GRI Standards (GRI, 2019), while the rest used other frameworks for reporting.

The expanding number of sustainability reports in the mining sector has been research by several scholars, with the emphasis on analysing the disclosed data, quality evaluation, and detecting trends. Jenkins and Yakovleva (2006) used case studies of the top 10 world mining companies to examine the trends in the social and environmental disclosures. The outcome of the study shows that even though there is increased sophistication in these reports, there is still substantial variation in the companies' reporting content and styles. Due to variations in the reporting style, policy development, and types of metrics, these companies' social and environmental performance cannot be compared between the reports. Boiral and Henri (2017), explored the comparability of the GRI reports on the example of 12 reports of worldwide mining companies registered by the GRI. Their findings suggest that due to the qualitative characteristics of many GRI indicators, general and unspecific information, use of different scales, lack of data on many indicators and the difficulty to interpret some of the indicators, it is hard to compare sustainability performance between the reports. Guethner et al. (2006), in their analysis of the environmental and social responsibility of 29 mining and 19 oil and gas companies worldwide. They found that companies were reporting only on one-third of the indicators suggested by the GRI, choosing to focus on those indicators most relevant for the industry. The study also revealed that some indicators, such as the produced amount of waste and significant air emissions, were not reported in the same matter in
the mining companies as in the oil and gas ones. Perez and Sanchez (2009) reviewed the evolution of sustainability reporting of four large mining firms around the world for a four-year period, and results showed there was progress in the report’s comprehensiveness and depth. Companies showed the best performance in the social category and general and strategic information on the companies and their policies, followed by environmental performance. The lowest score was in the economic performance and accessibility and assurance information categories.

These studies suggest that the GRI sustainability report is increasingly adapted by in the mining sector; however, there are several critics of the outcomes of these sustainability reports. Moneva et al., (2006) state that the use of the GRI framework for reporting sustainability can mislead decision-makers and camouflage organizations' unsustainability by using "selected" indicators and metrics which provide better reputation to organizations. Additionally, by using the GRI framework, companies focus on certain issues within organizations and might not have a broader view of sustainability (Moneva et al., 2006).

Fonseca (2010) provided a critique of the GRI approach among 16 ICMM member mining companies suggesting how to improve the effectiveness of the framework. He claims that the GRI framework concentrates only on the organizational data collected for the past year's performance, instead of understanding the future consequences of the mining industry to ecosystems and society. According to Fonseca (2010), a desirable approach would be to use the biosphere's capacity as the guiding vision, and the reporting to be should not only be disclosed at the corporate level, but as well at regional and mine site level. It should also include a retrospective and prospective approach with a greater understanding of long-term effects, context, interactions, and trade-offs. Same study also revealed that seven companies did not have an external assurance despite public commitment, while for the remaining nine companies issues like low levels of stakeholder involvement in the assurance were identified. Another paper studied five types of mining sustainability frameworks used by or recommended for businesses and industry associations – the GRI, Towards Sustainable Mining, Seven questions to sustainability, Innovation and technology driven sustainability performance management framework and Adisa Azapagic’s framework. The results showed that frameworks are predominately retrospective in measuring mining sustainability without considering
trade-offs and synergies among sustainability dimensions (Fonseca et al., 2013). A set of sector-specific measurement principles was, therefore, recommended to validate the long-term sustainability of resource exploitation at the site, regional, and global levels.

2.3 Sustainable development and the European mining industry

Majority of the analysis of the mining industry contribution to sustainable development are at the global or national level. Not much academic research is exploring the sustainability challenges of mining sector at the regional level, particularly within the Europe and is mainly evaluating companies in different Nordic countries. Ranangen and Zobel (2014) studied whether implemented international standards contribute towards improved sustainability performance. It is a case study of the Swedish mining company Boliden AB which uses a framework based on ISO 26000, guidance on social responsibility, which intends to help organisations contribute to sustainable development (ISO, 2017). Even though company complied with most of the requirements from the framework, the research also revealed that such management systems do pressure the increased use of renewable energy or greenhouse gas emission reductions.

Another research explored mining companies’ practices in Norway, Sweden, and Finland, included content analysis of sustainability reports and a stakeholder survey. The research aimed to determine if Corporate Social Responsibility (CSR) activities of those companies fulfil stakeholder interests. Even though the results showed that the Nordic mining industry’s CSR practices mostly comply with stakeholders’ interests, there were certain areas in the reports that should be communicated more thoroughly. Those areas are the respect for laws and regulations, anti-corruption, sustainable resource, energy, land use, and the recycling of metals (Ranangen & Lindman, 2018). This study indicated that if these areas were improved, mining companies would gain the crucial social license to operate. It also showed that investments such as philanthropy and sponsorship are not so important to the Swedish mining industry’s stakeholders. Social licence to operate includes the community’s consent of the company’s operations and expands beyond legal rights (Kemp, 2010; Boutilier et al., 2012).

Besides sustainability reporting, the SDGs present the core element of the sustainable development. The UN Environment Programme’s (UNEP) white paper Mapping Mining to the Sustainable Development Goals: An Atlas provides a thorough overview of the
sustainable development relations with the mining industry (CCSI et al., 2016). At the European level, the mining industry's role in contributing to the SDGs has not been studied widely. A recent study by Endl et al., (2019) explores how European mining innovations contribute to the SDGs, with the aim to develop an impact framework regarding the European mining industry challenges and the SDGs. Some of the innovation concepts presented in the paper that would contribute to the SDGs were autonomous equipment and operations, better resource characterization and mine design, enhanced transparency and traceability, renewable energy solutions, and towards zero accidents. Results also showed that nearly all innovation concepts impact individual SDGs, implicating that these innovations illustrate synergies and trade-offs among the SDGs.

The mining industry will confront a variety of challenges in the future (WEF, 2015). In the Europe mining will specifically be pressured with the security of supply, its negative climate change contribution, the absence of circular economy transition, and increased demand for transparency. The mining industry's challenges will have to focus on sustainability, the SDGs, and innovations if the industry is to become a part of the solution.

### 2.4 Sustainability reporting and frameworks

The sustainability reporting and frameworks section consists first of the definition of a sustainability report, its purpose, and the most commonly used sustainability reporting frameworks. Furthermore, sustainability frameworks, guidance and standards used in the sustainability reports of the studied companies are described, together with their connection to the mining industry. The sustainability frameworks, guidance and standards applied are The Global Reporting Initiative (GRI) Standard, The United Nations (UN) Global Compact, The Sustainable Development Goals (SDGs) and The International Council on Mining and Metals (ICMM).

#### 2.4.1 Sustainability report

A sustainability report represents communication disclosed by a company or organization related to the economic, environmental, and social impacts caused by its day-to-day operations and core business (GRI, n.d. a; Johannsdottir & McInerney, 2018). The organization's values and governance model are presented in the reports together with the connection between its strategy and dedication to sustainable development (GRI, n.d. a; Johannsdottir & McInerney, 2018).
These reports help to communicate on sustainability performance and positive or negative effects, as well as setting goals and manage changes more effectively. Reports enable companies to be transparent which leads to better decision-making and to build trust among stakeholders. Other terminologies for non-financial disclosures, include triple bottom line reporting, corporate social responsibility (CSR), integrated reporting, ESG reporting and similar, are synonymous with sustainability reporting. Triple bottom line reporting moves beyond the usual way of reporting by taking consideration of the whole impact of the business activities and as well as to go over the economic performance (Dutta & Dutta, 2015). A CSR report is a communication tool for disclosure of company’s CSR efforts to the its stakeholders in terms of accomplishments and challenges, not only in economic, but also environmental and social fields, including corporate governance, climate change, employee and supplier initiatives and community investments (Moravcikova et al., 2015).

Sustainability report can also be a part of integrated reporting which conjoins financial and non-financial performance analysis (GRI, n.d. a). These reports are not only issued by businesses, but also by organizations of all types, sizes, and sectors around the world. Some of the main sustainability reporting frameworks are the GRI’s Sustainability Reporting Standards, the UN Global Compact, and the International Organization for Standardization and Sustainable Development Goals (GRI, n.d. a). All four concepts will be used as analysis tool since they were also recognized as the most common frameworks used by the studied companies (Table 5.)

2.4.2 The GRI standards
The Global Reporting Initiative (GRI) Standards are accepted global standards for voluntary sustainability reporting by businesses and other organizations worldwide. The GRI database includes over 23,000 GRI reports recorded, and the number is growing annually (GRI, n.d. b). Also, 35 countries use GRI in their sustainability policies as guidance. The GRI collaborates with international organizations such as the UN Global Compact, OECD, and the UN Working Group on Business & Human Rights.

GRI supports companies and governments identify and report their impact on sustainability issues related to climate change, human rights, governance, and social well-being (GRI, n.d. b). These standards cover a wide range of sustainability topics, from anti-
corruption to biodiversity, health and safety, and others. GRI Standards can be combined with numerous reporting frameworks like the Carbon Disclosure Project (CDP) or the SDGs. They are based on the Reporting Principles, which are mandatory to use to say that a report has been prepared according to the GRI Standards. The Reporting Principles are aimed at the quality of the information in a report and are divided into Principles to identify report content and Principles to define report quality (Table 1) (GRI, n.d. b).

Table 1. GRI Reporting Principles (GRI, n.d. b)

<table>
<thead>
<tr>
<th>Reporting Principles for defining report content</th>
<th>Reporting Principles for defining report quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Stakeholder Inclusiveness</td>
<td>• Accuracy</td>
</tr>
<tr>
<td>• Sustainability context</td>
<td>• Balance</td>
</tr>
<tr>
<td>• Materiality</td>
<td>• Clarity</td>
</tr>
<tr>
<td>• Completeness</td>
<td>• Comparability</td>
</tr>
<tr>
<td></td>
<td>• Reliability</td>
</tr>
<tr>
<td></td>
<td>• Timeliness</td>
</tr>
</tbody>
</table>

A typical report written following the GRI standards should include the vision and strategy, corporation profile, governance structure, and management systems, the GRI content index, and performance criteria (Adams and Narayanan, 2007). An organization should identify relevant 'material' topics related to its activities and operations to report. Material topics define the social and environmental themes that are the most important to the company and stakeholders (KPMG, 2014). GRI Standards contain of universal and topic-specific standards. The universal standards identify material topics and contain disclosures about the organization's size, activities, governance, and stakeholders' engagement (GRI, n.d. c). The topic specific GRI Standards contain disclosures on the economic, environmental, and social impacts concerning its material subjects and how they are managed.

The GRI framework had a few versions, with the latest transition from G4 Guidelines to GRI Standards. Previous versions of the guidelines published additional sector-specific disclosures for several industry sectors, including the Mining and Metals industry. Sector disclosures can still be used in combination with the GRI Standards; however, it cannot be a substitute for the Reporting Principles (GRI, 2016). Supplements were issued in 2010
and are based on the G3 Guidelines. Sector Supplement was updated at the same time as introduced G4 Guidelines in 2013. The document includes a set of disclosures that cover key aspects of sustainability performance relevant to the Mining and Metals sector, which were not enough covered in the G4 Guidelines (GRI, 2013). The necessity of sector disclosure is in the diversity of the mining and metals sector, involving exploration, mining, and primary mineral processing from project development, and an operational lifetime to closure. Companies can be specialized in one part of this cycle or be large multi-national or vertically-integrated enterprises. The main issues covered in the sector supplement are the control, use, and land management, the contribution to national economic and social development, community and stakeholder engagement, labour relations, environment, relationships with artisanal and small-scale mining and an integrated approach to minerals use (GRI, 2013). An organization should identify relevant ‘material’ topics which are related to its activities and operations to report on. The GRI Standards contain the universal and topic-specific standards. The universal ones identify material topics and contain disclosures about organization’s size, activities, governance, and stakeholder engagement (GRI, n.d. c). The topic specific GRI Standards contain disclosures on the economic, environmental, and social impacts in relation to its material subjects and how are they managed.

2.5 The UN Global Compact

The United Nations Global Compact (UNGC) is one of the most comprehensive frameworks in terms of adopters among various CSR initiatives (Ortas et al., 2015) with more than 12,000 signatories operating in 170 countries worldwide (UN Global Compact, n.d. a). This framework offers extensive guidelines for the implementation of responsible practice. Former secretary-General of the UN, Kofi Annan, launched the initiative at the World Economic Forum in Switzerland in 1999. It is based on ten universal principles established from the Universal Declaration of Human Rights, the International Labour Organization's Declaration on Fundamental Principles and Rights at Work, the Rio Declaration on Environment and Development, and the UN Convention against Corruption. Principles address problems concerning human rights, labour, the natural environment, and corruption (Table 2):
Table 2. The Ten Principles of the UN Global Compact (UN Global Compact, n.d. b)

<table>
<thead>
<tr>
<th>Human Rights</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Businesses should support and respect the protection of internationally</td>
<td>Businesses should support and respect the protection of</td>
</tr>
<tr>
<td>proclaimed human rights;</td>
<td>internationally proclaimed human rights;</td>
</tr>
<tr>
<td>2. Make sure that they are not complicit in human rights abuses.</td>
<td>Make sure that they are not complicit in human rights abuses.</td>
</tr>
<tr>
<td>3. Businesses should uphold the freedom of association and the effective</td>
<td>Businesses should uphold the freedom of association and the</td>
</tr>
<tr>
<td>recognition of the right to collective bargaining;</td>
<td>effective recognition of the right to collective bargaining;</td>
</tr>
<tr>
<td>4. The elimination of all forms of forced and compulsory labour.</td>
<td>The elimination of all forms of forced and compulsory labour.</td>
</tr>
<tr>
<td>5. The effective abolition of child labour;</td>
<td>The effective abolition of child labour;</td>
</tr>
<tr>
<td>6. The elimination of discrimination in respect of employment and occupation.</td>
<td>The elimination of discrimination in respect of employment and</td>
</tr>
<tr>
<td>Labour</td>
<td>occupation.</td>
</tr>
<tr>
<td>Environment</td>
<td></td>
</tr>
<tr>
<td>7. Businesses should support a precautionary approach to environmental</td>
<td>Businesses should support a precautionary approach to</td>
</tr>
<tr>
<td>challenges;</td>
<td>environmental challenges;</td>
</tr>
<tr>
<td>8. Undertake initiatives to promote greater environmental responsibility;</td>
<td>Undertake initiatives to promote greater environmental</td>
</tr>
<tr>
<td>9. Encourage the development and diffusion of environmentally friendly</td>
<td>Encourage the development and diffusion of environmentally</td>
</tr>
<tr>
<td>technologies.</td>
<td>friendly technologies.</td>
</tr>
<tr>
<td>Anti-Corruption</td>
<td></td>
</tr>
<tr>
<td>10. Businesses should work against corruption in all its forms, including</td>
<td>Businesses should work against corruption in all its forms,</td>
</tr>
<tr>
<td>extortion and bribery.</td>
<td>including extortion and bribery.</td>
</tr>
</tbody>
</table>

To join the UNGC, organizations have to write a letter of commitment to the UNGC10 Principles to the UN Secretary General. Furthermore, to keep an active status, they are obligated to provide an annual report called “Communication on Progress” (COP) in which all the efforts of sustainability actions are presented (Orzes et al, 2018). COP can be integrated into sustainability or annual report or an alternative open document and are posted on the UNGC website. By committing to the UNGC’s principles businesses should integrate them into the business strategy, day-to-day operations, decision-making processes and engage in responsible business practices with peers, partners, consumers, and society in general (UN Global Compact, n.d. c).

