TOWARDS SUSTAINABILITY IN NORDIC MINING

A path towards sustainability for the Nordic mining industry

Nordic Council of Ministers

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Nordic co-operation
Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland, and Åland.

Nordic co-operation has firm traditions in politics, the economy, and culture. It plays an important role in European and international collaboration, and aims at creating a strong Nordic community in a strong Europe.

Nordic co-operation seeks to safeguard Nordic and regional interests and principles in the global community. Shared Nordic values help the region solidify its position as one of the world's most innovative and competitive.

Contents

Summary

Rapid global development has led to an increased demand for raw materials such as minerals and metals – a trend that has also benefited the Nordic mining industry. However, as there are economic, environmental and social challenges related to the extraction of minerals and metals, it is important to know which aspects to prioritise for sustainability purposes. Therefore, the aim of this project is to examine the Nordic mining industry's sustainability practices and develop guidelines for its sustainability efforts. The analysed data includes a literature review, a review of mining company websites, an analysis of sustainability reports, a review of existing sustainability initiatives, a stakeholder survey and interviews with company officials. The study has resulted in sustainability criteria guidelines for the Nordic mining industry.

The guidelines are divided into the following seven core subjects: corporate governance, fair operating practices, economic aspects, human rights, labour practices, society and the environment. Corporate governance is the framework for decision making within the company, the most important aspects of which are stakeholder management, respect for the rule of law, risk management and self-regulatory practices and management systems. Fair operating practices concern ethical conduct in a company's relationships with other organisations, where anti-corruption, responsible political involvement, fair competition and responsible supply chain management should be prioritised. The economic dimension of sustainability concerns a company's impact on the economic conditions of its stakeholders and economic systems at local, national and global levels. Economic performance includes direct economic value for society. In contrast, indirect economic values relate to investments and services that can have an impact on communities. Local procurement practices mean the purchase of local products and services. Human rights are the basic rights to which all human beings are entitled. The suggested sustainability criteria are non-discrimination, freedom of association and collective bargaining and indigenous rights. The labour practices of a company include all the policies and practices that relate to the work that is performed within, by or on behalf of the company, including sub-contract work. Here, the sustainability criteria to be given precedence are employment, training and education, occupational health and safety, diversity and equal opportunity, conditions of work and social protection and work-life balance.

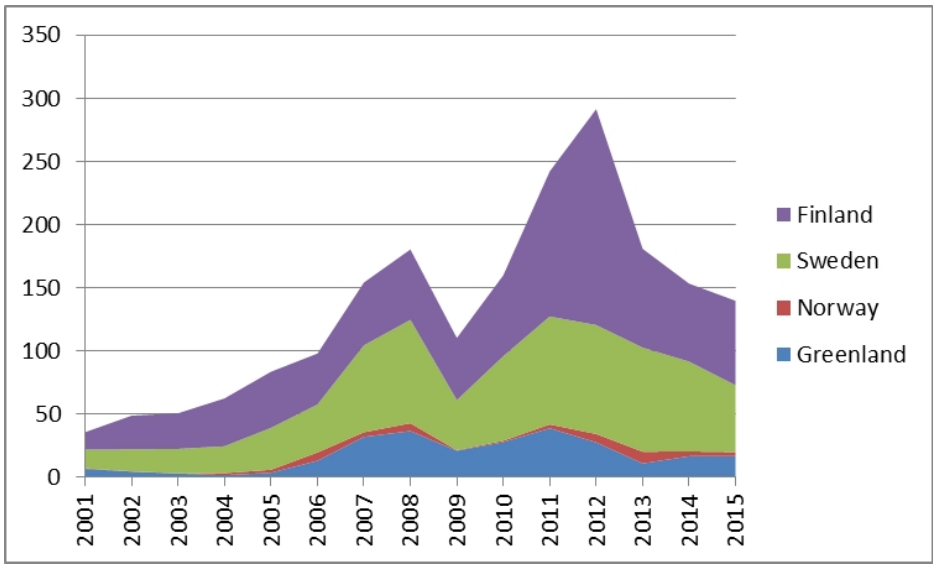
Companies have a relationship with the communities in which they operate. This relationship should ideally be based on community involvement and contribute to community development. This means participation in and support for civil institutions, involvement in networks of groups and individuals in society and taking responsibility for the impact of the mining operations on society and the environment. The last core subject is the environment, which generates a variety of aspects and results in a number of sustainability criteria in the suggested guidelines. Important sustainability criteria are the sustainable resources of materials, energy and water, sustainable land use, emissions, effluents and waste, sustainable transport, biodiversity, climate change mitigation and adoption, the restoration of natural habitats and the recycling of metals. Compared to the Finnish Towards Sustainability Mining standard, the guidelines presented in this report has a more comprehensive approach.

1. Introduction

Rapid global development has led to an increased demand for raw materials such as minerals and metals. So far in the 21st century, economic development, population growth, the speed of urbanisation in Asia and the developments that have taken place in China and India have all been unusually high. Strong economic growth and the sophisticated requirements of the developed world have led to an increased demand for infrastructure and construction projects requiring minerals and metals (ICMM, 2013). When the global production of minerals cannot keep pace with the rising demand, the mining industry faces higher price levels. The opposite is the case when the demand is low. When prices are high, the attractiveness of exploration increases in that the profitability of new mining projects increases.

The last two decades have been somewhat dramatic for the Nordic mining industry. Rising and falling commodity prices have led to huge increases and decreases in the exploration and extraction of minerals. For example, Sweden is currently one of the EU's leading producers of ores and metals. In 2011, investment in exploration reached a record level (SGU, 2013). In the light of this development, studying the mining industry from a Nordic perspective is important. Figure 1, below, illustrates the Nordic exploration expenditure as reported by the consultancy IntierraRMG (2015).

Figure 1: Nordic exploration expenditure



The effect of the commodity price boom in the first decades of the 21st century can be clearly seen in the diagram. The effect of the global financial crisis in the same period is also evident. Up to now, Nordic exploration has been dominated by projects in Sweden and particularly in Finland and has resulted in expanding mining industries. However, the lower commodity price levels in recent years and their effect on exploration activities can also easily be deduced from the diagram. Overall, the trend in recent decades has been positive.

There are several challenges related to the extraction of minerals and metals. One is that extraction is capital intensive, highly technological and affects society economically, environmentally and socially. At the same time as mining is the primary source of important metals and minerals for everything from traditional construction to green technology, it also has negative consequences, such as the production of large quantities of waste, emissions to water and air and noise. In addition, mineral markets are cyclical in nature, and both booms and busts create challenges for companies and communities.

In several cases, mining activities have been welcomed locally as a source of new jobs and for providing development opportunities. However, in other cases, they have also sparked conflicts, particularly in regions where mines potentially compete with other business sectors and stakeholders for land. Thus, mining and sustainable development has become an important topic of discussion in the Nordic region. For example, in traditional mining towns such as Kiruna in Sweden, where mining has been a major industry for decades or even centuries, the mining company and its operations are generally viewed as more legitimate by local stakeholders and understood as vital for the local economy. However, in regions without a comparable mining legacy, new greenfield projects have emerged which have caused conflict and concern among the local population, not least from the indigenous Sámi population's point of view. When it comes to the safety of workers (Jenkins, 2004), the accident and ill-health record of the mining industry makes it one of the most hazardous sectors, particularly with regard to the dust and noise associated with rock blasting, artificial air and light supplies, harmful gases, ergonomic hazards and so on. In addition, local communities often experience social problems as a result of the mining activities (Hermanus, 2007).

The extractive industry has faced increased stakeholder pressure over the last twenty years from non-governmental organisations (NGOs), social movements and indigenous peoples, mainly due to the industry's major impact on the environment and society (Kapelus, 2002). As a result, initiatives, guidelines and tools have often been adopted (Hamann, 2003, Jenkins and Yakovleva, 2006, Perez and Sanchez, 2009, Vintró and Comajuncosa, 2010). In addition, major international organisations, such as the United Nations (UN), the International Labour Organization (ILO), the World Bank and the Organization for Economic Co-operation and Development (OECD) promote and monitor sustainability initiatives (Benn and Bolton, 2011).

Given that the Nordic mining industry affects society economically, environmentally and socially, and that different groups in society are affected by the industry's activities and decisions in different ways, is it important to determine what the industry needs to prioritise when developing sustainability work. Against this background, the purpose of this project is:

- to examine the Nordic mining industry's current sustainability practices
- to develop guidelines for the Nordic mining industry's sustainability efforts.

The study is commissioned by NordMin – a Nordic network of expertise for a sustainable mining and mineral industry. The focus is therefore limited to the Nordic mining industry, with the intention of developing a Nordic platform that not only addresses the companies already operating in the Nordic countries, but also new actors and new mines.

In order to carry out this assignment, information was gathered from different sources. The remainder of the report is organised as follows: Chapter 2 provides an overview of the different research methods that were applied in this project. Chapter 3 presents the findings and Chapter 4 presents the suggested sustainability criteria guideline together with concluding remarks and a discussion.

2. Research method

This chapter presents an overview of the different research methods used in the project. These include a literature review, a survey of mining companies' websites, an analysis of sustainability reports, a review of existing sustainability initiatives, guidelines and tools, a stakeholder survey and interviews with mining company officials.

2.1 Literature review

A literature review is important for acquiring an understanding of a topic, what has already been discovered about it, how it has been researched and what the key issues are (Hart, 1998). In this project, a literature review was conducted in order to study previous research on sustainability criteria and indicators in the mining industry. The search for literature took place in the autumn of 2015 and was conducted in the Google Scholar, Scopus and Web of Science databases on article titles, abstracts and keywords. The following search strings were used:

- "Sustainability criteria" AND *mining* OR *metal* OR *extractive*
- "Sustainable indicator" AND *mining* OR *metal* OR *extractive*
- "Sustainable development indicator" AND *mining* OR *metal* OR *extractive*
- "Sustainable development criteria" AND *mining* OR *metal* OR *extractive*

A list of literature titles and abstracts was printed out from each search/database and irrelevant literature and duplicates were discarded. Examples of irrelevant literature are when the focus is on forestry or gas. Some of the articles were found by skimming through reference lists in the already identified articles. Comparing the reference lists in the relevant articles made it easier to identify frequently cited and important papers in the subject area. Searching for quotations and important papers in the Web of Science database was particularly successful. This also enabled us to search for articles chronologically. The entire procedure resulted in 23 scientific papers.

2.2 Websites

A list of the mining companies operating in the Nordic countries is provided in Table 1. Their communication of sustainability issues was studied on the companies' websites, the purpose being to identify sustainability criteria based on the information that was available. The preconception was that the company communicates the sustainability criteria it regards as the most important for the company and its stakeholders. The result is presented in Chapter 3.

Table 1: The mining companies included in this study with active mines in the Nordic countries

Mining companies	Mines	Sustainability report
Agnico Eagle Mines Ltd.	Kittilä gold mine	Yes
Boliden AB	Aitik, Garpenberg, Boliden area (Kankberg, Renström, Kristineberg, Maurliden, Maurliden östra), Kylylahti	Yes
Dragon Mining AB	Svartliden gold mine	No
Dragon Mining Oy	Jokisivu gold mine, Orivesi gold mine	No
Endomines Oy	Pampalo gold mine	No
First Quantum Minerals Ltd.	Kevitsa polymetallic mine, Pyhäsalmi zinc mine	Yes
LKAB	Kirunavaara, Malmberget, Mertainen, Leveäniemi, Gruvberget	Yes
Lovisagruvan AB	Lovisa lead/zinc mine	No
Lundin Mining AB	Zinkgruvan zinc/lead/copper mine	Yes
Mandalay Resources Corp.	Björkdal gold mine	No
Sydvaranger Gruve AS	Sydvaranger iron ore mine	No
Outokumpu Chrome Oy	Kemi chrome mine	Yes
Rana gruber Mineral AS	Rana iron ore mines	No
Talvivaara Mining Company Plc [1]	Talvivaara nickel/copper/cobalt mine	Yes

2.3 Sustainability reports

The search on company websites identified a number of sustainability reports. In the first instance, we looked for sustainability reports published for 2014. In two cases the report for 2013 had to be used because reports from 2014 were not available. The companies that had published sustainability reports were Agnico Eagle Mines Ltd, Boliden AB, First Quantum Minerals Ltd., LKAB, Lundin Mining AB, Outokumpu Chrome Oy and Talvivaara Mining Company Plc.[1]

In the first phase, the content of the sustainability reports was studied to determine whether the reporting companies used or referred to any of the sustainability

[1] The Talvivaara mine is currently operated by Terrafame Ltd. However, the sustainability report included in this study was produced by the former owner, Taivivaara Mining Company Plc.

initiatives, guidelines or tools identified in the literature review. Any new initiatives, guidelines and tools that were identified during this process were added. The result is presented in Appendix IV.

In the second phase, a software application for qualitative text analysis called Leximancer was used to translate the content of the sustainability reports into a list of key sustainability criteria. Leximancer is a text analysis tool that can be used to analyse the content of collections of textual documents and to display the extracted information visually. Content analysis is a research tool for determining the presence of words or concepts in collections of textual documents and is used to break down the material into manageable categories and relationships for quantification and analytical purposes. Hence, this analysis provides information about which core subjects the reporting companies regard as important and which sustainability criteria are practised and communicated in each core subject.

The result of the content analysis was double checked in order to merge concepts with the same meaning or delete those that were not relevant for the study. The merged and deleted concepts are presented in Table 2. The result of the content analysis is presented in Chapter 3.

Table 2: Merged and deleted concepts during the analysis of sustainability reports

Sustainability reports	Merged concepts	Common concept	Deleted concepts
Boliden AB	reporting, report, reported, GRI	reporting	Areas, aspect, aspects, based, basis, during, order, period, significant, use, used, material aspect, company, development, performance
	Boliden, Boliden's, group	Boliden	
	employees, employee	employees	
	work, working	work	
LKAB	mining, mine, mines, ore, iron	mining	Amount, based, bene, cant, current, de, di, during, ed, million, percent, pro, SEK, sigri, ts, used, year, future, important, plan, companies, company, Kiruna
	LKAB, lkab's, board, group	LKAB	
	product, products	Product	
Lundin Mining AB	mining, mine, mines, pit, copper	mining	Including, potential, significant, total, use, year, site, sites, area, activities, process, during, areas, company, development, performance

Sustainability reports	Merged concepts	Common concept	Deleted concepts
	Lundin mining, Aqua blanca, Neves-corvo, Zinkgruvan, eagle	Lundin mining	
Agnico Eagle Mines Ltd.	Agnico Eagle, goldex, kittila, meadowbank, pinos altos	Agnico Eagle	Business, ensure, future, million, ounces, probable, reserves, tonne, tonnes, processed, development, performance
	community, communities	community	
	mining, ore, mine, gold	mining	
	environment, environmental	environment	
	Employees, employees	employees	
	operation, operations	operation	
First Quantum Minerals Ltd.	First quantum, first quantum's, cobre panama, kansanshi, trident	First Quantum	Area, better, build, company, development, ensure, future, life, site, team, time, use, Zambia
	community, communities	community	
	mine, mining	mine	
	sustainability, sustainable	sustainability	
	people, residents, families	people	
Outokumpu Chrome Oy	Outokumpu, outokumpu's, group, group's, plant, site, sites	Outokumpu	Areas, business, development, during, during, including, example, internal, issues, million, performance, process, related, results, shop, total, units, use, used, year, germany, sweden, tornio
	material, materials	material	
	environment, environmental	environment	
Talvivaara Mining Company Plc.	talvivaara, talvivaara sotkamo, talvivaara's, board of directors, group, plant	talvivaara	Amount, area, company, COMPANY, company's, development, due, during, EUR, key, million, options, ore, period, price, process, related, reorganisation, significant, time, total, use, year, value, members, subscription
	mine, mining, nickel	mining	
	risk, risks	risk	
	shares, share	share	

2.4 Review of existing sustainability initiatives

A review of the existing sustainability initiatives, guidelines and tools in the mining industry was conducted in order to identify what the mining industry already focused on in its efforts for sustainability. The literature search was conducted during same time period as the literature review using the same databases. The literature review of previous research also facilitated the mapping of existing initiatives.

2.5 Surveys

In March 2016 an online questionnaire (see Appendix I) was sent by email to a total of 230 mining stakeholders in Finland, Norway and Sweden. The results from a case study performed at a Swedish mining and metal company were used to identify the relevant stakeholders (Ranängen, 2015). The case study identified Sámi communities, politicians and authorities, employees, capital market, neighbours, owners, business partners, the media and public opinion-makers as relevant stakeholder groups. Politicians and authorities include county administrative boards, municipalities, country councils, the Mining Inspectorate of Sweden, the Swedish Environmental Protection Agency, the Sámi Parliament, the Geological Survey of Finland, the Finnish Safety and Chemicals Agency, the Centre for Economic Development, Transport and the Environment in Finland, Regional State Administrative Agencies in Finland, regional councils (Finland), the Ministry of Trade, Industry and Fisheries in Norway, the Geological Survey of Norway and the Norwegian Environment Agency. Employees also include union representatives. Capital market comprises international banks and investors and ethical funds. Neighbours include local folklore societies, athletic clubs, recreation, cultural, hunting and fishing associations etc. Business partners are both suppliers and customers. Public opinion-makers include business associations, NGOs and labour unions.

The questionnaire was translated into each country's native language. The choice of an online survey was regarded as the best option, partly due to the project's time-frame and partly for ease of access. The time-frame of the project was a limiting factor, given that a paper-based survey takes longer to dispatch and return.

To begin with, all the stakeholders received an introductory letter informing them that as the mining industry affects society economically, environmentally and socially and its activities and decisions affect different groups in society, they were regarded as important stakeholders (i.e. individuals or groups with an interest in an organisation's decision or activity). Due to this, it was important to hear what they thought the

industry should prioritise when developing its sustainability work. The stakeholders were also informed that the survey was part of a research project on how the Nordic mining industry currently works with sustainability.

The respondents were informed that their answers were important and that their responses would remain anonymous. The results are therefore reported in such a way that the identification of individuals is not possible. They were also told that if another person in their organisation / association was better suited to answer the questions the email could be forwarded to him or her. In connection with the introductory letter, the respondents were also given a direct link to the online questionnaire and were encouraged to contact the researchers if they had any questions about the survey or research project.

The first part of the questionnaire consisted of a number of background questions (gender, age, their highest completed education etc.) The next section included questions about their views (as a representative of an industry, organisation, association etc.) of the Nordic mining industry's sustainability efforts. The respondents were asked to circle the number that best matched their opinion in the various sustainability criteria, on a scale of 1–5, where 1 symbolised "not important at all" and 5 "very important". See Appendix I for an English version of the survey.

2.6 Interviews

Officials at the mining companies that had published sustainability reports were interviewed. The assumption was that these companies were more proactive and had the most comprehensive and implemented sustainability work. An interview guide was constructed based on the result of the literature review, the website study and the sustainability reports. The interview guide is presented in Appendix II.

