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Wili Helenius

Conflict and extended minerals: Balancing responsibility, risks, and regulatory compliance

– Assessment for a case company working within the automotive industry

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Bachelor’s Thesis | Abstract

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The supply chain of certain minerals, such as conflict and extended minerals, including gold, tantalum, tin, and tungsten, as well as cobalt and mica, respectively, have been associated with various environmental, human health, and social issues in particular. These minerals are often extracted from conflict-prone regions, and in some cases, the revenue generated from their production has been linked to the continuation of conflicts. Various regulations have been introduced to address these issues and regulate the sourcing and supply chains of these minerals.

The objective of this thesis was to assess the potential risks, adverse impacts in the supply chain, production, industrial applications, current and upcoming regulations with their associated obligations, and sourcing practices of conflict and extended minerals for a case company working within the automotive industry. This was done so that appropriate due diligence systems and measures could be implemented.

Through the assessment, it was determined that the company is currently in compliance with existing regulations regarding conflict and extended minerals sourcing. However, due to the upcoming regulations, as well as the risks and impacts associated with conflict and extended minerals, it is recommended that a due diligence system based on OECD guidance should be implemented.

Keywords:

Conflict minerals, Extended minerals, Due diligence, Mineral production, Mineral supply chain, Responsible sourcing of minerals

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List of abbreviations

Abbreviation	Explanation of abbreviation
3TG	The term refers to conflict minerals. The abbreviation is derived from the initial letters of the minerals (tantalum, tin, tungsten and gold).
ASM	Artisanal and Small-Scale Mining
CAHRA(s)	Conflict-Affected and High-Risk Area(s)
CMRT	Conflict Minerals Reporting Template
CRM	Critical Raw Material
CRMA	Critical Raw Materials Act
CSDDD	Corporate Sustainability Due Diligence Directive
DRC	The Democratic Republic of the Congo
EMRT	Extended Minerals Reporting Template
GHG	Greenhouse Gas Emmissions
IMDS	International Material Data System
LSM	Large Scale Mining
OECD	Organisation for Economic Co-operation and Development
RMI	Responsible Minerals Initiative
SEC	U.S. Securities and Exchange Commission
SRM	Strategic Raw Material

1 Introduction

1.1 Background

Throughout history, minerals have played a pivotal role in human development, evolving from their initial applications in tools and fire making, to their current irreplaceable functions in cutting-edge technologies, processes, and diverse applications. The effective utilisation of minerals has been significantly impacted by an understanding of both their capabilities as well as their availability. Due to the projected exponential growth in demand for specific minerals in the near future, it becomes imperative for companies to fully comprehend and take responsibility for the environmental, human health, and social impacts, as well as the inherent risks associated with their mineral supply chains.

This becomes particularly relevant for certain minerals already linked to adverse impacts, such as those commonly knows as conflict or 3TG minerals. These minerals, including tantalum, tin, tungsten, and gold, are often sourced from regions plagued by armed conflicts and human rights abuses. The extraction and trade of conflict minerals have, in some instances, contributed to and perpetuated violence, leading to humanitarian crises and instability in these areas. The international community has also increasingly acknowledged the ethical challenges posed by the use of conflict minerals, demanding regulatory sourcing measures and calls for responsible mineral sourcing practices.

In addition to conflict minerals, there is a category of minerals known as extended minerals, which includes cobalt and mica. Extended minerals are not specifically defined in any regulations and currently lack comprehensive legal sourcing requirements, like to those established for conflict minerals. Nevertheless, the extraction and production of these minerals, especially cobalt, have been found to have similar issues as seen in the conflict minerals supply chains.

1.2 Commissioner, goals, and research questions of the thesis

The objective of this thesis was to assess the potential risks, adverse impacts in the supply chain, production, industrial applications, current and upcoming regulations with their associated obligations, and sourcing practices of conflict and extended minerals within the scope of a product manufacturer in the automotive industry. This examination is conducted with the purpose of enabling the case company to implement appropriate due diligence policies and systems for these minerals.

The research questions aimed at achieving these goals are as follows:

- What are the usual methods utilised in mineral extraction and production?
- What are the primary adverse impacts associated with mineral production?
- Where are conflict and extended minerals typically produced?
- How are conflict regions classified and where are they located?
- What roles do the different participants in the mineral supply chain typically fulfil?
- What are the risks associated with the supply chains of conflict and extended minerals?
- How are the supply chains of conflict and extended minerals typically managed?
- What regulations affects the sourcing and utilisation of conflict and extended minerals, and how do these regulations impact the case company?
- What are the different applications of conflict and extended minerals?

The assessment in this thesis does not encompass all regulations and management systems related to conflict and extended minerals. Instead, the focus is specifically on regulations and systems that are relevant for the case company.

1.3 Sturcture of the thesis and the theoretical framework

The thesis is comprised of eight chapters, each containing several subsections. Figure 1 shows the theoretical framework, aligning with the structure of the thesis and offering a basic overview of the various topics.

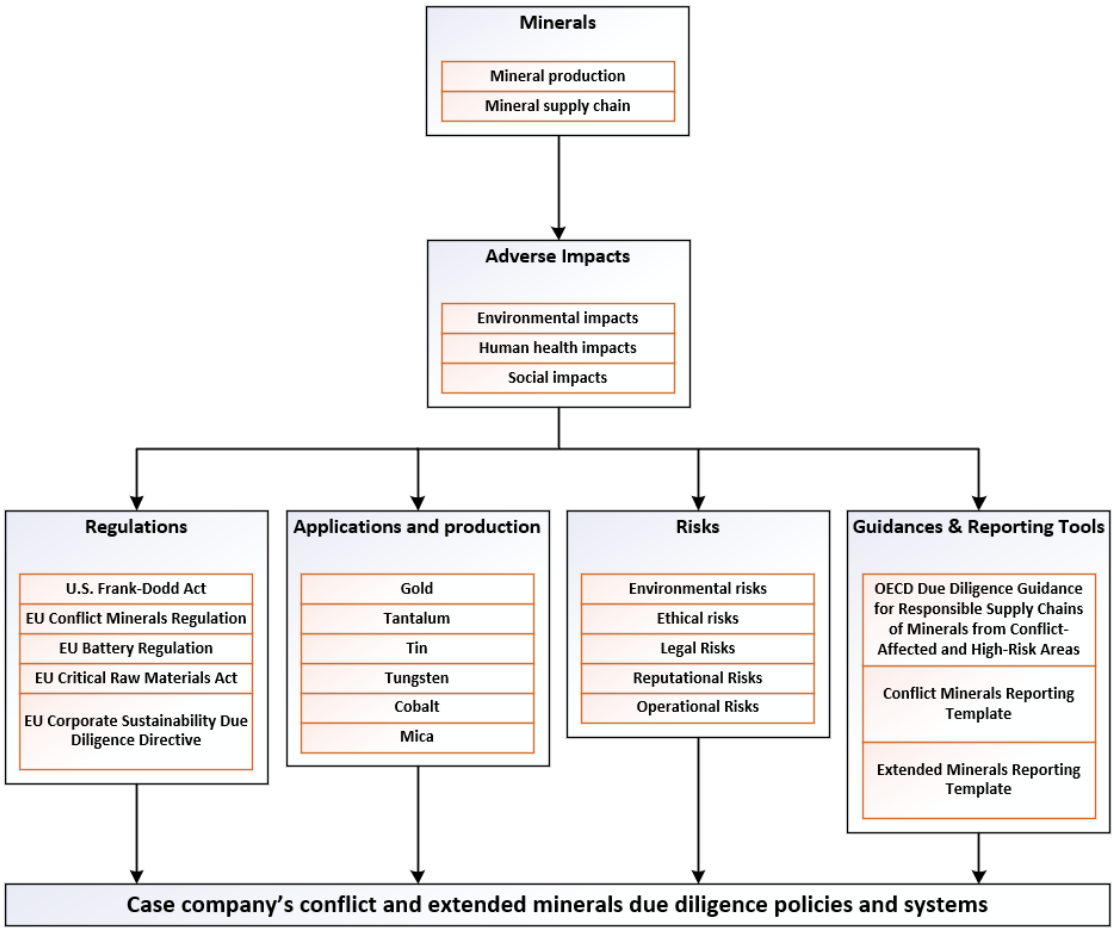

Figure 1. Theoretical framework of the thesis.

The second chapter introduces the fundamentals of mineral production and their supply chain, showing the roles of each participant in the mineral supply chain. Following this, the third chapter explores the environmental, human health, and social impacts caused by mineral production, with a particular focus on the context of extraction of the mineral ores. Subsequent chapters four to seven address the various aspects related to conflict and extended minerals, including regulatory frameworks, applications and production, risks, and management systems and practices.

In the regulations chapter, different obligations and the basics of relevant legislations are introduced, with their implications for the case company. The applications and production chapter discusses the properties and utilisation of conflict and extended minerals, as well as showcases the countries producing these minerals. The risks chapter goes into the different risks associated with conflict and extended minerals and how to address them. Following these chapters, the OECD's industry-standard guidance for sourcing minerals from conflict regions is presented, along with the different mineral reporting templates used to transfer information along the supply chain. The final chapter is the conclusion, where the results of the thesis will be discussed.

1.4 Research methods

The primary sources for this study included a comprehensive literature review covering various reports and guides related to minerals and sustainable practices, as well as regulations concerning conflict and extended minerals. Additionally, references from authoritative sources, news articles, encyclopaedia entries, and published books were utilised. The majority of references were discovered through Google searches, with a few exceptions found from the online library of the Turku University of Applied Sciences. To ensure the most current information on the different topics, sources older than 10 years were mostly excluded.

The selection of keywords for searches played an imortant role in identifying relevant literature. The main keywords and phrases used for searches included: minerals, conflict/extended minerals, impacts caused by mining, mineral supply chains, mineral production, conflict/extended minerals regulations, conflict/extended minerals in the automotive industry, production of conflict/extended minerals, conflict/extended minerals due diligence, and business risks. These keywords were carefully chosen to align with the specific research questions and objectives, contributing to the overall thoroughness of the study.

2 Mineral production and the mineral supply chain

Minerals are naturally occurring, inorganic solid materials formed through geological processes. They are extracted from different kinds of ores which are mined from ore deposits. Minerals are typically chemical compounds, although some minerals can exist in nature uncombined with other chemical elements, such as gold (Britannica, n.d.a).

Each mineral has a distinguished chemical composition and crystalline structure, which together determine its physical and chemical properties. Examples of these properties include colour, density, hardness, tenacity, radioactivity and electrical conductivity. (Aydinalp, 2012, pp. 1-3, 5-6.)

Ores containing minerals require different types of processing before they can be used in various applications, and in many cases, these processes are aimed at extracting the chemical elements or metals that make up the minerals themselves. The minerals are then further processed and refined to prepare them for use in end products. Different minerals and their constituting elements are used for distinct applications based on their properties and availability. (Aydinalp, 2012, p. 13.)

To enable the use of these minerals in different end products, various stakeholders work together and forms the mineral supply chain. This network streamlines the extraction, transformation, and transportation of minerals, resulting in the creation of products for end-users.

In the following subsections, an examination will be conducted on the general methods of mineral production as well as what is the different roles and responsibilities of each participant in the mineral supply chain. Additionally, some of the auditing methods for each stakeholder will be briefly analysed to get a basic understanding on how traceability and accountability are maintained throughout the mineral supply chain.

2.1 Mineral supply chain

In addition to the mining operations and the subsequent refining facilities, the mineral supply chain consists of a diverse array of stakeholders, such as different types of traders, transporters, exporters, storage providers, recyclers, manufacturers and retailers (Figure 2). Each of the stakeholders are important in the conversion of raw minerals into the finished products. These stakeholders are typically categorised as either upstream or downstream entities depending on where they are located within the mineral supply chain. (European Commission, n.d.a.)

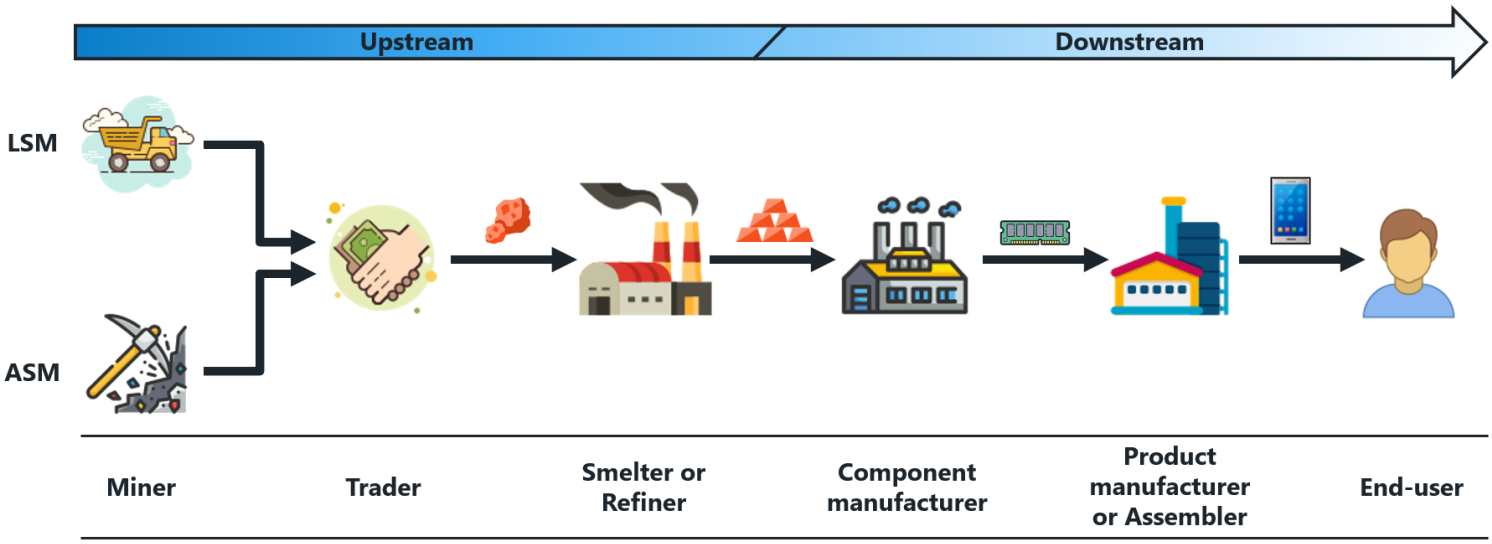

Figure 2. The mineral supply chain actors.