As mentioned in the section 2.1. companies are exposed to pressures to act responsibly, especially on the subject of environment and human rights (Lehmann et al, 2010). Ortes et al. (2017) recognized a number of actors pressuring the companies to adopt CSR practices and UNGC, including NGOs, union, media, and the government with the legal environment acts. The pressure from the competition is one of the main
motivations for joining this initiative (Perez-Batres et al., 2010; Garayar Erro & Calvo Sanchez, 2012) and evident mimetic pressures to adopt the UNGC (Ortas et al., 2015). UNGC has been criticized for minimal efforts needed to join the UNGC without efficiently applying its Principles (Sethi & Schepers, 2014). It also lacks control mechanisms (Bellace, 2014), and miss the monitoring and enforcement mechanisms (Berliner & Prakash, 2015). The UNGC Principles provide very little detail regarding their definition and scope (Garsten & Jacobsson, 2011) which leads to the decoupling phenomenon of numerous companies obeying to UNGC without major behaviour changes (Orzes et al., 2017).

2.6 The Sustainable Development Goals

The 17 Sustainable Development Goals (SDGs), listed in Figure 1., adopted by all UN Member States in 2015, are a call for action to end poverty, protect the planet, and assure peace and prosperity by 2030 to humanity (UNDP, 2020). They could be considered as a supplement to the UNGC principles which represent core CSR values, while SDGs are the framework for taking actions (Orzes et al., 2017). The Goals are comprehensive and include 169 targets linked to 232 indicators for measuring the status and progress to the SDGs (UN Stats, 2019). The SDGs give a universal framework for navigating the most pressing economic, social, and environmental challenges of the present, involving the roles of all actors in reaching sustainable development. All goals are linked between economic, social, and environmental dimensions of sustainable development, including the trade-offs and synergies across the goals. They are not only for developing countries but for all the countries in the world. The SDG principles are universality, indivisibility, inclusiveness and leave no one behind (UN SDG, 2020). Meeting the SDGs by 2030 requires collaboration among all segments of society, including governments, non-governmental organizations, the private sector, and communities. Therefore, all the stakeholders must incorporate the SDGs into their actions and operations (United Nations, n.d.).

Business sector can have an important part in sustainable development by implementing SDGs into their business strategies and addressing current and future stakeholder needs (UN Global Compact, 2019). Sustainability reporting can as well influence corporate actions and consequently initiate the implementation of SDGs into the business strategy (Anasi et al., 2018) and can be a significant driver of organisation’s sustainability strategy
Lozano, 2015). SDGs can also influence the evolution of sustainability reporting as they are generally recognized definition of sustainable development (Bebbington et al., 2017). However, previous research fund that not many companies had cited SDGs in their reports (Schramade, 2007; Rosati & Faria, 2019). Izzo et al., (2020) observed on the case study of Italian companies that majority of companies mentioned SDGs in their reports, but companies did not assess specific key performance indicators or integrated the SDGs into their business strategies. The implementation of SDG reporting is connected to several internal organisational factors, including a size of a company, a higher level of intangible assets, a stronger commitment to sustainability frameworks and external assurance, a greater share of female directors and a younger Board of directors (Rosati & Faria, 2019). Also, implementation of SDGs can differ due to the country of origin and its institutional characteristics like political and labour systems, economics, sociocultural norms, and education (Jensen and Berg, 2012).

SDG reporting practices has been criticized for “rainbow washing”, meaning that companies overuse the SDG rainbow wheels and focusing on style instead of the content (Izzo et al., 2020). Additionally, some authors emphasized that the SDGs do not explain how these goals relate one to another or identify the drivers of the impacts (Bebbington et al., 2018; Griggs et al., 2017). As being interdependent, conflict relations might occur among the SDGs which may lead to conflicting results (Nilsson et al., 2016). Interactions in which progress of one goal supports another one are classified as synergies, while the opposite interaction of one goal’s progress hinders another are called trade-offs (Pradhan et al., 2017). In the analysis of SDGs interactions, Pradhan et al., (2017) discovered that SDG 1 is linked with progress in SDGs 3, 4, 5, 6 and 10. Similar synergies are observed with SDG3 and SDGs 1, 4, 5, 6 and 10. On the contrary, SDG 8, 9, 12 and 15 demonstrated the greatest portion of trade-offs across SDGs. SDGs related to human development and socioeconomic standards were in conflict with environmental goals. The reason for most discovered trade-offs can be related to the focus on non-sustainable economic growth at the expenses of environment (Sen, 1983).
2.7 The mining industry and the Sustainable development goals

The mining industry has the potential to have a positive impact by contributing to the 17 sustainable development goals. Relations between mining and SDGs are described in the whitepaper titled *Mapping Mining to the Sustainable Development Goals: An Atlas* published in 2016 by the Columbia Centre for Sustainable Investment, the UN Development Programme, the World Economic Forum, and the UN Sustainable Development Solutions Network. It offers a summary of challenges and opportunities of the mining to contribute to the SDGs through their operations and the partnership with governments, communities, and civil society. The mining sector’s positive impact is given through providing employment, business development, increased income, and infrastructure, and by securing essential minerals for technologies, infrastructure, energy, and agriculture (CCSI et al., 2016). Unfortunately, mining contributes to numerous negative aspects like environmental degradation, social inequality, corruption, increased health problems, and human rights’ violation (CCSI et al., 2016). Figure 2 illustrates the major issues of the connection between the mining industry and each of the SDGs. An Atlas suggests several goals as a starting point for companies as they attempt to align their operations with the SDGs. For environmental sustainability it recommends the use of SDG 6 Clean water and sanitation, SDG 7 Affordable and clean energy, SDG 13 Climate
action and SDG 15 Life on land. Mining can contribute to social inclusion through SDG 1 No poverty, SDG 5 Gender equality, SDG 10 Reduced inequalities and SDG 16 Peace, justice, and strong institutions. Economic contribution can be expressed in SDG 8 Decent work and economic growth, SDG 9 Industry, innovation and infrastructure and SDG 12 Responsible consumption and production (CCSI et al., 2016).

Sustainable development goals offer a framework that the mining industry can use to tackle these global challenges and integrate sustainable development dimensions into practice. Moreover, integrating SDGs into the core business can lead to cost-savings, better alignment with regulations, better relations with communities and stakeholders, and provide an improved business environment (Scheyvens et al., 2016; Bebbington & Unerman, 2017). Goals offer an opportunity to participate in the discussion on contributing to sustainable development within the industry and its stakeholders, to share their efforts and detect new chances for partnership and innovation.

### 2.8 The Paris Agreement

The Paris Agreement is an agreement adopted by 196 Parties at the Paris climate conference (COP 21) in 2015 with aim to combat the climate change by limiting a Earth’s temperature growth to well below 2 degrees Celsius above pre-industrial levels, and trying to reduce the rise to 1.5 degrees Celsius. It also wants to improve the ability of countries to confront the climate change impacts and provide financial funding for the development of low-carbon and climate-resilient development (UNFCCC, 2020a). It entered into force in November 2016 and 189 Parties have ratified the Paris Agreement (UNFCCC, 2020b).

Each Party is required to develop own mitigation measures through nationally determined contributions (NDCs) and to regularly inform on the emissions and implementation activities, as well as to assess their current pledges after 5 years with aim to strengthen their targets. It is legally binding and applies to all countries, making them accountable to their commitments (UNFCCC, 2020c). Urgent call to tackle with climate change and its consequences is vital in achieving SDGs. The Paris Agreement is strongly associated to the Sustainable Development Goals as both agendas offer the basis for sustainable, low-carbon and resilient development (UNFCCC, 2020d).
The International Council on Mining and Metals (ICMM) is an international organization committed to a safe and sustainable mining and metal industry (ICMM, 2019a). ICMM was established in 2003 by the publishing of 10 Principles for sustainable development to make a change in the mining sector and improve performance. Principles are developed through a collaboration with NGOs, international organizations, and academics. There are in total 26 mining and metals companies which are part of this council, together with 35 regional and supply associations, including Euromines and Eurometaux (ICMM, 2020). All member companies are represented on the highest decision-making body, the Council of CEOs, and the Principal Liaisons Committee. Currently, ICMM is developing guidance for performance validation at the operational level assessed by independent third-party. Members are obligated to implement 10 Principles and eight position statements, where
Principles are used as the best framework for sustainable development for the mining industry. Part of Principle 10 is annual reporting at the corporate level using the GRI Sustainability Reporting Standards according to the core option of GRI’s G4 Mining and Metals sector disclosures. (ICMM, 2019b). Position statements include several obligatory requirements that member companies must fulfil. These statements are related to Water stewardship, Tailings governance, Indigenous people and mining, Principles for climate change policy design, Mining partnership for development, Transparency of mineral revenues, Mercury risk management, and Mining and protected areas.

**ICMM 10 Principles are:**

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principle 1.</td>
<td>Apply ethical business practices and sound systems of corporate governance and transparency to support sustainable development.</td>
</tr>
<tr>
<td>Principle 2.</td>
<td>Integrate sustainable development in corporate strategy and decision-making processes.</td>
</tr>
<tr>
<td>Principle 3.</td>
<td>Respect human rights and the interests, cultures, customs and values of employees and communities affected by our activities.</td>
</tr>
<tr>
<td>Principle 4.</td>
<td>Implement effective risk-management strategies and systems based on sound science and which account for stakeholder perceptions of risks.</td>
</tr>
<tr>
<td>Principle 5.</td>
<td>Pursue continual improvement in health and safety performance with the ultimate goal of zero harm.</td>
</tr>
<tr>
<td>Principle 6.</td>
<td>Pursue continual improvement in environmental performance issues, such as water stewardship, energy use and climate change.</td>
</tr>
<tr>
<td>Principle 7.</td>
<td>Contribute to the conservation of biodiversity and integrated approaches to land-use planning.</td>
</tr>
<tr>
<td>Principle 8.</td>
<td>Facilitate and support the knowledge-base and systems for responsible design, use, re-use, recycling, and disposal of products containing metals and minerals.</td>
</tr>
<tr>
<td>Principle 9.</td>
<td>Pursue continual improvement in social performance and contribute to the social, economic, and institutional development of host countries and communities.</td>
</tr>
</tbody>
</table>

**Table 3. International Council on Mining and Metals 10 Principles (ICMM, 2019b).**
3 Research methods

The method employed in this multi-case study on the sustainability trends in the European mining industry is based on the scholar literature review, sustainability initiatives and guidelines with the main research focus on the content analysis of the sustainability reports from 10 mining companies operating in Europe. The case study is a research method that simplifies the research of trend within its context using variety of data sources, which allows the understanding of various aspects of the phenomenon (Baxter & Jack, 2008). A multiple case study provides an understanding of the connections and differences between more cases (Yin, 2003).

3.1 Data collection

To get a broader view of sustainability standards used in the mining industry, especially in Europe, a review of the scientific literature and sustainability initiatives, guidelines, and tools was carried out. The relevant literature was collected through Science Direct and Google Scholar using several keywords, including “mining,” “sustainability,” “report,” “sustainable development,” “SDGs,” “CSR,” “GRI” and “Europe.” Additionally, several papers written about this subject were found in the reference list of the previously gathered academic papers using the snowball technique, method of data collection through the identification of an initial subject which provides the names of other actors (Lewis-Beck, Bryman & Liao, 2004). The analysis of sustainability frameworks included relevant initiatives used by the mining industry, such as Global Reporting Initiative (GRI), International Council on Mining & Metals (ICMM), United Nations Global Compact and Sustainable Development Goals (SDGs).

Main criteria for choosing the companies’ sustainability reports in the research were:

1. Mining companies with a mine or an ore processing plant within Europe;
2. Companies using a sustainability framework or standards for their sustainability reports;
3. Sustainability reports publicly published in English on the company’s website or in the GRI Database;
One of the criteria for choosing mining companies, whose sustainability reports were used in the analysis is that they have mine sites and ore processing operations in European countries, as the main research question examines impacts of mining on the stakeholders in Europe, including the local communities (Wood & Jones, 1995; Harris, 2007). Primarily, the GRI Database was used to gather information about mining companies in Europe. However, not all companies are listed in the database or use GRI Standards for sustainability reports. For this reason, an additional search was carried out. Several recent academic papers, which analysed Nordic mining industry, were used to expand the list of the companies relevant for this analysis.

The number of companies was updated by exploring the members of the major European mining associations such as Euromines, Eurometaux, and IMA Europe (Euromines, n.d., c; Eurometaux, n.d. b; IMA Europe, n.d. b). Still, not all companies had sustainability reports published on their websites, and some of the reports were not published in English, which was part of the selection criteria. The timescale for the conducted sustainability reports were years 2016 to 2018.

Furthermore, it was necessary to determine if their operation site meets the main criterion of location in European countries through this process. Most of the companies had listed locations of the mining or processing sites in their sustainability reports or on their websites. However, few of them did not specify the exact position, just the country of operations. Businesses with headquarters in European countries but have mining operations only in the other parts of the world, were not included in the research. The final number of companies studied is 10 (see Table 4.).

3.2 Content analysis

To answer the research questions for the thesis, a content analysis of the 30 sustainability reports from 10 mining companies published over a period of three years (2016-2018) was carried out. Content analysis is a common method applied to define large amounts of quantitative and qualitative methods concentrating on the analysis of documents through systematic coding and categorisation to group information around concepts or themes (Krippendorff, 2004). It was performed manually by reading each report and writing down the data from each report related to the research questions in an Excel document by company and year of publishing. The coding process for the content analysis
was based on an inductive approach, where the categories are developed from the raw data into a model with key themes and processes (Thomas, 2003). During this process, similar patterns from the reports' content became noticeable as materiality areas on which companies are reporting; therefore, each materiality topic was marked with a different colour. Afterward, data were sorted in separate sheets according to the key topic recognized in the data analysis and by each company from the list. The next step was gathering the data that were common for all studied companies and present it by the main topics related to the research questions.