Semi-structured interviews and a group interview were performed with people responsible for the selected mining company's sustainability management. Further information about the interviews is found in Table 3. The interviews were held at the companies' head offices or by telephone. In one case the respondent preferred to submit a written response due to difficulties in finding time for a scheduled meeting. The result of the interviews is presented in Chapter 3.

Table 3: General information about the interviews

Interview	Company	Post	Time	Date
1	Boliden AB	Human Resources (HR) and sustainability director	1.5 h	13/4/16
2	LKAB	Senior vice president HR and sustainability	1.5 h	20/4/16
3	Lundin Mining AB	Vice president, environmental manager, HR manager, safety manager	3.0 h	4/5/16
4	First Quantum Minerals Ltd.	Managing director	2.0 h	26/4/16
5	Agnico-Eagle Mines Ltd.	Sustainable development & quality manager	-	30/5/16

3. Findings

This chapter presents the study's findings. The literature review is presented in section 3.1, and the mining companies and the result of the website study is presented in section 3.2. The literature review and the study of the mining companies' sustainability reports identified a number of sustainability initiatives, guidelines and tools that are used by the industry or have been studied in previous research. A review of existing sustainability initiatives, guidelines and tools and the results are presented in section 3.3. The result of the content analysis is presented in section 3.4, the result of the survey is presented in section 3.5 and, finally, the results of the interviews are presented in section 3.6.

3.1 Previous research

The literature review identified a number of sustainability criteria which according to previous research are considered important for the mining industry. The following sections provide a brief presentation of each article, followed by a summary of the review. It should be mentioned that although the focus of this study is limited to the Nordic mining industry, the research that has been reviewed has a global orientation.

In this section the articles are summarised in brief. The intention is to cover the purpose, method and results. Each article is summarised in a structured way under different sub-headings. The articles are sorted by the year of publication, with the oldest article being presented first.

3.1.1 Indicators of Sustainable Development for Industry: A General Framework

Authors

Adisa Azapagic and S. Perdan (2000).

Purpose

To develop a comprehensive general framework for indicators of sustainable development for industry.

Method

The authors review the drivers for the sustainable development of industry and earlier attempts to develop indicators and bring these earlier attempts together with the purpose of contributing towards a standardisation of the sustainability indicators. The framework combines environmental, economic and social indicators that are supposed to be relatively simple, informative and relevant for industry.

Results

The proposed framework is based on environmental, economic and social sustainable development and includes 31 indicators (all of which are categorised in Appendix III). The result is general in order to be applicable across industry. The framework is designed to allow a modular approach for a gradual implementation in the organisational structure. Furthermore, it provides a link between the micro- and macro-aspects of sustainable development through appropriate indicators. As a consequence, it works as a tool that can help companies to assess their performance of the goals and objectives embedded in the idea of sustainable development.

3.1.2 Developing a framework for sustainable development indicators for the mining and minerals industry

Author

Adisa Azapagic (2004).

Purpose

To develop a framework for sustainability indicators as a tool for performance assessment and improvements that are specifically relevant to and tailored for the mining and minerals industry.

Method

The author's work is based on the Brundtland definition of sustainable development in general and follows the outcomes of the MMSD project in particular. The indicators have been developed in conjunction with a minerals company and aim to interpret the key sustainable development issues for the industry into the significant measures of sustainability performance.

Results

The framework covers economic, environmental, social and integrated indicators. It is suitable for sustainability reporting and stakeholder engagement and for internal use by mineral companies. In order to standardise corporate reports and facilitate cross-comparisons, the framework is compatible with the indicators proposed by the Global Reporting Initiative (GRI). Some sector-specific indicators have also been developed in order to reflect the characteristics of the specific industry. An overview of all the indicators can be found in Appendix III.

3.1.3 IMA-Europe adopts a Sustainable Development Charter

Author

Patricia Iannelli (2004).

Purpose

The industrial mineral association (IMA-Europe) was founded to represent the industrial minerals industry in Europe and defend its interests. The purpose of the charter is to set out the sector's commitment to sustainable development with a view to moving their sector forward in a sustainable way.

Method

The charter was launched at IMA-Europe's 10th anniversary conference in Brussels in 2004 and includes eight guiding principles.

Results

The 8 principles are:

- Integrating sustainable development considerations within member companies' decision-making processes.
- Implementing ethical business practices and sound systems of governance.
- Facilitating and encouraging responsible product and process design, use, re-use, recycling and disposal of their products.
- Supporting the development and implementation of sound, scientifically based approaches to land use planning and conservation of biodiversity.
- Seeking improvement in health, safety and environmental performance.
- Providing regular monitoring reports that verify progress on environmental, social, health and safety objectives including the sustainable development

indicators contained in the European Commission's voluntary scheme for the extractive industry.

- Working with stakeholders including customers, suppliers, contractors, unions, NGOs and governments, towards achieving a balance of interests.
- Contributing to the social, economic and institutional development of the communities in which member companies operate.

3.1.4 *Eco-intensity Analysis as Sustainability Indicators related to Energy and Material Flow*

Authors

Koji Amano and Misato Ebihara (2005).

Purpose

To use simple ratios as sustainability indicators to evaluate the environmental intensity in local regions and industrial sectors. These ratios could be compared across regions and industrial sectors to give a comprehensive evaluation of sustainability.

Method

The authors use data from the national physical distribution census, national and prefectural input-output tables and comprehensive energy statistics for Japan in 1995, including all 47 Japanese prefectures. 16 industrial categories (agriculture, mining, food, fibre, pulp, chemical, coal and petrol, cement, steel, metal, non-ferrous metals, construction, energy supply, transport, service and commercial) are considered. The objective environmental load items are carbon dioxide, nitric oxide, sulphuric oxide and suspended particulate matter emissions.

Results

The ratio of the primary energy supply to the total material input for service industries ranges from 0.1 to 0.5 TOE/103 ton for the 47 prefectures. However, as all the variations in these sustainability indicators have not been examined, there are uncertainties as to how life cycle tools can be applied in emerging markets, including the service industry and public sector.

3.1.5 *Mining sustainability and policy initiatives*

Authors
Suranjan Sinha and Rajasree Banerjee (2006).

Purpose
To establish a conceptual framework to promote policy changes for the growth of the local economy.

Method
The authors review and build their theoretical foundation of sustainability and sustainable development on previous literature. They use a case study approach covering iron ore mines in eastern India to examine the problems of mining sustainability.

Results
Given that most of the environmental and other social costs of mining are inflicted on the local community, some of the profits from mining should therefore go to the local community. The results of the case study demonstrate that doing this means that the long-term local economy can be sustained.

3.1.6 *Use of simulation and modelling to develop a sustainable production system*

Authors
David M. R. Taplin, Trevor A. Spedding and Hsien H. Khoo (2006).

Purpose
To establish a practical (and measurable) definition of sustainable development and its relationship with company performance.

Method
The authors focus on various sustainability indicators for a metal production system that includes casting and recycling and how they affect decisions concerning materials usage, energy consumption and other business activities. They use a case study to demonstrate the application of different simulation and modelling techniques in order to test a company's environmental and sustainability performance.

Results

Based on the simulation results, the final sustainability indicators can be summarised as follows:

- More efficient use of energy.
- More efficient use of raw material (primarily zinc in this case).
- Reduction of greenhouse gas (CO_2) per product due to electrical power generation and transportation.
- Less generation of scrap and waste.
- Higher productivity (producing more from less).
- Together with the simulations, these concepts are expected to make sustainable development practical and measurable.

3.1.7 Top-down/bottom-up approach for developing sustainable development indicators for mining: Application to the Arlit uranium mines (Niger)

Authors

Aurélie Chamaret, Martin O'Connor and Gilles Récoché (2007).

Purpose

To define procedures and obtain robust indicators that are understood and accepted by all stakeholders and adapted to site specificities and to assess a mining site's impact and performance from local to national level in Africa.

Method

The authors propose a top-down/bottom-up approach in order to combine indicators from international frameworks that are scientifically valid and generic (top-down) with indicators that more directly respond to stakeholders' needs on specific sites (bottom-up).

Results

The authors propose the following four main sources of indicators:

- Raw stakeholder propositions.
- Equivalents of stakeholder propositions from international initiatives.
- Indicators from international initiatives responding to stakeholders' expectations.

- Indicators from international initiatives that do not directly respond to stakeholders' expectations but are judged to be necessary for assessing mining projects.

3.1.8 Global trends in gold mining: Towards quantifying environmental and resource sustainability

Author
Gavin M. Mudd (2007).

Purpose
To analyse the available sustainability data on gold mining for Australia, North America, Africa and Asia-Pacific, including waste volumes, ore grades, economic resources and resource intensity.

Method
The author uses historical data sets to link historic gold mining production trends to resource intensity.

Results
By linking data sets on historic gold mining production trends with sustainability reporting to estimate resource intensity, the sensitivity of ore grade for gold production and sustainability can be demonstrated. The author stresses the importance of recognising the links between gold production trends and resource intensity, which is viewed as critical for understanding future sustainability challenges.

3.1.9 Derivation of mineral processing environmental sustainability indicators using a DEA weight-restricted algorithm

Author
I. Tsolas (2008).

Purpose
To present and apply the framework to the development of environmental sustainability indicators (i.e. indicators that focus on both the environmental and economic dimension of the sustainable development) in mineral processing plants by means of data envelope analysis (DEA) using single (component) indicators (i.e.

environmental, economic and/or integrated indicators that interrelate two dimensions of sustainability).

Method

The author presents a literature review on sustainability indicators in the mineral processing industry and discusses the DEA. In order to fulfil the aim of the study, the author illustrates how the proposed approach could be implemented in practice by presenting a case study based on real publicly available data.

Results

According to the author, this study provides environmental sustainability indicators that can be used internationally for benchmarking purposes to pinpoint plants exhibiting bad performance and for external use for sustainability reporting.

3.1.10 Devising indicators of sustainable development for the mining and minerals industry: An analysis of critical background issues

Authors

Gavin Hilson and Arun J. Basu (2009).

Purpose

(1) To use excerpts from the literature to define sustainable development in the corporate mining context (corporate sustainability) and (2) to identify, against the background of this interpretation, many of the issues that need to be addressed before devising Sustainable Development Indicators (SDIs) for use in the mining and minerals extraction industry.

Method

In order to fulfil the above-mentioned purposes, the authors review earlier literature to define sustainable development in the corporate mining context and address many of the significant issues associated with developing credible Sustainable Development Indicators (SDIs) for the mining and minerals extraction industry.

Results

The authors illustrate the struggle to find an appropriate working definition of sustainable development for an industry and to develop an acceptable set of universal standards for measuring environmental and socioeconomic performance.

3.1.11 *Towards a sustainability criteria and indicators framework for legacy mine land*

Authors

Rhys Worrall, David Neil, David Brereton and David Mulligan (2009).

Purpose

To develop a sustainability criteria and indicators framework informed by established resource sector frameworks but specific to legacy mine land.

Method

In order to accomplish their objectives the authors begin by providing an overview of the relationship between mining and sustainable development. They then explore the impact and scale of the legacy mine land issue. As a case, they discuss an area of legacy mine land in Australia, together with an assessment of the regulatory frameworks in place. After that, an introduction to how sustainability can be measured is presented, drawing on the mining, forestry and agriculture sectors. Finally, a sustainability criteria and indicators framework is developed that specifically addresses the particular requirements of legacy mine land.

Results

The resulting framework consists of 14 criteria and 72 indicators (all of which are categorised in Appendix III). Several of the indicators in the framework are quantitative, with measures that could either be expressed as absolute values or ratios. Nevertheless, some aspects of sustainability, especially those related to social and ethical performance, are expressed in qualitative terms as descriptive statements. This is also something the authors regard as a strength, in that the use of both quantitative and qualitative indicators in combination is expected to present a more complete and balanced picture of sustainable development performance.

3.1.12 *Deriving sustainability measures using statistical data: A case study from the Eisenwurzen, Austria*

Authors
Friedrich Putzhuber and Hubert Hasenauer (2010).

Purpose
To use available data recorded by the Statistical Office of Austria to derive local sustainable impact indicators as they are defined by the SENSOR consortium.

Method
The authors formalise statistical models for the assessment of sustainability impact indicators by using a public data source provided by the Austrian Government. They use the Eisenwurzen region of Austria, which includes 99 municipalities, as a case study. The authors are specifically interested in (1) testing whether the existing data can be used to derive impact indicators, (2) determining the key relationships in the Eisenwurzen region based on a statistical analysis and (3) examining the importance and theoretical behaviour of selected indicators.

Results
15 indicators covering economic, social and environmental impact are defined. For all the impact indicators, the authors develop response functions by using the publicly available data. According to the results, the available data is an important source for deriving sustainable impact indicators in specific regions. Furthermore, the presented approach could serve as an analytical tool in order to gain insights into the regional drivers for assessing sustainability indicators.

3.1.13 *Mining sustainability indicators to classify hydrocarbon development*

Authors
Muhammad Shaheen, Muhammad Shahbaz, Aziz Guergachi and Zahoorur Rehman (2011).

Purpose
To suggest a method for classifying a nation's hydrocarbon development into one of five classes: (1) futuristic, (2) conforming, (3) sustainable, (4) unsustainable or (5) critical.

Method

The authors develop a method for clustering world countries according to energy development. Each cluster group consists of similar countries (out of a total of 40), and each country has 27 indicator values. The authors apply a correlation analysis between (1) sustainability indicators and total production and (2) sustainability indicators and total consumption. In each cluster, the average correlation value of a sustainability indicator with production and consumption rate is multiplied by the actual value of the indicator. All the indicators are then added to assign a single value to a cluster. The clusters are then able to be sorted into the five different classes.

Results

In this article, a method for assessing the energy development of a country by exploiting data mining techniques and sustainability indicators is presented. The authors use both supervised and unsupervised classification techniques on a sustainability indicators database to find the present status of countries in energy development and to extract general rules for sustaining or improving energy development.

3.1.14 A Fuzzy Logic Based Approach to Assess Sustainable Development of the Mining and Minerals Sector

Authors

Basanth Kommadath, Runa Sarkar and Binayak Rath (2012).

Purpose

To create a framework for assessing the sustainability of the mining and minerals sector by re-examining the definitions, fundamentals, economic underpinnings and criteria for sustainable development.

Method

The authors use a fuzzy logic computational approach based on context dependent economic, ecological, societal and institutional sustainability indicators in order to suggest a methodology for the improvement of current sustainability assessment processes. As an illustration of how the proposed methodology can be applied, they use a hypothetical reference mining city.

Results

The results show that the overall sustainability can be calculated as an end result by defining sustainability as a function of a number of variables and linking them with expert judgement and the numerical values of sustainability for each domain. This could be of practical value, since the results derived can be used for the identification of hot spots, for sustainability reporting and for stakeholder engagement. However, the authors also point out a serious limitation of the assessment for sustainability framework and fuzzy logic approach by highlighting the subjectivity of defining membership functions.

3.1.15 Metrics for sustainable production in process industry

Authors

Minna Päällysaho, Nani Pajunen, Roope Husgafel, Maaria Wierink, Inga-Lisa Paavola, Kari Heiskanen, and Ari Ekroos (2012)

Purpose

(1) To survey the characteristics and operating principles of existing sustainability indices and their suitability for measuring sustainability from the local point of view. The purpose is to identify the key sustainability issues and assess their relevance at the operational level and (2) to provide information about the sustainability indicators that were developed to assess sustainability at the plant level.

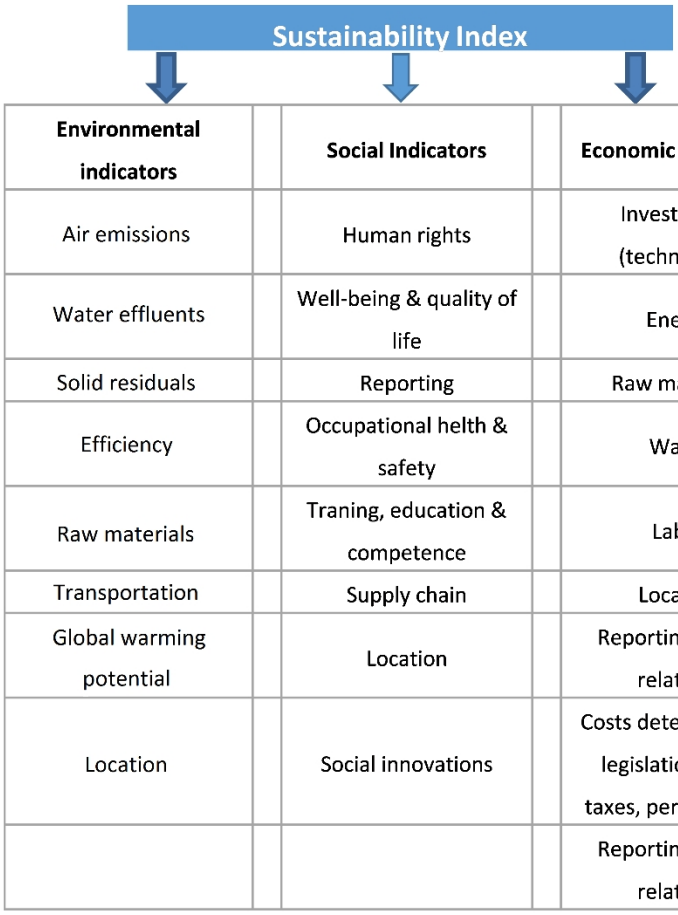
Method

The authors base their work on a literature review of public documents, legislation literature and literature relating to the area. They also base their work on interviews with operators and environmental managers at the cooperation companies.

Results

The sustainability index and its hierarchy is presented in Figure 2.

Figure 2: Sustainability index in Päällysaho *et al.* (2012)



Environmental indicators	Social Indicators	Economic indicators
Air emissions	Human rights	Investments (technology)
Water effluents	Well-being & quality of life	Energy
Solid residuals	Reporting	Raw materials
Efficiency	Occupational helth & safety	Water
Raw materials	Traning, education & competence	Labor
Transportation	Supply chain	Location
Global warming potential	Location	Reporting, public relations
Location	Social innovations	Costs determined by legislation (fees, taxes, permits, etc.)
		Reporting, public relations

In their research the authors conclude that a number of different approaches are used to assess sustainability in the process industry. However, they emphasise that many of these indices evaluate sustainability at the company's management and strategic level without bringing the concept to the operational plant level. The authors further emphasise the importance of comprehensive, industrial, sustainability evaluation. Integrating the concept of sustainability into a company's decision making process makes it possible to overcome future challenges in an operational environment.

3.1.16 An analysis of indicators disclosed in corporate sustainability reports

Authors
Laurence Clément Roca and Cory Searcy (2012).