As minerals progress from the upstream to the downstream stakeholders, the crucial information regarding their origins and the involvement of the upstream stakeholders should ideally travel along with them. Some downstream companies may also send inquiries to their immediate upstream suppliers to gain a comprehensive understanding of the supply chain and ensure the ethical and sustainable sourcing of minerals. This exchange of information is typically done by using standardised reporting templates such as the Conflict Minerals Reporting Template (CMRT) and the Extended Minerals Reporting Template (EMRT). These templates will be covered in detail in chapter 7.2 of the thesis.

2.1.1 Upstream

The upstream section of the mineral supply chain begins with miners and concludes at the smelters and refiners. Situated nearest to the raw material source, this segment is often regarded as the most risky, resulting in more thorough auditing and regulations compared to the downstream (European Commission, n.d.a.)

Miners and mining operations

The production of minerals begins with the mining of ores. Miners are the ones responsible for the extraction, making them the most essential actors in the supply chain when ensuring that minerals are responsibly sourced and extracted.

The method of extraction depends heavily on the type of deposit and how deep in the Earth’s crust the deposit is located. Mining is generally classified into two main categories: surface mining and subsurface mining. Surface mining focuses on extracting ores from or near the Earth’s surface using different techniques such as open-pit mining, area strip mining, contour strip mining and hydraulic mining. Sub-surface or deep mining involves extracting ore minerals typically at varying depths beneath the Earth's surface. Usually, this is accomplished by excavating a vertical shaft and subsequently creating horizontal tunnels outwards, extending into the mineral deposit. Sub-surface mining is considered to be more expensive and dangerous compared to surface mining. (Aydinalp, 2012, pp. 12-13.)

Following the mining of ores, various processing methods are used, tailored to the specific minerals being extracted. These processes can take place either at the mining site or at a separate location.

For most minerals, the ores generally undergo crushing and concentration before they are subjected to further processing such as smelting and refining.

The companies and people working in the mining industry are classified into two primary sectors: medium- & large-scale miners (LSM) and artisanal & small-scale miners (ASM).

Medium- and large-scale mining operations are generally conducted by large corporations or companies, utilising advanced technologies to extract minerals from large areas. These technologies include mechanical drills, blasting techniques, heavy machinery, automated systems, and data analytics. The advantages of employing these technologies in mining include high yield and efficiency, as well as safety in mineral extraction. Some downsides are that they require substantial investments, a skilled workforce, and extensive infrastructure.

Artisanal and small-scale mining operations involve the use of simplified methods for exploration, extraction, processing, and transportation of minerals. Miners rely on manual labour and basic tools to extract the minerals. One of the benefits of this approach is that ASM requires much less capital compared to LSM. Typically, ASM operations consist of smaller work groups, often comprising of less than ten workers. In some cases these work groups can also include hundreds or even thousands of miners, and such operations are classified as ASM enterprises. (OECD, 2016, p. 65.)

As ASM operations are generally carried out by an unskilled workforce, the environmental, health and safety practices are typically inadequate. This makes the extraction extremely dangerous both to the miners and nearby communities.

Although the majority of minerals are extracted through LSM operations, the ASM sector has a significantly larger workforce. In 2014 around 30 million people were directly employed in ASM, compared to the 7 million engaged in industrial mining in 2013. (The International Institute for Sustainable Development, 2018, p. IV.)

In 2023 the amount of miners in the artisanal and small-scale sector had risen to be close to 45 million (Pactworld, n.d.).

Evaluating the ethical and environmental practices of LSM and ASM operations is done by audits. These audits are performed by different entities, for example third-party audit firms, governmental regulatory agencies, industry associations, non-govermental organisations, and various certification bodies. (OECD, 2013, p. XII.)

In the case of large-scale mining operations, audits are more feasible, primarily because such operations are managed by well-established and larger companies. For instance, audits in large-scale mining operations can be more comprehensive due to the available resources and infrastructure, and they are also more likely to attract the attention of multiple stakeholders. (OECD, 2013, p. 13)

In contrast, tracking and auditing artisanal and small-scale mining operations presents unique challenges that can make it harder compared to large-scale mining operations. While large-scale mining is typically conducted by well-resourced corporations, ASM operations are often much smaller as well as more informal and independent. These small-scale miners may also lack the financial resources, infrastructure, and access to formal regulatory frameworks that larger companies can afford. As a result, auditing ASM operations can be much more complex and resource-intensive. (OECD, 2013, p. 34.)

Additionally, the sheer number of ASM sites worldwide poses a logistical challenge for audits. The ASM activities are widespread, unlike the large-scale mining operations that are relatively limited in number. This makes it difficult for audit entities to reach and assess each ASM site comprehensively. Moreover, the informal and sometimes secretive or illegal nature of some ASM operation can further complicate the auditing process. Some ASM sites may also operate in remote or politically unstable regions, making access and oversight challenging. (EITI, 2022.)

Traders, transporters, exporters

Within the mineral supply chain, traders, transporters, and exporters hold pivotal roles, serving as the connectors for the various stakeholders and companies.

Their tasks are multifaceted and essential in ensuring responsible mineral sourcing. Traders, in particular, serve as intermediaries responsible for sourcing minerals and verifying their origin, playing an important role in enforcing ethical and environmental standards in the supply chain. Transporters, on the other hand, are responsible for physically moving minerals from mining sites to trading hubs, manufacturers, and, in the case of exports, international destinations.

Auditing procedures are crucial in this section of the supply chain as well. Auditors ensure that traders, transporters, and exporters comply with current standards, with a primary focus on preventing the trade of minerals extracted through environmentally harmful or exploitative methods. Additionally, their efforts aim to restrict the illegal smuggling of minerals. These comprehensive audits typically include interviews with various people along the supply chain, examinations of records related to the minerals, cross-referencing the volume of minerals traded and transported with the amount mined, conducting on-site inspections of the facilities, and verifying transport routes. (OECD, 2013, p. 16-18.)

The information gathered by these stakeholders throughout the supply chain, such as the mining locations and transport routes, is extremely valuable for the downstream companies' due diligence processes. This data ensures that minerals are not associated with illegal or harmful activities, facilitating responsible mineral supply chains. This also provides downstream manufacturers with the assurance of ethically sourced minerals. (OECD, 2013, p. 9.)

Smelters and refiners

Smelters and refiners are considered to be the final upstream actors and they are responsible for refining the ore concentrates, recycled materials and secondary materials from various sources into usable minerals and metal-stage products for the downstream companies.

Smelting involves melting the raw material in furnaces to eliminate impurities from the minerals and through repeated melting cycles, it enhances the purity of the final product. In the case of minerals being extracted from ores, electrowinning and heap leaching are also widely used techniques. In the electrowinning process, ores are initially treated with an acid solution to isolate the desired mineral from the ore. Subsequently, the mineral is extracted from the solution by electroplating it onto a cathode using an electric current. Heap leaching in the other hand involves spraying a cyanide solution onto crushed ores, causing the desired mineral to dissolve and separate from the remaining ore. Following this step the mineral is extracted from the solution. (Aydinalp, 2012, p. 13.)

After the extraction of minerals from the ores, they may undergo additional refining and processing to enhance their purity and quality. Alternatively, minerals can be used in their current state, depending on the specific requirements of the intended end use.

Due to the transformative role of smelters and refiners, they are uniquely positioned to trace the raw material's origin before it is mixed and processed for distribution to the numerous downstream users. Furthermore, smelters and refiners are relatively few in number compared to the amount of upstream suppliers and downstream users. Due to this, smelters and refiners are often referred to as the 'pinch point' of the supply chain. (RMI, n.d.a.)

Smelters and refiners that are not found to be conformant to responsible sourcing standards or do not have adequate due diligence policies in place can pose several risks to the companies utilising the refined minerals produced by them.

Due to the critical role of smelters and refiners, several initiatives have been established to address the challenges associated with their involvement in the mineral supply chain. Notable examples include the Responsible Minerals Assurance Process and the Conflict-Free Smelter Program. These initiatives involve the thorough auditing of smelters and refiners, with a focus on

assessing their management systems, procurement practices, and processing activities. Auditing these is done to ensure the compliance with the established ethical and responsible standards. (RMI, n.d.b.)

2.1.2 Downstream

In the downstream phase of the mineral supply chain, the minerals refined by smelters and refiners are utilised in the production of end-user products. The downstream is considered to begin from the component manufacturers and conclude at the end-users. Furthermore, much like in the upstream phase of the mineral supply chain, the downstream segment may also include a diverse range of traders, transporters, and exporters. Each of these play a role in facilitating the movement of minerals and products within this section of the supply chain. (OECD, 2016, p. 33.)

Component manufacturers

Component manufacturers produce a diverse range of parts and components using minerals sourced from the smelters and refiners. The information concerning the raw materials of the minerals is typically also transferred to the component manufactures by the smelters and refiners. This information is extremely significant as it allows component manufacturers to conduct their sourcing responsibly and transparently. Furthermore, this data is not only essential for maintaining compliance with various regulations, but also for meeting the specific requirements of many customers.

In particular, certain product manufacturers and assemblers may request and thoroughly review the raw material information before establishing business relationships with the component manufacturers. This ensures that the supply chain remains ethical, accountable, and aligned with industry standards.

The products manufactured by component manufacturers come in a diverse range of forms and serve various functions. While the majority of components are typically channeled to product manufacturers, the distribution process can

vary, with some components being directly distributed to retailers and end-users.

Product manufacturer and Assemblers

Product manufacturers use the products made by component manufacturers to produce finished goods or end products. This process often involves assembling various components and materials together into a final product that meets specific design and functionality requirements.

Since the case company does not directly import metal-stage products for their own operations, it falls under the classification of product manufacturers. They engage in assembling various components and materials to create finalised goods or end products.

In the mineral supply chain, multiple product manufacturers may contribute to the creation of a single end product. This is because some manufacturers specialise in producing products or specialised parts for other companies. For instance, in the automotive industry, product manufacturers making battery packs supply their products to companies that produce battery-powered electric vehicles. This highlights the interconnected nature of the manufacturing process. The interconnectedness however might further complicate the transfer of information related to the raw materials.

To address this challenge, various systems have been developed in different industries to help manufacturers and suppliers manage and exchange information about the materials they use. One notable example is the International Material Data System (IMDS), which is widely used in the automotive industry. Component and product manufacturers as well as their suppliers input data about the materials utilised in their products into the IMDS. The data includes information about the composition of the products, including the specific substances used and their concentrations. This valuable data can then be shared with other stakeholders in the supply chain, ensuring an effective way of transferring information. (AIAG, n.d.)

Retailers and End-users

After products have undergone manufacturing and assembly, they make their way to retailers and end-users. Retailers are responsible for distributing the products, while end-users, including both individuals and businesses, are the ultimate consumers of these products.

In the mineral supply chain, retailers and end-users are often the last links in the chain, but they still play a significant role in shaping the industry's common practices. They have the power to influence the market by making informed choices about the products they buy or use based on factors like ethical sourcing of minerals, environmental responsibility, and compliance with regulations. For instance, a socially responsible retailer may choose to only sell products that are made with conflict-free minerals, aligning their business with ethical practices. Similarly, environmentally conscious end-users can impact the ultimate destination of products through choices to engage in recycling and sustainable disposal practices.

End-users also have the potential to impact the mineral sourcing of companies. Through petitions they can exert pressure on regulators to propose new legislative regulations related to minerals, promoting a more responsible and transparent mineral supply chain. (Regulation 2017/821, 2017, p. 2.)

3 Environmental, health, and social impacts of mineral production

Over the past decade, there has been a growing trend for companies to identify environmental and social issues found in their supply chains. The environmental consequences caused by mineral extraction and production are significant, both on a regional and global scale. However, such impacts are particularly visible in areas located at a close proximity to mines and processing and refining facilities.

Mineral production operations can severely affect the surrounding water resources, air, and soil quality, as well as the health of wildlife and ecosystems. These consequences can then in turn impact the well-being of miners and nearby communities. (Environmental Law Alliance Worldwide, 2010, pp. 8-14.)

Mineral production can also give rise to various social consequences, leading to a range of problems including the displacement of local communities, the loss of livelihoods, armed conflicts, and human rights violations. These challenges can be particularly prevalent in the extraction of specific minerals such as conflict minerals. (Environmental Law Alliance Worldwide, 2010, pp. 15-17.)

The potential environmental, human health and social impacts associated with the production of minerals will be analysed in the subsequent subsections. The focus will mainly be on the impacts caused by the extraction, as these impacts are typically the most common to conflict and extended minerals.

3.1 Environmental impacts of mineral production

Impacts on water resources

While certain mining techniques require significant amounts of water and can deplete water resources in an area, mining can also pose additional challenges to nearby water sources. One well-known issue or challenge is acid mine drainage, where materials, such as those from mine walls and waste rocks,

begin reacting with oxygen and water, leading to sulfuric acid being produced. This acid can then dissolve harmful metals and contaminants from the mined materials, resulting in an acidic solution rich in sulfates and metals. The solution may then flow into nearby surface and groundwater sources, contaminating them. (Environmental Law Alliance Worldwide, 2010, p. 11.)

Other impacts include erosion of soil and mine wastes into surface waters. This can have serious short- and long-term issues for the fish and other aquatic life. (Environmental Law Alliance Worldwide, 2010, pp. 12-13.)

By-products of metal extraction, such as the used cyanide solution from heap leaching also need to be disposed of. This is usually done by mixing the waste solution (tailing) with water and letting the slurry dry in a tailing impoundment. Sometimes these impoundments flood due to heavy rain resulting in some of the toxic substances being released into nearby water sources. (Environmental Law Alliance Worldwide, 2010, pp. 6, 10-11.)

Impacts on air quality

Mineral production activities result in the release of airborne emissions, which enter the atmosphere and undergo chemical and physical transformations, ultimately affecting the air quality. Equipment and processes associated with mineral production generate different types of air pollutants, including carbon monoxide, nitrogen oxides, sulfur oxides, particulate matter, and heavy metals. (Environmental Law Alliance Worldwide, 2010, p. 12.)