Table 4. List of the analysed mining companies in Europe

<table>
<thead>
<tr>
<th>Company</th>
<th>Business locations</th>
<th>Minerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agnico Eagle</td>
<td>Finland</td>
<td>gold</td>
</tr>
<tr>
<td>Boliden</td>
<td>Ireland, Norway, Sweden, Finland</td>
<td>zinc, copper, lead, nickel, gold, silver</td>
</tr>
<tr>
<td>Eldorado Gold</td>
<td>Greece, Romania</td>
<td>gold, silver, lead, zinc, copper</td>
</tr>
<tr>
<td>Elkem</td>
<td>Norway, Spain</td>
<td>silicones, silicon, micro silica, carbon, ferroalloys</td>
</tr>
<tr>
<td>Glencore</td>
<td>Sweden, Spain, Germany, UK</td>
<td>copper, cobalt, nickel, zinc, lead, ferroalloys, aluminium, coal</td>
</tr>
<tr>
<td>Hydro</td>
<td>Norway, Germany, Spain, Italy, Poland, France, Hungary, Portugal</td>
<td>aluminium</td>
</tr>
<tr>
<td>Imerys</td>
<td>Spain, France, Italy, Germany, Sweden, Finland, Austria, Netherlands</td>
<td>industrial minerals (bentonite, calcium carbonite, mica, quartz, talc)</td>
</tr>
<tr>
<td>LKAB</td>
<td>Sweden</td>
<td>iron ore</td>
</tr>
<tr>
<td>Lundin</td>
<td>Portugal, Sweden</td>
<td>copper, zinc, nickel</td>
</tr>
<tr>
<td>Rio Tinto</td>
<td>Serbia, Iceland, Spain</td>
<td>iron ore, aluminium, copper, borates</td>
</tr>
</tbody>
</table>

Note: complete info of the sources is in Appendix A

In the data analysis for mitigating the impacts caused by the European mining companies, the focus was on the qualitative content analysis of the policies, engagement, actions, and indicators presented in the sustainability reports to determine the performance and potential progress in a specific field. Furthermore, a quantitative
content analysis of the reported indicators’ data was carried out to see if the implemented actions resulted in improvement or reduction of the negative impact.

To examine the contribution to the sustainable development and implementation of the SDGs into the companies’ business strategy and the sustainability reports, content related to these subjects was searched in the reports. It was necessary to examine if the SDGs were part of the reports, on which level the content was linked to SDGs, and which goals were the most common. Contribution to the SDGs described in the reports was also collected and categorized for each SDG.

Since the differences between reports was not the main research question, analysis was not conducted in depth to determine as many differences as possible, but to examine the possibility of comparing the data between the studied reports in terms of disclosed materiality topics and performance indicators. Additionally, based on other studies (Jenkins & Yakovleva, 2006; Boiral and Henri, 2017), uniformity of the measurement units used to express the results for specific indicators was also examined. Finally, assessment if the reports were assured by external assurance was also performed.

For examining the pressures under which mining companies in Europe act to progress in CSR practices, institutional theory (DiMaggio & Powell, 1983) was utilized as a theoretical framework, as it provides a basis for explaining why an organisation implements certain structure or reporting practices. Mining industry experience higher pressure to act responsibly due to its significant impact (Gardberg & Fombrun, 2006), therefore determining the external drivers for those actions are one of the research questions of this thesis.
4 Results

Prior to the content analysis of the sustainability reports, it was necessary to determine if selected mining companies met the selection criteria for the thesis research. The list of the companies which met the criteria is presented in the table 5, together with the sustainability reporting frameworks used by each company.

In the sustainability reports for 2016, all studied mining companies use the GRI G4 Guidelines: Core option where the majority of the companies also applied the Mining and Metals Sector Supplement. There is a visible transition towards using GRI Standards due to the change from GRI G4 Guidelines to GRI Standards in 2016. Only one company issued disclosures in accordance with the older GRI G4 guidelines in all three years of the reporting period examined in this study. Three companies are members of The ICMM and therefore are obligated to report using the GRI Standards annually.

A notable trend was observed in the use of the UN Global Compact principle, where nine out of 10 companies were signatories of the UN Global Compact by 2018. Similar improvements are visible in the commitment to the Sustainable Development Goals. In 2016 only four mining companies from the list included SDGs in their reports, while two years later, all the companies had started implemented SDGs into their sustainability strategy and reporting.

4.1 Mitigating impact

The qualitative content analysis of the studied sustainability reports showed the main materiality topics presented by the European mining companies in their sustainability reports. The structure of the reports varied between companies; however, all of them disclosed the data in the common categories. The most impacted areas recognized by the mining companies were governance, economic performance, social impact, environment, employees, occupational health and safety, product responsibility, and stakeholder engagement.

4.1.1 Corporate governance

Code of Conduct was the primary document for the firms analysed in this study on which the business strategy and ethical behaviour of a company were based.
<table>
<thead>
<tr>
<th>Company</th>
<th>Reporting framework</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agnico Eagle</td>
<td>In accordance with GRI G4 Guidelines/ Mining and Metals Sector Supplement</td>
<td>In accordance with GRI G4 Guidelines/Mining and Metals Sector Supplement</td>
<td>In accordance with GRI G4 Guidelines/Mining and Metals Sector Supplement</td>
<td>In accordance with GRI G4 Guidelines/Mining and Metals Sector Supplement</td>
</tr>
<tr>
<td>Boliden</td>
<td>In accordance with GRI G4 Guidelines: Core option/Mining and Metals Sector Supplement</td>
<td>In accordance with GRI Standards: Core Option/Mining and Metal Sector Supplement</td>
<td>In accordance with GRI Standards: Core Option/Mining and Metal Sector Supplement</td>
<td>In accordance with GRI Standards: Core Option/Mining and Metal Sector Supplement</td>
</tr>
<tr>
<td>Eldorado Gold</td>
<td>In accordance with GRI G4 Guidelines: Core Option; UN Global Compact</td>
<td>In accordance with GRI G4 Guidelines: Core Option; UN Global Compact; SDGs</td>
<td>In accordance with GRI Standards: Core Option; UN Global Compact; SDGs</td>
<td>In accordance with GRI Standards: Core Option; UN Global Compact; SDGs</td>
</tr>
<tr>
<td>Elkem</td>
<td>In accordance with GRI G4 Guidelines: Core Option; UN Global Compact</td>
<td>In accordance with the GRI Standards: core option; UN Global Compact; SDGs</td>
<td>In accordance with the GRI Standards: Core option; UN Global Compact; SDGs</td>
<td>In accordance with the GRI Standards: Core option; UN Global Compact; SDGs</td>
</tr>
<tr>
<td>Glencore</td>
<td>In accordance with GRI G4 Guidelines: Core Option/Mining and Metals Sector Supplement; UN Global Compact; SDGs; ICMM</td>
<td>In accordance with GRI Standards: Core Option/Mining and Metals Sector Supplement; UN Global Compact; SDGs; ICMM</td>
<td>In accordance with GRI Standards: Core Option/Mining and Metals Sector Supplement; UN Global Compact; SDGs; ICMM</td>
<td>In accordance with GRI Standards: Core Option/Mining and Metals Sector Supplement; UN Global Compact; SDGs; ICMM</td>
</tr>
<tr>
<td>Hydro</td>
<td>In accordance with GRI Standards; UN Global Compact; SDGs</td>
<td>In accordance with GRI Standards: Core option; UN Global Compact; SDGs; ICMM</td>
<td>In accordance with GRI Standards: Core option; UN Global Compact; SDGs; ICMM</td>
<td>In accordance with GRI Standards: Core option; UN Global Compact; SDGs; ICMM</td>
</tr>
<tr>
<td>Imerys</td>
<td>Citing GRI G4 Guidelines: Core option; UN Global Compact</td>
<td>Citing GRI Standards: Core option; UN Global Compact; SDGs</td>
<td>Citing GRI Standards: Core option; UN Global Compact; SDGs</td>
<td>Citing GRI Standards: Core option; UN Global Compact; SDGs</td>
</tr>
<tr>
<td>Lkab</td>
<td>In accordance with GRI G4 Guidelines: Core option/Mining and Metals Sector Supplement; UN Global Compact; SDGs</td>
<td>In accordance with GRI G4 Guidelines: Core option/Mining and Metals Sector Supplement; UN Global Compact; SDGs</td>
<td>In accordance with GRI G4 Guidelines: Core option/Mining and Metals Sector Supplement; UN Global Compact; SDGs</td>
<td>In accordance with GRI G4 Guidelines: Core option/Mining and Metals Sector Supplement; UN Global Compact; SDGs</td>
</tr>
<tr>
<td>Lundin</td>
<td>In accordance with GRI G4 Guidelines/Mining and Metals Sector Supplement; UN Global Compact; SDGs</td>
<td>In accordance with GRI Standards: Core option/Mining and Metals Sector Supplement; UN Global Compact; SDGs</td>
<td>In accordance with GRI Standards: Core option/Mining and Metals Sector Supplement; UN Global Compact; SDGs</td>
<td>In accordance with GRI Standards: Core option/Mining and Metals Sector Supplement; UN Global Compact; SDGs</td>
</tr>
<tr>
<td>Rio Tinto</td>
<td>In accordance with GRI G4 Guidelines: Core option/Mining and Metals Sector Supplement; UN Global Compact; SDGs; ICMM</td>
<td>In accordance with GRI Standards: Core option/Mining and Metals Sector Supplement; UN Global Compact; SDGs; ICMM</td>
<td>In accordance with GRI Standards: Core option/Mining and Metals Sector Supplement; UN Global Compact; SDGs; ICMM</td>
<td>In accordance with GRI Standards: Core option/Mining and Metals Sector Supplement; UN Global Compact; SDGs; ICMM</td>
</tr>
</tbody>
</table>

Note: complete info of the sources is in Appendix A
A Code of Conduct provides a framework for all employees on the company's responsible and ethical business practices, and every employee is obligated to annually read the Code of Conduct and sign the statement of understanding of the Code. In the reports, emphasis was placed on no tolerance for discrimination or harassment, corruption, and bribery and on the respect of human rights, labour rights, and the environment. The Code of Conduct is usually available at the operating sites or on the companies' intranet. Mandatory training and e-learning sessions were provided to employees, while training on anti-corruption and anti-bribery in some companies was required only for the targeted groups which could be exposed to the risks of corruption.

Besides the Code of Conduct, companies have developed additional policies in terms of health and safety, human rights, anti-bribery and anti-corruption, environment, diversity, sustainable development, Indigenous people, and employees. The Board of Directors is accountable for corporate governance; however, companies often establish Sustainability/CSR committees which are responsible for overseeing compliance and implementations of the policies and practices related to corporate responsibility and for sustainability reporting. As companies stated, sustainability is an integral part of their business strategy and aligns with the international standards and commitments such as UN Global Compact, Sustainable Development Goals, UN Guiding Principles on business and human rights, ISO Standards and Global Reporting Initiative Standards. European mining businesses are members of various industry associations such as Euromines and Eurometaux, which promote sustainable development in their agenda.

Responsible supply chain management was an essential part of the governance strategy of eight studied companies. They developed requirements for suppliers related to the environment, human rights, anti-corruption and working conditions, and Supplier Standards based on the Code of Conduct or Supplier Code of Conduct. Suppliers with a higher risk were additionally assessed and had more requirements to achieve. Detailed risk assessments of the suppliers were conducted, and regular audits and inspections, including external audits, were carried out. In the reports companies stated that they were committed to the prevention of child labour, modern slavery, and trade of conflict minerals. Corporate social responsibility was aligned with international standards like the UN Universal declaration of human rights, UN Guiding Principles on business and human rights, and UN Global Compact. Companies that operate in Indigenous people areas, such
as Sami villages in the north of Sweden, Norway and Finland, were committed to the respect of Indigenous rights, maintaining an open relationship through the Indigenous communities' agreements, and offering employment, training, and learning opportunities for Indigenous people.

Grievance mechanisms for reporting illegal, corrupt or unethical behaviour and any other complaints related to the company are established for internal and external stakeholders. Complaints can be reported via phone, email, and special whistle-blower channels managed by external agencies for anonymous reporting.

4.1.2 Economic performance
The goal common for all companies regarding economic sustainability is creating short- and long-term economic value for the national and local economies where they operate. Creating job opportunities within the company, for contractors and suppliers in the local communities and the countries of operations is one of the main contributions of mining companies to economic growth. Companies promote hiring workforce from the local communities and invest in their skill development. Besides wages and employee benefits, mining companies support the local and national governments' budgets by paying taxes, royalties, and fees.

Local and national procurement of goods and services were highly represented in the reports and varied from 64 to 92 percent within the firms. Companies are dedicated to supporting local businesses through direct investments and skill development to increase economic resilience. Several companies, like Lundin and Glencore, are particularly committed to economic diversification in the local communities, emphasizing women entrepreneurs by actively helping them start or develop their business. Diversification reduces the local community's dependence on the mines or process plants, which is important for the local economy since most of the mines have a life cycle of several decades. Likewise, building or maintaining shared public infrastructure and community development investments contribute to generating economic value.

By providing minerals necessary for societal development and specifically for low-carbon technologies, mining companies contribute to long-term economic growth. Most of the companies from the list are crucial for the European economy since they are among
the leading suppliers for certain minerals and metals, such as steel, aluminium, and industrial minerals.

Indicators used to express economic performance were direct value generated and distributed, local procurement share, community investments spent and payments to governments.

4.1.3 Stakeholder engagement
Building a strong relationship and maintaining an open and inclusive dialogue with stakeholders was the main objective for the analysed companies as part of their social responsibility. They were recognized as critical areas to maintain the social licence to operate. Therefore, stakeholder engagement, especially community engagement, is an integral part of their social acceptability. Dialogue with the affected parties was based on extensive stakeholder mapping, where the priority stakeholder groups were defined. Each company identified its important group of stakeholders, which are shown in table 6. Employees, local communities, governments, suppliers, and shareholders/owners were mutual stakeholders on each list, along with the high representation of non-governmental organisations and customers. Other recognized stakeholders from the reports were industry associations, media, universities and research institutions, business partners, media, and Indigenous people, while only one company saw the natural environment as a stakeholder.