Purpose
To identify the indicators that are currently disclosed in corporate sustainability reports.

Method
In order to fulfil the purpose of their study, the authors begin by reviewing the literature on corporate sustainability and sustainability reporting. Canada is used as a case study. The indicators are identified based on a content analysis of 94 Canadian reports from 2008.

Results
Their findings show that a total of 585 different indicators are used in the reports. 31 of the 94 reports encompassed in their study include indicators explicitly identified as GRI indicators. The most reported GRI indicators are included in 28 of the reports, while the least reported indicators appear in 5 reports.

3.1.17 Selection of social demand-based indicators: EO-based indicators for mining

Authors
W. Eberhard Falck and Joachim H. Spangenberg (2014).

Purpose
Given the belief that knowledge about complex scientific, technical and socioeconomic issues can best be framed and communicated in the form of indicators, the authors aim to describe a practical process of indicator development and testing. The purpose is to attain a stakeholder-needs, rather than an expert-judgement driven process for indicator development and for the selection of techniques to support these indicators.

Method
The authors describe the social process by which complex physical and socio-economic information can be simplified into indicators that reflect the stakeholders' concerns. These indicators have been tested at three sites with different socio-economic and environmental surroundings on three continents: the Sokolov lignite mining area in the

northern Czech Republic, the eMahaleni (Witbank) coal mining area near Johannesburg in South Africa and the Makmal gold mine near Kazarman in central Kyrgyzstan.

Results

A set of 59 candidate indicators are identified, which the authors group into the following 11 categories:

- Land-use.
- Mass and energy flows.
- Air quality and other nuisances.
- Soil quality.
- Water quality.
- Transport.
- Geotechnical hazards and accidents.
- Industrial and other accidents.
- Social impact.
- Regional development.
- Economic vulnerability/resilience.

3.1.18 Corporate Sustainability Indicators: an Australian Mining Case Study

Authors

Sumit Lodhia and Nigel Martin (2014).

Purpose

To investigate the usefulness of corporate sustainability indicators (CSI) to an organisation and its stakeholders.

Method

The paper follows the case study research approach. The authors use content analysis of archival data and interviews as research methods. They conduct their research in two stages. In the first stage they use the literature on CSI to guide the archival analysis. A set of CSI for the period 2001 to 2009 is developed using data (e.g. revenue, emissions, waste, pollution, water consumption and employment creation) drawn from the corporate releases (annual and sustainability reports) of the BHP Billiton Group. In the

second stage the authors seek the views of company officials and stakeholders on the CSI set by means of semi-structured interviews.

Results

The results show that trends can vary in any of the authors' listed CS criteria. There could be positive trends, i.e. areas in which the company performs well, and less positive trends that point to potential issues or directions for improvement. This would in turn support the process of decision making and performance management within the company. Furthermore, the company interviewee made two important points. The first is that the "licence to operate" is fundamental to the company's long-term plans and ongoing success. A solid sustainability record would allow the company to get resource projects in on time and budget without any regulatory and community problems influencing performance. The second is that the company is aware that an increasing number of investors are interested in sustainable resources development, which means that corporate sustainability trends and patterns are likely to become more important in the future.

3.1.19 Prospects for sustainability certification of metals

Authors

S. B. Young, Y. Zhe and G. Dias (2014).

Purpose

To explore the emergence of sustainability certification of metals by looking at the status of this phenomenon and the prospects for growth with reference to several cases, in particular a detailed case study on assured sourcing of "conflict-free" metals.

Method

The authors review four formal certification initiatives to illustrate the status and prospect of metal certification. Especially, the "conflict Free Smelter Programme" operated by the global electronics industry is investigated in more detail.

Results

According to the authors, the future of metal certification will depend on the extent to which end-users in large markets are interested in the origin of their metal resources. This is based on the summation of similarities and differences between the cases, suggesting that it has in many cases followed different tracks.

3.1.20 *Social sustainability performance indicators – experiences from process industry*

Authors

Roope Husgafvel, Nani Pajunen, Kirsi Virtanen, Inga-Liisa Paavola, Minna Päällysaho, Ville Inkinen, Kari Heiskanen, Olli Dahl and Ari Ekroos (2015).

Purpose

(1) To pilot the implementation of social sustainability performance indicators at the plant level. (2) To review the implications of social indicators as a sustainability performance measurement tool for linking corporate and plant-level sustainability performance management and measurement. (3) To benchmark the obtained results with previous studies and relevant literature.

Method

The research materials cover the plant-level results of the social sustainability performance assessment using a set of social indicators. The authors base their research methodology on sustainability assessment in line with previous theoretical frameworks of sustainability science.

Results

The applied social sustainability index is one part of the whole sustainability index, which aims to give a balanced and holistic view of plant-level sustainability performance. The results of the pilot implementation indicate a very high level of social sustainability performance with minor areas of improvement. These minor areas are:

- Social risk management auditing covering the whole supply chain.
- Suppliers communication on social responsibility requirements to workers and sub-suppliers.
- Signing of the code of conduct by employees.
- Reporting on policies on local community relations, safety in supply chain covering suppliers and contractors and factory health and safety performance in relation to average field of industry performance in this field.

3.1.21 *Sustainable development indicators for mining sites in protected areas: tool development, ranking and scoring of potential environmental impacts and assessment of management scenarios flow*

Authors

E. Marnika, E. Christodoulou and A. Xenidis (2015).

Purpose

To analyse the potential impact of mining activities in protected areas and to formulate indicators that represent all the factors affecting a protected area.

Method

In order to quantify parameters of mining activity that might have an impact on a protected area, flora, fauna and the environment in general, an environmental indicator-based tool was developed. The authors develop the indicators by taking all the activities associated with a mining project into account (e.g. road network construction, extraction, processing, loading, transportation, waste disposal, closure and rehabilitation).

Results

By using this assessment support tool suggested in the study, the authors aim to integrate available scientific knowledge, technical expertise and numerous environmental and other parameters into a method/process that could potentially be used for similar projects in protected areas. The tool is designed to provide an integrated approach and facilitate efficient decisions on mining activities in protected areas, with an optimal balance concerning important ecosystems and socioeconomic development via the relevant stakeholders.

3.1.22 *Sustainable clean-up technologies for soils contaminated with multiple pollutants: Plant-microbe-pollutant and climate nexus*

Authors

Vishal Tripathia, Leonardo F. Fracetob and P.C. Abhilasha (2015).

Purpose

(1) To address the difficulties in remediation of soils contaminated with multiple pollutants. (2) To delineate the plant-microbe-pollutant and climate nexus. (3) To identify the key sustainability indicators for evaluating the remediated system.

Method

The authors discuss the difficulties of testing microbial and plant species for the remediation of soil pollutants. They claim that the success of any phytoremediation technology depends on three important factors: (i) inherent nature of the plant species, (ii) micro flora present in the soil and (iii) physico-chemical properties of the pollutant itself. Afterwards, the authors discuss and explain the consequences of these factors in more detail. Given that phytoremediation technique mainly depends on the plant-microbe-pollutant interactions, the authors then discuss the affect that climate change will have on the phyto/bioremediation of pollutants, in that it will affect plant-microbe-pollutant interactions directly or indirectly. Regarding (1) and (2) above, the authors discuss the challenges of defining benchmarks for evaluating the performance of a plant-based clean-up technology for the onsite remediation of polluted soils. In particular, they discuss the importance of paying attention to sustainability components, carbon emissions and the socioeconomic components of the restored system.

Results

As a result, the authors stress the importance of framing and validating suitable indicators periodically when analysing the sustainability of the remediation process. They find the following sustainability components to be important: clean-up potential, soil quality, soil microorganisms, biodiversity, groundwater quality, carbon emissions, bio economy and social aspects. These components are followed up with a series of more detailed indicators (which can be seen in Appendix III).

3.1.23 Sustainable development outcomes of coal mine methane clean development mechanism Projects in China

Authors

Noim Uddin, Mascha Blommerde, Ros Taplin and David Laurence (2015).

Purpose

To investigate how coal mine methane projects under the CDM contribute to sustainable development and how their contribution to sustainable development is reported. In addition, assessments are made of whether information is sufficiently documented in CDM project documents and reporting with regard to sustainable development contributions by coal mine methane projects.

Method

The authors review the sustainable development contributions of CDM projects involving coal mine methane utilisation in China and compare them with six similar projects initiated under the CDM in other developing countries.

Results

The authors conduct a content coverage with regard to sustainable indicators and report on:

- Environmental benefits: air, land, water and conservation.
- Social benefits: health, welfare/safety, learning and employment.
- Economic benefits: growth, energy and balance of payments.
- Other benefits: sustainability tax, corporate social responsibility and technology transfer.

However, the analysis reveals that not all the sustainable development indicators exist in the CDM documents. The authors argue that this could be due to the time of establishment of the projects, the absence of an approved set of sustainable development indicators for CDM governance and national CDM administration.

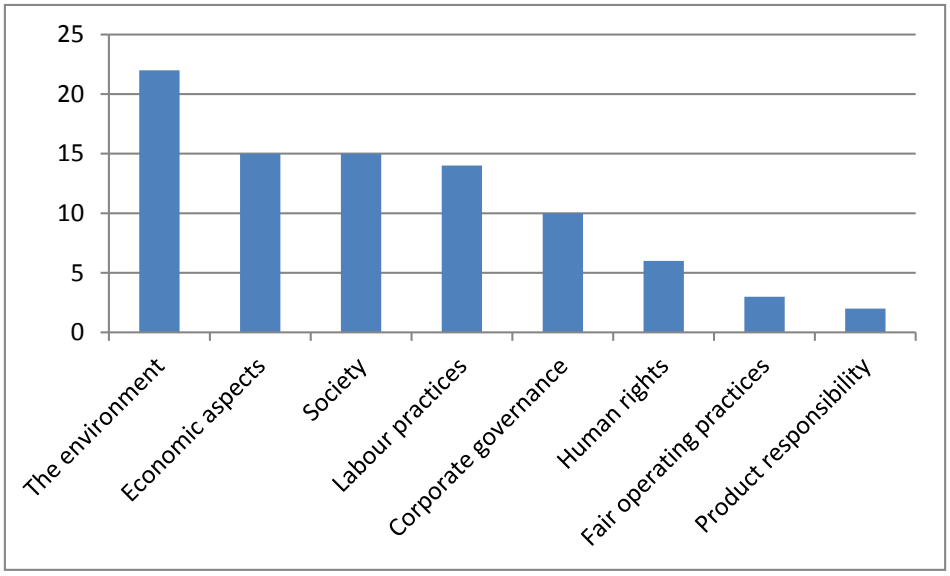
3.1.24 Summarising the review

The following section provides a summary of the results of previous research concerning the sustainability criteria that are considered important for the mining industry. The review is based on 23 scientific papers. Even though the focus of this report is limited to the Nordic mining industry, the research in the literature review is global, which means that the following results can relate to the entire mining industry.

The above articles have different approaches and include different sustainability criteria. Some discuss the criteria in depth, while others are more general. On the whole, the environmental aspects are presented in depth and the economic aspects are described more generally. The content of the entire literature review can be summarised in the following core subjects: the environment, economic aspects, society, labour practices, corporate governance, human rights, fair operating practices and product responsibility. As shown in Figure 3, the most frequently mentioned core subjects are the environment, economic aspects and society, and the least mentioned is product responsibility. According to the literature review, the environmental and economic aspects are regarded as vital. However, regarding the environmental aspects,

the research provides more detailed examples of which criteria to prioritise. In terms of the economic aspects, the research is more general, in that the economic aspects are not specified.

Figure 3: The diagram shows how many articles highlight the respective core subjects



3.2 The mining companies

In this section, the mining companies operating in the Nordic countries when this project started are presented, together with information about the sustainability communications on their websites.

3.2.1 Agnico Eagle Mines Ltd.

Agnico Eagle Mines Ltd. has mines in Canada, Finland and Mexico, with exploration and development activities in each of these regions and also in the United States. The company's Finnish gold mine, Kittilä, is located in northern Finland (Agnico, 2015).

Sustainability appears to be important and the company's approach is presented on its website. It is stated that the company is committed to "create value for shareholders by operating in a safe, socially and environmentally responsible manner while contributing to the prosperity of our employees, their families and the communities in which it operates". This is translated into four fundamental values in a

sustainable development policy: respect for our employees, protect the environment, operate safely and respect for the communities. The company's sustainability report is available on the website and the report from 2014 is included in this study (ibid.).

3.2.2 *Boliden AB*

Boliden is a mining and metals company with core competences in the fields of exploration, mining, smelting and metals recycling. The mines are located in Sweden, Finland and Ireland and produce complex ore containing zinc, copper, lead, gold and silver. The Swedish mines are Aitik, Garpenberg, Boliden area and Kylylahti in Finland (Boliden, 2015).

Boliden communicates its commitment to sustainable development clearly on its website. Under the heading "sustainability", the company states its obligation to long-term sustainable development and to being the first sustainable link in the value chain of metals. This commitment is divided into social responsibility, where health and safety is highlighted, environmental responsibility with a focus on the reduction of the operations' environmental impact and economic responsibility, where the aim is to contribute to a positive economic and social development in the community. Boliden also emphasises the importance of a dialogue with business partners relating to the adoption of internationally accepted standards of corporate ethics (ibid.). The company's sustainability report is available on its website and the report from 2014 is included in this study.

3.2.3 *Dragon Mining*

Dragon Mining is a Nordic gold producer with mines in Sweden and Finland. The Swedish mine Svartliden is located in Västerbotten, Sweden. The Finnish mines Orivesi and Jokisivu are situated in southern Finland (Dragon, 2015).

The subject of sustainability is not very clearly communicated on the company's website. However, a code of conduct, diversity policy and sustainability policy were identified on closer examination. The sustainability policy includes a commitment to environmental performance, community relations and health and safety. No sustainability report is available on the website (ibid.).

3.2.4 Endomines Oy

Endomines Oy is involved in the exploration and development of gold deposits and planned gold mining in north Karelia. The Finnish mine, Pampalo, is located in the central part of the Karelian Gold Line, 5 km north of the village of Hattuvaara (Endomines, 2015).

The company's commitment to sustainability is communicated by an environmental policy and a brief description of sustainable development, a good working environment, nature conservation work, risk perspective, open and objective information and exploration with respect to the interests of landowners, contractors and development and education. No sustainability report is available on the website (ibid.).

3.2.5 First Quantum Minerals Ltd.

First Quantum Minerals Ltd. is a mining and metals company that produces copper, nickel, gold, zinc and platinum group elements. The company's assets are located in Zambia, Spain, Mauritania, Australia, Finland, Turkey, Panama, Peru and Argentina. The Finnish mine, Pyhäsalmi, is situated in central Finland (FQM, 2015).

The company has a clear focus on sustainability and its CSR programme is divided into five key areas – governance, economics, the environment, social aspects and labour. Governance and risk management includes independent board members, the identification and management of risk, monitoring and auditing the code of conduct and the implementation of external codes of practice. The economic area comprises a profitable business, local job creation, contribution to fiscal and foreign exchange income and access to mineral and capital resources. Labour highlights training and development, career development for talent retention, safety and occupational health, a wider community health and staff motivation. The environment embraces impact assessment and mitigation management, management procedures and systems, scarce resource efficiency management, biodiversity management and effluent emissions management. Finally, the social aspects are an effective community engagement and impact assessment, facilitation of broader poverty alleviation, human rights management and social infrastructure development (ibid.). The company's sustainability report is available on the website and the report from 2014 is included in this study.

3.2.6 LKAB

LKAB is an international minerals group and a producer of processed iron ore products. The Swedish mines, Kirunavaara, Malmberget, Mertainen, Leveäniemi and Gruvberget, are located in northern Sweden (LKAB, 2015).

LKAB presents its strategy for sustainable development on its website, with the stated aim of becoming "one of the most innovative and resource-efficient mining companies in the world". The strategic focus areas are; an attractive LKAB, attractive communities, responsible operations and resource-efficient production. Attractive LKAB includes employment, health and safety, values, ethics, diversity and equality, recruitment and competence management. Responsible operation embraces emissions to air and discharges to water, operational waste, biodiversity, land use and remediation, impact on landscape, ponds/landfills, deformations, grievance handling and supplier requirements. Attractive communities consist of stakeholder dialogues, conflicts of interest, relocation of households/communities, housing, compensation issues and community services. Finally, a resource-efficient production includes energy efficiency, CO_2, fossil fuels/renewable, green products and services, extractive waste and waste rock, ore bed and ore yield, material use in processes and production, water use and recycling. LKAB presents a variety of policies on its website, for example personnel policy, environment and energy, work environment, code of conduct and communications policy. On its website the company highlights its work for occupational health and safety, quality and environment and the local communities (ibid.). The company's sustainability report is available on the website and the last report from 2014 is included in this study.

3.2.7 Lovisagruvan AB

The Lovisa mine is located in the municipality of Lindesberg in Sweden and produces zinc, lead and silver (Lovisagruvan, 2015).

Sustainability is not given any priority on the company's website. The only information that is related to the subject concerns the environmental impact of its operations: utilisation of land, emissions to water and noise and vibration (ibid.). No sustainability report is available on the website.

3.2.8 Lundin Mining AB

Lundin Mining AB has operations and projects in Chile, Portugal, Sweden, Spain and the USA and produces copper, zinc, lead and nickel. The Swedish mine, Zinkgruvan, is located in south-central Sweden (Lundin, 2015).

Corporate responsibility is given prominence on the company's website and is divided into four focus areas. The environmental responsibility includes energy use and greenhouse gas emissions, water management, land use and biodiversity. The social responsibility embraces human rights and the local community. Lundin Mining is also

committed to a safe, productive and healthy working environment for all employees, contractors and visitors. In the last area, corporate governance, the company strives to be a good corporate citizen in order to create shareholder value. Lundin mining also highlights its responsible mining policy on the website with accompanying framework and guidelines (ibid.). The company's sustainability report is available on the website and the report from 2014 is included in this study.

3.2.9 Mandalay Resources Corp.

The Canadian company Mandalay Resources Corp. operate mines in Chile, Australia and Sweden. The Björkdal gold mine is located in Västerbotten, Sweden (Mandalay, 2015).

The Mandalay Resources Corp. presents an approach called "Living our values" on the company website, with the mission to build a long-lived, values-based and value-focused organisation that is founded on safe and efficient work practices, continuous improvement, fiscal responsibility and effective community relationships. The approach targets the areas of safety and health, the environment and the community. The company presents the Mandalay safety & health policy and the environmental protection policy on the website and informs about a set of guidelines to support community action plans across all sites (ibid.).

A sustainability report is available on the website for the Australian site Costerfield, but the Björkdal mine is not included. The report is included in this study because it highlights the sustainability criteria the company prioritises in its work for sustainability.

3.2.10 Sydvaranger Gruve AS

Sydvaranger Gruve AS is mining company located in Kirkenes, Norway. The Norwegian mine produces iron ore (Sydvaranger, 2016).