Impacts on soil

Mining operations have various impacts on landscapes and in soil quality. These projects can leave the land vulnerable to erosion, while the minerals and by-products they generate can cause soil contamination. Soil contamination can be particularly harmful to human health when agricultural activities are close to the mining operation. The amount of harm caused by the contamination depends significantly on the specific ore being extracted. Contamination can occur by several ways, such as windblown dust carrying harmful particles or

chemical spills seeping into the soil. (Environmental Law Alliance Worldwide, 2010, p. 14.)

Impacts on animals and ecosystems

The impacts caused by mineral production on wildlife and biodiversity varies considerably depending on the specific location of the mines and processing or refining facilities. Mineral production impacts the environment and its associated ecosystems by depleting vegetation and topsoil, displacing wildlife, emitting pollutants, producing noise, and causing habitat loss as well as habitat fragmentation. (Environmental Law Alliance Worldwide, 2010, pp. 13-14.)

Habitat loss can occur due to several reasons, including deforestation and the excavation of land areas. Habitat loss is especially common in cases where mining operations are established in areas which were previously untouched. The destruction or modification of habitats can lead to a decline in local wildlife populations, with potential effects for the entire food chain. Additionally, habitat loss is visible in surface water bodies such as rivers, marshes, and lakes when these areas are contamined by mineral production activities. (Environmental Law Alliance Worldwide, 2010, p. 14.)

Habitat fragmentation in the other hand is a process in which a large, continuous habitat is divided into smaller isolated patches. This fragmentation can occur for various reasons, including the development of mines, facilities, and infrastructure. Habitat fragmentation can disrupt migratory routes, contribute to the decline of species, and intensify inbreeding within the isolated areas. (Environmental Law Alliance Worldwide, 2010, p. 14.)

Greenhouse gas emissions

Beyond the more localised impacts discussed earlier, mineral production also causes global environmental impacts in the form of greenhouse gas (GHG) emissions. These emissions are not only caused by the excavation and processing operations but also by the transportation of the minerals. The total greenhouse gas emissions produced from mineral production and mining

industry have been calculated to be around 4 % - 7 % of the worldwide GHG emissions (GlobalData, 2022).

In addition to direct emissions, the amount of carbon dioxide absorbed by vegetation and forests is reduced when they are cleared for mineral production activities. This eventually leads to an increase in carbon dioxide levels in the atmosphere. (Environmental Law Alliance Worldwide, 2010, p. 17.)

3.2 Human health impacts of mineral production

Mineral production significantly impacts human health, not only affecting the workers engaged in extraction and processing, but also the nearby communities living near mining and refining facilities.

For the workers the effects include of course occupational injuries and accidents related to the production and transportation of the minerals. Examples of these are falls, machinery- and explosion-related accidents, cave-ins of mine tunnels, being hit by different objects, and traffic collisions. (Geological Survey of Denmark and Greenland, 2017, pp. 89-90.)

The exposure to pollutants and toxic substances originating from water sources, the air, and the soil is also a prevalent concern. Waterborne pollutants can include bacteria and viruses, particularly when proper sewage management is lacking at mining sites and campsites. The cramped working conditions in some mines can likewise facilitate the spread of these pathogens. (Environmental Law Alliance Worldwide, 2010, p. 17.)

Furthermore, heavy metals, notably mercury, and organic chemicals have the potential to infiltrate water systems. This can lead to severe consequences to people using the water, such as permanent organ and brain damage, miscarriages, and developmental issues for children. Moreover, individuals can be exposed to these contaminants through their diet when consuming contaminated aquatic wildlife or crops irrigated with polluted water. (ASM Ghana 83-84)

Respiratory illnesses and abnormal lung functions are also frequent among miners and nearby communities. This is caused by the exposure to radioactive elements, dust and fine particles resulting from blasting, drilling and processing of the ores. These adverse effects are particularly noticeable in artisanal and small-scale mining operations and their neighboring communities. This is often due to the subpar safety standards and a lack of proper equipment and expertise among miners to mine the ores safely. (The International Institute for Sustainable Development, 2018, p. IV.)

3.3 Social impacts and human right abuses related to mineral production

Mineral production and especially mining operations can have both beneficial and unbeneficial social impacts. Mining projects have the potential to generate employment opportunities, improve infrastructure, and stimulate economic activity in remote regions. However, the projects can also have several different adverse impacts. One of the primary concerns is the displacement of local communities as mining operations expand. Many indigenous and vulnerable populations live in mineral-rich regions, and they are often forced to relocate without proper compensation or consent, resulting in the loss of their land and means of livelihood. This displacement also disrupts their traditional ways of life and access to essential resources like water. (Environmental Law Alliance Worldwide, 2010, p. 15)

Furthermore, the migration of people into or out of mining areas can lead to various challenges related to land use, water access, and resource utilisation. The influx of individuals into a particular area can also strain sanitation and waste disposal systems, making the environmental and public health concerns even worse. (Environmental Law Alliance Worldwide, 2010, pp. 15-16.)

Additionally mining operations can inadvertently lead to the loss of access to clean water and disrupt various economic activities like agriculture and fishing. These consequences can have devastating effects on communities and individuals who depend on these economic activities for their livelihoods. All of

the negative social impacts of mineral production might contribute to conflict situations between different groups suchs, as the miners and local communities. (Environmental Law Alliance Worldwide, 2010, p. 16.)

In addition to these social impacts, mineral production has been associated with numerous human rights abuses against miners and workers. These abuses encompass a range of violations, including violence, forced and child labour, inhumane or degrading treatment, sexual violence, and violations of international humanitarian law. (OECD, 2016, p. 35.)

Some mineral producers and other parties within the mineral supply chain have also been linked with non-state armed groups. These types of connections can take various forms, including armed groups taking control of entire mines, labour forces, transport routes, or actively engaging in the mineral trade themselves to finance the group’s activities. Furthermore, it's common for these armed groups to impose illegal taxes and extort money from mining operations, transport routes, and associated facilities. The increased funding that these armed groups acquire can have severe consequences, potentially leading to an increase of different types of armed conflicts between non-state and state armed groups. These conflicts might range from wars of liberation and insurgencies to civil wars, which all cause regional instability. (OECD, 2016, p. 13.)

Typically, these armed conflicts are multifaceted in nature and can have multiple underlying causes. However, often these conflicts are due to political, ideological, territorial, or even ethnic factors and they may also occur between two or more nongovernmental armed groups. (IMF, 2020, p. 8.)

4 Conflict & extended minerals regulations and their implications

In the modern globalised economy, corporations often operate extensive supply chains that stretch across vast distances. Sometimes these supply chains extend into regions afflicted by violence and human rights abuses. This might lead to companies knowingly or unknowingly contributing to different types of conflicts or to the other impacts that these conflicts may cause. Consequently, various governing bodies have introduced legislation aimed at regulating the sourcing of specific minerals, such as conflict minerals, from regions prone to conflict.

Two key laws addressing responsible supply chains in this context are the Dodd-Frank Act in the United States and the Conflict Minerals Regulation in the European Union. Under the Dodd-Frank Act Section 1502, the regions afflicted by conflict are categorised as Covered Countries, while the Conflict Minerals Regulation designates them as Conflict-affected and high-risk areas. The primary objectives of these legislative measures include addressing human rights issues, enhancing transparency and accountability for companies, increasing consumer awareness, and fostering peace and stability in conflict-prone regions. (Regulation 2017/821, 2017, pp. 1-2.)

In addition to these two regulations, there are several other laws that significantly impact the sourcing of conflict and extended minerals. Depending on the specific legislation and the region in question, the legislative measures can either apply to all of the actors in the supply chain or only to a certain portion. Understanding these regulations and their implications is critical for each participant in the supply chain to ensure compliance and also to comprehend the requirements of the previous and next participants in the supply chain.

The following subsections will provide a comprehensive analysis of both existing and upcoming conflict and extended minerals legislations relevant to

the case company as well as their implications. While Some regulations have extensive obligations spanning a wide range of aspects, the main focus of the analysis will be on the obligations related to the sourcing of conflict and extended minerals as well as the subsequent due diligence policies and mandates related to them.

4.1 Dodd-Frank Act: Title XV, Section 1502

The regulation in general

The Dodd-Frank Wall Street Reform and Consumer Protection Act, was passed into law in the US on July 21, 2010, as a direct response to the global financial crisis of 2007-2008. The legislation sought to achieve several key objectives, including enhancing financial stability, promoting transparency and accountability, safeguarding consumer interests, as well as introducing vital reforms in the mortgage and regulatory landscapes across various industries. (Ballotpedia, n.d.)

The Act itself consisted of 16 distinct titles, each directed at specific aspects of financial regulations and reforms across different systems and federal laws. The titles were further divided into smaller sections, providing more detailed regulations related to the broader topics covered by each title. While most of the Act's primary focus was to reform the financial industry, it also included regulations that addressed a range of social and environmental concerns. (Dodd-Frank Wall Street Reform and Consumer Protection Act, 2022, pp. 1-12.)

Notably, within the Dodd-Frank Act, Title XV, Section 1502 emerged as the first major legal framework to grapple with the issues associated with conflict minerals. This section was introduced in response to the recognition that publicly-listed U.S. companies were contributing to some conflicts by sourcing conflict minerals from conflict-affected regions, officially known as Covered Countries in the Act. As a result, the U.S. Congress decided to regulate the sourcing and use of conflict minerals by incorporating the Dodd-Frank Act's Section 1502 into the Securities Exchange Act of 1934, thus making the

Securities and Exchange Commission (SEC) the agency responsible for overseeing and enforcing this regulation. (Dodd-Frank Wall Street Reform and Consumer Protection Act, 2022, p. 370.)

In the context of Section 1502, conflict minerals were specified as columbite-tantalite, cassiterite, gold, wolframite, or any of their derivatives as well as any other mineral that is determined by the SEC to be financing conflicts in the Covered Countries. (Dodd-Frank Wall Street Reform and Consumer Protection Act, 2022, p. 375.)

Section 1502 mandates that companies with influence over the manufacturing of products containing conflict minerals must trace the origin and supply chain of the conflict minerals. This involves determining whether these minerals are sourced from the Covered Countries. If conflict minerals originate from these regions, companies must also investigate whether the sourcing methods directly or indirectly contribute to the financing of armed conflicts, human rights abuses, or violence. Furthermore, these companies are required to take steps to mitigate any identified risks and to disclose their findings and efforts through annual reports submitted to the SEC. (SEC, 2017)

Penalties for providing false or misleading statements in filed documents are not specified in Section 1502. However, under Section 18(a) of the Securities Exchange Act of 1934, companies that make false or misleading statements in documents filed with the SEC can be held liable in legal cases or may face fines. (Securities Exchange Act of 1934, 2022, pp. 285-286)

Approximately 6 000 U.S. based companies are affected by Section 1502 of the Dodd-Frank Act. (Source Intelligence, 2022.)

U.S. the Dodd-Frank Act Section 1502: Covered countries

The Dodd-Frank Act Section 1502 designates a total of ten countries as conflict regions, consisting of the Democratic Republic of the Congo (DRC) and its neighboring nations: Angola, Burundi, the Central African Republic, the Republic of the Congo, Rwanda, South Sudan, Tanzania, Uganda and Zambia.

These countries are situated in the Middle and Eastern subregions of Africa (Image 1).

Image 1. Covered Countries specified by the Dodd-Frank Act, section 1502.

Conflict has long plagued these subregions, with ongoing issues predating the 2000s. Although there has been a reduction in reported conflicts, the decline hasn't been as significant as in the other parts of Africa. Population displacement has been one of the major driving factors in some of the reported conflicts. (IMF, 2020, pp. 8-9.)

These conflicts have also had an effect on the economic growth of the Covered Countries, all of which are classified as low-income countries by the International Monetary Fund (IMF), except for Angola, the Republic of the Congo, and Zambia, which fall into the middle-income category. (IMF, 2023a, p. VI.)

Additionally, sometimes the resources found in these countries have been a significant driver of the violence and conflicts and in fact, conflicts have been reported to be more common in the resource-rich countries when compared to non-resource-intensive nations. (IMF, 2020, p. 7.)

Implications for the case company

As the case company has US-based companies as customers that fall under the scope of the regulation, the case company has to be able to provide information related to the origin of the conflict minerals contained within the supplied products. This means that the case company needs to have a system that determines where these are being sourced from. If these minerals are confirmed to be sourced from scrap, recycled materials, or any location outside the Covered Countries, no additional information is needed to be disclosed for the US-based company's reporting process. (SEC, 2017.)

In cases where there is suspicion or confirmation that conflict minerals are being sourced from Covered Countries, the US-based company is obligated to take due diligence measures to trace the source and chain of custody of these minerals. These due diligence measures should be based on a nationally or internationally recognised due diligence framework. Additionally, the company must assess whether the conflict minerals in their supply chain are used to finance or benefit armed groups. The results of the due diligence measures also need to be verified before they are sent to the SEC by an independent private sector auditor. This is done to ensure that the results are reliable and that the due diligence measures are conformant with the used due diligence framework. (SEC, 2017.)

The US-based company might mandate the case company to further help with the due diligence measures and provide additional information about the minerals, depending on the terms of the supply or manufacturing contract. This often involves disclosing the names and locations of the smelters and refiners in the supplier's supply chain, along with the origin of the minerals by using minerals reporting templates. (Ford, n.d.)

Summary of the regulation

Table 1. Summary of the Dodd-Frank Act, section 1502.

The Dodd-Frank Wall Street Reform and Consumer Protection Act, Title XV, Section 1502	
Region/Country:	The United States of America
Signed into law:	July 21, 2010
Overseeing agency:	The U.S. Securities and Exchange Commission (SEC)
Affected companies:	Publicly-listed US companies who have influence over the production of the product and contains any amount of conflict minerals.
Requirements:	Affected companies need to determine the source of their conflict minerals and possibly conduct due diligence measures as well as fill in Conflict Minerals Reports. Findings need to be reported to the SEC.
Target minerals:	Columbite-tantalite, cassiterite, gold, wolframite, or any of their derivaties as well as any other mineral that is determined by the SEC to be financing conflicts in the 'Covered Countries'.
Target region:	Covered Countries (Angola, Burundi, Central African Republic, Democratic Republic of the Congo, Republic of the Congo, Rwanda, South Sudan, Tanzania, Uganda, Zambia).
Penalties:	Companies can be subject to penalties under Section 18(a) of the United States Securities Exchange Act of 1934 for making false or misleading statements in documents filed with the SEC.