For a better overview of stakeholder engagement, some companies have developed software, tools, or strategic standards and plan to monitor progress. Likewise, they were collecting internal and external stakeholders’ perception surveys and impact assessments. Engagement with the employees is through internal communication via magazines, newsletters, intranet, and social media, employee surveys, development tracking, and training. Dialogue with other stakeholders was conducted through meetings, site visits, audits, publishing annual financial and sustainability reports, partnerships, memberships in external organisations and initiatives, stakeholder surveys, and grievance mechanisms.
Table 6. Stakeholders' list

<table>
<thead>
<tr>
<th>Company</th>
<th>Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agnico Eagle</td>
<td>Employees, local communities, governments, Indigenous people, partners, shareholders</td>
</tr>
<tr>
<td>Boliden</td>
<td>Employees, future employees, neighbours, owners, capital market, business partners, authorities, media, Sami villages, consumers, Universities/research, Environment</td>
</tr>
<tr>
<td>Eldorado Gold</td>
<td>Employees, contractors, suppliers, shareholders, local community, governments, non-governmental organisations, industry groups</td>
</tr>
<tr>
<td>Elkem</td>
<td>Employees, authorities, suppliers, customers, shareholders, local community, unions, research institutions, non-governmental organisations</td>
</tr>
<tr>
<td>Glencore</td>
<td>Employees, suppliers and contractors, local communities, local and national governments, non-governmental organisations, unions, investors, customers</td>
</tr>
<tr>
<td>Hydro</td>
<td>Society, Media, Authorities, non-governmental organisations, industry associations, customers, partners, suppliers, employees, unions, shareholders, banks, Norwegian state</td>
</tr>
<tr>
<td>Imerys</td>
<td>Employees, business partners, shareholders, investors, suppliers, customers, Governments, Industry associations, Local communities, media</td>
</tr>
<tr>
<td>LKAB</td>
<td>Employees, owner, communities, customers, suppliers, society</td>
</tr>
<tr>
<td>Lundin</td>
<td>Employees, local communities, government, customers, labour unions, non-governmental organisations, shareholders, financial institutions, suppliers</td>
</tr>
<tr>
<td>Rio Tinto</td>
<td>Employees, Host communities, Suppliers and contractors, Customers, Governments, Shareholders and investors, non-governmental organisations, industry associations, media</td>
</tr>
</tbody>
</table>

4.1.4 Community engagement

Local communities were identified as one of the most important stakeholders of the mining companies analysed in this study, since the mine site operations have a direct impact on local communities. By contributing to the social and economic development of the communities and upholding continuous dialogue with them, mining companies maintain and secure a crucial social licence to operate. To retain social acceptance, different community development initiatives have been implemented. From the studied companies’ view, the main contribution of the mining businesses is creating job opportunities, not only direct employment but also additional indirect jobs from procuring goods and services. As stated in the reports, emphasis was on hiring local
workforce, their skills’ development, and education to support host communities. However, to reduce dependency on the mining assets, companies encourage diversification of the local economy through investment and support of local entrepreneurs to start their own businesses.

Analysis showed that community investments were mostly philanthropic donations related to community development, infrastructure, health and well-being, education, and sports. Mining companies provided scholarships and internships and invest in schools to increase interest in science and technology and to attract skilled personnel. They cooperated with universities and research institutions on various projects related to technology development and biodiversity issues. Continuous dialogue was secured through channels on the websites, social media, regular public and individual meetings, and grievances mechanisms.

All the mining companies have complaint reporting mechanisms to report any concerns or unethical and illegal behaviour. Complaints were received over the phone, email, and special whistle-blower lines managed by external agencies. Most of the received complaints were related to environmental issues and emissions, noise, traffic, and employment concerns, which were majority resolved by the end of the reporting year. Impact on the communities was regularly monitored, and actions to address received grievances were implemented. Some of the actions included changing the blasting schedule, installing dust collection technology, and building new roads out of the populated areas. On each site, there is either a site manager or a community relations team responsible for the community and public relations, and particular community relations protocols or standards were developed as a guidance on the implementation for community programs.

Two analysed companies had to resettle several local communities in the studied period due to mine expansion and to ensure the safety in the area. Swedish company Boliden will have to move 50 permanent residents of some villages in the proximity of their mine to a new, safe area. Resettlement was still in negotiation with the residents where the company offered a replacement plot and a new house or purchase of the property and additional bonus. Another Swedish company, LKAB, is relocating the entire three towns situated next to their mines caused by the mine expansion, which will have
a significant impact on the people and communities. As stated in the report, the company is the EU's largest iron ore producer making this project relevant on the European level. By 2018, the urban transformation had started with the relocation of significant cultural heritage buildings and new residential areas development. Property owners were offered an equivalent house or monetary compensation, tenants that were living in the rented accommodation were offered new rented housing, and business received relocation expenses coverage and advice from business analysts. The urban transformation was carried out in partnership and agreement with the stakeholders, where an annual survey was conducted to examine residents' satisfaction with the urban transformation.

4.1.5 Employees
In the reports, mining companies describe employees as key stakeholders, driving forces, and the best ambassadors to attract new employees. The number of employees and contractors in the studied companies varied from around 4000 at Eldorado Gold and LKAB, 17,000 at Imerys, 47,000 in Rio Tinto to 158,000 workers in Glencore. Local workforce and contractors were prioritized among the companies, with aim to employ 100 percent local workforce. Emphasis is on the diverse and inclusive workplace and mutual respect with no tolerance to any form of discrimination or harassment. They want to attract new skilled employees through graduate and internship programs while retaining existing employees and tracking the development of their knowledge and skills. The personnel's competence building was done by several in-house training programs, including training in safety, anti-corruption, diversity, Code of Conduct, and others. Training was performed over e-learning platforms, on-job training, workshops, and seminars and is mandatory for either all employees or targeted groups of employees. Likewise, employees receive regular performance and career reviews for further skills and talent development. Leadership skill development was recognized as a critical factor for a safe and diverse workplace and responsible mining operations; therefore, companies are implementing training and skills development programs in their business strategies. Six mining companies conduct surveys of engagement and satisfaction of employees every few years.

Companies said that they are committed to respecting human and labour rights in accordance with the international standards, employees right of collective bargaining and
freedom of association. The percentage of employees covered by collective agreements varies from 45% for Rio Tinto to 84% for Lundin, although the percentage depends on the countries where the companies are operating. As stated in the reports mining companies are working on the prevention of child, forced, or compulsory labour within the company and supply chain. Age limit, suppliers assessments, and audits tackling artisanal mining, modern slavery statements, and preventing conflict minerals trade are some of the steps in addressing these issues.

Diversity is widely represented in the reports, emphasizing the employment of local management and workforce, and aiming to achieve better gender balance. Promotion of gender equality is done through the development of diversity policy, offering a workplace without gender-based discrimination or harassment, and equal compensations based on the roles, responsibilities, and work experience. However, several companies stated that incidents of discrimination or harassment occurred in the studied period (Boliden, Hydro, LKAB), and two reported on zero cases of discrimination or harassment (Eldorado Gold, Lundin), while the rest did not address this issue. Additionally, companies offered scholarships for women and job opportunities to female graduates. They set up targets to increase the share of female employees within the company. The percentage of women employees was not high, with the lowest share of female employees in Eldorado Gold with 11 percent, and highest in Elkem with 25 percent of female employees. The numbers in other companies varied between 14 and 20 percent. Also, female representatives in the Board of directors are below 50% or lower. During the three years, the share of women in companies remained the same or has been increased slightly.

4.1.6 Occupational health and safety
The health and safety of employees, contractors, and communities were among the main concerns and core values for the analysed mining companies. They all have the objective of zero harm injuries; however, none of the companies had reached it yet. Companies have developed health and safety policies, management systems, and protocols as frameworks to manage health and safety risks and achieve their objective of zero harm. Additionally, safety programs and guidance were developed with the best health and safety practices to address common and significant risks. Employees and contractors are offered regular health and safety training, together with the safety events that were
organized within the company to increase their safety knowledge and awareness. Training was recognized as a key factor in achieving a safe workspace. Underground mines have trained emergency responding and mine rescue teams with consistent in-house training and simulated practice scenarios. Safety technology like collision avoidance and fatigue monitoring is implemented to prevent repeat accidents and reduce the dependence on human behaviour.

Risk management is a main element in the health and safety strategy in the prevention of accidents. Identification, mitigation, and analysis of the safety risks is the first step for the continuous safety improvement companies are striving for. Companies have procedures to make risk assessments, hazard identifications, and incident reporting. Six mining companies have the health and safety management system certification OHSAS 18001 implemented. Health and safety performance were frequently monitored using several indicators – total recordable injury rate, lost-time injury frequency, lost-time severity rate, sick leave, and fatalities. The mining companies analysed in this study differed in their use of metrics to calculate injury rates; therefore, it is harder to compare their safety performance. However, the trends in safety are positive, according to the data presented in the reports (Table 7.). Still, only two of the companies analysed had not experienced fatality accidents at their worksites during the studied period, Agnico Eagle and Lundin.

Occupational health is an additional important topic related to mining activities. In the reports, mining businesses monitor employees' health by tracking the number of new cases of occupational disease. Identification of potential workplace contaminants and exposures was frequently inspected to check compliance with safe workplace exposure limits and minimize workers' contact with hazardous substances. Employees receive regular on-site medical screening and medical treatment coverage in case of occupational disease diagnoses. Additionally, employees with diagnosed occupational illnesses were given alternative jobs. Most of the health risks on the mine sites were related to the airborne contaminants, exposure to the ergonomic challenges causing long-term musculoskeletal damage, and noise. The numbers in the reports indicated a reducing trend in new cases of occupational disease.
Another important topic for health and safety in the mining industry is catastrophic hazard management because catastrophic events could have disastrous consequences on the people and the environment. Companies have established catastrophic hazard management, detailed catastrophic hazard guidelines, and hazard protocols for the prevention of fatalities and catastrophic incidents. A site-specific knowledge base of critical controls is collected, and innovative technology has been implemented to reduce dependency on human behaviour. Underground mines are equipped with emergency facilities, secondary escape ways, first aid, and emergency equipment.

Table 7. Health and safety performance of analysed mining companies for 2016-2018 period

<table>
<thead>
<tr>
<th>Health and safety</th>
<th>OHSAS 18001</th>
<th>TRIFR</th>
<th>LTIFR</th>
<th>Fatalities</th>
<th>New cases of occupational illnesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agnico Eagle</td>
<td>↑</td>
<td>↓</td>
<td>↓</td>
<td>↑</td>
<td>n/r</td>
</tr>
<tr>
<td>Boliden</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>n/a</td>
</tr>
<tr>
<td>Eldorado Gold</td>
<td>↑</td>
<td>↓</td>
<td>↑</td>
<td>↑</td>
<td>n/r</td>
</tr>
<tr>
<td>El kem</td>
<td>↓</td>
<td>↑</td>
<td>n/r</td>
<td>↑</td>
<td>n/a</td>
</tr>
<tr>
<td>Glencore</td>
<td>↓</td>
<td>↑</td>
<td>↓</td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td>Hydro</td>
<td>↑</td>
<td>↓</td>
<td>n/r</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Imerys</td>
<td>↓</td>
<td>↑</td>
<td>↑</td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td>LKAB</td>
<td>↑</td>
<td>↓</td>
<td>n/r</td>
<td>↓</td>
<td>n/r</td>
</tr>
<tr>
<td>Lundin</td>
<td>↑</td>
<td>↓</td>
<td>↓</td>
<td>↑</td>
<td>n/a</td>
</tr>
<tr>
<td>Rio Tinto</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
</tr>
</tbody>
</table>

Note: ↓ refers to “negative trends”; ↑ refers to “positive trends”; n/a refers to “not applicable”, n/r to “not reported”.

4.1.7 Environment

The mining companies analysed in this study, recognizes that mining by its nature impacts the natural environment. Therefore, their objectives for environmental performance improvement are to efficiently use natural resources to prevent or limit their emissions and reduce the generation of waste. Developed environmental policies are a baseline for environmental management, compliance with regulations and operating permits, and commitment to continuous improvement. They also apply the best available technology and are committed to rehabilitating impacted areas by their operations. Eight companies from the list had most of their operating sites certified according to the ISO 14001 Environmental Management System (EMS). There are special environment teams responsible for the management of environmental policies and the monitoring of
environmental performance. Employees have regular training on environmental best practices, while suppliers are assessed on their environmental performance and required to comply with the requirements. Environmental impact is monitored and reported on a monthly basis, together with comprehensive EMS and independent third-party environmental audits. The main material topics in the sustainability reports related to the environment are water management, energy, and greenhouse gas emissions, effluents, waste, and air emissions. At the same time, the majority of the examined companies also included topics of climate change, biodiversity, and mine closure and remediation. Main results from the reports’ analysis in terms of environmental issues are presented in Table 8, where “no applicable” relates to the data which were presented only in one reporting year therefore it was not possible to track the progress, while “not reported” means that the topic was not covered in the reports.

4.1.7.1 Energy consumption

Energy consumption represents one of the significant environmental impacts and one of the largest components of operating costs of the extractive industry. Energy is primarily used for the ore processing plants and the ore extraction operations on the mine sites. Mining companies aim to reduce their energy impact through increased energy efficiency, energy recovery, and renewable energy resources. Primary sources of energy are electricity from the national grid, fossil fuels, and renewables; however, the distribution of the energy sources differs. Fossil fuels are still highly represented as the energy source within mining operations, particularly coal, natural gas, diesel, and charcoal. They have been used in the smelting processes for mining operations, equipment, and power generation. Some companies try to reduce the use of coal and fuel oil in their operations; therefore, they switch to less energy-intensive sources such as charcoal (Elkem), natural gas (Hydro), and biomass (Boliden).
Table 8. Environmental performance of analysed mining companies for the 2016 – 2018 period

<table>
<thead>
<tr>
<th>Environment</th>
<th>Energy</th>
<th>GHG emission</th>
<th>Air emissions</th>
<th>Water</th>
<th>Waste</th>
<th>Land use</th>
<th>ISO 14001</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Consumption</td>
<td>Renewables</td>
<td>SO₂</td>
<td>NOₓ</td>
<td>Dust</td>
<td>Withdrawal</td>
<td>Recycled/reused</td>
</tr>
<tr>
<td>Agnico Eagle</td>
<td>↓</td>
<td>↓</td>
<td>↑</td>
<td>n/r</td>
<td>n/r</td>
<td>↓</td>
<td>n/r</td>
</tr>
<tr>
<td>Boliden</td>
<td>↓</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>n/r</td>
<td>↓</td>
<td>→</td>
</tr>
<tr>
<td>Eldorado Gold</td>
<td>↓</td>
<td>↓</td>
<td>↑</td>
<td>n/r</td>
<td>n/r</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Eldorado Gold</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elkem</td>
<td>↓</td>
<td>↑</td>
<td>↓</td>
<td>↓</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Glencore</td>
<td>↓</td>
<td>↑</td>
<td>↓</td>
<td>n/r</td>
<td>n/r</td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td>Hydro</td>
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Note: ↓ refers to “negative trends”; ↑ refers to “positive trends”; → refers to “no change”; n/a refers to “not applicable”, n/r to “not reported”.
At some companies, such as Hydro, Elkem, and Lundin, the share of renewable energy in the energy mix, especially hydropower, is around 50 percent or higher, followed by Rio Tinto, with a 30 percent share of renewables and Glencore with 19 percent. Imerys had installed renewable solar units and wind turbines, while Boliden had used some biomass and bio-based fuels, although compared to their total energy consumption, their renewable energy use is negligible. Agnico Eagle, Eldorado, and LKAB did not report on energy produced or purchased from renewable sources.