The company presents information on the website about existing code of conduct, risk management policy, safety policy and environmental policy. As these documents are not downloadable or expanded on the website, we were unable to determine which sustainability criteria the company has implemented (ibid.). No sustainability report is available on the website.

3.2.11 *Outokumpu Chrome Oy*

Outokumpu Chrome Oy is situated in Kemi, Finland and the mine produces chrome concentrates (Outokumpu, 2015).

The company has a comprehensive communication about sustainability and states that "sustainability always has been, and continues to be, a key element of their strategy". Its focus areas are sustainable operations, sustainable products, climate change, product lifecycle and corporate responsibility.

Sustainability in the operations stands for a safe and healthy workplace and the continuous development of processes to minimise the environmental impact of stainless steel production. The company's environmental policy is implemented by means of environmental, energy and risk-based management systems. The company markets stainless steel as the key building block for a sustainable future. A safe and healthy workplace is emphasised as a key issue for Outokumpu and a commitment to further improve its current level of safety is communicated. Corporate responsibility is guided by its ethical principles of human dignity, sustainable development, good corporate citizenship and a safe and healthy workplace (ibid.). The last communicated sustainability report available on the website is from 2014.

3.2.12 *Rana Gruber Mineral AS*

Rana Gruber Mineral AS is a Norwegian mining company. The Rana mines produce iron ore (Rana, 2016).

Rana Gruber Mineral AS communicates its sustainability work with a responsibility for the environment, health and safety. It strives to minimise any inconvenience to and impact on the environment and is concerned about employees' job satisfaction and work environment. Its primary objective is zero injuries. The corporate social responsibility involves a local commitment by sponsoring schools and sports clubs, cultural events and scholarships for secondary school students (ibid.). No sustainability report was found on the company's website.

3.2.13 *Terrafame Ltd.*

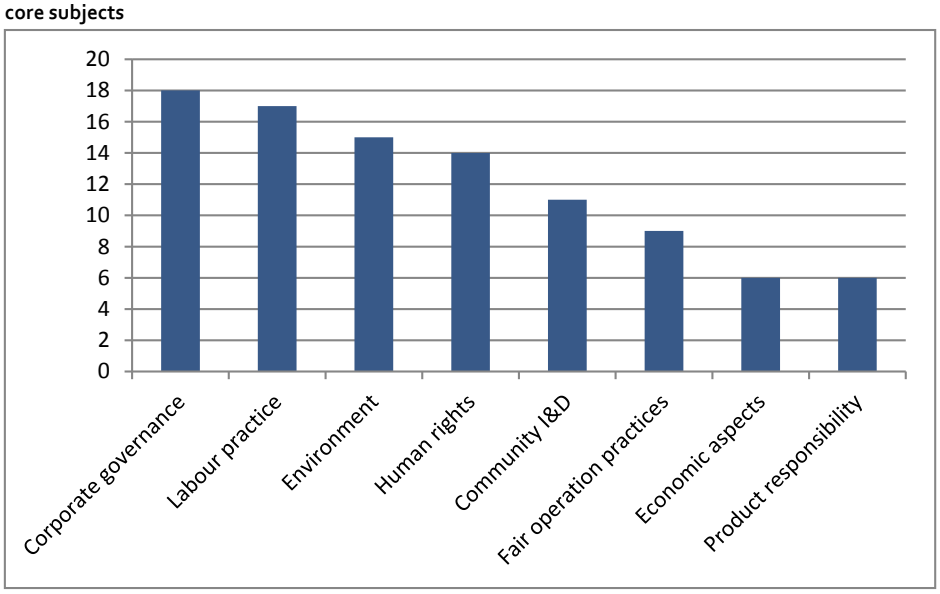
The Talvivaara mine, which was previously owned by Talvivaara Mining Company Plc., is currently operated by Terrafame Ltd. The Finnish mine is located in Sotkamo, Finland and produces nickel, zinc, copper and cobolt (Terrafame, 2016).

Terrafame's objective is to operate an environmentally sustainable, safe and economically viable mine. The most important criteria are water management, land use and other local environmental impacts such as dust and noise (ibid.). The mine's last annual report was produced by the Talvivaara Mining Company Plc. in 2013 and is included in this study.

3.3 Sustainability initiatives, guidelines and tools

The literature review and the sustainability reports study identified a number of sustainability initiatives, guidelines and tools for the mining industry that are either practised by the industry or have been studied in previous research (Raufflet *et al.*, 2014, Ranängen & Zobel, 2014). These initiatives, guidelines and tools have different approaches and include different sustainability criteria. Some focus on one single subject, for example the United Nations Universal Declaration of Human Rights and ISO 14001 for environmental management. Others embrace several subjects, such as the UNs Global Compact, ISO 26000 or the Global Reporting Initiative (GRI) framework. All the documents have been reviewed and their content can be summarised in the following core subjects: corporate governance, fair operating practices, economic aspects, human rights, labour practices, product responsibility, society and the environment. As shown in Appendix IV and Figure 4, the most frequently mentioned core subjects are corporate governance, labour practices and the environment. The least mentioned are product responsibility, which seems to be of limited relevance for the mining industry, probably because it is a "business to business" industry and does not sell products to end users, and the economic aspects.

Figure 4: The diagram shows how many initiatives, guidelines and tools highlight the respective core subjects



The most frequently used criteria in the core subject of corporate governance are self-regulatory practices and management systems, stakeholder management and respect for the rule of law. Risk assessment/management is also commonly mentioned. This means developing and applying self-regulatory practices and management systems that foster a relationship of confidence and mutual trust between enterprises and the societies in which they operate (ISO, 2015a, OECD, 2011; TSM, 2004). Stakeholder management signifies that the company should respect, consider and respond to the interests of its stakeholders (GRI, 2015; ISO, 2010; ICMM, 2003). The company should also respect that the rule of law is mandatory (ISO, 2015a; OECD, 2011; TSM, 2004). Risk assessment/management involves various methods to manage the effect of uncertainty on a company's objectives, i.e. managing risk by detecting and understanding risk and modifying it where necessary (ISO, 2015b; OECD, 2011, ISO, 2009).

For the core subject of fair operating practices, anti-corruption and fair competition are highlighted. Examples of corruption include bribery, conflict of interest, fraud, money laundering, embezzlement, concealment and obstruction of justice and trade in influence. There are many forms of anti-competitive behaviour. Some examples are price fixing, bid rigging and predatory pricing (ISO, 2010; UN, 2003; UN, 1999).

The economic aspects are not commonly highlighted, but the indirect economic impact on society and procurement practices is mentioned. The indirect economic

impacts could include infrastructure investments and services supporting economic development in areas of high poverty, indirect economic impacts of improving or deteriorating social or environmental conditions and enhancing skills and knowledge in the community (GRI, 2015; ISO, 2010; UNE, 2008). The procurement practices relating to the spending on local suppliers and supplier assessments focus on environmental issues, society, labour practices and human rights (GRI, 2015; GRI, 2010; UNE, 2008).

Respect for human rights is an important core subject, where non-discrimination, freedom of association and collective bargaining, child labour and forced or compulsory labour are the most frequently mentioned criteria. An effective human rights policy and conducting appropriate human rights due diligence can help companies to address the risk of being implicated in human rights violations by knowing and showing that they took every reasonable step to avoid involvement (WGC, 2012; UN, 1999; UN, 1948).

For the core subject of labour practice, occupational health and safety and training and education at the workplace are the most important criteria. Health and safety at work concerns the promotion and maintenance of the highest degree of physical, mental and social well-being of workers and the prevention of harm to health caused by working conditions. Human development includes the process of enlarging people's choices by expanding human capabilities and functioning, thus enabling women and men to lead long and healthy lives, improve their knowledge and have a decent standard of living (SAI, 2014; ISO, 2010; OHSAS, 2007).

Product responsibility includes product and service labelling, marketing communications and consumer privacy (data protection). Many initiatives, guidelines and tools include the core subject of society and community involvement and development, where the local community and wealth and income creation are common (GRI, 2015).

The environment is an important core subject in many of the initiatives, especially when the focus is on sustainable resource use and the prevention of pollution. To ensure the availability of resources in the future, current patterns and volumes of consumption and production need to change so that the earth's carrying capacity is not exceeded. Key areas are energy efficiency, water conservation and the efficient use of materials. A company can improve its environmental performance by preventing pollution, including emissions to air, discharges to water, waste management and use and disposal of toxic and hazardous chemicals (ISO, 2015; ISO, 2011; ISO, 2010). A compilation of the initiatives, guidelines and tools and their content is presented in Appendix IV.

A review of the sustainability reports shows that some of the identified sustainability initiatives, guidelines and tools are more often referred to that others. The global reporting initiative (GRI) was mentioned in all the reports and the ISO 14001 standard for environmental management in six out of seven. The OHSAS 18001

standard for occupational health and safety and the GRI Mining and metals supplement were mentioned in four of the seven reports.

GRI is an international independent organisation that helps businesses, governments and other organisations to understand and communicate the impact of business on critical sustainability issues such as climate change, human rights, corruption and many others. By using the GRI guidelines, reporting organisations disclose their most critical impacts on the environment, society and the economy. They can generate reliable, relevant and standardised information with which to assess opportunities and risks and enable more informed decision making – both within the business and among its stakeholders. The GRI mining and metals supplement deals with aspects of sustainable development that characterise the mining and metals sector.

The ISO 14001 standard is part of the ISO 14000 series, which has been developed to provide organisations with a structure for managing environmental impact. ISO 14001 sets out the criteria for an environmental management system (EMS) and is certifiable. In 2013, the global number of certificates issued amounted to more than 300,000. The standard does not state requirements for environmental performance, but maps out a framework that a company or organisation can follow to set up an effective EMS, regardless of its activity or sector. Using ISO 14001 can guarantee that environmental impact is being measured and improved (ISO, 2016).

Table 4: The sustainability initiatives, guidelines and tools presented in the sustainability reports

	Boliden AB	LKAB	Lundin Mining AB	Agnico Eagel Mines Ltd	First Quantum Minerals Ltd	Outo-kumpu	Taivivaara Mining Company Plc
The UN Global Compact	x	x				X	
ILO Declaration on Fundamental Principles and Rights at Work	x						
The Universal Declaration of Human Rights (UN)		x	x			X	
The UN's Convention against Corruption							
UN Guiding Principles on Business and Human Rights		x					
The OECD Guidelines for Multinational Enterprises	x	x	x				
The Act on Equality between Women and Men							x
Extractive Sector Transparency Measures Act (Canada)			x				
The Voluntary Principles on Security and Human Rights			x				

	Boliden AB	LKAB	Lundin Mining AB	Agnico Eagel Mines Ltd	First Quantum Minerals Ltd	Outo-kumpu	Taivivaara Mining Company Plc
The Mining Association of Canada. TSM Guiding Principles				x			
ICMM Sustainable Development Framework. 10 Principles							x
GRI	x	x	x	x	x	X	x
GRI. Mining and Metals Sector Supplement		x		x		X	x
AA 1000			x				x
SA 8000							
ISO 14001	x	x	x	x		X	x
ISO 26000						X	x
OHSAS 18001	x		x	x			x
SGE-21. Forética.							
UNE 22470							
ISO 50001	x	x				X	
ISO 9001	x	x				X	x
The Conflict-Free Gold Standard. World Gold Council.				x			
ISO 31000							x
Carbon Disclosure Project (CDP)				x			x

An occupational health and safety management system (OHSMS) promotes a safe and healthy working environment by providing a framework that allows an organisation to consistently identify and control its health and safety risks and improve its overall performance (BSI, 2013). BS OHSAS 18001:2007 is the most common standard for OHSMS in the world and has a structure that corresponds well with other ISO standards (Ammenberg, 2012).

The requirements are divided into policy and planning, hazard identification, risk assessment and risk control, legal and other requirements, objectives, targets and management programmes, implementation and operation, checking and corrective action and management review (OHSAS, 2007). For the other initiatives, guidelines and tools the references are more fragmented and scarce, as shown in Table 4.

3.4 Core subjects and sustainability criteria in sustainability reports

The software for qualitative text analysis, Leximancer, was used to translate the content of the sustainability reports into a list of key concepts. The analysis provided information about which core subjects the reporting companies regard as important and which sustainability criteria are practiced and communicated in each core subject. The results of the content analysis of the sustainability reports from Agnico Eagle Mines Limted, Boliden AB, LKAB, Lundin Mining AB, Outokumpu Oy and Taivivaara Mining Company Plc. are presented below.

3.4.1 Agnico Eagle Mines Ltd.

The most relevant concepts in Agnico Eagle's sustainability report are presented in Table 5. The majority of the concepts relate to the core subjects of corporate governance, labour practices, society and the environment. For corporate governance, the concepts are "stakeholders", "system" and "report". The concept "system" almost always refers to the responsible mining management system, which includes occupational health and safety and the environment.

For labour practices, the concepts are "health" and "safety". For the environment, the focus is on "waste" and "tailings". Society is also communicated through "communities".

Table 5: Concepts found in the analysis of Agnico Eagle's sustainability report

Concept	Count	Relevance (%)
mine	123	100
Agnico Eagle	97	79
communities	59	48
employees	51	41
environmental	36	29
operations	36	29
health	31	25
safety	31	25
work	24	20
production	22	18
waste	21	17
local	20	16
stakeholders	16	13
system	15	12
report	15	12
tailings	15	12
contractors	12	10
programs	12	10
project	12	10

3.4.2 Boliden AB

The most relevant concepts in Boliden's sustainability report are presented in Table 6. Most of the concepts are related to the core subjects of the environment, labour practices and corporate governance. For the environment, the concepts are "environmental", "emissions", "water", "waste" and "energy". For labour practices, the concepts are "employees", "health", "safety" and "gender". The most prominent concepts in corporate governance are "reporting", "management" and "legislation". The concept "management" is connected to the criteria risk management, management systems and skills management.

Table 6: Concepts found in the analysis of Boliden's sustainability report

Concepts	Count	Relevance
reporting	136	35%
employees	128	33%
work	96	25%
operations	76	20%
impact	57	15%
environmental	55	14%
management	51	13%
business	47	12%
process	44	11%
value	41	11%
emissions	41	11%
local	39	10%
sustainability	37	10%
production	34	9%
metals	32	8%
water	31	8%
waste	29	7%
health	28	7%
safety	27	7%
rights	26	7%
gender	25	6%
energy	25	6%
human	24	6%
legislation	21	5%

3.4.3 First Quantum Minerals Ltd.

The most relevant concepts in this company's sustainability report are presented in Table 7. Most of the concepts are related to the core subject of society by "people", "community", "local", "project", "programme", "resettlement", "farming", "education", "homes", "health", "school" and "social".

For labour practices, the concept is "health" (even though most of the time the concept refers to society). For the environment, the focus is on "species" and "water".

Table 7: The concepts identified in the content analysis of the sustainability report for First Quantum Minerals Ltd.

Concept	Count	Relevance (%)
mine	131	85%
people	120	77%
community	100	65%
local	54	35%
sustainability	47	30%
project	47	30%
program	39	25%
resettlement	35	23%
impact	35	23%
conservation	33	21%
environmental	32	21%
farming	31	20%
education	28	18%
economic	27	17%
homes	27	17%
work	27	17%
responsibility	26	17%
health	26	17%
school	26	17%
species	26	17%
social	25	16%
water	25	16%
construction	23	15%
government	21	14%
report	19	12%

3.4.4 LKAB

The most relevant concepts in LKAB's sustainability report are presented in Table 8. The majority of the concepts are related to economic aspects, including "financial", "value", "assets", "income", "market", "costs", "liabilities", "investments" and "growth". Others are more related to descriptions of the operations by "ore", "production", "products", "operations", "work" and "plant".

The concept of "management" is used extensively and covers a number of different areas. The most frequent area is "risk management", followed by "asset management". Other used areas are sustainability, environmental, waste, energy and competency management. Environmental "emissions" and issues related to "employees" seem to be of less importance in the communication with stakeholders.

Table 8: The concepts identified in the content analysis of LKAB's sustainability report

Concepts	Count	Relevance
Ore	492	92%
financial	255	48%
value	227	42%
assets	201	38%
production	185	35%
income	182	34%
products	176	33%
market	142	27%
operations	114	21%
liabilities	106	20%
costs	88	16%
investments	86	16%
management	84	16%
customers	80	15%
risk	80	15%
impact	79	15%
work	71	13%
growth	67	13%
emissions	66	12%
employees	62	12%
plant	59	11%

3.4.5 Lundin Mining AB

The most relevant concepts in Lundin Mining AB's sustainability report are presented in Table 9. Most of the concepts are related to the core subjects of corporate governance, labour practices and the environment. The most prominent concepts in corporate governance are "management", "monitoring" and "reporting". For labour practices, the concepts are "employees" and "health". For the environment, the concepts are "environmental", "waste" and "emissions". The concept "management" is connected to areas such as risk, stakeholder, waste, crises, water, energy, tailings management and HSE (health, safety and environmental) management systems.

Table 9: Concepts found in the analysis of Lundin Mining AB's sustainability report

Concepts	Count	Relevance
mine	256	100%
water	98	38%
operations	92	36%
management	76	30%
safety	63	25%
environmental	58	23%
local	56	22%
community	49	19%
closure	41	16%
employees	39	15%
health	38	15%
project	35	14%
construction	34	13%
tailings	33	13%
waste	32	12%
impacts	30	12%
emissions	30	12%
monitoring	29	11%
production	29	11%
support	28	11%
work	28	11%
rock	27	11%
reporting	24	9%
exploration	22	9%

3.4.6 Outokumpu Crome Oy

The most relevant concepts in Outokumpu's sustainability report are presented in Table 10. The majority of the concepts are related to the core subjects of corporate governance, labour practices and the environment. For corporate governance, the concepts are "management", "system" and "report". The concepts "management" and "system" almost always refer to various kinds of management systems include the environment, energy, occupational health and safety and risk management.

For labour practices, the concepts are "employment" and for the environment the focus is on "energy", "water", "emissions" and "waste".

Table 10: Concepts found in the analysis of Outokumpu's sustainability report

Concept	Count	Relevance (%)
steel	166	100%
stainless	155	93%
production	143	86%
environmental	129	78%
energy	120	72%
emissions	108	65%
operations	100	60%
material	88	53%
management	75	45%
efficiency	74	45%
local	72	43%
employees	70	42%
water	66	40%
report	64	39%
work	56	34%
impact	55	33%
products	50	30%
waste	46	28%
sustainability	43	26%
system	40	24%
customers	39	23%

3.4.7 Taivivaara Mining Company Plc.

The most relevant concepts in Taivivaara's sustainability report are presented in Table 11. Most of the concepts are related to the core subjects of corporate governance, economic aspects, labour practices and the environment. For corporate governance, the key concepts are "management" and "risk". The concept "management" often refers to "water" and "risk" management, but sometimes also include "environmental", "safety" and "sustainability" management and management systems. For the core subject economic aspects, the concepts are "financial", "shares", "assets", "costs", "market" and "tax". For labour practices the concepts are "personnel" and "safety". For the environment, the focus is on "water".