4.2 EU Conflict Minerals Regulation (EU 2017/821)

The regulation in general

As the issues of conflict minerals began to be more widely documented and reported on, the European Parliament urged the European Commission in October 2010 to begin developing a framework for a conflict mineral regulation in the EU, similar to the one in Section 1502 of the Dodd-Frank Act. (European Commission, 2014.)

After more than five years of development the EU Conflict Minerals Regulation, officially known as Regulation (EU) 2017/821, was finally approved by the European Commission and the EU's member states in November 2016. (European Commission, 2016.)

The regulation came into force on May 17, 2017, however the obligations outlined in the regulation were not enforced until January 1, 2021. The regulation consists of 20 different articles. These articles state that all union importers of conflict minerals are obligated to perform due diligence measures based on the framework set out by the Organisation for Economic Co-operation and Development's (OECD's) 'Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas'. Companies sourcing conflict minerals from conflict regions, or as they are officially termed in the regulation, conflict-affected and high-risk areas, are subject to more thorough due diligence measures. These companies need to provide additional information when reporting their due diligence results, such as the location of sites where the minerals were extracted, as well as the actors involved with the trading and processing of the minerals. These companies also have to address the issues found to be linked to armed conflicts and labour rights. (Regulation 2017/821, 2017, pp. 5, 7-8.)

Article 10 of the regulation specifies that each member state is responsible for designating the authorities in charge of enforcing and overseeing the regulation. (Regulation 2017/821, 2017, p. 12.)

Annex I of the regulation lists the minerals and metals categorised as conflict minerals and their import thresholds. Minerals in this context refer to ores and concentrates containing tin, tantalum, tungsten, or gold, while metals include various metal products containing these minerals. (Regulation 2017/821, 2017, pp. 17-18.)

The term 'union importers' includes both all of the upstream companies within the mineral supply chain and downstream companies importing metal-stage products, referring to component manufacturers who process metals into

finished products. While downstream companies operating beyond the metal-stage are not obligated by the regulation to conduct due diligence, they are strongly encouraged to do so in order to enhance transparency and promote sustainable mineral supply chains. (European Commission, n.d.a.)

Penalties for non-compliance with the regulation's mandated obligations can vary significantly, as they are not outlined within the regulation itself. Instead, it is the responsibility of designated authorities in the member states to determine and enforce penalties for companies found to be in violation of these obligations. (Regulation 2017/821, 2017, pp. 14-15.)

An estimated 600 to 1 000 importers and 500 smelters and refiners fall under the scope of the EU Conflict Minerals Regulation. (European Commission, n.d.a.)

EU Conflict Minerals Regulation: Conflict-affected and high-risk areas

The EU’s Conflict Mineral Regulation is more extensive when it comes to the categorisation of conflict-affected regions, compared to the U.S. Dodd-Frank Act, as it considers areas worldwide. The EU defines the Conflict-affected and high-risk areas (CAHRAs) as “areas in a state of armed conflict or fragile post-conflict as well as areas witnessing weak or non-existent governance and security, such as failed states, and widespread and systematic violations of international law, including human rights abuses” (Regulation 2017/821, 2017, p. 6).

The CAHRA list is updated regularly based on developing situations by RAND Europe, which is a non-profit research institute. Unlike the Dodd-Frank Act’s Covered Countries, conflict-affected and high-risk areas represent specific regions within countries rather than encompassing entire nations. These regions are further categorised as either 'Conflict-affected' or 'High-risk’. Typically, conflict-affected regions are experiencing or have a history of armed conflicts. In high-risk areas there are risks to the safety and security of individuals due to armed conflicts, but these risks can also be caused by various other factors such as crime and natural disasters.

In total there are 285 conflict-affected and high-risk areas distributed across 28 different countries. The countries with identified conflict-affected or high-risk areas include Afghanistan, Burkina Faso, Burundi, Cameroon, the Central African Republic, Chad, Colombia, the Democratic Republic of the Congo, Egypt, Eritrea, Ethiopia, India, Libya, Mali, Mozambique, Myanmar, Niger, Nigeria, Pakistan, the Philippines, Somalia, South Sudan, Sudan, Türkiye, Ukraine, Venezuela, Yemen and Zimbabwe. Most of the countries on the CAHRA list include both conflict-affected and high-risk areas or consist only of conflict-affected regions. Exceptions to this pattern are Burundi, Eritrea, Libya, Venezuela, and Zimbabwe, which consist solely of high-risk areas. (List of conflict-affected and high-risk areas, 2023.)

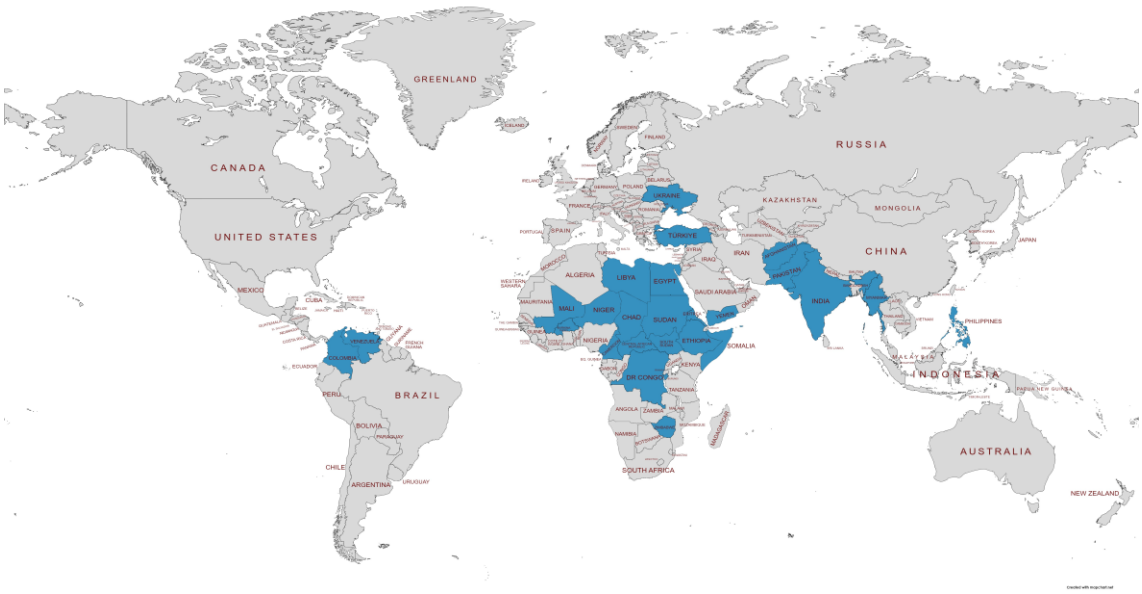

Image 2. Conflict-affected and high-risk areas as of September 2023.

Most of the CAHRA countries are located in Africa, followed by Asia and South America (Image 2). A common theme among a majority of the CAHRA countries is that they are categorised as low-income countries (IMF, 2023b).

Implications for the case company

Most of the EU Conflict Minerals Regulation's requirements for the Union importers and their due diligence policies are detailed in articles 4-7 of the

regulations and are based on the five-step framework outlined in the OECD's guidance on minerals sourced from CAHRAs. This involves establishing a management system for conflict minerals, identifying and assessing risks in the supply chain, designing and implementing a strategy to respond to the identified risks, carrying out third-party audits of the due diligence practices, and reporting annually the results of the due diligence measures. (Regulation 2017/821, 2017, pp. 7-10.)

A detailed description of the OECD's due diligence framework is found in chapter 7.1 of this thesis.

The case company is categorised as a product manufacturer and only buys products beyond the metal-stage and thus falls outside the scope of the regulations. However, it is still recommended for the company to establish a conflict minerals management system for conducting due diligence, as it assembles products containg conflict minerals.

Summary of the regulation

Table 2. Summary of the EU 2017/821 regulation.

EU Conflict Minerals Regulation (Regulation (EU) 2017/821)	
Region/Country:	EU
Signed into law:	May 17, 2017
Overseeing agency:	Each member state has its own enforcing authority.
Affected companies:	EU-based companies that import conflict minerals over the threshold amounts specified by the regulation.
Requirements:	Union importers of conflict minerals are obligated to perform due diligence measures based on the framework set out by the OECD. Companies sourcing conflict minerals from conflict-affected and high risk areas are mandated to more rigorous due diligence measures.
Target minerals:	Minerals: Ores and concentrates containing tin, tantalum, tungsten, or gold. Metals: Various different metals and compounds containing tin, tantalum, tungsten, or gold.
Target region:	Every country, special obligations for conflict-affected and high-risk areas.
Penalties:	Designated authorities in each member state determines and enforces penalties for companies found to be in violation of the regulation.

4.3 EU Battery Regulation (EU 2023/1542)

The regulation in general

In order to achieve the goals outlined in the EU's 'The European Green Deal' initiative, which aims to address climate change, environmental degradation, and sustainable development, the European Commission introduced a proposal in December 2020 regarding the production and distribution of various types of batteries. The Commission's proposal involved revising the EU's existing 2006 Batteries Directive and introducing several new provisions concerning raw material sourcing, battery production, recycling, and repurposing. The proposal was agreed upon by the European Parliament and the Council in December 2022. (European Commission, 2022.)

The regulation, officially known as Regulation (EU) 2023/1542, came into force on August 2023. It consists of 14 chapters, each containing various articles addressing different aspects of battery manufacturing. These include design requirements, end-of-life management, traceability and information, and due diligence policies. The regulation is planned to be introduced in several phases over a five-year period, starting on 18 February 2024. (Kącki, n.d.)

Most of the design requirements for batteries are listed in chapter two of the regulation. They are mostly related to restricted substances, carbon footprint, recycled content, performance and durability, removability and replaceability, and the safety of stationary battery energy storage systems. (Regulation 2023/1542, 2023, pp. 30-37.)

End-of-life management aspects of batteries are detailed in chapter eight with the aim of increasing recycling and material recovery targets. The chapter also imposes several obligations on the different actors in the battery supply chain for example to the manufacturers, distributors, treatment facility operators, end-users and even Member States. (Regulation 2023/1542, 2023, pp. 55-72.)

Provisions for traceability and information related to newly produced batteries are outlined in chapters three and nine. These provisions are mainly describing

the obligations of manufacturers needing to label the battery to indicate different information. The information includes type of battery in question, markings if the battery contains lead or cadmium, as well as a QR code for the newly adopted battery passport introduced also in the regulation. The battery passport includes all the relevant information related to the battery, for example, the composition, contact details of sources for replacement parts, dismantling information, and safety measures. (Regulation 2023/1542, 2023, pp. 37-39, 72-74 108-109.)

Due diligence policies for battery raw materials such as cobalt, natural graphite, lithium and nickel are specified in chapter seven of the regulation and they are similar to the ones in the EU Conflict Minerals Regulation. Affected companies are obligated to set up a raw material management system, assess and manage risks, audit their due diligence policies by a third-party, and disclose their due diligence results. The due diligence obligations are mandatory from 18 August, 2025, onward. (Regulation 2023/1542, 2023, pp. 51-55.)

These regulations and requirements apply to all economic operators in the battery market meaning manufacturers, producers, distributors, and importers of batteries placed within the EU market. (Arhold et al., 2023.)

An exception to this are the due diligence policies and provisions, which do not apply to businesses with a net turnover of less than 40 million euros or to businesses that are part of a group whose annual turnover doesn’t exceed 40 million euros. (Regulation 2023/1542, 2023, p. 51.)

Specific penalties for violations of the regulation are not specified, however the regulation states that each Member State is responsible for enforcing the rules and provisions of the legislation. (Regulation 2023/1542, 2023, p. 81.)

Implications for the case company

As the case company operates within the battery market and has a turnover of more than 40 million euros, it is subjected to the due diligence requirements set out by the regulations as described in the previous section for the various battery raw materials.

Summary of the regulation

Table 3. Summary of the EU 2023/1542 regulation.

EU Battery Regulation (Regulation (EU) 2023/1542) due diligence obligations	
Region/Country:	EU
Signed into law:	August 17, 2023
Overseeing agency:	Each member state has its own enforcing authority.
Affected companies:	All economic operators (manufacturers, producers, distributers, and importers). Due diligence obligations for target minerals are not mandatory to businesses with a net turnover of less than 40 million euros or to businesses which are part of a larger group which net turnover is less than 40 million euros.
Requirements:	Various requirements addressing different aspects of battery manufacturing, such as design requirements, end of life management, traceability and information, and due diligence policies. Due diligence policies should be based on a internationally recognised due diligence framework.
Target minerals:	Cobalt, natural graphite, lithium, nickel and chemical compounds that includes these elements and are used for the manufacturing of the active materials of batteries.
Target region:	Every country, special obligations for conflict-affected and high-risk areas.
Penalties:	Designated authorities in each member state determines and enforces penalties for companies found to be in violation of the regulation.

4.4 EU Critical Raw Materials Act

The regulation in general

In 2011 the EU began publishing a list of critical raw materials (CRMs), which contains specific minerals and metals that are both essential to the EU's economy due to their pivotal role in a wide range of technologies and industries as well as subject to a high risk of supply disruptions. Risks related to the supply can be affected by several reasons, suchs as high demand, limited sources and reserves, as well as different types of geopolitical factors and crises. (European Commission, n.d.b.)

Most of the critical raw materials are primarily sourced from outside the EU. With the disruptions in supply chains caused by the COVID-19 crisis and the war in Ukraine, and in anticipation of an increase in demand for many of these materials, the European Commission proposed the 'Critical Raw Materials Act'

(CRMA) in March 2023. The act was proposed to address some of the supply risks associated with these materials. The draft of the legislation was agreed upon by the Members of the European Parliament on September 2023. The date when the act would pass into law wasn't agreed upon as further negotiations would be needed to finalise the legislation. (European Parliament, 2023a.)

The most recent critical raw materials list was also published in the annex of the act's proposal and it also introduced the term 'strategic raw materials' (SRMs). SRMs refers to materials that are essential for strategic technologies used for the green, digital, defense and space applications (Table 4). The list contained a total of 34 raw materials, with 32 classified as CRMs, among which 15 were also categorised as SRMs, while copper and nickel were exlusively classified as SRMs. (Grohol & Veeh, 2023, p. 3.)

Table 4. List of critical and strategic raw materials for the EU in 2023.