The main indicators used to report on energy performance are total energy consumption, and energy intensity per tonne of ore processed. Two different units were being used among the companies analysed in this study to express total energy consumption. Agnico Eagle, Elkem, and LKAB are using gigawatt-hours (GWh). The rest are using SI multiples of joule like gigajoules, terajoules, and petajoules. Only Hydro and Rio Tinto had reduced total energy use in the period from 2016 to 2018. Other companies’ energy consumption increased mostly due to increased production, starting a new production or the acquisition of other companies. However, the mining companies analysed here, adopted actions to reduce energy consumption, such as utilizing energy recovery from the excess heat for electricity or heating, improving energy efficiency by implementing better technologies in the processes, optimizing existing technology and processes, and replacing used fuels with the more efficient energy sources. Seven companies were certified with ISO 50001, the energy management standard.

4.1.7.2 Greenhouse gas (GHG) emissions
Greenhouse gas emissions are closely related to energy consumption because they are mostly caused by fuel combustion and electricity purchase. Companies have set the targets to reduce their emissions or to become carbon neutral in the long-term run, however some of the targets are not ambitious. To report their performance on GHG emissions, companies disclose data for the total GHG emissions, Scope 1 emissions (direct), Scope 2 emissions (indirect emissions from purchased energy). Some companies include Scope 3 emissions (indirect emissions that occur in the value chain) and GHG emissions’ intensity. Decreasing trends in total GHG emissions are noticeable in the data for Agnico Eagle, Boliden, Eldorado Gold, Hydro, and Rio Tinto. Reasons for the increase of GHG emissions in other companies are the similar to reasons for energy increase, for
example increased production. Implemented actions to reduce GHG emissions include energy recovery from excess heat, replacement of fossil fuels and fossil fuel equipment with renewable energy sources, use of recycled input materials, improvement of efficiency for the used technology, and assessment of the opportunities to reduce the impact of operations.

4.1.7.3 Climate change
Climate change is not represented in all the studied sustainability reports. Boliden recognizes risks and opportunities in its activities due to climate change, such as the stress of heavy rain on water management systems. To address the climate change issues, it focuses on mitigating climate change which includes improving heat recovery, the further electrification of transport, and replacing fossil fuels with biofuels in processes. Smelter operations are exposed to the European Emission Trading Scheme. The company set a target of reducing CO2 intensity by 3% per year. Eldorado Gold also recognizes negative climate change effects on people, infrastructure, and equipment such as heat health-related risks, higher risks of drought and flooding, and potential investments to adapt to climate change risks. It also reports under the Carbon Disclosure Project (CDP). Glencore produces diversified resources such as copper, nickel, and zinc required for low-carbon technologies. However, Glencore is also a producer of coal, but they stated in the report that they have limited coal production capacity. The company conduct a climate change risk analysis to understand better and mitigate climate-related risks. It participates in one carbon offset programme and one carbon capture and storage project. Furthermore, Glencore publishes a standalone climate change report. Hydro set a target to become carbon-neutral from a life-cycle perspective\(^1\) by 2020 and was on track in 2018 by increasing their use of hydropower and their recycling volumes of post-consumer scrap. Hydro recognizes risks related to climate change such as physical risks, risks related to the transition to a low-carbon economy, and environmental risks. Imerys became a signatory of the French Business Climate Pledge, through which it is obligated to take urgent actions

\(^1\) As Hydro stated in its 2018 Annual Report p.80, carbon neutrality in a life-cycle perspective is „the balance between the direct and indirect emissions from our own operations, and the savings of applying our metal in the use phase“. It is based on reduced emissions from own production, increased use phase benefits and increased recycling of post-consumer scrap. Even though some plants might have higher carbon emissions, the overall balance for the company should be zero or negative (Hydro, 2020).
to combat climate change. It has a climate change working group to assess risks and opportunities related to climate change. Imerys also participates in the CDP’s climate change program. Lundin is mining commodities, such as copper, zinc, nickel, and lead, that are critical for technologies required for a low-carbon future and which are among the most recycled materials. It also conducts the assessment of climate-related risks and opportunities and adapts the infrastructure and activities to increase resilience against climate change risks. At one mine site, Imerys signed a 10-year contract with the energy provider to increase the share of renewable energy to 80 percent. Rio Tinto sees climate change as a strategic imperative. It produces materials like aluminium and copper, which are essential for a low-carbon economy and does not produce coal. Its emissions footprint has been reduced by almost half since 2008, while the share of renewable sources increased significantly. Rio Tinto published a separate Task Force on Climate-related Financial Disclosure (TCDF) report on climate change. Agnico Eagle, Elkem, and LKAB do not have climate change as a materiality topic in their reports.

4.1.7.4 Air emissions

Air emissions produced by mining operations are usually sulphur dioxide, nitrogen oxides, dust, and particulates. Sources of emissions are blasting, transportation of ore, mineral processing, and road traffic. Only Agnico Eagle did not report on the air emissions in the studied period. To reduce dust dispersion in the mine area, and ore transportation, water spraying of the equipment is installed, roads are salted and watered, and protective barriers around storage area are placed to reduce dust escape. There are also dust collecting systems on the equipment, like filters and scrubbers, while some sites have dust measuring equipment.

Sulphur dioxide (SO2) emissions depend mostly on sulphur content in raw materials and process stability. To reduce these emissions, it is necessary to have a stable process with the installed scrubbing or filter systems to capture emissions. Despite the efforts, most of the companies had increased SO2 emissions due to boosted production or higher sulphur content in the raw material. Only Boliden and Rio Tinto had lower SO2 emissions in 2018. LKAB had a significant drop in 2016 caused by the investment in a flue gas scrubbing equipment; however, they slightly increased in the next two years. Agnico Eagle, Eldorado Gold, and Lundin did not track SO2 emissions. Nitrogen oxides (NOx)
emissions were lower for Boliden, Elkem, LKAB, and Rio Tinto, while Hydro and Imerys had rising NOx emissions. Agnico Eagle, Eldorado Gold, Glencore, and Lundin did not track NOx emissions. Elkem, Hydro, LKAB and Rio Tinto measured particulates emissions.

4.1.7.5 Water management

Water is an essential input material used in the mining operations, especially for mineral processing. Vast amounts of water are utilized in mineral production; therefore, water management has a crucial role in reducing the negative ecosystems’ impact. Companies are trying to reduce their water consumption, discharges, and emissions to water. They have developed strategic water management frameworks and policies to guide best practices related to water management, compliance with the regulations, and maintaining environmental quality standards.

Companies conduct water-related risk assessments, collect data for water consumption, and water quality. When reporting on the total water withdrawal, three companies use litres, six use cubic metres, and LKAB does not present data for this indicator. Eldorado Gold, Lundin, and Rio Tinto had reduced their water withdrawal compared with the 2016 year, while other companies had increased amounts of withdrawn water. Elkem does not have numbers for years before 2018. The reason for increased quantities of water withdrawal for some companies was the dewatering of the underground mine sites from groundwater flows. Companies present data for this indicator by locations and by water sources, which are surface water, groundwater, treated wastewater, and seawater. To reduce the impact, companies implement conservation, reuse, and recycling of water, together with the usage of closed systems in the production. Hydro is recovering caustic soda to reuse it in the process and reduce impact. Agnico Eagle and Elkem do not disclose quantities of the recycled water from the operations, while the share of the reused/recycled water is lowest with the 10 percent for Hydro, highest for Lundin with around 200 percent, and other companies above 51 percent. They have water treatment facilities for the wastewater to reduce the quantity of chemicals like sulphate, nitrogen, and heavy metals in the discharged water.

Seawater is used for cooling the equipment and water supplied from desalinized seawater, especially in the areas with water scarcity. Additionally, in water-stressed areas, companies use only dry process technology. Runoff water is collected and treated
prior to the discharge to avoid contamination of the water bodies. Quality of discharged water and water bodies are regularly analysed and monitored internally and externally. Companies reported on the environmental incidents related to the discharges without effluent treatment or water treatment malfunction, spills, or leaking due to the heavy rainfall, but no major incidents were reported.

4.1.7.6 Waste management

The majority of the generated waste from the mining operations is barren rock, tailing and other residues from mineral processing, nonmineral waste, and wastewater. Waste rock is stored on the waste storage areas near the production, while tailings are disposed of in specially designed tailing dams. Companies use barren rock as backfill in underground mines, as a construction material, and in cement production. Some of the waste is recycled or reused to make new products. For example, Imerys has developed certified products from recycled materials which are used as construction materials, while Elkem collects micro silica and uses it as a by-product.

Tailings management is a substantial focus for the companies who have tailings facilities due to the potential of dam failure and major environmental incident risk, including acid drainage. Only Elkem and Imerys do not have tailing facilities in their operations since they exploit minerals whose processing does not produce tailings. None of the companies had tailings related failures at their operations. Tailings are assessed against numerous safety, and governance criteria, including tailing-related risks. Quarterly or annual independent dam safety inspections, reviews, and audits are performed. Catastrophic hazard protocol for the management of tailings storage facilities is developed to minimize or eliminate related risks. Tailings have installed upstream, and downstream monitoring facilities and are monitored daily. Mining companies try to reduce tailings impact by reusing or recycling waste or implementing new technologies. Agnico Eagle and Bolide partially use tailings as backfill in underground mines. Lundin mixes tailings with sand or cement for the disposal in the previously mined open pit. Eldorado Gold and Hydro implement dry stack tailings to reduce water footprint. Moreover, Hydro treats residue to lower the alkalinity, recovering caustic soda for use in the production, recovering aluminium from process waste, and examining the recovery of the other minerals. Boliden also recovers metals from the process residues. Results of
the waste management are partly mentioned in the product responsibility section, as Boliden recycles secondary materials from the external sources.

4.1.7.7 Biodiversity and reclamation

Biodiversity and reclamation are included as a material topic in the sustainability reports, except for Elkem and Glencore, since biodiversity was not recognized as a priority area in their materiality analysis. Mining has a significant impact on the land and ecosystems because it uses large land areas for mining, exploration, and the construction of the mining infrastructure. To understand the impact, to increase the knowledge of the impacts of mining on biodiversity, and to preserve biodiversity, companies partner with different organisations such as universities, non-governmental organisations, and research institutes in the biodiversity field. They have developed biodiversity management plans and remediation plans after the mine closure. Areas of high biodiversity values and protected areas are identified, together with the species inventory. Lundin has collected International Union for Conservation of Nature (IUCN) red list species for their operational areas and, if necessary, relocates protected plants to a sheltered area. Imerys conducts studies and research on biodiversity in partnership with French institutions, has pilot projects on biodiversity, and collects seeds of endangered species for its nursery. It also enhances rehabilitation of impacted areas during the mine life. Boliden has its forests, in which it practises responsible forestry, defined by the Forest Stewardship Council (FSC) to promote nature conservation interest through the establishment of nature conservation land, key habitats, and habitat protected areas. Agnico eagle has conservation projects of endangered species. Boliden, Imerys, Hydro and Rio Tinto used two land-use indicators – total disturbed surface area and total rehabilitated area. Even though they carry out restoration activities, rehabilitated area per year is much lower than the affected area.

4.1.7.8 Product responsibility

Boliden contributes towards a circular economy by recycling a variety of metal waste, including used lead-acid batteries, hazardous and electronic waste. Products and services are labelled in accordance with legislation, particularly with the EU chemical legislation. Boliden measures customer satisfaction biannually by conducting surveys among regular customers and considers their suggestions. Eldorado Gold’s product responsibility is to
produce gold and other metals by adhering their operating mines to the ISO 14001 Environmental Management System Standard, OHSAS 18001 Occupational Health and Safety Management System Standard, World Gold Council’s Conflict-Free Gold Standard and International Cyanide Management Code. Company states that since their products are unrefined gold and silver which are sold in bulk to the refineries for further processing, they have no environmental or safety risks associated with handling or disposal, therefore their products require no product service or labelling. However, cyanide used in the gold processing can be hazardous to the exposed workers (Henny et al., 1994) despite having International Cyanide Management Code, so company should elaborate this statement. Elkem provides safety data sheets for all its applicable products in accordance with the UN Globally Harmonised System of Classification and Labelling of Chemicals. The company is also focused on silicone innovations with more than 1,200 patents and approximately ten products developed each year.

Elkem sees research and development as a critical asset; therefore, it founded an innovation team in 2016. Glencore has a product stewardship programme and operates in compliance with the EU directive on regulation, evaluation, and authorisation of chemicals (REACH), which addresses the production and use of chemical substances and their potential negative impact. It promotes responsible sourcing education throughout the supply chain and provides documentation that their minerals are not sourced from conflict-affected or high-risk areas. The database on the potentially hazardous substances is regularly updated, and products have safety data sheets. The company is also preparing for the new EU Regulation 2017/821 of 17 May 2017 (the Conflict Minerals Regulation) entering into force in 2021. Hydro has a life-cycle assessment for all major product groups and the assessment of energy, material consumption, toxicity, and recyclability of the products. It also emphasises promotion and recycling of aluminium packaging through a pan-European network. Imerys operations comply with the European REACH Directive, while 70 percent of sites have ISO 9001 Quality management system certification, which according to ISO (n.d.), helps to get consistent, good-quality products and services. The company measures the sustainability of the products through the assessment from the World Business Council on Sustainable Development. It also performs cradle to gate life-
cycle assessments for 14 of the products. Lundin transports its products in accordance with EU and international standards, it performs product stewardship audits of the outbound port facilities and gives safety data sheets for each shipment. Rio Tinto has separately published a product stewardship strategy document. Agnico Eagle and LKAB do not report on product responsibility.