Table 11: Concepts found in the analysis of the sustainability report for Talvivaara Mining Company Plc.

Concept	Count	Relevance (%)
Mining	395	42%
financial	272	29%
management	230	24%
water	219	23%
shares	199	21%
production	189	20%
risk	169	18%
operations	167	18%
corporate	164	17%
assets	159	17%
environmental	158	17%
safety	121	13%
costs	117	12%
subscription	112	12%
work	110	12%
information	84	9%
impact	79	8%
metals	78	8%
personnel	78	8%
market	70	7%
tax	68	7%
equipment	65	7%

The results of the content analysis of the seven sustainability reports shows that all the above companies prioritise three core subjects in their sustainability reports: corporate governance, labour practices and the environment. The communicated sustainability criteria in the core subject of corporate governance are "self-regulatory practices and management systems", "disclosure", "risk management", "stakeholder management" and "respect for the rule of law". For labour practices, the focus is on "employment", "occupational health and safety", "training and education" and "diversity and equal opportunity". The prioritised environmental criteria are "water", "emissions", "effluents and waste", "energy", "biodiversity" and "the recycling of metals".

The core subjects of economic aspects and society are prioritised in three of the seven sustainability reports. The criteria for economic aspects are "market presence" and "economic performance" and for society "local communities", "education and culture", "wealth and income creation" and "health". The findings are summarised in Appendix V.

3.5 The stakeholder survey

In March 2016 an online questionnaire was distributed to a total of 230 mining stakeholders in Finland, Norway and Sweden to find out what they thought about the Nordic mining industry's sustainability efforts. The survey had a response rate of 23%, which is regarded as average for online surveys (Nulty, 2008). The findings of the stakeholder survey are presented in the following sections.

3.5.1 The Swedish mining industry's stakeholders

The Swedish mining industry's stakeholders provide the highest scores (mean 4.62) for all the sustainability criteria in a range from 4.2 to 4.9. The most important criteria (score ≥ 4.8) are found in the core subjects of corporate governance, human rights, labour practices and the environment. For corporate governance, respect for laws and regulations and risk management are important criteria. Non-discrimination is of great concern for the respect of human rights. Occupational health and safety is the most important criterion in labour practices. Most of the important sustainability criteria are found in the environment in terms of sustainable resource use, energy, water, sustainable land use, emissions, effluents and waste and the recycling of metals.

Even though many of the Swedish mining industry's stakeholders give high scores for all the criteria, some generate lower scores. The least important criteria (score ≤ 4.4) are found in the core subjects of fair operating practices (responsible political involvement and fair competition), economic aspects (economic performance, indirect economic impact on society and procurement practices), labour practices (employment, training and education and labour/management relations) and, for society, (employment creation and skills and social investment). The results of the survey are presented in Table 12.

3.5.2 The Norwegian mining industry's stakeholders

In general, the Norwegian mining industry's stakeholders also provide high scores (mean 4.49) for all sustainability criteria in a range from 4.0 to 5.0. The most important criteria (score ≥ 4.8) are found in the core subjects of corporate governance, fair operating practices, human rights and the environment. For corporate governance, respect for laws and regulations and risk management are very important criteria. Anti-corruption is also of great importance. Non-discrimination is a concern for the respect of human rights. Most of the important sustainability criteria are found in the environment in terms of sustainable resource use, energy, water, sustainable land use,

emissions, effluents and waste, biodiversity, climate change mitigation and the adoption and recycling of metals.

In general, the Norwegian mining industry's stakeholders' scores are high, with the lowest (score ≤ 4.4) being found in the core subjects of corporate governance (stakeholder management), fair operating practices (responsible political involvement and fair competition), economic aspects (economic performance, indirect economic impact on society and procurement practices), human rights (freedom of association and collective bargaining), labour practices (employment, training and education, occupational health and safety, diversity and equal opportunity, social security and labour/management relations) and society (local communities, employment creation and skills, wealth and income creation, social investment). The results of the survey are presented in Table 12.

Table 12: Results of the stakeholder survey

Subject/sustainability criteria	Mean	Mean	Mean
Corporate governance	**Sweden**	**Norway**	**Finland**
Stakeholder management	4.6	4.3	4.8
Respect for laws and regulations	4.9	5.0	4.9
Self-regulatory practices and management systems	4.7	4.7	4.5
Risk management	4.9	5.0	4.8
Fair operating practices	**Sweden**	**Norway**	**Finland**
Anti-corruption	4.7	5.0	4.7
Responsible political involvement	4.4	4.3	3.3
Fair competition	4.3	4.1	3.8
Economic aspects	**Sweden**	**Norway**	**Finland**
Economic performance	4.3	4.0	4
Indirect economic impact on society	4.4	4.0	4.5
Procurement practices	4.3	4.1	4.2
Human rights	**Sweden**	**Norway**	**Finland**
Non-discrimination	4.8	4.7	4.2
Freedom of association and collective bargaining	4.7	4.4	4.6
Indigenous rights	4.5	5.0	4.4
Labour practices	**Sweden**	**Norway**	**Finland**
Employment	4.2	4.0	4.6
Training and education	4.3	4.0	4.4
Occupational health and safety	4.9	4.1	4.8
Diversity and equal opportunity	4.7	4.0	4.1
Social security	4.7	4.0	4.1
Labour/management relations	4.4	4.2	4.1
Society Sweden		**Norway**	**Finland**
Local communities	4.5	4.1	4.9
Employment creation and skills	4.4	4.1	4.6
Wealth and income creation	4.5	4.3	4.5
Social investment	4.4	4.1	4.2
The environment	**Sweden**	**Norway**	**Finland**
Sustainable resource use	4.9	4.9	4.5
Energy	4.9	5.0	4.3
Water	4.8	4.8	4.5
Sustainable land use	4.9	4.9	4.4
Emissions	4.8	4.9	4.6
Effluents and waste	4.9	4.9	4.7
Sustainable transport	4.7	4.6	4.3
Biodiversity	4.7	4.8	3.9
Climate change mitigation and adoption	4.6	4.9	3.8
Recycling of metals	4.8	4.9	4.6

3.5.3 The Finnish mining industry's stakeholders

The Finnish mining industry's stakeholders' scores are relatively high (mean 4.38) for all the sustainability criteria in a wider range from 3.3 to 4.9. The most important criteria (score ≥ 4.8) are found in the core subjects of corporate governance, labour practice and society. For corporate governance, stakeholder management and risk management are important criteria. Occupational health and safety is the most important criteria in labour practices. For the core subject society, the local communities are an important criterion.

The Finish mining industry's stakeholders have relatively high scores in all the criteria, although some of the criteria generated lower scores. The least important criteria (score ≤ 4.4) are found in the core subjects of fair operating practices (responsible political involvement and fair competition), economic aspects (economic performance and procurement practices), human rights (non-discrimination and indigenous rights), labour practices (training and education, diversity and equal opportunity, social security and labour/management relations), society (social investment) and the environment (energy, sustainable land use, sustainable transport, biodiversity, climate change mitigation and adoption). The results of the survey are presented in Table 12.

3.5.4 A comparison between countries

The Swedish mining industry's stakeholders have a higher mean score (mean 4.62) for the importance of the sustainability criteria included in the survey than the Norwegian (mean 4.49) and Finnish (mean 4.38) stakeholders.

The widest range of scores for the importance of sustainability criteria is found amongst the Finnish mining industry's stakeholders, in a range from 3.3 to 4.9. The importance among the Norwegian stakeholders is in the range 4.0 to 5.0 and for the Swedish stakeholders from 4.2 to 4.9.

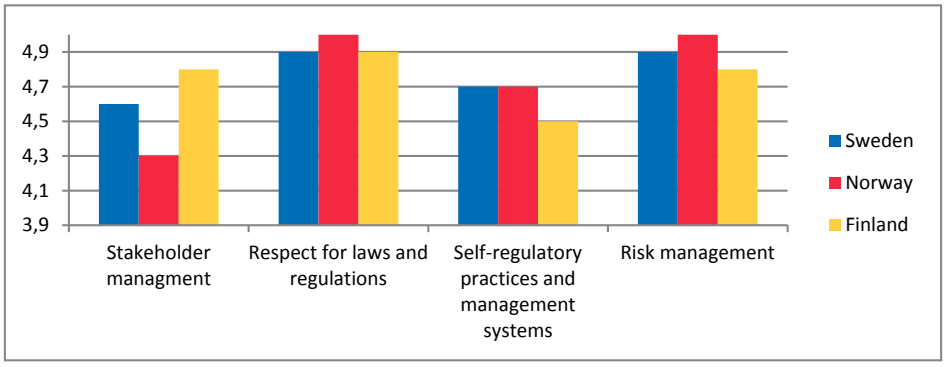
A comparison between the sustainability criteria generating the highest scores (score ≥ 4.8) show both similarities and differences. In all three countries, the core subject of corporate governance and, more specifically, respect for the rule of law and risk management are very important criteria. There are also similarities among the lowest scorers. Fair operating practices (responsible political involvement and fair competition), economic aspects (economic performance and procurement practices), labour practices (training and education and labour/management relations) and society (social investment) generated lower scores in all three countries. The general differences between the countries are that the Swedish and Norwegian stakeholders prioritise the environmental criteria, whereas the Finnish stakeholders prioritise society

and stakeholder management criteria. A more detailed comparison of each core subject and its associated criteria appears below and is based on the similarities and differences identified in the empirical data.

Corporate governance

The result of the survey for the core subject of corporate governance is presented in Figure 5. As has already been mentioned, in all three countries "respect for the rule of law" and "risk management" are regarded as highly important. "Stakeholder management" has a high score in Finland, a medium score in Sweden and low score in Norway. That the mining companies should have self-regulatory practices and management systems in place seems to be of minor importance.

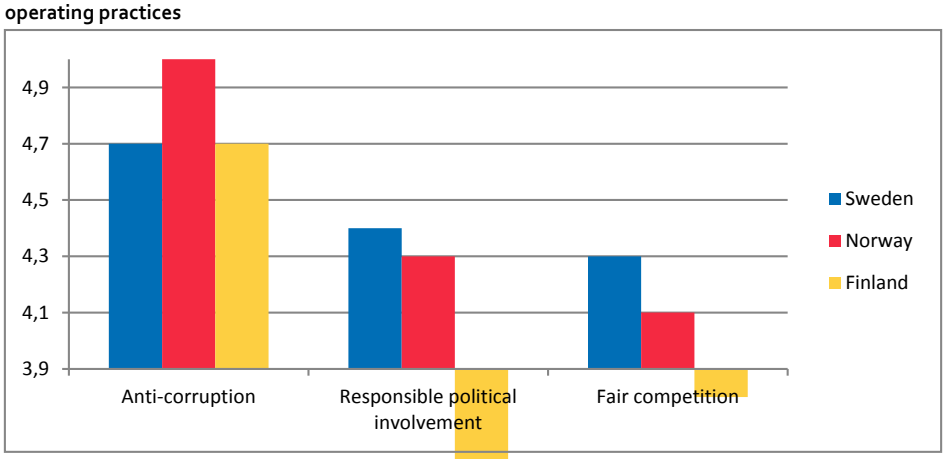
Figure 5: The scores for the importance of the sustainability criteria included in the core subject of corporate governance



Fair operating practices

The result of the survey for the core subject of fair operating practices is presented in Figure 6. The bar chart shows that "anti-corruption" is highly important for the Norwegian stakeholders and less important for those in Sweden and Norway. For the other criteria the importance is lower.

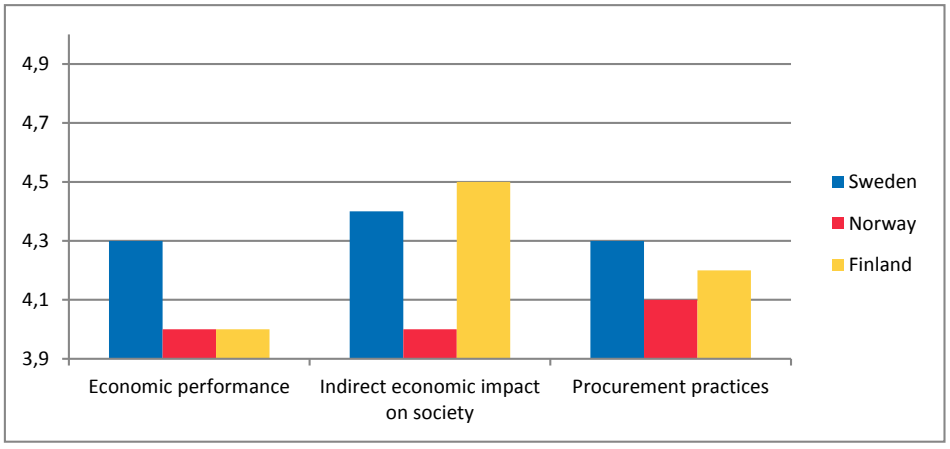
Figure 6: The scores for the importance of the sustainability criteria included in the core subject of fair operating practices



Economic aspects

The result of the survey for the core subject economic aspects is presented in Figure 7. As previously stated, the economic aspects are of less importance for all the stakeholders and especially those in Norway.

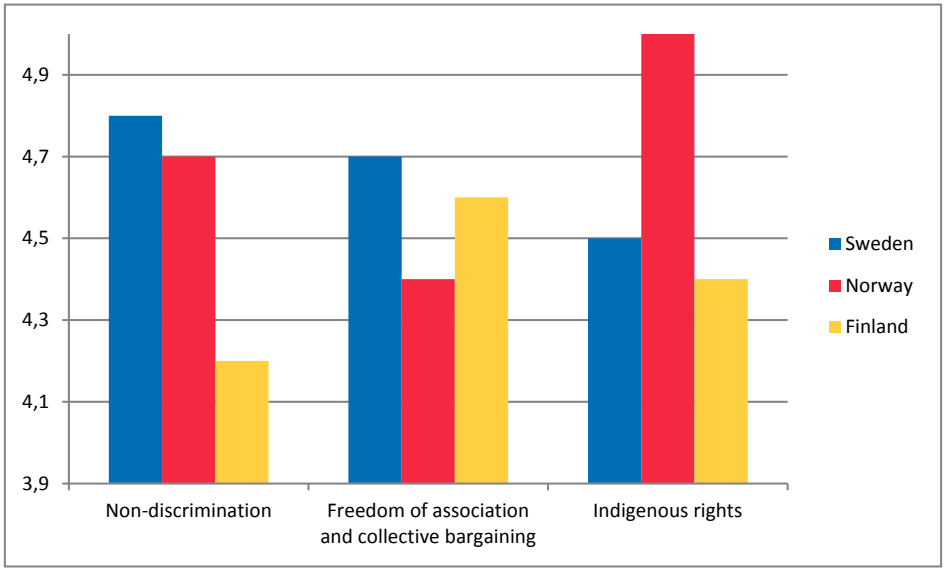
Figure 7: The scores for the importance of the sustainability criteria included in the core subject economic aspects



Human rights

The result of the survey for the core subject of human rights is presented in Figure 8. For the Swedish stakeholders, the criterion non-discrimination is the most important. Indigenous rights received the highest score in Norway. For the Finnish stakeholders the criteria in the core subject of human rights are less important.

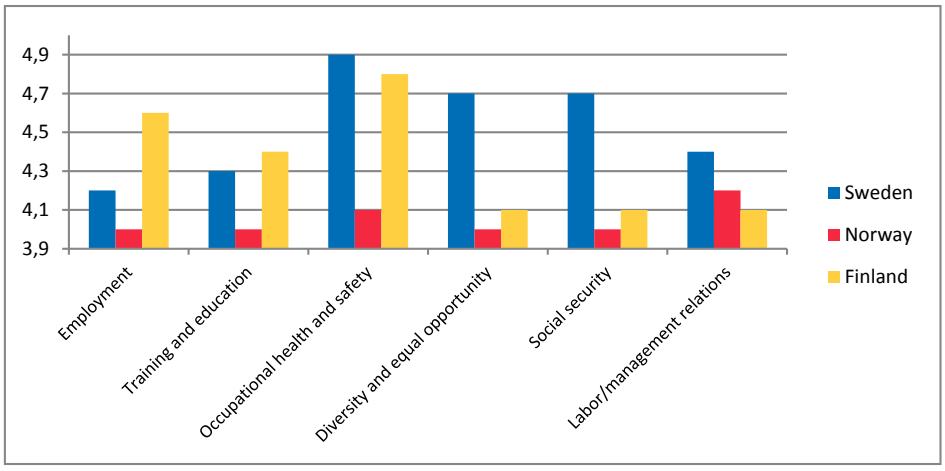
Figure 8: The scores for the importance of the sustainability criteria included in the core subject of human rights



Labour practices

The result of the survey for the core subject of labour practices is presented in Figure 9. For the Swedish and Finnish stakeholders, the criterion occupational health and safety is the most important. For the Norwegian stakeholders, the total core subject is less valued.

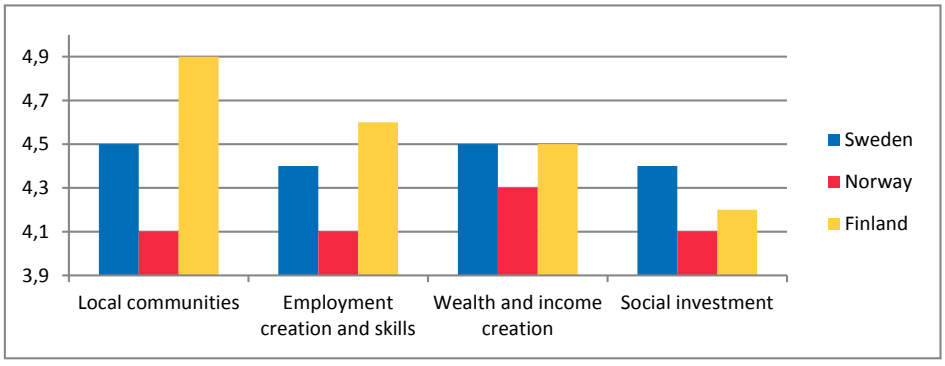
Figure 9: The scores for the importance of the sustainability criteria included in the core subject of labour practices



Society

The result of the survey for the core subject of society is presented in Figure 10. Local engagement in society is a very important criterion for the Finnish stakeholders. For the Swedish, and especially the Norwegian stakeholders, this core subject is of less importance.