Fifth edition (2023) of the EU's critical and strategic raw materials			
Aluminium/Bauxite	**Copper***	**Lithium**	Scandium
Arsenic	Feldspar	**Magnesium**	**Silicon metal**
Baryte	Fluorspar	**Manganese**	Strontium
Antimony	**Gallium**	**Natural Graphite**	Tantalum
Beryllium	**Germanium**	**Nickel***	**Titanium metal**
Bismuth	Hafnium	Niobium	**Tungsten**
Boron/Borate	**Heavy rare earth elements**	Phosphate Rock	Vanadium
Cobalt	Helium	Phosphorus	
Coking Coal	**Light rare earth elements**	**Platinum group metals**	

The act itself consists of 47 articles within 10 separate chapters and its primary objective is to guarantee a stable and environmentally sustainable supply of CRMs and SRMs to the EU. This is achieved through four objectives, which are outlined in the first chapter: strengthening the self-sufficiency of SRMs in the EU, diversifying the sourcing of SRMs, improving the EU's ability to oversee and mitigate potential CRMs supply disruptions, and facilitating the unobstructed movement of CRMs within the internal market of the EU while

maintaining a strong level of environmental protection. (Critical Raw Materials Act Proposal, 2023, pp. 1-2)

Strengthening the self-reliance of SRMs will be done by setting targets that need to be achieved by the year 2030 (Figure 3). These targets are related to increasing the utilisation of Member States own mineral deposits as well as the processing and recycling capacities in the EU. In practice, this will be done by conducting more mineral surveys, expanding accessible information about mineral occurrences, streamlining the permitting procedures for CRMs projects, implementating programs to advance the technological maturity of recycling and processing methods and technologies, and ramping up the collection of waste containing CRMs especially permanent magnets. (Critical Raw Materials Act Proposal, 2023, pp. 17-18, 26-30 ,38-40.)

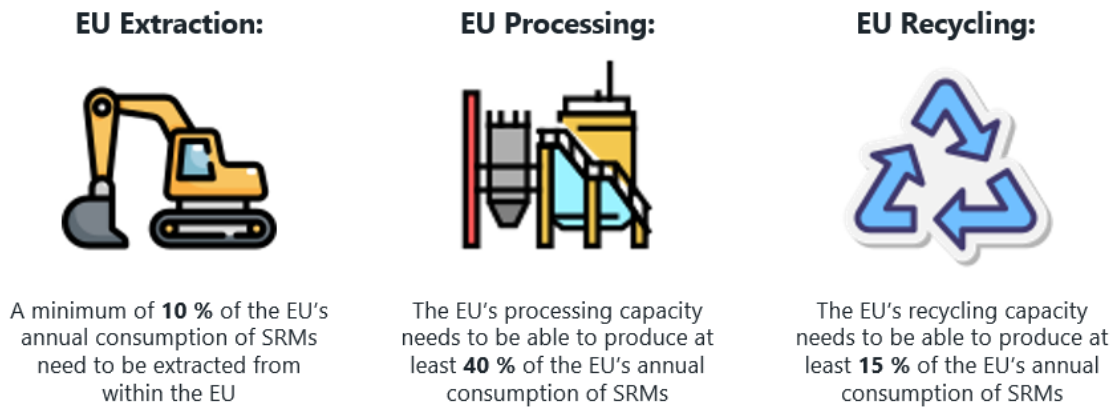

Figure 3. EU 2023 targets regarding strategic raw materials.

Diversifying the sources of SRMs is undertaken to mitigate the risks associated with supply disruptions that may arise from relying on a single country for sourcing. To tackle this issue, the Critical Raw Materials Act proposes that by the year 2030, the supply from a single country of any SRMs shouldn't exceed over 65 % of the EU's annual consumption. This will be handled partly by the first objective as well as by analysing the amount of sourced raw materials from each country and increasing the amount of strategic partnerships if needed for materials exceeding the limit. (Critical Raw Materials Act Proposal, 2023, pp. 17-18, 50-51.)

To oversee and mitigate the supply disruptions, the Commission proposed that the EU should have a monitoring system. This system would track trade flows, demand and supply, concentration of supply, as well as the production and production capacities within the Union and globally at various points along the CRMs value chains. In addition to these, designated authorities should perform stress tests on the different strategic raw materials to evaluate the EU's supply chain's vulnerability to various scenarios that might cause supply disruptions. Stress tests need to be also done every other year by companies that manufacture strategic technologies, employing more than 500 employees, and with a worldwide turnover of more than 150 million euros. (Critical Raw Materials Act Proposal, 2023, pp. 18-22, 33-34, 37.)

To ensure the unobstructed movement of critical raw materials and products containing them in the EU, while maintaining a strong commitment to environmental protection, the act specifies that responsible operators must assess and disclose the environmental footprint of their products and materials before placing them on the market. This way the customers can make informed decisions about the products they decide to buy. The act additionally dictates that Member States shall not obstruct or restrict the distribution or availability of products and materials on the market that are compliant with the regulation. (Critical Raw Materials Act Proposal, 2023, pp. 46-50.)

The enforcement of the regulation and penalties for infringements are delegated to the authorities appointed by each Member State (Critical Raw Materials Act Proposal, 2023, pp. 56-57).

Implications for the case company:

The act is mostly meant to address the issues on an EU and member state level rather than specifying obligations for companies. Exceptions to this are the evaluations of the environmental footprint of products as well as the stress tests needed to be done by large companies manufacturing strategic technologies, including batteries for e-mobility (Critical Raw Materials Act Proposal, 2023, p. 37).

Based on these criteria, the case company would also be mandated to perform the stress tests. While the act doesn't directly state any obligations to sourcing critical and strategic raw materials, the goals set out by the act can affect the prices and availability of CRMs and SRMs in the EU, thus causing operational risks.

Summary of the regulation

Table 5. Summary of the EU Critical Raw Materials Act proposal.

EU Critical Raw Materials Act Proposal	
Region/Country:	EU
Signed into law:	Pending
Overseeing agency:	Each member state has its own enforcing authority
Affected companies:	Companies that manufacture strategic technologies employing more than 500 employees and with a worldwide turnovers of more than 150 million euros
Requirements:	Various requirements on an EU and member state level such as increasing the extraction, processing, and recycling capacities of SRMs within the EU. Affected companies are obligated to perform biennial stress tests for the different SRMs to evaluate the companys supply chain's vulnerability to various scenarios.
Target minerals:	Critical and strategic raw materials
Target region:	Every country outside of the EU
Penalties:	Designated authorities in each member state determines and enforces penalties for companies found to be in violation of the regulation.

4.5 EU Corporate Sustainability Due Diligence Directive

The regulation in general

Corporate responsibility has become a widely accepted concept, meaning that companies should be accountable for their actions and effects regardless of where these actions and effects take place in their value chains. In response to this, the European Commission proposed 'The Corporate Sustainability Due Diligence Directive' (CSDDD) in early 2022. The proposal was done to address companies' responsibility for due diligence practices as well as the issues related to human rights abuses and environmental harm throughout their global value chains, including the value chains of all types of minerals and raw

materials. The European Parliament agreed upon its stance regarding the legislation in June 2023 and the directive is expected to come into force in some point of 2024 or 2025. (Bloemen et al., 2023)

What the directive requires companies to do is to integrate due diligence policies, identify actual and potential adverse environmental and social impacts caused by their operations, prevent the identified negative impacts, establish and maintain a complaints procedure, monitor the effectiveness of the due diligence policies as well as publically disclose the due diligence policy measures and results. (Corporate Sustainability Due Diligence Directive Proposal, 2022, p. 53.)

The due diligence policies should include an explanation of the company's approach to due diligence and a code of conduct of the common practices and principles that the company's employees and subsidiaries are expected to adhere to (Corporate Sustainability Due Diligence Directive Proposal, 2022, p. 54).

Prevention or mitigation of the identified adverse impacts should be done with a prevention action plan, detailing the timelines for prevention actions as well as qualitative and quantitative parameters for measuring the effectiveness of the actions. The company also has to ensure that there are necessary funds available to implement the planned measures. If the impacts have already resulted in harm to individuals or communities, the company might be liable to compensate for the damage. Commercial relations with companies linked to identified adverse impacts need to be thoroughly evaluated. In cases where adverse impacts cannot be prevented or mitigated, the relationship should be either suspended or terminated, depending on the severity of the adverse impact. (Corporate Sustainability Due Diligence Directive Proposal, 2022, pp. 55-57.)

The directive mandates companies to create an effective complaint procedure, allowing individuals and communities to voice concerns regarding the adverse impacts caused by the company's operations. This ensures that well-founded

complaints can be appropriately addressed (Corporate Sustainability Due Diligence Directive Proposal, 2022, p. 58).

Each aspect of the due diligence policies and measures also needs to be monitored so that they can be assessed periodically and improved upon based on the assessments. The results of the assessment, policies and measures need to be disclosed annually on the company's website to ensure compliancy with the regulation. (Corporate Sustainability Due Diligence Directive Proposal, 2022, pp. 58-59.)

The companies affected by the directive include EU-based companies with more than 500 employees on average and a worldwide turnover exceeding 150 million euros. In addition to this, EU-based companies with more than 250 employees and a turnover of more than 40 million euros are obligated to be compliant with the regulation, if they are operating within high-impact sectors and receive half of their net turnover from these operations. High-impact sectors are a wide range of industries that are often linked to adverse environmental and social impacts. These sectors include the textile industry, mineral extraction and production, agriculture, forestry, fisheries, the manufacture of food products, and the wholesale trade of agricultural raw materials. (Corporate Sustainability Due Diligence Directive Proposal, 2022, pp. 46-47.)

Like with the rest of the EU's regulations, the enforcement of the regulation is left to the authorities of each member state (Corporate Sustainability Due Diligence Directive Proposal, 2022, pp. 60-61).

Penalties for non-compliance with the regulation may include a fine of at least 5% of the company's net worldwide turnover and the withdrawal of the company's products from the market. (European Parliament, 2023b)

Implications for the case company

The directive explicitly states that in addition to the due diligence measures specified in the Conflict Minerals Regulation to ensure conflict-free gold, tantalum, tin and tungsten sourcing, large companies also need to address the

adverse climate and environmental impacts related to these and all other minerals (Corporate Sustainability Due Diligence Directive Proposal, 2022, p. 6).

As the case company is classified as a large company, the value chains of every material in the case company's products need to be evaluated, and adequate social and environmental due diligence policies and systems need to be implemented based on the evaluations. Results of the systems need to be also disclosed annually. Inadequate policies can lead to the company having to pay the fines defined in the regulations or compensations to parties negatively affected by the case company's operations.

Summary of the regulation

Table 6. Summary of the EU Corporate Due Diligence Directive proposal.

EU Corporate Due Diligence Directive Proposal	
Region/Country:	EU
Signed into law:	Pending
Overseeing agency:	Each member state has its own enforcing authority.
Affected companies:	EU-based companies with more than 500 employees on average and a worldwide turnover exceeding 150 million euros. In addition to this, EU-based companies with more than 250 employees with a turnover of more than 40 million euros are obligated to be compliant to the regulation, if they are operating within high-impact sectors and receive half of their net turnover from these operations.
Requirements:	Integrate due diligence policies, identify actual and potential adverse environmental and social impacts caused by companies' operations, prevent the identified impacts, establish and maintain a complaints procedure, monitor the effectiveness of the due diligence policies as well as publically disclose the due diligence policy measures and results.
Target minerals:	All minerals.
Target region:	Every country.
Penalties:	Penalties for non-compliance with the regulation may include a fine of at least 5% of the company's net worldwide turnover and the withdrawal of the company's products from the market. Compensations to parties affected negatively by the case company's operations may also need to be paid.

5 Applications and production of conflict & extended minerals

Conflict and extended minerals have unique chemical and physical properties, which is why they are used for a wide range of applications and industries. Most of them are extracted and produced in various countries, with the exception of tungsten and cobalt, whose production is highly concentrated in specific countries.

A noticeable portion of the conflict minerals are extracted by artisanal and small-scale mining operations. This makes it easier for non-state armed groups and other entities to exploit the miners and their minerals. (The International Institute for Sustainable Development, 2018, p. VI)

The upcoming subsections will analyse the characteristics of conflict and extended minerals in order to clarify why these minerals are so crucial for many different applications. Additionally, the occurrence and global production of these minerals will be presented to provide a comprehensive understanding of their distribution and the countries involved in their production.

5.1 Gold

Characteristics

Gold is an element classified under the transition metals group, denoted by the symbol Au and possessing an atomic number of 79. Golds most prominent attribute is its inertness, which renders it highly resistant to chemical reactions and interactions with other elements or solutions. (Kalpakjian & Schmid, 2014, p. 164.)

In addition to its inertness, gold has several extraordinary physical attributes that make it a preferred choice for countless applications. Gold is known for its remarkable softness, malleability, and ductility, making it easy to shape and manipulate. With a density of 19 300 kg/m³, it surpasses almost all other metals

in this regard, all while maintaining a relatively high melting point of approximately 1 050 °C. Gold also excels as an exceptional conductor of both electricity and heat. Furthermore, it showcases a high level of reflectivity, particularly within the infrared region of the electromagnetic spectrum. (Britannica, n.d.b.)

Applications

Gold's non-reactive nature makes it an excellent choice for environments prone to chemical reactions or oxidation, remaining stable and reliable. The infrared reflectivity is utilised to control the temperature of satellites and spacecrafts. (Britannica, n.d.b.)

Its high electrical conductivity on the other hand is a critical factor in its use in electronic components like connectors, printed circuit boards, and semiconductors, ensuring efficient and reliable electrical connections. These are also the most common applications for gold in passenger vehicles. (Drive Sustainability et al., 2018, p. 20)

Additionally, gold's visual allure, ease of shaping into intricate designs, and resistance to tarnish and corrosion make it a important material for jewelry, accounting for 47% of its consumption. Another significant portion, at 36%, takes the form of bullion, which includes gold coins and bars, serving as a trusted form of investment, store of value, and a universally recognised currency. (USGS, 2023, p. 81.)

Occurrence & production

Gold is widely distributed in nature and can be found in various locations, often occurring alongside minerals containing zinc, copper, nickel, and platinum. It can also occur in its pure form, uncombined with other chemical elements. (Nassar et al., 2015, p. 3.)

Table 7. Global production of gold in 2021-2022 (USGS, 2023, p. 81).