4.2 Implementation of sustainable development and SDGs
Sustainable development is integrated into the business strategy and day-to-day activities of the analysed mining companies at the operational, executive, and Board of directors’ levels. Mining companies’ sustainability work is based on their own established norms and values, as well as on the UN Global Compact principles and the SDGs. The values of these companies reflect their commitment and purpose, and they are the basis for sustainability management along with other policies. Most of the companies include integrity, respect, and responsibility as their core values. Furthermore, their mutual aims are to create added value to the stakeholders from the mining operations and minimize the negative impact on the environment and society. Other sustainability priorities are creating a safe, healthy, and diverse workplace, using resources efficiently, having an open and inclusive dialogue with stakeholders, respecting human, and labour rights, and set high standards of ethics and corporate governance. Their commitment to sustainable development is expressed through participation in the external international and industry initiatives, which promote sustainable development.

Additionally, majority of companies set short-term and long-term objectives related to sustainable development to track their performance and commit to continuous improvement. In each report, they present the performance for the previous year and set new objectives for the next reporting period. However, some of the objectives had not been achieved at the end of the reporting year. Also, some objectives are set for a more extended period and are in progress, but not fully achieved. The reasons for not meeting the targets are various, ranging from equipment malfunctioning, acquisitions of new sites, and increased production, to safety incidents caused by human behaviour. Imerys developed an annual competition for its employees called SD Challenge to encourage

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2 Cradle-to-gate is a partial life cycle assessment of a product from resource extraction (cradle) to the factory gate (Cao, 2017).
them to participate in the sustainable development progress within the company. Lundin initiated the development of a Five-Year Sustainability Strategy to advance the implementation of the UNGC Principles and SDGs into the business strategy.

Majority of studied companies just referred to the UN Global Compact as being the guidance for the activities in areas of human rights, labour standards, the environment, and anti-corruption (Eldorado Gold, Elkem, Glencore, Rio Tinto, Imerys). The reason for that could be in publishing separate report as UN Global Compact COP in which the relations with the Principles is explained more thorough. Hydro stated its commitment to the UN Global Compact by the letter to shareholders by the President & CEO and referred to the stand-alone COP report. Imerys addressed relevant UN Global Compact Principles to each materiality topic. LKAB stated that its supplier’s requirements are based on the UN GC. Boliden integrated its UN Global COP with the sustainability report, where it related and explained company’s performance to the Principles. Same as the other companies, Boliden use UN Global Compact as a basis for sustainability work. Lundin as well incorporated COP into the sustainability report, where it explained company’s progress on each Principle mostly through its various documents and policies, standards and plans and participation in associations. It also addressed related SDGs to every Principle.

Implementation of the SDGs into the sustainability reports of the mining companies analysed in this study considerably improved over three years. In 2016 only Glencore, Hydro, Lundin, and Rio Tinto started to align their sustainability strategies with the SDGs. Glencore was the only company that had related the SDGs to their materiality topics. Though, its contribution to the SDGs was not explained. Glencore did not link all the SDGs to its report content, just the ones which are associated with its sustainability activities. By the 2018 reporting year, there had been considerable progress in supporting the SDGs, where all the mining companies adopted SDGs as a part of their business strategy. Their contribution to the SDGs is explained in special sections within the report or directly linked to the materiality topics. As Glencore identified key SDGs where they thought company contributed the most in 2016, the other companies took the same approach of selecting related SDGs and integrating them into their reports. Additionally, some companies have case studies linked to certain SDGs to present their contribution.
The results for all referred SDGs from the reports are presented in the Table 9. The only mutual SDG was Goal number 8, Decent work and economic growth, for all companies, followed by SDG 3 Good health and well-being and SDG 13 Climate action, which were identified in most of the reports. Another highly identified Goal was SDG 16 Peace, justice, and strong institutions. Other relevant SDGs within the studied reports are SDG 4 Quality education, SDG 5 Gender equality, SDG 6 Clean water and sanitation, SDG 9 Industry, innovation and infrastructure, SDG 10 reduced inequalities, SDG 11 sustainable cities and communities, SDG 12 responsible consumption and production, SDG 14 Life below water SDG 15 Life on land and SDG 17 Partnerships for the goals. The following subchapters present the data collected from the analysed sustainability reports, in which companies stated how they see their contribution to SDGs.

Table 9. Sustainable Development Goals referred in the analysed reports

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4.2.1 SDG 3 Good health and well-being

The contribution of mining companies to SDG 3 Good health and well-being is through prioritizing the health and safety of their employees and contractors. They prevent incidents by implementing new technologies such as collision avoidance and fatigue monitoring technology and focus on the continuous training of the employees in the health and safety area. By addressing potential catastrophic hazardous events through developed protocols and management plans, companies ensure the safety of their employees and communities where they operate. Through product stewardship management with quality certification and compliance with EU regulations, together with
safety data sheets for each shipment, companies guarantee the safety of their products. Tracking employees' health through regular medical screening, giving a medical treatment if necessary, and setting targets to reduce the number of occupational diseases contributes to the good health of the workforce. In addition, by monitoring and limiting the exposures of chemicals in the working environment, the health-related risks are reduced.

4.2.2 SDG 4 Quality education
Mining companies recognized the importance of quality education. Therefore, they invest in education programs and infrastructure within the communities. They ensure inclusive and equitable quality education and lifelong learning opportunities for all employees through education programs, numerous training, and skill development. Through regular performance and career reviews, companies encourage employees to develop their knowledge and grow their talents.

4.2.3 SDG 5 Gender equality
Mining companies promote gender equality and women empowerment by providing a workplace without gender-based discrimination or harassment, and by offering equal compensation for men and women for the same job positions and responsibilities. All companies have the objective of increasing the share of women employees within the companies through the scholarships and internships for women, and by establishing different women in mining initiatives. They support women entrepreneurs in local communities through funds and business counselling.

4.2.4 SDG 6 Clean water and sanitation
Mining companies contribute to SDG 6 Clean water and sanitation by reusing and recycling the water in the operations, which reduces freshwater consumption. Water management systems are based on water treatment investments, improving water efficiency, monitoring water quality, and minimizing water discharges. In the water scarcity areas, dry process technologies are implemented to minimize water consumption. Additionally, some companies use desalinated seawater to reduce the stress on freshwater bodies.
4.2.5 SDG 7 Affordable and clean energy
Mining companies’ input for clean energy is demonstrated in several actions: having less-energy intensive processes, improving energy efficiency, and reducing fossil fuel energy sources. They also increase the share of renewable energy sources in their energy mix. Additionally, the majority of the studied companies produce minerals required for renewable energy technologies production, such as solar panels and wind turbines.

4.2.6 SDG 8 Decent work and economic growth
Mining companies have a direct and indirect positive impact on the communities where they operate. Economic contributions of the analysed companies are through wages and salaries to employees, and taxes, royalties, and fees paid to governments. Economic value is distributed through community investments in education, economic diversification, and local entrepreneurs, infrastructure, and local procurement. Analysed mining companies are dedicated to respecting international human rights and labour standards and promoting a safe and secure working environment. They have applied measures to eradicate child and forced labour and modern slavery, with an emphasis on the supply chain through mandatory supplier assessments and requirements for respecting human rights, anti-corruption, and working conditions.

4.2.7 SDG 9 Industry innovation and infrastructure
Investments in research and development, especially in innovative products, together with the investments in new technology and infrastructure, are main contributors to the SDG 9. Mining companies cooperate with local businesses and universities to promote research and development.

4.2.8 SDG 10 Reduced Inequalities
The promotion of equality, inclusion, and empowerment for all employees through the Code of Conduct and other policies and zero tolerance for discrimination or harassment supports the goal of reducing inequalities. Companies have established open dialogue and cooperation with local communities, including Indigenous people. They reduce inequalities by providing jobs to women, Indigenous people, along with giving education and skills development opportunities for everyone.
4.2.9 SDG 11 Sustainable cities and communities
Mining companies see their support of SDG 11 Sustainable cities and communities by acting in a socially responsible manner and contributing to local communities' social and economic development. As mentioned in subchapter 4.2.5., these companies produce metals and minerals required for sustainable cities and low-carbon technology.

4.2.10 SDG 12 Responsible production and consumption
The main contribution to SDG 12 Responsible production and consumption is the minimization of negative environmental impact by reducing waste generation and emissions to air, water, and soil. Besides, sustainable management and efficient use of mineral resources, including the reuse and recycle of materials, play a significant part in responsible production and consumption.

4.2.11 SDG 13 Climate action
The mining companies analysed in this study mitigated the effects of climate change by improving energy efficiency through the implementation of energy management system standards and by reducing GHG emissions through low-carbon technology and replacing fossil fuels with renewable sources. They support the Paris Agreement and the SDGs and have aligned their sustainability actions with them. Some of the companies participate in the carbon trading scheme and carbon storage projects. The use of recycled material and excess heat reduces energy consumption and consequently, greenhouse gas emissions.

4.2.12 SDG 14 Life below water
Contribution of mining companies to protecting the life below water, SDG 14, is through participation in different biodiversity initiatives, including partnerships with institutions and communities in water ecosystems conservation and preservation projects. Furthermore, the environmental impact assessments of the project are conducted before the mine site opening. At the same time, plans for conservation and reclamation of mining areas during the operations and after closing are developed. Used process water is being treated before discharges, as well as regular monitoring of the water quality.

4.2.13 SDG 15 Life on land
To reduce the impact on the land, mining companies have developed a mine site remediation and closure plans. Likewise, they enhance rehabilitation during the mine life
to minimize the negative effect of mining operations. Preservation of biodiversity is part of the sustainability activities, together with the participation in many ecosystem conservation programs.

4.2.14 SDG 16 Peace, justice, and strong institutions
By being transparent, respectful, and honest in stakeholder dialogue, acting in an ethically responsible manner by following the Code of Conduct, and having a respect for international organisations and standards, studied mining companies support SDG 16. Also, they meet legal requirements, promote anti-corruption activities, and provide grievance mechanisms.

4.2.15 SDG 17 Partnership for goals
Analysed mining companies establish collaboration initiatives with industrial organizations, universities, research institutes, non-governmental organisations, and local communities to create additional value, drive innovations, and mitigate the negative impacts of their business. They also share best practices through participation in various industry associations.

4.2.16 Other SDGs
SDG 1 No poverty and SDG 2 Zero hunger were not well represented in the analysed sustainability reports.
5 Discussion

This thesis examines the commitment of mining companies in Europe in preventing or mitigating negative impacts caused by their operations, the efforts they take to contribute to sustainable development and implement SDGs and the comparability between the reports evaluated by this research. The following sections emphasise how the study aim was reached, and the research questions are answered.

5.1 How committed are mining companies in Europe in preventing or mitigating negative impact caused by their operations?

The results from this study indicate that the mining companies which operate in Europe implement various activities in their business strategy and day-to-day operations to reduce or mitigate negative impacts caused by their operations. Analysed mining firms disclosed sustainability reports annually, in some cases as well their COP for UN Global Compact and ICMM mandatory reporting (Fonesca et al., 2010). They develop governance policies and regulations to have standardized procedures at each operation, focusing on the Code of Conduct as a central document for transparent and ethical behaviour (European Commission, 2017). These findings support previous review of CSR practice in mining industry which demonstrated that Code of Conduct, together with sustainability reports and community engagement, dominantly represent sustainability management (Ranangen & Zobel, 2014). With the development of anti-corruption policies and training of employees, and conducting the assessments of suppliers, mining companies reduce the risks of unethical behaviour and violation of human or labour rights within their company and supply chain (UN Global Compact, n.d. c; Hauser, 2018; Foerstl et al., 2010).

Providing job opportunities, paying wages to the employees, and taxes to the governments, emphasising local procurement, and economic diversification mining companies create short-term and long-term economic value (Walser, 2002; Petkova et al, 2009; Garnett, 2012; Kotev & Rolfe, 2014). However, there have been tax avoidance claims for some of the analysed companies, including Agnico Eagle in Finland (Finer & Ylonen, 2017), Eldorado Gold in Greece (Euractiv, 2017) and Rio Tinto, that by using mailbox companies in the Netherlands (SOMO, 2018) they caused tax revenue losses for
the countries where they operate. These allegations were not addressed in the analysed reports.

Maintaining a strong and open dialogue with stakeholders and their engagement through various activities is an important objective for the mining companies. This has been recognized as priority activity to secure a social licence to operate (Dare, Schirmer & Vanclay, 2014; Kemp, 2010; Hedin & Ranangen, 2017). Based on the cases of Swedish mining industry (Ranangen & Lindman, 2017) which identified several areas that matter to the stakeholders but are not in the focus of the companies, mining companies should implement strategies with in-depth understanding of stakeholders interest (Freeman et al., 2007; Hedin & Ranangen, 2017). An interesting result is observed among the key stakeholder identification, where only Boliden identified the environment as the priority stakeholder. Considering the significant negative impact of the mining operations on the environment and the natural resources extracted from it (Azapagic, 2004), other mining companies should include the environment as key stakeholder (Jacobs, 1997). According to the concept of sustainable development (Brundtland, 1987), recognizing future generations interests is also a way of considering the environment as a stakeholder, since future generations are affected by the present decisions of companies or society, but they cannot influence their decisions (Jacobs, 1997).