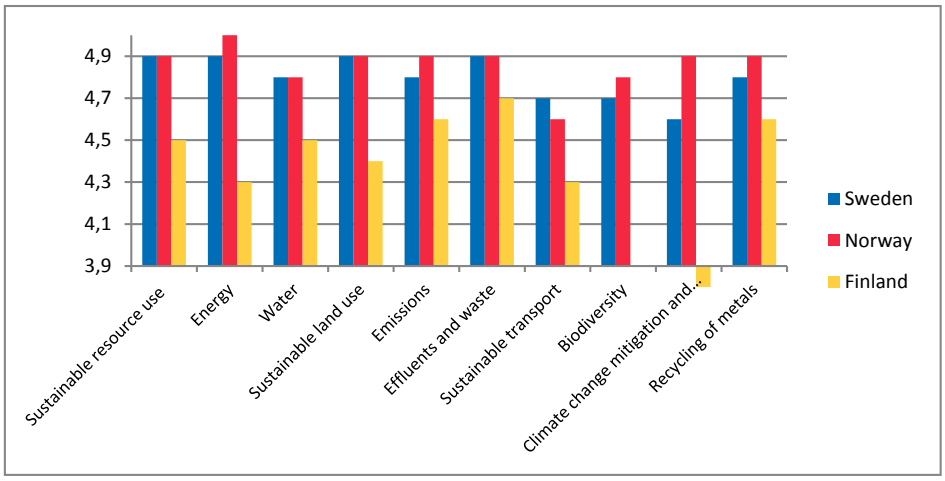
Figure 10: The scores for the importance of the sustainability criteria included in the core subject of society



The environment

The result of the survey for the core subject of the environment is presented in Figure 11. In general, this is the most important core subject both in Norway and in Sweden, although it is not as important in Finland.

Figure 11: The scores for the importance of the sustainability criteria included in the core subject of the environment



3.5.5 *Stakeholder comments and concluding remarks*

The questionnaire provided stakeholders with an opportunity to comment on each core subject and make concluding remarks. The comments vary, but some general conclusions can be drawn. A number of stakeholders advocate long-term mining operations where future generations are highlighted. They also promote economic sustainability, with more critical assessments regarding the possibility of conducting economical mining operations where there is no room for wishful thinking. The stakeholders also highlight ecological sustainability, where the protection of the environment should be priority number one and not subordinated to economic profitability. The polluter pays principle should also be applied to environmental impact and CO_2 emissions from the mining industry and no subsidies should be made for energy or waste. The reuse and recycling of metals should be prioritised.

3.6 Interviews with company officials

It can be assumed that the companies producing sustainability reports are proactive in their sustainability performance and have the most comprehensive and implemented sustainability work. In the following sections the results of the interviews with mining company officials are presented.

3.6.1 Corporate governance

When the officials from the mining companies are asked to highlight their focus areas for sustainability they mostly refer to occupational health and safety, environmental performance and the community. The community and its stakeholders are extremely relevant for two of the companies. In the first case, an entire community has to move due to the mine and in the second case the mine is coming to the end of its productive life and will close in about 3 to 5 years, which will affect employment, wealth and income opportunities in the area. Strategic land use and the post mining phase are also mentioned.

All the mining companies are aware of their stakeholders and have created forums for dialogue purposes. One company official states that the climate for mines has changed the last couple of years and affects the acceptance for mining operations. However, it is clear that strategic and structured stakeholder management is missing and is instead performed more ad hoc. One of the companies has conducted a stakeholder analysis in order to acquire more information about what stakeholders think about its sustainability work.

Traditional management system standards are frequently used in the Nordic mining industry and are seen as effective tools. These standards are ISO 14001, OHSAS 18001, ISO 50001, ISO 9001, ISO 26000 and the GRI framework. One company refers to internal HSE group standards instead. Most mining companies seem to be proactive, continue to look for new ways of working and have an interest in the Canadian initiative Towards Sustainable Mining (TSM), which is currently being implemented in Finland, and the International Council on Mining and Metals (ICMM) sustainable development framework.

The mining companies have a comprehensive and well implemented risk management at multiple levels, for example for large-scale scenarios such as fires, chemical accidents and rock slides in mines etc., and for the daily ongoing operations, especially in occupational health and safety and the environment.

3.6.2 Fair operating practices

All the mining companies have corporate guidelines or codes of conduct for anti-corruption. Some also provide training and workshops, especially for senior managers, where different kinds of dilemmas are discussed, as well as digital training for other staff. Some companies have implemented a whistle blower function. None of the companies have corporate guidelines for responsible political involvement, although some claim to be "fully aware" of what is accepted. When it comes to the sustainability criterion fair competition, it is assumed that the Nordic mining industry complies with

competition law and regulations. The respondents refer to their company's marketing and purchasing functions and purchasing policy. One states that the company prefers local suppliers, which also have to be competitive. Another company requires three tenders per contract in order to strengthen competition. The companies are at different stages in their work when it comes to the promotion of social responsibility in the value chain. The area of occupational health and safety seems to be well implemented among the contractors, which is not very surprising given that safety is an important focus area for all the companies. One company refers to "specific programmes", whereas the rest do not seem to promote other sustainability criteria in the value chain, at least not in any structured way.

3.6.3 Human rights

The responsibility to respect human rights in the Nordic countries tends to be about respect for indigenous people and non-discrimination. Two of the mining companies have mines in Sámi communities. These mining companies have created cooperation agreements with the Sámi community, in which they recognise the influence the mine has on reindeer herding, draw up plans for how the two operations can work side by side and provide for compensation for any damage caused: "It's all about finding sensible solutions". For the sustainability criterion of non-discrimination, the companies refer to documents such as human rights policy, non-discrimination and victimisation policy, equality policy and corporate codes of conduct. Two of the companies are about to educate and train their senior managers in this, while another mining company simply refers to the occupational health and safety legislation.

3.6.4 Labour practice

The legislation relating to working conditions and occupational health and safety is quite extensive in the Nordic countries and the practices in this area are comprehensive. Most of the companies conduct wage surveys to ensure equal pay for equal work and no discrimination based on gender, sexual orientation, skin colour etc., is acknowledged. For most of the mining companies the question of diversity is linked to gender issues. Two of the companies work systematically (strategy, policy and objectives) to attract more female labour. One of the companies addresses migrants when highlighting a business association's initiative focusing on diversity. One area that has received more attention in recent years, both in the legislation and in different kind of sustainability initiatives, is the work-life balance. Two of the companies have gone further in this work. The problem with a high workload seems to be more extensive

among first-line managers and academics belonging to support functions; a problem that the companies' occupational health services have also identified. The companies highlight the importance of a change in corporate norms and values and their attempts to raise awareness about the importance of balance. The training of managers is in progress. Other companies still refer to this area in terms of health-related activities organised by corporate committees.

3.6.5 The environment

The sustainable use of resources like energy, raw materials and water is an important area for the mining industry. Regarding energy, one company points to the importance of working with the actual consumption, for example by using ISO 50001, and alternative energy sources. Another company maintains that major technological leaps are made in its new mining projects. In short, there appears to be great potential for improvement in this area. Water consumption and purification have for a long time been linked to permits and the practice is therefore more advanced. A sustainable use of water means that as little water as possible enters the mine. One respondent says: "We separate clean and polluted water, for example by dense ditches, and the clean water is led directly to the recipient." Some companies are also preparing for higher water-flows due to global warming. Another company refers to itself as a big water user and estimates the possibilities of recycling the water as limited due to the variation in the pH values.

Emissions from the operations are reduced due to flue gas purification. Nuisance is another important aspect. A number of actions have been taken to prevent/reduce the spread of dust. The tailings are processed by helicopter, are built in, and the water balance in the tailings is raised in order to prevent dust. The mining companies regard dust as a very important pollution issue for their neighbours. Noise is reduced by building dikes, upgrading facilities, adjusting how to tip and so on. This is also an area that is controlled by permits and the focus is on limits.

The actual mining operation creates a lot of waste, which is also regulated by permits and legislation. The issue that some of the companies are engaged with at present is how to make landfills more attractive and take up less space. This seems to be an issue that is becoming increasingly relevant for the mining companies, although they are clearly at different stages in this process. Nevertheless, an official from one of the mining companies said that its footprint is fairly small and that most of its tailings are underground.

When it comes to transport to and from the mine the picture looks very different between the companies. One of the companies almost exclusively uses train transport, while others mainly use trucks. Another company uses trucks connected to boat transportation. From an environmental point of view, there is room for improvement in this criterion.

One of the companies has begun to work with biodiversity, both when opening new mining areas and at abandoned sites. This is regarded as compensation, i.e. trying to create the same values elsewhere or to recreate the nature that was destroyed decades before. However, as one respondent put it: "This is something new, we did not work this way in the 90s."

One of the Nordic mining companies is a world leader when it comes to the recycling of metals. Rare earth metals in waste rock dumps are a concern for one of the companies. This is seen as a potential resource that could be very profitable in the future. For example, when the iron ore prices were high the same company processed the rock waste through the system once more to extract more iron. Another mining company is hesitant about this, because it believes that with the existing high yields this would be impossible.

3.6.6 Society

Involvement and engagement in society can take many different forms. The major focus of the studied companies is on education, job creation and philanthropy. Education is an important focus area for all the interviewed mining companies. One company official said: "We will have Sweden's best schools in the communities in which we operate". The company supports local schools with donations, skills development for teachers, student projects, site visits etc. The main reason for this support is to promote interest in technology, which ultimately leads to a potential labour force. One of the companies supports the construction of a new science park for children for the same reason. Managers at group level often visit universities to lecture about the company and its operations and support students' master theses and research projects. The mining companies also frequently support sports in various ways and different kinds of cultural events such as theatre tours and contemporary dance events.

When it comes to employment, the majority of the employees are locals. However, as the companies also need special skills, they are obliged to search worldwide. One of the mining companies employs 60 or 70 trainees during the summer for work life experience. No efforts are made to attract more female employees.

One of the companies is engaged in local business corporations to create local, additional businesses. Others support local kiosks and small shops to maintain good services close to the sites. Two companies use local suppliers and buy local products, but the others have no strategy for local procurement.

When it comes to health issues, most of the activities are in the form of philanthropic contributions to local sports associations or the local swimming club. Otherwise, they talk a lot about health activities for their own employees, but these mostly relate to occupational health. Other social investments are rare, more ad hoc and the companies lack strategies for long-term social sustainability.

We ended the interviews by asking the respondents what they thought the outcome of this project should be and the answers varied. One respondent thought that common guidelines for the Nordic mining industry would be a good idea. A Finnish respondent thought that the Finnish TSM initiative was sufficient. Another company representative: said; "We do not want any new standards, we are quite busy following the ones that already exist."

Instead, the companies' main challenge seems to be how to communicate their sustainability practices, reach out to stakeholders and be socially accepted in society: "We aim to be the best in the class at producing the metals that humanity needs. How do we achieve "social license to operate"? I'd like to have the answer to that."

3.7 Summarising the findings

The data collected for the literature review and the revision of existing sustainability initiatives, sustainability reports and surveys has been compiled and analysed and made available in Table 13. The core subjects and sustainability criteria identified in the study are presented in the first column. In the second column, the core subjects and criteria identified in previous research are represented by a number that illustrates how many of the papers discuss each core subject/criterion. In the two following columns the same is presented for sustainability initiatives, guidelines, tools and reports. The number of times the core subjects and criteria are identified in these three different sources is then summarised in the fourth column.

The sustainability criteria that received more than 5 points were considered for the survey, with a few exceptions. For example, the criteria concerning child labour, force or compulsory labour and remuneration are not included, because they are not relevant from a Nordic perspective. In columns six, seven and eight, the findings from the Swedish, Norwegian and Finnish surveys are presented. The abbreviations "li", "I" and "vi" stand for "less important", "important" and "very important". "Less important" is a

mean ≤ 4.4, "important" is a mean between 4.4 and 4.8 and "very important" represent a mean ≥ 4.8.

Our recommendation is based on the findings from the surveys, where priority level A is given if any of the countries' stakeholders have responded with "very important", priority level B for "important" and priority level C for "less important". The summarised findings resulted in sustainability criteria guidelines for the Nordic mining industry (see Table 14 in the next chapter).

Table 13: Summarised findings

	Literature review	Sustainability initiatives	Sustainability reports	Summary	Survey, Swe	Survey, No	Survey, Fi	Recom-mendation
Corporate governance	*10*	*18*	7	*35*				
Stakeholder management	10	10	3	23	i	li	vi	A
Respect for the rule of law	4	9	1	14	vi	vi	vi	A
Respect for international norms of behaviour	1	4	0	5				
Self-regulatory practices and management systems	0	14	6	20	i	i	i	B
Disclosure	0	3	5	8				
Risk management	0	8	5	13	vi	vi	vi	A
Private security	0	1	0	1				
Public security	0	1	0	1				
Fair operating practices	*3*	*9*	*0*	*12*				
Anti-corruption	2	9	0	11	i	vi	i	A
Responsible political involvement	2	4	0	6	li	li	li	C
Fair competition	0	5	0	5	li	li	li	C
Responsible supply chain management	1	11	0	12				A
Respect for property rights	0	2	0	2				
Cooperation and alliances	0	1	0	1				
Economic aspects	*15*	*6*	*3*	*24*				
Economic performance	1	3	1	5	li	li	li	C
Market presence	0	2	2	4				
Indirect economic impact	0	4	0	4	li	li	i	B
Procurement practices	0	5	0	5	li	li	li	C
Human rights	*6*	*14*	*1*	*21*				
Due diligence	0	4	0	4				
Non-discrimination	2	12	0	14	vi	i	li	A
Freedom of association and collective bargaining	1	10	0	11	i	li	i	B
Child labour	3	10	0	13				
Forced or compulsory labour	1	10	0	11				
Security practices	0	2	0	2				
Indigenous rights	2	5	0	7	i	vi	li	A
Human rights grievance mechanisms	0	6	0	6				
Civil and political rights	0	7	0	7				
Economic, social and cultural rights	0	6	0	6				
Labour practices	*14*	*17*	*7*	*38*				
Employment	7	6	6	19	li	li	i	B
Training and education	6	12	1	19	li	li	li	C
Labour/management relations	1	6	0	7	li		x	
Occupational health and safety	11	11	5	27	vi	li	vi	A
Diversity and equal opportunity	4	3	1	8	i	li	li	B
Remuneration	1	6	0	7				
Labour practices grievance mechanisms	0	2	0	2				
Provide reasonable notice of changes	2	2	0	4				
Health and safety of our contractors	1	1	0	2				
Disciplinary practices	0	1	0	1				

	Literature review	Sustainability initiatives	Sustainability reports	Summary	Survey, Swe	Survey, No	Survey, Fi	Recom-mendation
Working hours	1	3	0	4				
Management of suppliers and contractors	1	1	0	2				
Conditions of work and social protection	4	2	0	6	i	li	li	B
Emergency preparedness and response	0	2	0	2				
Work-life balance	2	3	0	5				
Product responsibility	*2*	*6*	*0*	*8*				
Consumer health and safety	1	4	0	5				
Product and service labelling	0	5	0	5				
Marketing communications	0	5	0	5				
Consumer privacy	0	5	0	5				
Sustainable consumption	0	1	0	1				
Consumer service, support and complaint and dispute resolution	0	3	0	3				
Access to essential services	0	1	0	1				
Costumer focus	0	1	0	1				
Society	*14*	*11*	*3*	*28*				
Local communities	10	7	3	20	i	li	vi	A
Grievance mechanisms for impacts on society	1	3	0	4				
Education and culture	0	1	1	2				
Employment creation and skills	5	1	1	7	li	li	i	B
Technology development and access	1	2	0	3				
Wealth and income creation	3	3	1	7	i	li	i	B
Health	2	2	1	5				
Social investment	5	1	0	6	li	li	li	C
Employ local workers	3	1	0	4				
Nuisance	4	6	0	10	vi	vi	li	A
The environment	*22*	*15*	*7*	*44*				
Sustainable resource use in general	12	9	0	21	vi	vi	i	A
Material (mineral resources)	10	**5**	0	15	vi	li	li	A
Energy	14	**7**	2	23	vi	vi	li	A
Water	10	6	5	21	vi	vi	i	A
Sustainable land use	9	1	0	10	vi	vi	li	A
Prevention of pollution in general	5	10	0	15				
Emissions	9	7	4	20	vi	vi	i	A
Effluents and waste	9	7	4	20	vi	vi	i	A
Products and services	2	3	0	5				
Sustainable transport	7	3	0	10	i	i	li	B
Contractor environmental assessment	1	0	0	1				
Environmental grievance mechanisms	0	4	0	4				
Precautionary measures	0	2	0	2				
Environmentally friendly technologies	3	2	0	5				
Environmental impact assessment	4	1	0	5				
Biodiversity	5	6	1	12	i	vi	li	A
Climate change mitigation and adoption	2	4	0	6	i	vi	li	A
Restoration of natural habitats	4	2	1	7	vi	li	vi	A
Recycling of metals	4	4	0	8	vi	vi	i	A

4. The sustainability criteria guidelines

Based on the literature review, the revision of sustainability initiatives, the Nordic mining industry's sustainability reports and the stakeholder surveys in Finland, Sweden and Norway, we suggest the following sustainability criteria guidelines for the Nordic mining industry (see Table 14). The sustainability criteria guidelines are divided into seven core subjects: corporate governance, fair operating practices, economic aspects, human rights, labour practices, society and the environment. Under each core subject, the sustainability criteria that the Nordic mining industry should focus on are presented. These criteria are further provided with a priority level of A, B or C, which symbolises the order in which the sustainability aspects should be implemented, where A is the most urgent. The guidelines' core subjects and sustainability criteria are described in the next section in order to give a more detailed picture of the expected activities for each criterion.

4.1 Corporate governance

Corporate governance is the framework for decision making within the company. As seen in Table 13, where the findings are summarised and the analysis is presented, the core subject includes a variety of aspects. However, the most important aspects are stakeholder management, respect for the rule of law, risk management and self-regulatory practices and management systems.

All the mining companies are mindful of their stakeholders and have created forums for communication with them. Nevertheless, it is obvious that a strategic stakeholder management is missing. Stakeholder management is referred to in many of the sustainability initiatives. Respect for stakeholders' interests means that the company should respect, consider and respond to the interests of its stakeholders. This requires a dialogue about mutual interests and joint values and not, as in many cases today, simply an information mode.

Respect for the rule of law means that a company should accept that respect for the rule of law is mandatory. This includes ensuring that its activities comply with legal

frameworks, knowing its legal obligations and periodically reviewing the company's compliance with applicable laws and regulations. The Nordic countries have an extensive occupational health and safety and environmental legislation in place and the mining companies' operations are controlled by permits. Our view is that respect for the rule of laws is already a prioritised area in the Nordic mining industry.

The mining companies should develop and apply effective self-regulatory practices and management systems that foster a relationship of confidence and mutual trust between the companies and the communities in which they operate. This is something that the mining companies have already implemented, especially in the focus areas occupational health and safety, the environment and quality. However, this structured and effective way of working should be expanded to also include human rights, fair operating practices and community involvement and development.