Top gold producing countries in 2021 and 2022 (in metric tons)					
	Production			Reserves	
Country	2021 (t)	2022 (t, %)*		2022 (t, %)	
Australia	315	320	10,4 %	8 400	16,3 %
Brazil	61	60	1,9 %	2 400	4,7 %
Burkina Faso	**67**	**70**	**2,3 %**	**NA**	
Canada	223	220	7,1 %	2 300	4,5 %
China	329	330	10,7 %	1 900	3,7 %
Colombia	**55**	**60**	**1,9 %**	**NA**	
Ghana	88	90	2,9 %	1 000	1,9 %
Indonesia	66*	70	2,3 %	2 600	5,0 %
Kazakhstan	116*	120	3,9 %	1 000	1,9 %
Mali	**51***	**50**	**1,6 %**	**800**	**1,6 %**
Mexico	120*	120	3,9 %	1 400	2,7 %
Papua New Guinea	54*	50	1,6 %	1 100	2,1 %
Peru	97*	100	3,2 %	2 900	5,6 %
Russia	320	320	10,4 %	6 800	13,2 %
South Africa	107*	110	3,6 %	5 000	9,7 %
Sudan	**50**	**50**	**1,6 %**	**NA**	
Tanzania	**60**	**60**	**1,9 %**	**NA**	
United States	187	170	5,5 %	3 000	5,8 %
Uzbekistan	100	100	3,2 %	1 800	3,5 %
Other countries	626	620	20,1 %	9 200	17,8 %
Global total production	3092	3090		51 600	

* = Estimated

In 2022, the worldwide gold production amounted to approximately 3 090 metric tons, with an estimated 9% originating from either the Covered Countries or CAHRA countries, as seen in bold in Table 7. It's worth noting that this percentage might potentially be higher, considering that certain conflict-affected regions could be encompassed within the broader category of other countries. The largest proven reserves of gold are currently in Australia, Russia and South Africa.

Roughly 20% of the world's gold supply originates from artisanal and small-scale mining operations (The International Institute for Sustainable Development, 2018, p. VI).

5.2 Tantalum

Characteristics

Tantalum, symbolised as Ta and occupying position 73 on the periodic table within the transition metals group, is distinguished by its impressive resistance to corrosion, particularly at temperatures below 150 °C. This property renders tantalum virtually impervious to chemical reactions, even in harsh environments. (Kalpakjian & Schmid, 2014, p. 162.)

Tantalum possesses several noteworthy physical attributes. It is renowned for its strength and durability, making it ideal for applications where mechanical reliability is crucial. Additionally, tantalum is among the densest naturally occurring elements, with a density of 16 600 kg/m³, which significantly contributes to its stability in the most extreme conditions. Moreover, tantalum exhibits an incredibly high melting point of around 3 000°C, allowing it to withstand elevated temperatures without degradation. Tantalum's ability to conduct both electricity and heat efficiently makes it invaluable in electronics and thermal management systems. (Britannica, n.d.c.)

Applications

Tantalum plays a pivotal role in many industries and is designated as a critical raw material by the EU due to its substantial economic significance in diverse manufacturing sectors (Grohol & Veeh, 2023, p. 3).

Its resistance to corrosion makes it an ideal choice for demanding environments, particularly in situations where materials must withstand harsh chemical conditions, such as within chemical processing facilities. Tantalum's high melting point also makes it a perfect fit for a range of thermal applications, including jet engines, gas turbines, heat exchangers, and furnaces. Additionally, its strength and durability make tantalum invaluable for boring and cutting tools. (USGS, 2023, p. 174.)

One of the most noteworthy applications of tantalum is in electrolytic capacitors, which find widespread use in electronic devices and systems across various domains. These include consumer electronics, automotive electronics, aerospace, defense applications, industrial equipment, and power supplies. Overall, tantalum capacitors are favored in applications where reliability, stability, and small form factors are crucial. (EE Power, n.d.)

Tantalum's versatility extends to its use in different alloys, where it enhances strength and impact toughness while reducing the transition temperature when incorporated into steel. (Kalpakjian & Schmid, 2014, p. 136.)

Occurrence & production

Tantalum's primary source is the columbite-tantalite ore, commonly known as coltan, which contains varying amounts of tantalum and niobium. Although this ore is found across the globe, the predominant suppliers are currently Brazil and multiple African nations.

Table 8. Global production of tantalum in 2021-2022 (USGS, 2023, p. 175).

Top tantalum producing countries in 2021 and 2022 (in metric tons)					
	Production			Reserves	
Country	2021 (t)	2022 (t, %)*		2022 (t, %)	
Australia	44	57	2,9 %	99 000	31,0 %
Bolivia	1	1	0,1 %	NA	
Brazil	360*	370	18,5 %	40 000	12,5 %
Burundi	**39**	**39**	**2,0 %**	**180 000**	**56,4 %**
China	76*	78	3,9 %	NA	
The Democratic Republic of the Congo	**790**	**860**	**43,0 %**	**NA**	
Ethiopia	**32**	**24**	**1,2 %**	**NA**	
Mozambique	**37**	**34**	**1,7 %**	**NA**	
Nigera	**110**	**110**	**5,5 %**	**NA**	
Russia	39*	39	2,0 %	NA	
Rwanda	**269**	**350**	**17,5 %**	**NA**	
Uganda	**38**	**38**	**1,9 %**	**NA**	
Global total production	1 835	2 000		319 000	

* = Estimated

In 2022, global tantalum production reached approximately 2 000 metric tons, with an overwhelming 70% originating from conflict-affected nations, primarily

driven by the production in The Democratic Republic of the Congo (Table 8). The most substantial, confirmed reserves are currently found in Burundi, Australia, and Brazil.

Approximately 26 % of the tantalum produced globally is sourced from artisanal and small-scale mining operations. (The International Institute for Sustainable Development, 2018, p. VI)

5.3 Tin

Characteristics

Tin, an essential element of the post-transition metals group, is represented by the chemical symbol Sn and has an atomic number of 50. A noteworthy chemical trait of tin lies in its propensity to undergo oxidation, rapidly forming a protective oxide layer when exposed to atmospheric conditions. This quality renders tin exceptionally resistant to corrosion. Moreover, tin is renowned for its malleability and ductility, granting it the versatility to be effortlessly shaped into a wide variety of products. Furthermore, it features a relatively modest melting point of approximately 230°C and conducts electricity decently. (Britannica, n.d.d.)

Applications

Tin stands out as a remarkably versatile metal with a broad spectrum of applications. Among its many uses, tin plays a vital role in the creation of certain chemicals and chemical products. (Grohol & Veeh, 2023, p. 76)

Tin's corrosion resistance, particularly in the presence of moisture and oxygen, makes it an excellent choice for coating steel, preventing it from rusting and extending its lifespan. This protective layer, known as tin plating, is important in the production of food packaging and various types of containers. Moreover, tin serves as a valuable alloying element for a variety of metals and metal alloys, including titanium, zirconium, and bronze. Tin alloys are commonly employed as materials for journal bearings. (Kalpakjian & Schmid, 2014, pp. 163-164.)

In the automotive industry, tin is extensively utilised, particularly for soldering applications throughout a passenger vehicle, as well as for lead-acid batteries (Drive Sustainability et al., 2018, p. 20).

Occurrence & production

Cassiterite, a mineral ore comprising tin dioxide, serves as the primary source of tin, although tin is also produced as a by-product of copper and zinc production. Cassiterite is abundant on a global scale, underscoring tin's status as the most widely produced conflict mineral. (Britannica, n.d.d; Nassar et al., 2015, p. 3.)

Table 9. Global production of tin in 2021-2022 (USGS, 2023, p. 183).

Top tin producing countries in 2021 and 2022 (in metric tons)					
	Production			Reserves	
Country	2021 (t)	2022 (t, %)*		2022 (t, %)	
Australia	8 772	9 700	3,1 %	570 000	12,3 %
Bolivia	19 628	18 000	5,7 %	400 000	8,7 %
Brazil	15 517	18 000	5,7 %	420 000	9,1 %
China	90 000*	95 000	30,2 %	720 000	15,6 %
The Democratic Republic of the Congo	**16 700***	**20 000**	**6,4 %**	**130 000**	**2,8 %**
Indonesia	70 000*	74 000	23,5 %	800 000	17,3 %
Laos	1 980*	1 900	0,6 %	NA	
Malaysia	36 900*	31 000	9,9 %	NA	
Myanmar	**5 000**	**5 000**	**1,6 %**	**700 000**	**15,1 %**
Nigeria	**1 600***	**1 700**	**0,5 %**	**NA**	
Peru	26 995	29 000	9,2 %	130 000	2,8 %
Russia	3 000	2 700	0,9 %	430 000	9,3 %
Rwanda	**2 000***	**2 200**	**0,7 %**	**NA**	
Vietnam	5 400*	5 200	1,7 %	11 000	0,2 %
Other countries	1 180	1 100	0,3 %	310 000	6,7 %
Global total production	304 672	314 500		4 621 000	

* = Estimated

Approximately 315 000 metric tons of tin were produced globally in 2022 (Table 9). Around 67% of this output was from Asian countries, while a relatively modest 9% was found to be originating from conflict-affected regions. The most substantial verified tin reserves are presently concentrated in Indonesia, China, and Myanmar.

A noteworthy 25 % of the total tin production was contributed by the artisanal and small-scale sector, showcasing the many sources of this vital resource (The International Institute for Sustainable Development, 2018, p. VI).

5.4 Tungsten

Characteristics

Tungsten, positioned within the transition metals group and symbolised as W with an atomic number of 74, has a distinctive set of chemical and physical characteristics that make it useful for a diverse range of applications. Tungsten is known for its chemical stability and corrosion resistance, even in the most challenging environments. (Corrosion Source, n.d.)

Beyond its chemical properties, tungsten showcases impressive physical attributes. Its extraordinary density, at 19 300 kg/m³, ranks it among the densest naturally occurring elements, providing substantial stability and strength for various structural applications. Tungsten also claims the title for the highest melting point (~ 3 400°C) among all the metals, in addition to its exceptional hardness and tensile strength. (Kalpakjian & Schmid, 2014, p. 162.)

Applications

Tungsten's properties render it an invaluable material across a wide spectrum of manufacturing sectors, which is why tungsten is classified as both a critical and strategic raw material by the EU (Grohol & Veeh, 2023, p. 3).

With its remarkable density, tungsten is often used in the creation of balancing weights and counterbalances for diverse mechanical systems (Kalpakjian & Schmid, 2014, p. 162).

Furthermore, tungsten is a crucial alloying element for several alloys, with tungsten carbide standing out as one of the hardest materials known to date. This hardness plays a pivotal role in the production of cutting and milling tools,

which are indispensable in industries such as construction, metalworking, mining, and oil and gas drilling. (Dymet Alloys, n.d.)

In the automotive industry, tungsten finds applications in the production of components, including crankshafts, bearings, ball joints, brakes, and the chassis (Drive Sustainability et al., 2018, p. 20).

Tungsten alloys play a vital role in high-temperature applications, serving as essential components in various products and systems. They are employed in circuit breakers and nozzle throat liners for missile and rocket engines. Additionally, a variety of electrodes including those for spark plugs, welding, and electrical discharge machining, utilise tungsten alloys. Moreover, in steel alloys tungsten is used as an alloying element to improve the tensile strength at elevated temperatures as well as the hardness. (Kalpakjian & Schmid, 2014, p. 162.)

Occurrence & production

The most significant source of tungsten is extracted from the mineral wolframite, which frequently contains varying concentrations of tungsten along with other elements.

Table 10. Global production of tungsten in 2021-2022 (USGS, 2023, p. 189).

Top tungsten producing countries in 2021 and 2022 (in metric tons)					
	Production			Reserves	
Country	2021 (t)	2022 (t, %)*		2022 (t, %)	
Austria	900*	900	1,1 %	10 000	0,3 %
Bolivia	1 563	1 400	1,7 %	NA	
China	71 000*	71 000	84,4 %	1 800 000	47,8 %
Portugal	502	500	0,6 %	3 100	0,1 %
Russia	2 300*	2 300	2,7 %	400 000	10,6 %
Rwanda	**1 340***	**1 100**	**1,3 %**	**NA**	
Spain	400*	700	0,8 %	56 000	1,5 %
Vietnam	4 800	4 800	5,7 %	100 000	2,7 %
Other countries	973	1 400	1,7 %	1 400 000	37,1 %
Global total production	83 778	84 100		3 769 100	

* = Estimated

In 2022, the worldwide production of tungsten reached approximately 84 000 metric tons, with China clearly dominating the market, accounting for nearly 85 % of the total output (Table 10). Vietnam followed as the second-largest producer contributing around 5 %. This shows Asia's commanding position in the world's tungsten supply chain, with over 90 % of global production concentrated on the continent. China also holds the most extensive proven tungsten reserves, followed by Russia and Vietnam. Only about 1 % of the globally produced tungsten originates from conflict regions, making it the least produced conflict mineral by percentage in such regions.

5.5 Cobalt

Characteristics

Cobalt, represented by the chemical symbol Co belongs to the transition metal group with the atomic number 27. Like the other transition metals, it resists corrosion quite well, making it suitable for several different applications (CK-12, 2019).

From a physical perspective, cobalt possesses ductility and a degree of malleability, enabling its use in the production of various typs of wires and sheets. Additionally, cobalt boasts a relatively high melting point of around 1 500 °C, allowing it to withstand elevated temperatures without undergoing degradation. One of the most distinctive features of cobalt is its magnetic properties, as it exhibits ferromagnetism at room temperature. This unique attribute is shared by only two other metals, iron and nickel. (Britannica, n.d.e.)

Applications

Cobalt, much like tungsten, is listed as a critical and strategic raw material as it is used in several key manufacturing sectors in the EU (Grohol & Veeh, 2023, p. 3).

Among its many applications, cobalt's prominent role has surged in the production of lithium-ion batteries, driven by its remarkable capacity and outstanding electrochemical performance (Enuh, 2022).

In addition to being applied in lithium-ion batteries for electric vehicles, cobalt is sometimes used in the speakers and microphones within passenger vehicles. Additionally, it is commonly found in tires to improve the bond between rubber and steel. (Drive Sustainability et al., 2018, p. 20.)

Cobalt's magnetic properties contribute to its utilisation for various permanent magnets, like samarium-cobalt magnets. These magnets are essential components in high-performance motors, machinery, pumps, medical devices, and other equipment serving the automotive, aerospace, medical, military, and industrial automation industries. (Integrated Magnets, n.d.)