Particular focus is placed on local communities because mining companies recognized local communities as one of the most crucial stakeholders (Dare et al., 2014; Dobele et al, 2014). The importance of local communities is also presented in the specially developed protocols, community monitoring programs, and community relations teams. Contribution through community investments is mostly philanthropic, such as investments in education, infrastructure, culture, and sports. However, the results from the previous study of Ranangen & Lindman, (2018) showed that philanthropy is not highly relevant to the stakeholders. Received complaints are mostly related to emissions, particularly dust, noise, and traffic; however, they are not covered enough in the reports. Even though only two companies are in the process of resettling neighbouring communities, the impact of the resettlement is vast, where the whole adjacent towns are being transferred to new locations causing the major social disruption (Owen & Kemp, 2016)
Most important stakeholders for the mining companies are their employees; therefore, great efforts are made to attract skilled new employees and to retain existing ones. Since these companies often operate in the remote areas and their image is viewed negatively, they struggle to attract high-qualified and locally available skilled people (Azapagic, 2004). Development of the skills and knowledge is done by numerous training programs in different areas, like safety, anti-corruption, Code of Conduct, and others. By tracking employees’ performance, companies are ensuring further skills and talent development, and some companies are regularly checking the satisfaction of the employees through surveys. Even though all companies state in their reports that they recognize the right of collective bargaining and freedom of association, by the data presented the share of employees covered by collective agreements in some companies is not even half, while on some sites, they are not covered at all. Problem of decreasing coverage by collective bargaining is identified by OECD (2017) where in more than half of OECD countries collective bargaining is declining and is around 50% or lower, and similar trends are observed in other parts of the world (Mishel, 2012; Card, 2001). These results contradict the claims of freedom of association and implicate the potential violations of fundamental workers’ rights (Handelsman, 2002) and mining companies should explain the reasons behind such a low numbers. Freedom of association and the right to collective bargaining are part of one of the main principles (Principle 3) of UN Global Compact (Un Global Compact, n.d. b), on which principles nine studied companies committed to respect. International Labour Organization identified freedom of association as an important factor in fostering and maintaining sustainable development by having a positive effect on economic growth, poverty reduction, reduced inequalities and partnership among governments and trade unions (ILO, 2011).

Diversity is highlighted in the reports, especially gender equality, with the aim to increase the share of women employees within the companies. However, the results show that even in Europe, the mining industry is still predominately male (Lahiri-Dutt & Macintyre, 2006), and the share of women is not changing or slightly increasing, meaning the efforts to attract female workers are not sufficient. Also, cases of harassment and discrimination are evidenced in this research, confirm the other studies outcome (Botha, 2016; Feyerherm & Vick, 2005) of women workers in mining industry still experience discrimination, negative attitude from male co-workers, disrespect and isolation in the
workplace and underestimation when being in the leadership positions. Botha, (2016) recommends increasing the participation of women at operational and professional levels, ensuring mentoring programmes for women, regular diversity training and female representatives at the mine sites. Rosati and Faria (2019) examined the connection between the SDG reporting and various internal organization factors and among the results found that a higher share of female directors and younger Board of directors are positively related to SDG reporting. These results support the issues recognized by Azapagic (2004) of mining industry struggling to attract and retain high skilled workforce and increase share of women employees.

The primary concern of all companies in the health and safety of the employees, contractors, and host communities. The results suggests that positive progress is visible in reduced injuries in the workplace due to the safety training, programs, risk assessment and implemented technology, which supports the research from Loow and Nygren (2019) on improved accident rates in the Swedish mining industry. Similar trends are observed in the United States (Katen, 1992), Canada (Haldane, 2013) and the EU (European Commission, 2010). Hebblewhite, (2009) emphasized the importance of good communication, education, and training of the employees for achieving maximum safety in mines. Likewise, the number of occupational diseases has reduced due to regular monitoring of exposure and medical check-ups for employees. However, fatalities still occurred in the majority of the studied firms, especially with contractors (Muzaffar et al., 2013), so there is a necessity for even stronger safety culture combined with the best technologies to prevent accidents (Loow & Nygen,2019), including safety culture programmes and certification (Madsen et al., 2018).

In terms of environmental performance, the results indicate that mining companies in Europe aim to improve their environmental footprint by efficient use of natural resources, minimizing or preventing emissions, and reducing waste generation. The majority of the companies have certified sites according to environmental (e.g. ISO 14001) or energy (e.g. and/or ISO 50001) management systems. However, Ranangen and Zobel’s (2014) study found that such systems do not contribute to higher use of renewable energy or reduction in GHG emissions. This study’s results show similar trends in terms of mining companies’ energy consumption. Energy presents a huge part of
mining impact (Nasirov & Agostini, 2018; McLellan et al., 2012). The majority of the companies increased their energy consumption due to increased production or acquisition of new companies. Fossil fuels are still a dominant energy source (Boden et al., 2017), while the implementation of renewable energy sources is highly variable among the companies analysed in this study, ranging from around half of the energy mix to zero. Use of renewable biofuels and charcoal have the highest theoretical potential to reduce emissions from thermal applications, while hydropower is crucial contributor to the reduction of electricity generation emissions (McLellan et al., 2012) Worldwide renewable energy (excluding hydro) in mining sector accounts for 0.1% of the total supply (Hamilton, 2016). Operating in the remote areas often presents a challenge for mining companies which use diesel as an energy source, however solar technologies with energy storage could be an alternative in future (Soberanis et al., 2015).

Mining companies often emphasise the importance of minerals for a low-carbon future; however, their production should also be based on efficient renewable energy use, energy saving in the production and use of secondary raw materials (European Commission, 2008). Hydro’s results justify the arguments of energy savings through its reported reduced total energy use by increasing the input of recycled aluminium. Also, it utilized almost a two-third share of renewable hydro energy. Better results were noticeable in the GHG emission reductions. Half of the studied companies decreased their emissions by using excess heat, recycled input materials, renewable energy sources and improved energy efficiency (Worell et al., 2009; McLellan et al, 2012). Some companies' targets related to energy consumption and GHG emissions are not ambitious enough and are no longer term to achieve significant improvements or focusing on energy intensity instead of total numbers (McKinsey & Company, 2020). Even though the GHG emissions from Scope 3 do not account as a major source of GHG emissions, more companies should track indirect impacts in their value chain to fully understand the impact of their operations, increase the knowledge of the life cycle of their products and try to reduce these emissions (Hertwich & Wood, 2018).

The majority of the mining companies report on climate change as a separate materiality topic. Companies recognize the effects of climate change on the business, and so they are conducting climate change risk analysis to increase their knowledge and
mitigate those risks. The mitigation of negative climate change impact is implemented by increasing renewable energy, utilizing excess heat, electrifying their operations, and participating in the Carbon Disclosure Project (McLellan et al., 2012). Some companies take part in the European Union’s Emissions Trading Scheme (EU-ETS), other carbon-offset programmes, and carbon capture projects. They also state that mining contributes to a low-carbon future by providing necessary minerals for new technologies (EIT Raw Materials, 2020; McKinsey & Company, 2020). Still, mining companies should not only be providers of raw materials, they should also be pioneers in the implementation of low-carbon technologies in their assets. As previously mentioned, targets for reducing carbon emissions are not very ambitious, and, moreover, 40 percent of the companies analysed in this study do not have any targets to reduce GHG emissions which is far below the Paris Agreement goals (McKinsey & Company, 2020). Objectives for carbon reduction should be long-term and in line with the Paris Agreement and the SDGs. The findings from this thesis indicate that the companies analysed are far from meeting the Paris Agreement goals (McKinsey & Company, 2020), EU’s objective of becoming climate neutral by decarbonizing the energy sector (European Commission, 2019).

The air emissions reporting varies between the studied firms, as they do not include the same indicators to track the emissions or they do not track them at all. The reduction of sulphur dioxide, nitrogen oxides, dust and particulates were mostly caused by the installation of emission collecting systems like scrubbers and air filter systems (Srivastava et al., 2001). Increased emissions of sulphur dioxide for some companies were due to higher sulphur content in the raw material or increased production. Even though dust and particulates present significant human health risk (Tian et al., 2019) and majority of complaints were related to dust, the problem of dust air pollution was not discussed enough within the reports. Air pollution from mining has a great impact on the environment (Asif and Chen, 2016), however communication on air emission impact is not thoroughly covered by the majority of the companies.

Mining companies use vast amounts of water for their operations (Mudd, 2008; Gunson et al., 2011), and for that reason, they act to reduce their impact by conserving and recycling water, as well as using closed or dry processes to reduce water withdrawal (Brown, 2003). Mining operations poses environmental risk for water sources from acid
drainage, contamination of water bodies from runoff water and discharges, and increased water scarcity (Younger & Wolkersdofer, 2004; Akcil & Kodas, 2006) According to the reports most of the water is recycled and reused in the operations (Gunson et al., 2010), however not all the companies disclose data on recycled water (Mudd, 2008). Although only three firms reduced their water withdrawal, the growth from the others does not necessarily mean that the companies used an increased use of water, as the inflow of groundwater had to be removed from some underground mines (Eldorado Gold). It is hard to compare water withdrawal due to different measuring units used, as well as some indicators are not disclosed in studied reports (Mudd, 2008), such as total water withdrawal in LKAB’s reports. More efforts to reduce water impact include water treatment prior to the discharge, regular control of the water quality (Mayer et al., 2008), collection and treatment of contact and runoff water (Gunson et al., 2011), use of seawater (Stegink et al., 2003) and use of dry stack tailings (Davies, 2004). As companies mentioned the use of water for dust suppression, to reduce the consumption several alternatives like salts, soil cements, organic binders should be considered (Organiscak et al., 2003)

The use of the generated waste from the mining operations is usually in the underground as backfill and construction material, while only a small part is used as a by-product or for the extraction of secondary minerals. Only a few companies highlight the use of secondary materials and investment in the research and development for extracting useful minerals from the waste (Bini et al., 2017). One of the companies, Boliden is recognized as an example of creating synergy in raw material sourcing and resource recovery (Florin et al, 2015). Utilization of mine waste has significant potential to solve the limited mineral supply, reduce waste generation and generate profit (Zhao et al., 2012; Nuss and Bleagini, 2018). The mining industry in Europe has already been criticized for its lack of transition towards a circular economy by the World Economic Forum (2015), while Ruokonen and Temmes (2018) pointed out that mining companies are missing circular economy contribution in their environmental programs. To contribute to the SDGs, the EU’s Green Deal, and the sustainable supply of raw materials (CCSI et al., 2016; European Commission, 2008), European mining companies should pay more attention to utilizing the generated waste to extract valuable secondary minerals. They will not only support a circular economy but also reduce their energy input,
environmental risks, and overall environmental footprint (Lottermoser, 2011). However, environmental regulations and lack of knowledge of the amounts and content of waste could be some of the obstacles in the transition towards circular economy related to the mining sector (Kinnunen & Kaksonen, 2019).

The impact of the mining operations on land and ecosystems is significant, yet some of the firms analysed in this study did not include biodiversity in their reports as the topic was not recognized a priority by the internal and external stakeholders in the materiality analysis. Reason why mining companies choose neutral tone when reporting on biodiversity is in presenting the believe that negative impact might damage their corporate image (Boiral, 2016). As Boiral and Heras-Saizarbitoria (2017) stated, biodiversity initiatives demonstrate companies’ commitment on reducing its impacts on ecosystems which can contribute to maintain social licence to operate. If the mining companies identified the environment as a key stakeholder due to their deterioration of the planet, biodiversity would not be excluded from some reports. Starik (1995) argues that due to human-caused degradation of the environment, organisations should consider the environment as a stakeholder because the natural environment is a vital component of business. These findings should also be taken into account when considering the assessment of materiality topics to provide a more holistic approach to stakeholder management.

Study on mining and biodiversity (Sonter, et al., 2018) argue that biodiversity conservation is narrowed down to the mine site, which was also recognized in this research as the conservation projects and biodiversity plans presented in the reports were mostly site-based. Same study also suggests that dialogue between mining companies, policymakers and biodiversity organisations is necessary for biodiversity conservation. In the analysed reports some mining companies stated that they cooperate with organisations in the biodiversity field on various conservation and research projects to increase their knowledge and protect the surrounding ecosystems. Progress on biodiversity is measured by the total disturbed and rehabilitated area, and the results demonstrate that the restored land area is significantly lower than the disturbed land. Companies should take approach proposed by ICMM, (2019c) and implement progressive closure which includes integration of mine closure from the development and during the
operation phase which would result in better outcomes like transparent stakeholder engagement and environment protection. Save for these indicators, it is almost impossible to track the progress on biodiversity since biodiversity activities among companies differ. Biodiversity preservation and restoration should be better represented in the business strategy of mining companies in Europe because the European Commission (2019) recognizes it as one of the essential activities to achieve a climate-neutral EU. As well by committing to Agenda 2030 which recognize the importance of biodiversity (SDG 14 and 15), mining companies should increase efforts to address biodiversity issues caused by their operations through more holistic approach (Sonter et al., 2018).

Mining companies view their contribution to product stewardship as respecting the legislation, adhering to international standards for products and research and development of new products. Life cycle assessments (LCA) of the products performed by two of firms in this study, indicate that some companies are making progress and moving towards life cycle of the mineral as the study by Gorman and Dzombak (2018) suggests. Others should follow their example of implementing LCA to assess the direct and indirect impacts of their products throughout all aspects of resource use. As Curran (2016) notes, LCA will provide a holistic view of environmental interactions from the extraction of raw materials to the final disposal and lead to a reduction of overall environmental impacts.

5.2 What efforts the mining companies in Europe take to contribute to sustainable development and to implement Sustainable Development Goals into the reports?

Studied mining companies base their sustainability framework on the UN Global Compact and the Sustainable Development Goals, as well as their norms and values. These results are aligned with the commitment to the UN Global Compact of integrating sustainable practices in business strategies and day-to-day operations. Continuous disclosure of sustainability reports in accordance with the GRI Standards indicates that studied mining companies are dedicated to tracking their impact on critical sustainability issues and their commitment to sustainable development. Likewise, their commitment to sustainable development is to create additional value for their stakeholders, prioritize a safe
workplace, protect the environment, and maintain an open dialogue with all stakeholders. These results show a similar conclusion on sustainable mining, as Gorman and Dzombak (2018) reached in their research. Interpretation of sustainable development in the reports partly supports the definition of sustainable mining from Allan (1995) in minimization of negative impact from the mining activities. However, limitation of the extraction rates was not present; on the contrary, companies are facing increased demands for their products. Participation in external international and industry initiatives support their promotion of sustainable development by sharing best practices and meeting the obligations set by the initiatives (Szekely & Knirsch, 2005; Hamann, 2003).

UNGC is a main framework used by nine studied mining companies in terms of human rights, the environment, labour standards, and anti-corruption, as they referred in their sustainability reports. However, more detailed explanation and reflection to each of its Principles is missing in the reports. Only two companies had integrated COP and sustainability report and provided deeper connections of their sustainability activities and the Principles. One reason for that can be decoupling phenomenon due to lack of detailed definition and scope of Principles (Garsten & Jacobsson, 2011; Orzes et al., 2017). Another reason could be that companies disclose stand-alone COP reports where more information on UNGC progress is presented.