Table 14: Sustainability criteria guidelines for the Nordic mining industry

Core subjects and sustainability criteria	Priority level
Core subject: Corporate governance	
Stakeholder management	A
Respect for the rule of law	A
Self-regulatory practices and management systems	B
Risk management	A
Core subject: Fair operating practices	
Anti-corruption	A
Responsible political involvement	C
Fair competition	C
Responsible supply chain management	A
Core subject: Economic aspects	
Economic performance	C
Indirect economic impact	B
Local procurement practices	C
Core subject: Human rights	
Non-discrimination	A
Freedom of association and collective bargaining	B
Indigenous rights	A
Core subject: Labour practices	
Employment	B
Training and education	C
Occupational health and safety	A
Diversity and equal opportunity	B
Conditions of work and social protection	B
Work-life balance	C
Core subject: Society	
Local communities	A
Employment creation and skills	B
Wealth and income creation	B
Social investment	C
Nuisance	A

Core subjects and sustainability criteria	Priority level
Core subject: The environment	
Sustainable use of material (mineral resources)	A
Sustainable use of energy	A
Sustainable use of water	A
Sustainable land use	A
Emissions	A
Effluents and waste	A
Sustainable transport	B
Biodiversity	A
Climate change mitigation and adoption	A
Restoration of natural habitats (clean-up potential)	A
Recycling of metals	A

Risk management is the identification, assessment and prioritisation of risks followed by the coordinated and economic application of resources to minimise, monitor and control the probability and/or impact of unfortunate events or to maximise the realisation of opportunities. The Nordic mining companies seem to have a comprehensive and well implemented risk management at multiple levels for large-scale scenarios (crisis management), such as dams bursting, fire, chemical accidents and rock slides in mines etc., and for the daily, ongoing operations, especially in occupational health and safety and the environment. This is also a prioritised criterion in the Finnish Towards Sustainable Mining (TSM) standard. The TSM standard was established by the Finnish Network for Sustainable Mining to act as a platform for discussion and to develop practical tools to improve the sustainability of mining and ore exploration in Finland (TSM Finland, 2016).

4.2 Fair operating practices

Fair operating practices concern ethical conduct in a company's dealings with other organisations. During the data collection a number of aspects were identified, which are presented in Appendix IV. The analysis identified anti-corruption, responsible political involvement, fair competition and responsible supply chain management as the most important.

Corruption is the abuse of entrusted power for private gain. Corruption can take many forms, such as bribery, involving public officials or people in the private sector, conflict of interest, fraud, money laundering, embezzlement, concealment and obstruction of justice and trading in influence. All the mining companies have corporate guidelines or codes of conducts for anti-corruption. Some have also provided training and workshops, especially for senior staff, where different kinds of dilemmas have been

discussed. Digital training has also been provided for other staff. Some companies have implemented a whistle blower function. This appears to be a prioritised criterion for the Nordic mining industry.

Organisations can support public political processes and encourage the development of public policy, but should prohibit the use of undue influence and avoid behaviour such as manipulation, intimidation and coercion, all of which can undermine the public process. None of the Nordic mining companies in the study have corporate guidelines for responsible political involvement, although some claim to be "fully aware" of what is accepted. Fair and widespread competition stimulates innovation and efficiency, reduces the costs of products and services, ensures that all companies have the same opportunities, encourages the development of new or improved products or processes and enhances economic growth and living standards. It is assumed that the Nordic mining industry complies with competition law and regulations. However, these are two sustainability criteria that could be better managed, for example by a policy or inclusion in a code of conduct.

The Nordic mining industry can influence other organisations through its procurement and purchasing decisions. By means of leadership and mentorship along the value chain, it can promote the adoption and support of the principles and practices of social responsibility, i.e. human rights, the environment, labour practices and impact on society. As already indicated, the companies are at different stages in their promotion of social responsibility in the value chain. The area of occupational health and safety seem to be well implemented among the contractors in that safety is an important focus area for all the companies. One company refers to "specific programmes", although the rest do not appear to promote other sustainability criteria in the value chain, at least not in any structured way.

4.3 Economic aspects

The economic dimension of sustainability concerns the organisation's impact on the economic conditions of its stakeholders and on economic systems at local, national and global levels. Economic performance includes direct economic value generated and distributed for example revenues, operating costs, employees' wages and benefits, payments to providers of capital, payments to government and community investments. Indirect economic impact is instead about investments and services that can have a positive or negative impact on communities. Local procurement practices means having a procurement budget for significant locations of operation spent on suppliers local to that operation, for example to ensure that a percentage of products

and services will be purchased locally. Two of the studied mining companies use local suppliers and buy local products, but the remainder do not appear to have any strategy for local procurement. Nevertheless, it is a core subject that the Nordic mining industry should consider implementing and the rather extensive research available in this area can be helpful.

4.4 Human rights

Human rights are the basic rights to which all human beings are entitled. In the Nordic countries, human rights are protected through the constitution and other laws and regulations, such as the European Convention for the Protection of Human Rights and Fundamental Freedoms. During the data collection numerous aspects regarding human rights were identified (see Appendix IV). Some of these aspects, for example child labour and forced or compulsory labour, have been disregarded in the guidelines because they are not relevant in a Nordic perspective The sustainability aspects suggested in the guidelines are therefore non-discrimination, freedom of association and collective bargaining and indigenous rights.

Discrimination means any distinction, exclusion or preference that has the effect of nullifying equality of treatment or opportunity, where that consideration is based on prejudice rather than legitimate grounds. Illegitimate grounds for discrimination are race, colour, gender, age, language, property, nationality or national origin, religion, ethnic or social origin, caste, economic grounds, disability, pregnancy, belonging to an indigenous people, trade union affiliation, political affiliation or political or other opinion. The respondents refer to various documents, such as a human rights policy, a non-discrimination and victimisation policy, an equality policy and a corporate code of conduct. Two of the companies are about to educate and train their senior staff in human rights issues, while another mining company simply refers to the occupational health and safety legislation. This is an area in which companies are at different stages. However, it is an important criterion for the mining industry's stakeholders and should therefore be included in both the strategic and operational management practices.

Workers and employers have the right to establish and join organisations of their own choosing without previous authorisation. Representative organisations that are formed or joined by workers should be recognised for purposes of collective bargaining. Terms and conditions of employment may be fixed by voluntary collective negotiation where workers so choose. Workers' representatives should have access to the appropriate facilities that will enable them to do their work effectively and allow them to perform their role without interference. Collective agreements should include provision for the

settlement of disputes. Workers' representatives should be provided with information required for meaningful negotiations. These are all issues covered by the Nordic labour legislation which is already fully implemented in the Nordic mining industry.

Indigenous peoples have experienced systemic discrimination that has included colonisation, dispossession of their lands, separate status from other citizens and violations of their human rights. From a Nordic perspective, this issue is often linked to the Sámi people. Two of the mining companies have mines in Sámi communities. The mining companies construct cooperation agreements with the Sámi community in which they recognise the influence the mine has on for example reindeer herding, develop plans for how the two operations can work side by side and provide for compensation for damage caused. The company representatives believe that they do what is legally required. However, based on the debate in society, this is a sustainability criterion that can clearly be improved.

4.5 Labour practices

The labour practices of a company include all the policies and practices relating to work performed within, by or on behalf of the company, including sub-contract work. This is an extensive core subject and includes the recruitment and promotion of workers, disciplinary and grievance procedures, the transfer and relocation of workers, termination of employment, training and skills development, health, safety and industrial hygiene, working hours and remuneration. As already mentioned, this is an area that is controlled by law in the Nordic countries, for example by an extensive occupational health and safety legislation. Hence, some of the identified aspects have been removed as they are not relevant from a Nordic perspective, for example remuneration and working hours. On the other hand, work-life balance was of less importance in the collected data but is included because it is commonly discussed in society and therefore important from a Nordic perspective. Hence, the prioritised sustainability aspects in the core subject of labour practices are employment, training and education, occupational health and safety, diversity and equal opportunity, conditions of work and social protection and work-life balance.

The sustainability aspects of employment and conditions of work and social protection mean a full and secure employment and decent working conditions, which imply rights and obligations for both employers and employees. Occupational health and safety concerns the promotion and maintenance of the physical, mental and social well-being of workers and the prevention of harm to health due to the working conditions. Occupational health and safety is also included in the Finnish TSM standard.

The legislation regarding employment, working conditions and occupational health and safety is quite extensive in the Nordic countries and our study shows that these practices are already comprehensive.

The company should promote diversity and equal opportunity and not discriminate due to gender, age, minority grouping etc. Most of the companies conduct wage surveys to ensure equal pay for equal work and ensure no discrimination based on gender, sexual orientation, skin colour etc. The question of diversity is for most of the mining companies linked to gender issues. Two of the companies work systematically (strategy, policy and objectives) to attract more female labour. One of the companies addresses migrants when highlighting a business association's initiative focusing on diversity. This is a sustainability aspect that can be improved in the Nordic mining industry.

Facilitating training opportunities and education for employees is highlighted in many of the sustainability initiatives and provided for by the mining companies in the study.

One area that has received increased attention in recent years, both in the legislation and in different kinds of sustainability initiatives, is the work-life balance. Two of the companies have gone further in this work. The problem with a high workload seems to be more extensive among first-line managers and academics belonging to support functions. This is also a problem that the companies' occupational health services have identified. The companies highlight the importance of a change in corporate norms and values and their attempts to raise awareness about the importance of balance. Management training is in progress. Other companies still refer to the area in terms of health-related activities organised by corporate committees.

4.6 Society

Companies have a relationship with the communities in which they operate and the relationship should be based on community involvement and contribute to community development. This is also a prioritised subject in the Finnish TSM standard. A focus on local communities in order to be a good corporate citizen includes participation in and support for civil institutions, involvement in networks of groups and individuals that constitute civil society and taking responsibility for impacts on society and the environment.

Creating employment is an important aspect and contributes to social and economic sustainability and skills development. The major foci among the companies we studied are in the areas of education, job creation and philanthropy. Education is an important focus area for all the studied mining companies. They support local schools with donations, skills development for teachers, student projects, site visits etc and

promote an interest in technology, which ultimately leads to a potential labour force. One of the companies has supported the construction of a new science park for children for the same reason.

Social investment takes place when companies invest their resources in initiatives and programmes aimed at improving the social aspects of community life. In this study this is mostly about supporting local sports associations or the local swimming club. Other social investments are rare, more ad hoc and the companies lack strategies for long-term social sustainability. This is an important area for improvement.

Nuisance is another form of pollution that negatively affects the health and well-being of communities. It includes noise, road dirt and dust, odour, visual impressions, light pollution, vibration etc. A number of actions have been taken to prevent/reduce the spread of dust. Noise is reduced by building dikes, upgrading facilities, adjusting tipping techniques and so on. This is also an area that is controlled by permits and limits.

4.7 The environment

The last core subject is the environment, which generates a large number of aspects, as can be seen in Table 13, and contributes to a number of sustainability criteria in our suggested guidelines. All but one of the criteria have the highest priority level of A. Consequently, the environment is a very important core subject for the Nordic mining industry to fully implement.

The most important and urgent sustainability aspects for the environment are the sustainable use of material, energy and water, sustainable land use, emissions, effluents and waste, sustainable transport, biodiversity, climate change mitigation and adoption, the restoration of natural habitats (clean-up potential) and the recycling of metals. Sustainable resource use includes energy efficiency, water conservation, use and access to water and efficiency in the use of materials. Efficiency in the use of materials (mineral resources) is an important aspect in order to reduce the impact on ecosystems and the emissions resulting from the use, transport and processing of materials. We did not identify any efficiency programmes or actions to minimise the use of materials in the studied mining companies, which suggests that this aspect can be improved.

The Nordic mining industry should implement energy efficiency programmes to reduce the energy demands of building, transportation, production processes, appliances and electronic equipment etc. It should also advance the sustainable use of renewable resources such as solar energy, geothermal energy, hydroelectricity, tidal and wave energy, wind power and biomass. One of the mining companies works with

the energy management standard ISO 50001, although in the main there would seem to be considerable room for improvement in this area.

Companies should conserve, reduce their use of and reuse water in their own operations and stimulate water conservation in their own spheres of influence. Water consumption and purification have for a long time been linked to permits and the practice is therefore more advanced among the established mining companies.

One of the aspects that is often highlighted in both previous research and by stakeholders is sustainable land use and the restoration of natural habitats. These aspects include the land that is currently occupied and reserved for future extraction and production activities and shows the company's direct footprint. Companies can become more sustainable by acting to protect the environment and restore natural habitats and the various functions and services that ecosystems provide. During the interviews some successful, international projects were discussed, but only a few of the companies have initiated discussions and small-scale pilot projects.

Emissions to air of pollutants such as lead, mercury, volatile organic compounds like sulphur oxides, nitrogen oxides, dioxins, particulates and ozone-depleting substances have a detrimental effect on the environment and health. Mining activities can cause water to become polluted through direct, intentional or accidental discharges into surface water bodies, runoff to surface water or infiltration to ground water. The generation of waste can cause contamination of air, water, land and soil and therefore requires responsible waste management. As these important sustainability aspects are covered by a rather comprehensive environmental legislation and permits in the Nordic countries, they have been incorporated into the mining companies' environmental management systems to varying degrees.

Another important aspect that is mostly initiated by previous research and stakeholders is sustainable transport. Long transport distances are typical for the metal production industries where large amounts of raw materials and products are transported to or from the plant site. As already indicated, transport modes to and from the mines differ between the mining companies and depend to some extent on which metal is mined. One of the companies mostly transports by train, whereas others mainly use trucks. Another company uses trucks connected to boat transportation. From an environmental point of view, there is room for improvement in this criterion.

Biodiversity is the variety of life in all its forms. Protecting the biodiversity aims to ensure the survival of terrestrial and aquatic species, generic diversity and natural ecosystems. The Nordic mining industry should therefore contribute to conservation and seek to minimise the impact of its operations on the environment and biodiversity in all stages of development, from exploration to closure. One of the companies has started to work with biodiversity when acquiring new areas and at abandoned mining

sites. This means compensating by trying to create the same values elsewhere or to recreate the nature that was previously destroyed. However, as this is not practised to any great extent in the Nordic mining industry it is another area for improvement.

Climate change is a critical global challenge. It is recognised that emissions of greenhouse gases (GHG) due to human activities cause global climate change and have a significant impact on the natural and human environment. The Nordic mining industry should commit to taking action to reduce emissions, support a low carbon future and adapt to a changing climate. This is a major area for improvement for the Nordic mining industry.

The recycling of metals was discussed both in previous research and in sustainability initiatives, but it is the stakeholders who most strongly emphasise the importance of this aspect. They state that before engaging in more mining activities better care should be taken of the metals that have already been extracted. One of the Nordic mining companies is a world leader when it comes to the recycling of metals and rare earth metals. Another company is concerned about waste rock dumps. Nevertheless, this is an important aspect not only for the Nordic mining industry, but also for the whole value chain of metals.

Tailings management, biodiversity conservation, water management, energy use and GHG emissions and mine closure are also acknowledged as important criteria in the Finnish TSM standard.

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Sammanfattning

Gruvindustrin har en stor påverkan på samhället – ur ett ekonomiskt, miljömässigt och socialt perspektiv inom ett stort antal kriterier. Vilka kriterier som bör prioriteras beror på var gruvdrift sker. Syftet är att undersöka den nordiska gruvindustrins praktiska hållbarhetsarbete och att utveckla riktlinjer för detta arbete. De forskningsmetoder som används i studien är; en litteraturgenomgång, en innehållsanalys av hållbarhetsredovisningar, en översyn av befintliga hållbarhetsinitiativ, riktlinjer och verktyg, en enkätundersökning och intervjuer med gruvföretag. Detta resulterade i ett förslag till riktlinjer den nordiska gruvindustrins hållbarhetsarbete, vilket inkluderar områden såsom verksamhetsstyrning, goda verksamhetsmetoder, ekonomiska aspekter, mänskliga rättigheter, arbetsvillkor, samhälle och miljö.

Projektet genomfördes som en del av ”Sustainability Criteria for the Nordic Extractive industry” finansierat av NordMin- Ett nordiskt expertnätverk för en hållbar gruv- och mineralindustri i Norden.

Appendix I. Survey

A survey on the sustainability work of the Swedish mining industry

The mining industry has an economic, environmental and social impact on society, and various social groups are affected in different ways by the industry's activities and decisions. You are one of the Nordic mining industries' most important stakeholders, i.e. one of the individuals or groups that have an interest in the decisions or activities of an organisation. We would therefore like to know what priorities you would like to see the industry make in order to develop its sustainability work. This survey is part of a research project on how the Nordic mining industry works with sustainability. The project started in June of 2015 and is planned for completion in August 2016. It is collaboration between the respective research units for Environmental Management and Economics at the Luleå University of Technology (LTU). The funding is provided by NordMin, a Nordic Network of Expertise for a sustainable mining and mineral industry funded by the Nordic Council of Ministers. The aim of the project is to look at how various actors view the work and sustainability of the Nordic mining industry.

The survey contains questions about how you (as the representative of an industry, organisation, interest group etc.) view the sustainability efforts of the Nordic mining industry, as well as a number of questions about yourself and your background. Your answers are important in this unique project. The more people complete the survey, the better an idea we get of what you feel is important. We would therefore be very grateful if you could help us by answering the survey questions. Your answers will of course remain anonymous. The results will be presented in a format that does not allow anyone to deduce what a certain individual has answered. If there is anyone else in your organisation/group that is better suited to answer the questions, please forward this e-mail to them.

Direct link to the survey

As the people responsible for the project, we thank you for your participation and encourage you to get in touch with one of us if you have any questions regarding the survey or the research project.

Respectfully,

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Appendix II. The interview guide

Presentation of the mission

We are a group of researchers at Luleå University of Technology that have been commissioned by NordMin (A Nordic network of expertise for a sustainable mining and mineral industry funded by the Nordic Council of Ministers) to propose a set of sustainability criteria for the Nordic mining industry. We have in this project looked at previous research, a variety of international sustainability initiatives (UN, ILO, GRI, ISO etc.), the Nordic mining industry's sustainability reports and through a survey to the Nordic mining industry's stakeholders in order to identify important sustainability criteria.

Our next step is to interview the Nordic Mining industry itself and specifically managers with responsibility within the area of sustainability and that is why we wanted to interview you.

Is it okay to record the interview?

1. On what areas do you focus your sustainability efforts?

Corporate governance

2. Which are the company's key stakeholders?
3. How do you manage these stakeholders? (Structured or ad hoc)
4. How do you inform/communicate with stakeholders?
5. What international norms of behaviour do you use / refer to?
6. How do you follow up your sustainability efforts?
7. What guidelines, standards or tools do you use in your sustainability efforts?
8. Are there any of these that you think is particularly important to live up to, and why?
9. How do you manage risks in the business?