Cobalt is also used as an alloying element for steel to increase its resistance to wear, corrosion and heat. (Diehl Steel, n.d.)

Moreover, cobalt finds use in the production of superalloys, which excel in high-stress, high-temperature environments. These superalloys are integral components in applications such as jet engines and gas turbines, where performance under extreme conditions is needed. (Kalpakjian & Schmid, 2014, p. 162.)

Occurrence & production

While cobalt ores like cobaltite, erythrite, glaucodot, and skutterudite exist, the majority of cobalt is produced as a by-product of copper, nickel, and platinum extraction. (Britannica, n.d.e; Nassar et al., 2015, pp. 2-3.)

The Democratic Republic of the Congo holds the dominant position in global cobalt production, contributing around 70% to the annual total of approximately 185 000 metric tons. Almost half of the world’s proven cobalt reserves can also be found in the DRC (Table 11).

Table 11. Global production of cobalt in 2021-2022 (USGS, 2023, p. 61).

Top cobolt producing countries in 2021 and 2022 (in metric tons)					
	Production			Reserves	
Country	2021 (t)	2022 (t, %)*		2022 (t, %)	
Australia	5 295	5 900	3,2 %	1 500 000	18,0 %
Canada	4 361	3 900	2,1 %	220 000	2,6 %
China	2 200*	2 200	1,2 %	140 000	1,7 %
The Democratic Republic of the Congo	**119 000***	**130 000**	**70,1 %**	**4 000 000**	**47,9 %**
Cuba	4 000*	3 800	2,0 %	500 000	6,0 %
Indonesia	2 700*	10 000	5,4 %	600 000	7,2 %
Madagascar	2 800*	3 000	1,6 %	100 000	1,2 %
Morocco	2 300*	2 300	1,2 %	13 000	0,2 %
Papua New Guinea	2 953	3 000	1,6 %	47 000	0,6 %
Philippines	**3 600***	**3 800**	**2,0 %**	**260 000**	**3,1 %**
Russia	8 000*	8 900	4,8 %	250 000	3,0 %
Turkey	**2 400***	**2 700**	**1,5 %**	**36 000**	**0,4 %**
United States	650*	800	0,4 %	69 000	0,8 %
Other countries	4 567	5 200	2,8 %	610 000	7,3 %
Global total production	164 826	185 500		8 345 000	

* = Estimated

It's worth noting that while the DRC is the primary source of cobalt, many of its mines are owned or financed by Chinese enterprises. Additionally, a significant portion, around two-thirds, of the extracted cobalt undergoes processing in China. These dynamics position China as a pivotal player in the global cobalt supply chain, a role it has assumed due to the significant growth, and continued expansion, of the electric vehicle and consumer electronics markets. (Baumann-Pauly, 2023, pp. 5-6.)

5.6 Mica

Characteristics

In contrast to conflict minerals and cobalt, mica does not represent an individual chemical element, instead, it is a subgroup of silicate minerals. In total there are 37 separate mica minerals (Minerals Education Coalition, n.d).

Mica minerals are made up of distinct layers, which allows them to be easily split into thin, flexible sheets or flakes. They are also known for their

transparency in thin sheets, heat resistance, electrical insulating capabilities, and resistance to chemical reactions. These qualities render mica minerals highly versatile across a wide range of applications. Mica minerals exist in different types, each with unique compositions and colors. (Britannica, n.d.f.)

Applications

Mica finds a wide range of applications across various industries owing to its unique properties. One prominent use of mica is as an insulator in electrical and electronic equipment due to its exceptional dielectric strength, which enables it to withstand high voltage and heat. In construction, mica is employed as a reinforcement material in plaster and cement to enhance their strength and durability. It also finds applications as a pigment extender in the field of paint production. (Minerals Education Coalition, n.d.)

In addition to the electrical components containing mica minerals, they are utilised in the automotive industry for several parts and applications, such as brake shoes and linings, screws, switches, valves, clutch pads and different types of sensors. Mica is also employed in automotive paints and coatings to impart a pearlescent visual finish to a car’s paint layer. (Responsible Mica Initiative, n.d.)

Occurrence & production

Among the mica minerals, the most prevalent include muscovite, biotite, phlogopite, and paragonite, each possessing distinct characteristics and applications. (Britannica, n.d.f).

Most of the world's mica is produced as scrap or flakes, while sheet mica, amounting to around 1 000 metric tons annually, is primarily produced in India. The most substantial proven reserves of sheet mica are also located in India. (USGS, 2023, p. 119.)

Table 12. Global production of mica in 2021-2022 (USGS, 2023, p. 119).

Top mica scrap and flake producing countries in 2021 and 2022 (in metric tons)					
	Production			Reserves	
Country	2021 (t)	2022 (t, %)*		2022 (t, %)	
Canada	15 000	16 000	4,1 %	NA	
China	100 000	100 000	25,9 %	NA	
Finland	55 900	60 000	15,5 %	NA	
France	19 000	19 000	4,9 %	NA	
India	**16 000**	**16 000**	**4,1 %**	**NA**	
Madagascar	70 000	65 000	16,8 %	NA	
Republic of Korea	11 000	13 000	3,4 %	11 000 000	94,7 %
Turkey	**1 670**	**1 700**	**0,4 %**	**620 000**	**5,3 %**
United States	40 600	42 000	10,9 %	NA	
Other countries	55 000	54 000	14,0 %	NA	
Global total production	384 170	386 700		11 620 000	

* = Estimated

Mica minerals for scrap and flake mica are extensively distributed and extracted on a global scale, with the largest confirmed reserves located in the Republic of Korea. Mica minerals are rarely mined in conflict regions, accounting for just approximately 5% of the annual production. However, it's important to note that, similar to the gold production, some of the countries categorised as ‘other countries’ may be conflict-affected countries. This means that the actual mica production within conflict areas could potentially surpass the 5% figure (Table 12).

6 Risks related to conflict & extended mineral supply chains

As conflict and extended minerals are being sourced from around the world to meet consumer demand, companies must identify, understand, assess, and react to the various risks associated with these materials. The risks can encompass a diverse range, including legal obligations, ethical considerations, potential damage to reputation, operational challenges, and environmental impacts associated with the extraction of these minerals. All of these risks highlight the multifaceted challenges faced by companies in managing conflict and extended minerals within their supply chains. Many of these risks are also interconnected, meaning that addressing or neglecting one may have implications for others. For instance, ethical considerations may impact a company's reputation, while compliance with regulations may involve operational adjustments. Understanding these interconnections is crucial for implementing effective and integrated risk management strategies that ensure both compliance with regulations and sustainability.

The subsequent subsections will delve into an analysis of the most crucial risks associated with conflict and extended minerals. The aim of this examination is to provide an understanding of the various challenges faced by companies involved with conflict and extended minerals. Moreover, practical measures on how to effectively address and manage these risks will be discussed.

6.1 Environmental and ethical risks

Companies operating within the conflict and extended minerals supply chain, have several different environmental and ethical risks that must be carefully assessed and managed to ensure responsible and sustainable business practices. The most significant environmental and ethical risks are due to the impacts caused by the mineral production activities, as described in the third chapter of this thesis.

The environmental impacts can have severe and long-lasting consequences on the ecosystems, soil, air, and water sources of a certain area, causing issues not only for the local communities but also for the flora and fauna. Sourcing minerals from uncertified sources can increase the likelihood of these risks and promote unsustainable mining practices.

In addition to environmental risks, companies sourcing conflict and extended minerals from conflict-affected regions risk perpetuating conflicts. Furthermore, these minerals may be procured under inadequate labour standards, unsafe working conditions, or even involve the exploitation of child or forced labour. Such practices not only pose a substantial threat to a company's reputation but also raises ethical concerns related to social responsibility and sustainable business practices. (Business for Social Responsibility, 2014, p. 4.)

To mitigate these risks, companies should prioritise responsible sourcing practices, engage in due diligence to trace the origin of minerals, and ensure compliance with regulations. Certification programs such as the Responsible Minerals Initiative (RMI) which promotes sustainable and ethical mining practices can also provide companies with guidance on responsible mineral sourcing. Implementing comprehensive environmental impact assessments and adopting transparent reporting mechanisms are essential steps towards minimising the ecological footprint and ethical risks of the conflict and extended minerals supply chain. These types of actions aligns companies with ethical and sustainable business practices which also contributes to the broader global efforts aimed at preserving the environment and fostering a more sustainable future. (Business for Social Responsibility, 2014, p. 15.)

6.2 Legal and compliance risks

As discussed in the fourth chapter of this thesis, the legal obligations of companies working with conflict and extended minerals can be extensive. Depending on the specific situation, companies might be obligated to develop different kinds of due diligence policies outlining the conflict and extended

minerals' management systems and the common practices for the company. If these due diligence measures are found to be inadequate, the company can be liable for a wide range of penalties, such as fines, as well as compensation for damage, and in some instances, legal cases. Non-compliant products can also be pulled from the market, which can lead to considerable financial losses. In addition to the direct legal consequences, non-compliance with conflict and extended minerals' regulations may trigger regulatory investigations, further worsening the legal challenges faced by the organisation. It is imperative for companies to proactively address these legal obligations, continually reassess their due diligence policies, and stay up-to date with the evolving regulatory frameworks. This is done to ensure conformity with the legal obligations as well as to mitigate the associated risks to their operations.

Other legal risks and consequences may arise if the company breaches customer contracts, specifically regarding terms related to conflict and extended minerals. These contractual terms may encompass critical aspects such as sourcing or due diligence policies and a breach of these terms can prompt legal action to be initiated by the customer.

Legal risks and penalties extend beyond direct financial implications, often also posing a threat to the company's reputation and brand image, resulting in indirect losses. For businesses, the implementation of a robust legal risk management system is imperative. This system plays a vital role in proactively identifying, assessing, and mitigating these risks, ensuring not only legal compliance but also the preservation of the company's reputation and brand. (Vaidya, n.d.)

6.3 Reputational risks

A company's reputation and brand image are two of the most important aspects of conducting business and they have a significant influence on the company's success in the marketplace. A positive reputation can provide a competitive advantage and it is built over time through consistent delivery of high-quality

products or services, ethical business practices, and positive interactions with customers, employees, and the broader community.

As dealing with conflict and extended minerals have inherent environmental, ethical and legal risks, if a company is reported to be linked to any of these risks, it can negatively affect the company’s reputation. Organisations monitoring and reporting on the compliance of companies with regulations or policies related to these minerals can also influence the reputation of a company.

A damaged reputation can have many consequences, affecting customer loyalty, investor confidence, and relationships with different stakeholders. The negative publicity can create an image of unreliability, affecting the opinion of both existing and potential clients. Moreover, the ripple effect of a tarnished reputation can extend beyond financial losses, impacting the company's ability to attract highly skilled professionals. Therefore, companies must not only focus on legal compliance but also prioritise sustainable and responsible practices and transparent communication to ensure their standing in the market and maintain the trust of their stakeholders.

6.4 Operational risks

Conflict and extended minerals introduce operational risks, many of which are directly linked to the previously mentioned risks. A clear example of this can be in the form of financial losses caused by reputational damage leading to a loss of customers or due to fines. Other financial losses can also be a result of increased costs due to the need to create a due diligence policies and a management system for conflict and extended minerals.

In addition to financial losses, supply disruptions of these minerals can profoundly impact a company's operations. Such disruptions may arise from various factors, including geopolitical instability and conflicts, trade restrictions, logistics delays, natural disasters, depletion of reserves, or changes in the market. (Zignify, n.d.)

Moreover, supply disruptions, sourcing issues, and increased costs can result from new regulations affecting companies' sourcing policies. As many of the conflict and extended minerals are mandated to be sourced from recycled materials in the future by different regulations, such as the Critical Raw Materials Act, the price of conflict and extended raw minerals might increase. There is a possibility of this balancing eventually, when the recycling methods and processes are streamlined and optimised, becoming part of the industry's standard way of conducting business. However, if the price for these raw minerals continues to be uneconomical, companies will most likely have to replace these minerals with alternative materials or increase the price of their own products.

Other operational issues and risks associated with conflict and extended minerals are related to their traceability and supplier relationships. As global supply chains are extremely complex, reliable information about the origin of the minerals can be hard to find. Companies need to realistically evaluate the information they are provided by their suppliers. It is crucial to identify suppliers that are providing falsified information about their raw material sources or suppliers that are sourcing conflict and extended minerals from conflict-affected regions and are linked to conflicts. These situations might lead to the company needing to change suppliers which could result in production disruptions, increased costs, and potential challenges in maintaining product quality and consistency. In the automotive industry the change of a supplier could possibly mean that several different tests are required such as crash tests when the new supplier's products are introduced to the production of vehicles and also for certain car parts.

Creating a conflict and extended minerals management system with clearly defined common practices for different scenarios can help to mitigate some of the operational risks.

7 Managing responsible conflict and extended mineral supply chains

To address the various issues related to conflict and extended minerals and to promote responsible mineral sourcing, several standards and guidelines have been developed. Notable among them is the OECD's Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas. In addition to these types of guidances, some initiatives have developed different types of standardised reporting templates to allow companies an easy way to transfer the information regarding minerals within the supply chains.

In the following subsections, the OECD's guidance for minerals sourced from CAHRAs will be introduced, focusing on the recommendations and instructions that are relevant for the case company. Additionally, the reporting templates developed by the Responsible Minerals Initiative for conflict and extended minerals will be examined to gain a better understanding of the type of information included in them.

7.1 OECD Guidance on minerals sourced from CAHRAs

The OECD's Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas is a framework for companies to ensure that their conflict mineral supply chain adheres to ethical and responsible practices, particularly when sourcing minerals from regions with a history of conflict and human rights abuses. It serves as the outline for the EU's Conflict Minerals Regulation and is also an internationally recognised due diligence framework, allowing it to be used by U.S. companies to ensure compliance with the Dodd-Frank Act's section 1502. (European commission, n.d.a; SEC, 2017.)

The guidance describes the five-step framework which companies can follow to exercise due diligence in their mineral supply chains. This comprehensive approach encompasses the establishment of strong management systems,

identification of risks, managing the identified risks, independent third-party audits, and transparent reporting mechanisms (Figure 4). Furthermore, the guidance details various risks associated with conflict minerals, outlining recommended measures and actions that specific parties within the conflict minerals supply chain can take to address them. (OECD, n.d.a.)