From the results related to the SDGs, it is clear that mining companies made considerable progress in supporting and linking their sustainability activities to the SDGs. Several firms expressed their commitment to the Goals in 2016, while only one linked specific SDGs to the specific topic in the report. Two years after, the SDGs were cited in all sustainability reports examined by this thesis using the different approaches. Most of the companies associated one or more SDGs to the report's materiality topic or indicators, while some had separate sections related to the identified SDGs. (Izzo et al., 2020) pointed out that separating SDGs might indicate marginalization effect. Several of them connected the GRI Index and indicators to one or more SDGs and UN Global Compact Principles, which should be a standard in the reports to have a clear overview in one place, instead of searching through the reports.
What is lacking in some reports is an evident explanation of the contribution of the associated SDGs and activities which was also observed in previous research (Bennet et al, 2013; Izzo et al., 2020). Just by addressing an SDG to a specific topic does not justify the contribution to the Agenda 2030. Explanations offered in the reports are limited to a few sentences and are mostly too general (Izzo et al, 2020). These results highlight that even though the process of SDGs implementation evolved over the studied period, there is space for improvement. To enhance their performance, companies should set and align their short-term and long-term objectives to the SDGs targets and indicators. Likewise, contribution to the particular areas should be comprehensive with exact activities connected to the Goals instead of general explanations. In order to improve the integration of the SDGs into their core business, companies could consult the whitepaper developed by CCSI et al. (2016), which offers a detailed summary of mining contribution to SDGs. Considering that SDGs are relatively new topic, and that the results suggest most of the analysed companies started aligning their business strategies to the SDGs in 2017 or 2018, longer period is required for mining companies to achieve higher level of maturity and understanding in implementation of SDGs into business strategy and sustainability disclosures (Farooq & de Villier, 2019).

Most companies identified several specific SDGs relevant to the most substantial impacts from the mining activities based on their assessment. An interesting finding from this research is that only one Goal was common for all companies, SDG 8 on decent work and economic growth. It demonstrates that these companies recognize their economic contributions as one of the most crucial segments of their impacts on sustainable development. The study from Izzo et al., (2020) which analysed presence of SDGs in the reports of Italian companies, demonstrated the same results where the most commonly disclosed SDG was SDG 8, followed by SDG 13, suggesting not only mining companies see economic growth as the main driver of sustainable development. The high representation of SDG 3 Good health and well-being indicates the importance of health and safety among the studied companies. The safety of employees was highlighted through the reports as one of the most significant areas. Even though climate change was not recognized as one of the materiality topics for some companies, SDG 13 Climate action was identified in most of the reports (Izzo et al., 2020). The share of other SDGs varies between the companies as a result of the different interpretations of the contribution to each SDG,
except for SDG 1 and 2, which were not identified by most of the companies analysed in this study.

5.3 How comparable are the reports of the companies evaluated by this research?

The results related to this research question demonstrate several differences and deficiencies among the examined reports. First, despite that common materiality topics were identified among the mining companies, there are still differences among the topics due to different materiality assessments. Since the materiality analysis is performed based on the importance of specific topics to the external and internal stakeholders, some materiality topics are not recognized as a priority. Therefore, topics like biodiversity, climate change and product stewardship are identified as high priority topics for some companies, while they are not covered in the reports of other companies which is surprising considering the negative impacts on ecosystems and the intensity of GHG emissions produced by mining activities (Azapagic, 2004; Kitula, 2006; Sonter et al., 2018; Tost et al., 2018; McKinsey & Company, 2020). The results on excluding biodiversity from the reports support the finding from Borial, (2016), which showed that mining companies in their sustainability reports stated a net positive or neutral impact on biodiversity while they deny or diminish their impact on biodiversity.

Second, not all companies include the GRI Content Index in the reports at all, or they suggest visiting their website to see it. These results are contrary to the Adams and Narayanan (2007) study, which states that a typical GRI report should, among other things, include the GRI Content Index as well to make information traceable and the report more transparent so the reader can easily evaluate the content of the report. GRI Index should contain used GRI indicators and the location of specific indicator in the report. Third, the performance indicators on which companies are reporting differ, where on the one hand, there are companies that present data for several indicators related to the same subject. On the other hand, some are only using one or do not present any numbers. Examples of that are GHG emissions where some companies measured direct (Scope 1) emissions, indirect (Scope 2) emissions, GHG intensity and other indirect (Scope 3) emissions, while the others presented numbers just for total GHG emissions. Another reason for the variation is the use of Metals and Mining Sector Supplement by some
companies, which offer more indicators specific to the mining industry. Also, many indicators are qualitative by nature with general descriptions which correlates with the findings from Boiral & Henri (2017). All these findings make the comparability between the presented data quite difficult.

Forth, due to the use of different measuring units for the same indicators, it is very challenging for the general audience to convert the data and compare company performance among reports. For example, monetary values are presented in different currencies like dollars, euros, or Norwegian krona; Units of mass and volume also vary from kilograms, metric tons, cubic metres, litres, and varieties of units such as kilotons, billions of m3, millions of litters and others. To better illustrate this problem, in the case of energy consumption for the same indicator, there are different measuring units used. One group of companies uses joules (GJ, TJ, PJ,) while the others are using watthour (kWh, MWh, GWh). Without specific knowledge of converting these units, it is almost impossible to evaluate the numbers presented in the reports. These results verify the findings from previous studies from Jenkins and Yakovleva (2006) and Boiral and Henri (2017), which both observed that it is almost impossible to measure and compare the sustainability performance due to similar issues.

Fifth, most companies disclose the performance data for indicators over some period or at least the previous year, however not all include this in the reports. Some companies present exact numbers in forms of tables and graphs, including data for different geographical locations or operation sites and a specified period. On the other hand, some companies disclose numbers only for the reporting year; hence, the reader cannot get the overall view of whether the company improved or not during a certain period. In doing so, companies are increasing the transparency and possibility to compare the performance over the years in one document, instead of searching through numerous pages. When comparing the results to previous studies, it must be pointed out that there is progress in disclosing data for different geographical locations or each operations’ sites. Several companies present numbers by the operations or countries that align with Fonesca (2010), suggesting that mining companies should implement reporting not only from corporate but also from the facility and regional-national level.
Significant disparity is evident from the presented results related to the differences between the reports in terms of used indicators, details of the disclosed data, and metrics. Some of the issues related to the comparability of the sustainability reports found in this research were already observed by other researchers who studied similar topics over 15 years ago (Jenkins & Yakovleva, 2006). Also, the question arises how some companies can claim that they report in accordance with the GRI Standards and not presenting the GRI Content Index, which is mandatory to present according to the GRI. The reason might be that the same companies that did not include it also did not have an external assurance for the report which can increase the reliability of the reports and stimulate the quality of disclosure (IIIRC, 2015).

5.4 What are the external drivers for mining companies in Europe to implement CSR practices?
As analysed companies have been publishing sustainability reports prior the period included in this research (KPMG, 2006), it can be argued that the pressures for such disclosure relates to normative isomorphism (De Villers et al, 2014), as well as the increased use of GRI Standards which have been accepted worldwide as a norm for sustainability reports (KPMG, 2006). However, EU Directive on non-financial reporting can be seen as a coercive force by obligating large enterprises, including the studied companies, to report on environmental and social issues (European Commission, 2014). Additionally, membership in the ICMM requires companies to publish annual sustainability reports in accordance with the GRI Standards (ICMM, 2019b). The positive trends observed of mining companies joining UNGC were influenced by mimetic pressures from industry peers (Ortas et al, 2015; Perez-Batres et al, 2010), as UNGC is a voluntary initiative, therefore no regulation obliges companies to join it.

Mining industry has been under pressure to act responsibly regarding the environment and social issues by several external drivers (Gardberg & Fombrun, 2006). Participation in internationally recognized sustainability initiatives, including previously mentioned GRI Standards and UNGC, and SDGs determines the company’s commitment to the implementation of CSR practices (Rasche et al., 2013). They align their business strategies, Codes of Conduct, and sustainability actions with the values and principles of such initiatives. Human rights and anti – corruption, including the supply chain,
environment, social issues, and governance are some of the areas on which international initiatives and standards can affect. These initiatives can be identified as one of the main isomorphic pressures to institutionalize CSR in business (Brammer & Walker, 2011). Furthermore, membership in industry associations encourages companies to apply and share best practices in the industry as the associations require their members to act in socially responsible way (Campbell, 2007; Deegan & Gordon, 1996). Also, companies tend to mimic the behaviour of another through these networks and adopt positive practices (Guler et al., 2002).

EU and its legislation are also recognized as one of the regularity forces for mining companies in Europe, as they need to align their operations and polices to the new regulations, such as REACH Directive, the Conflict Minerals Regulation and EU Directive on non-financial disclosure and many other regulations (European Commission, 2014). EU is strongly committed to Sustainable Development Goals and Paris Agreement through the Green Deal (European Commission, 2019) which puts additional pressure on the mining companies operating in the Europe to integrate decarbonisation of sector, energy efficiency, biodiversity conservation and partnerships to improve environmental performance (European Commission, 2019). Moreover, countries have obliged on targets to reduce their GHG emissions on national level, consequently obliging the mining companies to align their GHG emission targets with Paris Agreement (UNFCCC, 2020c). As climate change is recognized as one of the main problems humanity is facing at the moment (Rockstrom et al., 2009), acting in line with the Paris Agreement and tackling climate change is required not only from regulatory bodies, but from the stakeholders as well, such as mining companies (Ranangen & Lindman, 2018).

National governments and legislation are another coercive factor which has an effect to the sustainable mining practices. Mining companies obtain the permits and licences to operate from the governments and during the operations they must comply with them. Governments force changes in sustainability activities through the environmental and social laws, taxation systems, labour practices, and corporate governance regulations (Delmas & Toffel, 2004). Two mining companies, LKAB and Hydro, are fully or partially owned by Sweden and Norwegian governments which can directly influence decisions taken within these companies.
Partnerships with external stakeholders such as NGOs, universities and research institutes are observed as a normative driver for sustainability activities in fields of biodiversity, education, and R&D. Need for cross-sector partnership is recognized by Van Zanten & Van Tulder (2018) who argue that through partnership companies can increase their core capabilities by using the knowledge from other agents and are crucial for realising Agenda 2030.

Stakeholders pressure analysed mining companies to improve the performance and maintain social licence to operate (Ranangen & Lindman, 2018). Analysed mining companies recognized the importance of stakeholders as they refer to the stakeholders engagement as a key action to maintain social licence to operate. Stakeholders in general enforce coercive and normative pressures on companies (Delmas & Toffel, 2004). Local communities forced mining companies to implement actions in mitigating negative impacts like dust, noise, and heavy traffic. Customers have certain expectations from the mining companies to implement standards and certifications into their operations and product responsibility (Delmas & Toffel, 2004).

5.5 Limitations

One of the limitations of this research was a time-consuming data collection and analysis due to manual grouping of the data. The scope of study included ten companies over a three-year period, however, to generate more accurate results, more companies or a longer period could have been included. Perhaps the most important limitation is that analysis is based on self-reported data which are used as a measure of company performance. Lack of previous studies in the field of sustainability reporting within the European mining industry was also a limiting factor in conducting this thesis. Future studies observing mining industry contribution should explore further implementation of SDGs among mining companies in Europe, as the period covering this research might be short to observe significant progress on this topic. Since the data used for the analysis were collected from the sustainability reports published by mining companies, future studies could use different research method or data source, such as interviews with sustainability committees or key stakeholders, to gather broader view and better understanding of the effectiveness of the mining companies’ implemented CSR actions.
6 Conclusion

The results of this thesis offer a unique contribution to understanding the sustainability activities of mining companies in Europe and their contribution to the Sustainable Development Goals, due to the lack of the academic research conducted on the performance of sustainable development regarding the European mining industry. However, mining companies experience various pressures which influence their decisions on CSR activities. International initiatives, industry associations, EU and national governments and external stakeholders are recognized in this research as some of the forces pushing the mining industry in Europe to implement CSR practices and improve their performance. Therefore, this research provides a new insight on the institutional theory and the external drivers for CSR. Since the EU recognized the extractive industry as one of the key partners in the realisation of The Green Deal, the findings are relevant to European policymakers responsible for the implementation of new regulations related to sustainable development. They are also applicable to the studied mining companies and other mining companies, to learn from their peers, improve their performance, and implement the industry's best practices.

Mining companies in Europe report on the following topics: governance, stakeholders and community engagement, employees, occupational health and safety, environment, and product responsibility. They are implementing various actions to reduce their impact from community investments, partnerships, new technologies, training, and skill development of the employees to reuse of natural resources. However, there is a lack of progress in renewable energy, generated waste utilization, and higher gender equality. Companies should put more effort into reducing fossil fuel and energy consumption, which are among the most significant environmental impacts. In order to minimize their overall environmental impact, they should consider the life cycle of their products. The results demonstrate significant progress in the implementation of SDGs regarding sustainability reporting since all the companies included them in their reports by the end of the analysed period, however disclosed contributions were too general without profounder explanation and set objectives lacked relation with SDGs key performance indicators. Findings provide a basis for further research on this important topic. Outcomes indicate that despite the uniform use of similar sustainable reporting
standards, there are some obstacles to the studied reports' comparability. They are important not only for the examined companies but also to the developers of reporting frameworks, particularly the GRI Standards on which all the companies based their sustainability reports. Relevance for the EU Directive on the Disclosure of Non-financial Information and its implementation is demonstrated as all the analysed companies are in the category of mandatory non-financial reporting.

This research offers a model for further studies, not just for Europe but also for global, regional, and national studies. Furthermore, it can be a comparative tool for future research on the progress towards sustainable development and the progress of sustainable development goals implementation of the mining sector.
7 References


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Appendix A. List of analysed reports used in the research

<table>
<thead>
<tr>
<th>Company</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glencore</td>
<td>Sustainability report 2016</td>
<td>Sustainability report 2017</td>
<td>Sustainability report 2018: Responsibly sourcing the commodities for everyday life</td>
</tr>
<tr>
<td>Hydro</td>
<td>Annual report 2016</td>
<td>Annual report 2017</td>
<td>Annual report 2018</td>
</tr>
<tr>
<td>LKAB</td>
<td>2016 Annual and Sustainability report</td>
<td>2017 Annual and sustainability report</td>
<td>2018 Annual and sustainability report</td>
</tr>
<tr>
<td>Lundin</td>
<td>2016 Sustainability report</td>
<td>2017 Sustainability report</td>
<td>2018 Sustainability report</td>
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