Fair operating practices

10. How do you work with anti-corruption? Tools, training?
11. Have you identified risks of corruption?
12. Do you have guidelines or guidance for responsible political participation?
13. Do you have procedures and safeguards to competition must be on equal terms?
14. How do you promote corporate social responsibility in the value chain?

Human Rights

15. What are the rights of indigenous peoples in the areas where you operate?
16. Are there any conflicts between the interests of indigenous peoples and the mine/mines?
17. How do you work against discrimination (respect for human rights)?
18. What tools / guidelines / practices do you use to ensure that you fulfil requirements such as health and safety legislation?
19. Do you conduct wage surveys (Equal pay for equal work, discrimination due to gender sexual orientation, skin colour)?
20. How do you work with diversity?
21. How do you work with working conditions for the contractors (working conditions and working environment)?
22. Do you have any projects regarding work-life balance for your employees?

The environment

23. What tools / guidelines / practices do you use to ensure that you meet the environmental requirements from for example the environmental legislation?
24. Sustainable use of resources – energy efficiency?
25. Sustainable use of resources – Protection, use and access to water?
26. Prevention of pollution – (emissions to air and water, waste)
27. Land use (new way of thinking at start-up, use, re-creation)
28. How are products transported to and from the mine?
29. Any prevention of nuisances caused by mining (noise, dust, dust, visual) beyond what the law requires?
30. How do you work with biodiversity?

31. How do you ensure that contractors are working in accordance with your specified requirements in the environmental field?
32. How do you work with mitigation and adaptation to climate change?
33. Recycling of metals?

Product liability

34. Do you sell products where health and safety must be considered?
35. Labelling?
36. How do you communicate the risks associated with the product?

Society

37. How does your local community involvement look like?
    a. Education and culture.
    b. Job creation and skills development (employment of local staff).
    c. Development of and access to technology.
    d. Creating wealth and income opportunities (local suppliers, local products).
    e. Health (projects in and outside the company).
    f. Social investments (sponsorships, community projects alone or with others, district heating, philanthropy).
38. Which of the sustainability areas that we raised are, according to you, the three most important for Nordic mining industry to work with?
39. Have we missed any important sustainability areas?
40. What do you think should be the outcome of this project?
41. Other comments?

Appendix III. Literature review

Figure 1: Literature review

	Husgafvel et al. (2015)	Mamika et al. (2015)	Tripathi et al. (2015)	Udin et al. (2015)	Falck & Spangenberg (2014)	Lodia & Martin (2014)	Young et al. (2014)	Kommadath et al. (2012)	Paallysaho et al. (2012)	Roca & Searcy (2012)	Shaheen et al. (2011)	Putzhuber & Hasenauer (2010)	Hilson & Basu (2009)	Worrall et al. (2009)	Tsolas (2008)	Chamaret et al. (2007)	Mudd (2007)	Sinha & Banerjee (2006)	Taplin et al. (2006)	Amano & Ebhara (2005)	Azapagic (2004)	Iannelli (2004)	Azapagic & Perdan (2000)
Core subject: Corporate governance	x		x				x		x	x				x		x					x	x	x
Accountability	x																						
Transparency																							
Ethical behaviour																							x
Stakeholder management	x		x				x		x	x				x		x					x	x	x
Respect for the rule of law	x						x							x									x
Respect for international norms of behaviour							x																
Self-regulatory practices and management systems																							
Disclosure																							
Risk assessment (risk management)																							
Private security																							
Public security																							
Core subject: Fair operating practices	x								x												x		
Anti-corruption	x																				x		
Responsible political involvement	x																				x		
Fair competition																							
Responsible supply chain management									x														
Respect for property rights																							
Cooperation and alliances																							
Core subject: Economic aspects		x				x	x	x	x	x	x	x	x		x	x		x			x	x	x
Economic performance						x																	
Market presence																							
Indirect economic impact																							
Procurement practices																							
Core subject: Human rights	x						x		x	x											x		x
Due diligence																							
Non-discrimination	x																				x		
Freedom of association and collective bargaining																					x		
Child labor	x																				x		x
Forced or compulsory labor																					x		
Security practices																							
Indigenous rights										x											x		
Supplier human rights assessment																							
Human rights grievance mechanisms																							
Civil and political rights																							
Economic, social and cultural rights																							
Core subject: Labour practices	x	x		x		x	x		x	x		x		x	x	x					x	x	x
Employment				x						x		x		x		x					x		
Training and education	x								x	x					x						x		x
Labor/management relations									x														
Occupational health and safety	x			x		x			x	x		x			x	x					x	x	x
Diversity and equal opportunity							x					x				x					x		
Remuneration																							
Equal remuneration for women and men										x													
Supplier assessment for labour practices																							
Labor practices grievance mechanisms																							
Provide resonable notice of changes	x									x													
Health and safety of our contractors		x																					
Disiplinary practices																							
Working hours	x																						
Management of suppliers and contractors																					x		
Conditions of work and social protection	x									x		x				x							
Emergency preparedness and response																							
Work-life balance	x																						x
Core subject: Product responsibility																x					x		
Consumer health and safety																					x		
Product and service labeling																							
Marketing communications																							
Consumer privacy (data protection)																							
Sustainable consumption																							
Consumer service, support and complaint and dispute resolution																							
Access to essential services																							
Costumer focus																							

	Husgafvel et al. (2015)	Marnika et al. (2015)	Tripathi et al. (2015)	Udin et al. (2015)	Falck & Spangenberg (2014)	Lodia & Martin (2014)	Young et al. (2014)	Kommadath et al. (2012)	Paalliysaho et al. (2012)	Roca & Searcy (2012)	Shaheen et al. (2011)	Putzhuber & Hasenauer (2010)	Hilson & Basu (2009)	Worrall et al. (2009)	Tsolas (2008)	Chamaret et al. (2007)	Mudd (2007)	Sinha & Banerjee (2006)	Taplin et al. (2006)	Amano & Ebihara (2005)	Azapagic (2004)	Iannelli (2004)	Azapagic & Perdan (2000)
Core subject: Society/community involvement and development	x	x	x	X	x	x		x		x		x		x	x	x		x			x		x
Local communities	x		x							x		x		x	x	x		x			x		x
Supplier assessement for impacts on society	x																						
Grievance mechanisms for impacts on society						x																	
Education and culture																							
Employment creation and skills	x	x	x											x	x								
Technology development and access				x																			
Wealth and income creation	x									x		x											
Health																							
Social investment						x				x				x		x							x
Employ local workers	x									x				x									
Core subject: The environment	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sustainable resource use in general		x		x	x	x			x		x	x			x				x	x	x		x
Materials		x							x	x					x		x		x	x	x		x
Energy		x		x	x	x			x	x	x	x			x		x		x	x	x		x
Water		x				x			x	x			x	x	x		x	x			x		
Land use		x			x					x	x	x		x				x			x	x	
Mineral resources																					x		
Prevention of pollution in general			x		x	x			x												x		
Emissions			x			x			x	x	x						x		x		x		x
Effluents and waste		x				x			x	x			x	x					x		x		x
Products and services																				x	x		
Transport					x				x				x					x	x	x	x		
Supplier environmental assessment																					x		x
Contractor environmental assessment																					x		
Environmental grievance mechanisms																							
Precautionary measures (försiktighetsprincipen)																							
Environmentally friendly technologies																			x			x	x
Environmental impact assessment									x						x	x							x
Nuisance		x			x									x									x
Biodiversity		x	x											x							x	x	
climate change mitigation and adoption		x																					x
Restoration of natural habitats														x							x		
Recycling of metals		x								x									x				x
Clean-up potential		x	x																				

Appendix IV. A compilation of the initiatives, guidelines and tools and their content

Table 1: A compilation of the initiatives, guidelines and tools and their content

	Government partnership with business								Business associations and other organizations
	United Nations global compact	ILO Declaration on Fundamental Principles and Rights at Work	The universal declaration of human rights (UN)	United Nations Convention against Corruption	OECD's guidelines for multinational enterprises	Voluntary principles on security and human rights	The extractive industries transparency initiative (EITI). The EITI principles	The mining association of Canada. TSM Guiding principles	International Council on Mining & Metals (ICMM). Sustainable development framework. 10 principles
Core subject: Corporate governance					*X*	*X*	*X*	*X*	*X*
Accountability							X	X	
Transparency							X	X	
Ethical behaviour								X	X
Stakeholder management					X			X	X
Respect for the rule of law					X	X		X	
Respect for international norms of behaviour					X				
Self-regulatory practices and management systems					X			X	X
Disclosure					X		X		
Risk assessment (risk management)					X	X			X
Private security						X			
Public security						X			
Core subject: Fair operating practices	*X*			*X*	*X*				*X*
Anti-corruption	X			X	X				X
Responsible political involvement					X				
Fair competition					X				
Responsible supply chain management					X				
Respect for property rights					X				
Cooperation and alliances									

	Government partnership with business								Business associations and other organizations
	United Nations global compact	ILO Declaration on Fundamental Principles and Rights at Work	The universal declaration of human rights (UN)	United Nations Convention against Corruption	OECD's guidelines for multinational enterprises	Voluntary principles on security and human rights	The extractive industries transparency initiative (EITI). The EITI principles	The mining association of Canada. TSM Guiding principles	International Council on Mining & Metals (ICMM). Sustainable development framework. 10 principles
Market presence									
Indirect economic impact							X		
Procurement practices									
Core subject: Human rights	*X*	*X*	*X*		*X*	*X*		*X*	*X*
Due diligence	X				X				
Non-discrimination	X	X	X		X				X
Freedom of association and collective bargaining	X	X			X	X			
Child labour	X	X			X				X
Forced or compulsory labour	X	X			X				X
Security practices									
Indigenous rights								X	X
Supplier human rights assessment					X				X
Human rights grievance mechanisms			X		X	X			
Civil and political rights			X		X	X		X	X
Economic, social and cultural rights			X			X		X	X
Core subject: Labour practices	*X*		*X*		*X*	*X*		*X*	*X*
Employment					X				
Training and education					X				X
Labour/management relations					X				
Occupational health and safety					X			X	X
Diversity and equal opportunity									
Remuneration			X						X
Equal remuneration for women and men									
Supplier assessment for labour practices					X				X
Labour practices grievance mechanisms									
Provide reasonable notice of changes					X				
Health and safety of our contractors								X	
Disciplinary practices									
Working hours			X						
Management of suppliers and contractors									
Conditions of work and social protection									
Emergency preparedness and response									
Work-life balance									

	Government partnership with business								Business associations and other organizations
	United Nations global compact	ILO Declaration on Fundamental Principles and Rights at Work	The universal declaration of human rights (UN)	United Nations Convention against Corruption	OECD's guidelines for multinational enterprises	Voluntary principles on security and human rights	The extractive industries transparency initiative (EITI). The EITI principles	The mining association of Canada. TSM Guiding principles	International Council on Mining & Metals (ICMM). Sustainable development framework. 10 principles
Product and service labelling					X				
Marketing communications					X				
Consumer privacy (data protection)					X				
Sustainable consumption									
Consumer service, support and complaint and dispute resolution									
Access to essential services									
Customer focus									
Core subject: Society/community involvement and development					*X*		*X*	*X*	*X*
Local communities					X			X	X
Supplier assessment for impacts on society					X				X
Grievance mechanisms for impacts on society									
Education and culture									
Employment creation and skills									
Technology development and access					X				
Wealth and income creation					X		X		
Health									
Social investment									
Employ local workers					X				
Health and safety of communities								X	
Core subject: The environment	*X*				*X*		*X*	*X*	*X*
Sustainable resource use in general					X		X	X	X
Materials					X				
Energy					X				
Water					X				
Land demand									
Prevention of pollution in general					X			X	X
Emissions					X				
Effluents and waste					X				X
Products and services									
Transport									
Supplier environmental assessment					X				X
Environmental grievance mechanisms									

	Government partnership with business								Business associations and other organizations
	United Nations global compact	ILO Declaration on Fundamental Principles and Rights at Work	The universal declaration of human rights (UN)	United Nations Convention against Corruption	OECD's guidelines for multinational enterprises	Voluntary principles on security and human rights	The extractive industries transparency initiative (EITI). The EITI principles	The mining association of Canada. TSM Guiding principles	International Council on Mining & Metals (ICMM). Sustainable development framework. 10 principles
Environmental impact assessment					X				
Emergency preparedness and response									
Biodiversity								X	X
climate change mitigation and adoption									
Restoration of natural habitats									
Recycling of metals					X			X	X

Table 2: A compilation of the initiatives, guidelines and tools and their content

	CSR principles, standards and tools													
	Global reporting Initiative (GRI)	Global reporting Initiative (GRI) Mining and metals supplement	Account Ability (AA 1000)	Social Account-ability (SA 8000)	ISO 14001 Environ-mantal manage-ment systems	ISO 26000	OHSAS 18001	SGE-21. Forética. Ethical and socially responsible management system	UNE 22470 Sustainable mining manage-ment indicators	ISO 50001 Energy manage-ment systems	ISO 9001:2015 Quality manage-ment systems – require-ments	The conflict free gold standard. World gold council.	ISO 31000 Risk manage-ment standard	Carbon Disclosure project (CDP)
Core subject: Corporate governance	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*		*X*	*X*	*X*	*X*	*X*
Accountability			X			X						X	X	
Transparency						X		X						X
Ethical behaviour						X		X						
Stakeholder management	X	X	X	X		X		X				X		
Respect for the rule of law					X	X	X	X		X		X		
Respect for international norms of behaviour					X	X						X		
Self-regulatory practices and management systems			X	X	X	X	X	X		X	X	X	X	X
Disclosure														X
Risk assessment (risk management)				X	X		X				X		X	
Private security														
Public security														
Core subject: Fair operating practices	*X*	*X*				*X*		*X*				*X*		
Anti-corruption	X	X				X		X				X		
Responsible political involvement		X				X						X		
Fair competition	X	X				X		X						
Responsible supply chain management						X								
Respect for property rights						X								
Cooperation and alliances								X						
Core subject: Economic aspects	*X*	*X*							*X*	*X*		*X*		
Economic performance	X	X							X					
Market presence	X	X												
Indirect economic impact	X	X							X					
Procurement practices	X	X							X	X		X		
Core subject: Human rights	*X*	*X*		*X*		*X*		*X*			*X*	*X*		
Due diligence						X						X		
Non-discrimination	X	X		X		X		X			X	X		
Freedom of association and collective bargaining	X	X		X		X		X				X		
Child labour	X	X		X		X		X				X		

	CSR principles, standards and tools													
	Global reporting Initiative (GRI)	Global reporting Initiative (GRI) Mining and metals supplement	Account Ability (AA 1000)	Social Account-ability (SA 8000)	ISO 14001 Environ-mantal manage-ment systems	ISO 26000	OHSAS 18001	SGE-21. Forética. Ethical and socially responsible management system	UNE 22470 Sustainable mining manage-ment indicators	ISO 50001 Energy manage-ment systems	ISO 9001:2015 Quality manage-ment systems – require-ments	The conflict free gold standard. World gold council.	ISO 31000 Risk manage-ment standard	Carbon Disclosure project (CDP)
Indigenous rights	X	X				X								
Supplier human rights assessment	X			X				X						
Human rights grievance mechanisms	X			X		X								
Civil and political rights				X		X								
Economic, social and cultural rights				X		X								
Core subject: Labour practices	*X*	*X*		*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*		
Employment	X	X				X		X	X					
Training and education	X	X		X	X	X	X	X	X	X	X			
Labour/management relations	X	X				X	X	X						
Occupational health and safety	X	X		X		X	X	X	X		X			
Diversity and equal opportunity	X	X						X						
Remuneration				X		X								
Equal remuneration for women and men	X			X										
Supplier assessment for labour practices	X			X				X						
Labour practices grievance mechanisms	X											X		
Provide reasonable notice of changes						X								
Health and safety of our contractors														
Disciplinary practices				X										
Working hours				X		X								
Management of suppliers and contractors				X										
Conditions of work and social protection						X		X						
Emergency preparedness and response					X		X							
Work-life balance						X		X						
Core subject: Product responsibility	*X*	*X*				*X*		*X*			*X*			
Consumer health and safety	X	X				X								
Product and service labelling	X	X				X		X						
Marketing communications	X	X				X		X						
Consumer privacy (data protection)	X	X				X		X						
Sustainable consumption						X								
Consumer service, support and complaint and dispute resolution						X		X			X			

	CSR principles, standards and tools													
	Global reporting Initiative (GRI)	Global reporting Initiative (GRI) Mining and metals supplement	Account Ability (AA 1000)	Social Account-ability (SA 8000)	ISO 14001 Environ-mantal manage-ment systems	ISO 26000	OHSAS 18001	SGE-21. Forética. Ethical and socially responsible management system	UNE 22470 Sustainable mining manage-ment indicators	ISO 50001 Energy manage-ment systems	ISO 9001:2015 Quality manage-ment systems – require-ments	The conflict free gold standard. World gold council.	ISO 31000 Risk manage-ment standard	Carbon Disclosure project (CDP)
Core subject: Society/community involvement and development	*X*	*X*		*X*		*X*		*X*	*X*			*X*		
Local communities	X	X				X		X						
Supplier assessment for impacts on society	X													
Grievance mechanisms for impacts on society	X			X								X		
Education and culture						X								
Employment creation and skills						X								
Technology development and access						X								
Wealth and income creation						X								
Health						X								
Social investment						X								
Employ local workers														
Health and safety of communities														
Core subject: The environment	*X*	*X*		*X*	*X*	*X*		*X*	*X*	*X*		*X*		*X*
Sustainable resource use in general	X	X			X	X			X					
Materials	X	X			X	X								
Energy	X	X			X	X			X	X				
Water	X	X			X	X			X					
Land demand									X					
Prevention of pollution in general	X	X			X	X		X	X					X
Emissions	X	X			X	X			X					X
Effluents and waste	X	X			X	X			X					
Products and services	X	X			X									
Transport	X	X			X									
Supplier environmental assessment	X			X	X			X		X				
Environmental grievance mechanisms	X			X	X							X		
Biodiversity	X	X			X	X								
Climate change mitigation and adoption					X	X		X						X
Restoration of natural habitats						X			X					
Recycling of metals					X									

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TOWARDS SUSTAINABILITY IN NORDIC MINING

The mining industry has a major impact on society – from an economic, environmental and social perspective and due to a vast number of criteria. Which criteria should be given priority depends on where the mining operations take place. The purpose is to examine the Nordic mining industry´s sustainability practice and to develop a guideline for its sustainability efforts. The research methods used in the study include a literature review, a content analysis of sustainability reports, a review of existing sustainability initiatives, guidelines and tools, a stakeholder survey and interviews with mining company officials. Based on the findings, a sustainability criteria guideline is suggested in the areas of corporate governance, fair operating practices, economic aspects, human rights, labour practices, society and the environment.

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