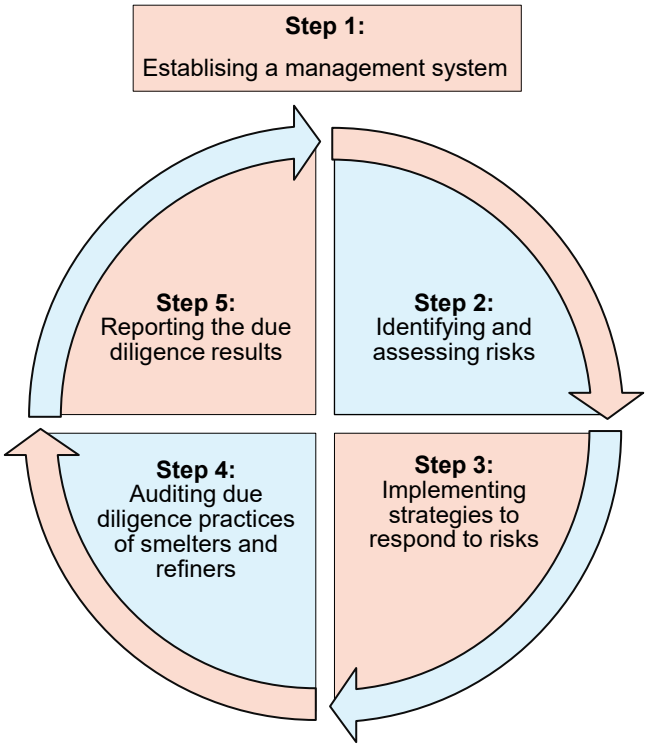

Figure 4. OECD's five-step framework for minerals sourced from CAHRAs.

Even though the guidance is typically used for conflict minerals, its principles and framework are considered adaptable to other minerals as well (RMI, n.d.d).

7.1.1 Step 1: Establishing a management system

The first step in the OECD's guidance is establishing a management system for the minerals in question. This involves defining and adopting due diligence policies, as well as common practices and measures. This is done to ensure the proper management of risks, especially for minerals originating from conflict-affected and high-risk areas. Furthermore, the company has to designate

different types of resources such as personnel and funds to facilitate the functions and procedures of the management system. (OECD, 2016, p. 36.)

As part of establishing the management system, it is crucial to define the actual process for identifying smelters and refiners that produce the refined metals in the company's supply chain. Typically, this is an annual process that, involves sending minerals reporting templates to suppliers, prompting them to disclose all relevant information about the minerals in question as well as the smelters found in their supply chain. Once identified, these smelters and refiners must be disclosed to downstream customers. (OECD, 2016, p. 37, 39.)

Identification of the smelter and refiners can be particularly challenging for companies producing products with numerous subcomponents, as pinpointing parts containing for example conflict minerals, can be somewhat problematic. In the automotive industry this can be solved by utilising the International Material Data System to check the bill of materials for each subcomponent, simplifying the determination of products containing conflict minerals and their respective suppliers.

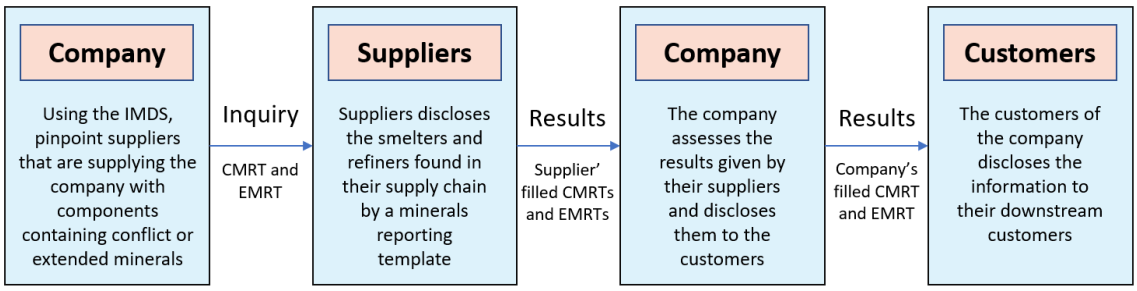

Figure 5. Transfer of information in the automotive industry.

In addition to the advice for due diligence policies, measures and processes, step one of the guidance provides recommendations on securing supplier commitment to conflict minerals policies. This includes fostering long-term supplier relationships to build leverage and transparently communicating expectations regarding mineral sourcing responsibility. The guidance also promotes establishing a grievance mechanism or system for interested parties to voice concerns related to any aspect of mineral production in conflict-affected and high-risk areas.

7.1.2 Step 2: Identifying and assessing risks

The second step of the guidance details how companies should try to identify and assess the risks related to the different aspects of mineral production.

This may entail reaching out and actively engaging with the identified smelters and refiners to acquire more detailed information about the minerals, including the mine of mineral origin, extraction dates, and mining methods employed. The information can extend to the transportation aspects as well, encompassing details about the routes and companies involved in transporting the minerals. (OECD, 2016, pp. 42-43).

Furthermore, the downstream companies may also need to review the due diligence policies and practices of the smelters and refiners found in the companies' supply chain to ensure that they are operating in a sufficiently responsible manner. In addition to these measures, companies are encouraged to engage in industry-wide initiatives in order to promote responsible mineral supply chains. (OECD, 2016, p. 43.)

7.1.3 Step 3: Implementing strategies to respond to risks

The objective of the third step is to address identified risks with the aim of preventing or mitigating adverse impacts. The first recommendation to achieve this is to report the gathered information about the suppliers and the smelters and refiners utilised by them, to the designated senior management of the company. Subsequently, companies should develop a risk management plan outlining actions to be taken in response to identified risks. For downstream companies, these actions typically revolve around supplier relations and may vary based on the severity of the risk. Minor risks may allow for continued trade with a supplier, especially if there are risk mitigation plans in place. Temporary suspension of supplier relations may be considered for more serious risks, with the possibility of resuming if there is a clear and measurable risk mitigation plan.

In extreme cases where risk mitigation is not feasible, termination of the supplier contract may be necessary. (OECD, 2016, pp. 44-45.)

All of the decisions related to supplier relations and other actions taken by the company to mitigate risks, should be done according to the common practices outlined in the minerals management system.

7.1.4 Step 4: Auditing due diligence practices of smelters and refiners

The fourth step of the guidance involves carrying out third-party audits of the smelter's and refiner's due diligence practices related to minerals sourced from conflict-affected and high-risk areas. It provides detailed recommendations for various auditing aspects, including the objectives and scope of the audit, the review process for different documents, guidelines for on-site investigations, and the content to be included in the final report. All of these topics and contents should be clarified to all parties before the auditing process begins. (OECD, 2016, pp. 47-49.)

As downstream companies may not have direct connections with smelters and refiners, the guidance recommends that these companies should actively engage and contribute to auditing initiatives and systems through industry organisations or other appropriate channels (OECD, 2016, p. 50).

7.1.5 Step 5: Reporting the due diligence results

The final step of the OECD's guidance outlines the reporting recommendations related to supply chain due diligence. It states that companies should publicly disclose their due diligence policies, systems and measures, as well as who is responsible for the systems in the company. Companies should also publish the audit reports related to their due diligence practices and integrate the results of due diligence into the company's sustainability or responsibility reports. (OECD, 2016, pp. 52-53.)

7.2 Conflict and extended minerals reporting template

The Conflict Minerals Reporting Template (CMRT) and the Extended Minerals Reporting Template (EMRT) are standardised, freely available reporting templates developed by the Responsible Minerals Initiative. They are intended to assist companies in gathering and disclosing information concerning the utilisation of conflict and extended minerals in their supply chains. The reporting templates consists of inquiries aimed at the company completing the form, detailing the presence of conflict and extended minerals in the company's products, along with information about the due diligence measures for these minerals. Additionally, the reporting templates includes information about smelters in the company's supply chain, such as the smelter's location, the type of mineral produced, the smelter identification number, and the origin of the raw minerals used by the smelter.

Through the utilisation of the CMRT and EMRT, companies can showcase their commitment to due diligence and transparency in supply chain practices concerning both conflict and extended minerals. These reporting templates also play a crucial role in assisting companies to achieve compliance with various regulations related to conflict and extended minerals. (Source Intelligence, 2023.)

Companies employ CMRTs and EMRTs by initially distributing them to suppliers responsible for providing products containing conflict or extended minerals to the company. Subsequently, the suppliers complete the templates, filling all relevant information for each smelter present in their supply chains for conflict and extended minerals. Once filled out, the templates are returned to the company, which compiles all received reporting templates from the suppliers into a unified CMRT or EMRT. These comprehensive documents showcase all the smelters associated with conflict or extended minerals in the company's supply chain. The finalised CMRTs and EMRTs are then communicated to downstream customers.

8 Conclusion

The goal of this thesis was to evaluate the supply chain, adverse impacts, existing and upcoming regulations along with their corresponding obligations, associated risks, applications, production, and management practices of conflict and extended minerals for a case company working in the automotive industry. The aim of this analysis was done so that the case company could establish adequate and effective management systems for these minerals. With the assessment, the set research questions were able to be answered, providing valuable information on conflict and extended minerals and their due diligence policies and measures. The results obtained in the study are primarily applicable to the case company and may not be directly transferable to other companies. For instance, many of the obligations set by regulations depend on factors such as the position within the supply chain, turnover, and the number of employees.

8.1 Summary and implications of the findings

Like other minerals, the production of conflict and extended minerals has numerous environmental impacts, including adverse effects on water sources, air quality, soil, and flora and fauna. Many of these impacts also directly affect the health of people and communities engaged in or residing near mining or mineral production operations. In addition to environmental and human health impacts, conflict and extended minerals have been documented to be linked to various social issues and human rights abuses. These include unethical labour practices, child and forced labour, as well as funding conflicts in certain regions. Some of these minerals are also widely produced in countries that have a history of conflict and human rights abuses, such as the Democratic Republic of the Congo and its adjoining countries. To address these issues and mitigate the associated risks, different types of regulations and industry initiatives have been implemented concerning the due diligence measures of companies.

Upon conducting the legislative review, it was determined that the case company is not subject to direct obligations under the Dodd-Frank Act Section 1502 or the EU's Conflict Minerals Regulation. However, the case company’s U.S. based customers might require the company to provide them with sourcing related information regarding products containing conflict minerals. The EU Conflict Minerals Regulation also recommends companies that are not obligated by the legislation to conduct due diligence measures.

Due to the company's involvement in the battery market, falling within the scope of companies regulated under the Battery Regulation (EU 2023/1542), it is required to establish a due diligence system for the various battery raw materials, including cobalt, by the 18th August 2025. Furthermore, the upcoming Critical Raw Materials Act and Corporate Sustainability Due Diligence Directive also impose obligations on the company. The CRM mandates the company to perform stress tests on the supply chains of tungsten and cobalt. The CSDDD imposes obligations on the case company to assess the value chains of all materials, including conflict and extended minerals, to address the found adverse social, climate, and environmental impacts as well as implement due diligence systems. Since these regulations are still in the proposal stage, the specific date when these obligations become mandatory for the case company remains uncertain. As a result, the company must actively monitor the developments concerning the CRM and CSDDD.

While there are currently limited obligations for the case company concerning conflict and extended minerals, the inherent risks of utilising these minerals in their products pose significant potential challenges. Companies associated with environmental or social issues linked to these minerals can face severe reputational risks, directly impacting customer relationships and causing financial and operational issues.

As regulations become stricter and due to the risks associated with conflict and extended minerals, in addition to customers' expectations for the case company to adhere to sustainable and responsible business practices, it is highly recommended for the case company to immediately set-up due diligence

policies and systems based on the framework outlined in the OECD's guidance. This proactive measure would allow the case company to effectively mitigate risks, prepare for upcoming regulations, acquire information about their supply chains, and potentially gain a competitive advantage over its competitors. Furthermore the case company would be able to provide its customers with information regarding the origin of conflict and extended minerals in their supply chain, thus promoting responsible sourcing practices throughout the supply chain and in the industry.

8.2 Further research and actions

To establish the due diligence system, the case company must first define conflict and extended minerals due diligence policies, allocate resources, and update the terms of conditions of their suppliers. Conducting further research on typical due diligence policies and measures in the industry is important in making sure that the implemented system aligns with industry standards. Accurate calculations of the resources needed to operate the system must also be done to ensure the proper budgeting and allocation of resources. As part of implementing the due diligence system, it is crucial to clearly define the personnel and departments responsible for reviewing suppliers and contacting them. Accessing information about products containing conflict and extended minerals through the IMDS provides a convenient method for the case company to identify suppliers affected by the due diligence policies. Gathering information from suppliers should be done by using conflict and extended minerals reporting templates, as these are an industry standard method. Additionally, these reports can be used to streamline communication and provide transparent information to the case company's customers.

In addition to these actions, the company should try to find ways of promoting sustainable and transparent mineral supply chains by perhaps participating in industry-wide schemes that evaluate the operations and compliance with regulations of smelters and refiners. Changes in regulations need to be also assessed regularly to ensure compliance.

8.3 Validity and reliability of the thesis

As most of the findings of the thesis were done based on a literature review of materials sourced from authoritative and reputable sources, these sources contribute to the overall credibility of this thesis. The validity of the materials used for the assessment is further complemented by the fact that the used sources include the regulations that mandate obligations for companies, as well as the OECD's guidance framework for due diligence concerning the sourcing of conflict and extended minerals. Regardless of the researcher, utilising information about the case company and relying on the same sources and laws, the findings should be similar, with variations primarily occurring in the conclusions section.

8.4 Self assessment

I chose this topic for my thesis out of many options provided by the case company because I didn't have much experience in my studies regarding sustainability regulations and systems. Furthermore, I had no prior knowledge of mineral production, so this was an opportunity to learn how minerals are produced, their impacts, and the different participants involved in transforming the raw materials into finished products, especially in the automotive industry. I also gained a basic understanding of how EU regulations are structured, how the enforcement of these regulations works, and the steps to enact a law, from its proposal state to the final form of the legislation. From a professional standpoint, doing the thesis improved my research, time management, and professional writing skills significantly.

At the beginning of the thesis, I underestimated the scale of the project, as the more I researched conflict and extended minerals, the more relevant topics emerged, expanding the scope of the thesis. Nevertheless, I was able to finish the thesis within the timeframe of my studies.

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