re-sourcing

State of play and roadmap concepts: Electronics Sector

RE-SOURCING Deliverable 4.3

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Abbreviations

3TG	Tin, tungsten, tantalum, and gold
5G	5th generation mobile network
ARM	ARM Alliance for Responsible Mining
ASGM	Artisanal and small-scale gold mining
ASM	Artisanal and small-scale mining
BC	Before Christ
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe
CAHRAs	Conflict-affected and high-risk areas
CCCMC	China Chamber of Commerce of Metals, Minerals & Chemicals
CE	Conformité Européenne
CEP	Circular Electronics Partnership
CRAFT	Code of Risk mitigation for ASM engaging in Formal Trade
CSO	Civil society organisation
CSRD	Corporate Sustainability Reporting Directive
CTC	Certified Trading Chains
DAP	Downstream Assessment Program
DD scheme	Due diligence scheme
DMCC	Dubai Multi Commodities Centre
DRAM	Dynamic random-access memory
DRC	Democratic Republic of the Congo
E-waste	Electronic waste
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EEE(S)	Electrical and electronic equipment (sector)
EHS	Environment, health, and safety
EITI	Extractive Industries Transparency Initiative
EMS	Electronics manufacturing services
EPA	Environmental Protection Agency
EPRM	European Partnership for Responsible Minerals
EU	European Union
EurAc	European Network for Central Africa
FPIC	Free, prior, and informed consent
GeSI	Global Enabling Sustainability Initiative
GHG	Greenhouse gas
GRI	Global Reporting Initiative
HRDD	Human rights due diligence
ICGLR	International Conference on the Great Lakes Region
ICMM	International Council on Mining and Metals
ICT	Information and communications technology
IFC	International Finance Corporation
IISD	International Institute for Sustainable Development
ILO	International Labour Organization
IPIS	International Peace Information Service
IRMA	Initiative for Responsible Mining Assurance
ITSCI	ITRI Tin Supply Chain Initiative
kozt	Thousand troy ounces

KPIs	Key performance indicators
LBMA	London Bullion Market Association
LCD	Liquid crystal display
LEDs	Light-emitting diodes
LME	London Metal Exchange
LSM	Large-scale mining
MAC	Mining Association of Canada
mHRDD	Mandatory human rights due diligence
MSI	Multistakeholder initiative
NFRD	Non-Financial Reporting Directive
NGO	Non-governmental organisation
ODM	Original design manufacturers
OECD	Organisation for Economic Co-operation and Development
OECD DDG	OECD Due Diligence Guidance
PACE	Platform for Accelerating the Circular Economy
PCBs	Printed circuit boards
PPA	Public Private Alliance for Responsible Minerals Trade; uses CRAFT schemes
PRI	Principles for Responsible Investment
RAM	Random-access memory
RBA	Responsible Business Alliance
RCM	Regional Certification Mechanism
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RINR	Regional Initiative against Illegal Exploitation of Natural Resources
RJC	Responsible Jewellery Council
RMAP	Responsible Minerals Assurance Process
RMI-mica	Responsible Mica Initiative
RMI-RBA	Responsible Minerals Initiative (of RBA)
RoHS	Restriction of Hazardous Substances in Electrical and Electronic Equipment
RS	Responsible sourcing
SEC	Securities and Exchange Commission
SOMO	Centre for Research on Multinational Corporations
TSM	Towards Sustainable Mining
TSMC	Taiwan Semiconductor Manufacturing Company
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNGP	United Nations Guiding Principles for Business and Human Rights
UNIDO	United Nations Industrial Development Organization
US	United States (of America)
USGS	U.S. Geological Survey
WBCSD	World Business Council for Sustainable Development
WGC	World Gold Council
WEEE	Waste electrical and electronic equipment
WEF	World Economic Forum

Executive summary

Electronics is one of the largest and fastest growing industries of the world, employing millions of workers. Consumer electronics are part of our daily life and have spurred economic growth across the globe. Further, electronics are increasingly intertwined with many technologies and economic sectors such as automotive, health, internet of things, defence, and security.

Electronics are key for ambitious global goals such as digitalisation and the energy transition. The global electronics industry is, however, associated with serious social and environmental risks and challenges for responsible sourcing along its supply chain. Therefore, the RE-SOURCING project has included this sector within its scope.

Chapter 1 of this *State of Play* report introduces the RE-SOURCING project and to the electrical and electronic equipment sector (EEES) and explains the reasoning for our focus on electronics.

Chapter 2 presents an overview of the electronics supply chain, from mining to end-use. We particularly focus on three segments of the supply chain: **mining**, **manufacturing** (both contract and component manufacturing), and electronics **brands**. For each of these three segments we provide an overview of key industry players as well as a non-exhaustive overview of social and environmental challenges associated with them.

Mining for key minerals to produce electronics can have many negative impacts on people and the planet, such as affecting the livelihoods of communities, health impacts, water pollution and depletion, biodiversity loss, and other forms of environmental degradation.

Civil society, trade unions, and academics have documented serious violations of human rights in electronics manufacturing. Some recurrent issues include: excessive working hours, health and safety hazards, exposure to chemicals, lack of respect for freedom of association and collective bargaining rights, and poor working conditions.

At the end of life, electronics have become the largest growing waste stream globally due to increased consumption and products being designed with short life spans or limited repairability. Electronics brands' buying practices (such as pricing, lead times, and technical specifications) have a direct impact on working conditions and sourcing practices along the entire supply chain. Brands have enormous leverage over the entire supply chain due to their purchasing and economic power.

The material focus of this *State of Play* report is on **3TG minerals (tin, tungsten, tantalum and gold)** and **mica**. These minerals were selected by the consortium partners and the project's Advisory Board and Platform Steering Committee as the focus for the electronics sector and confirmed at the Validation Workshop with external stakeholders held in March 2020.

In chapter 3 we discuss the main standards and initiatives applicable to the electronics sector with regards to responsible sourcing of minerals. We divide these into four categories: **international frameworks for due diligence; laws and international instruments**; **voluntary schemes for due diligence (standards);** and **initiatives**. The OECD due diligence principles guided our selection of such standards and initiatives.

Chapter 4 describes the results of a **narrative analysis** of online media content commissioned by the RE-SOURCING consortium from an external consultant. The objective of the analysis was to assess how selected key terms (referred to as *narratives*) are discussed in online media content, who are the main actors driving the online discussion, and what type of reactions they generate from readers. The results of this analysis have not influenced the decision on the scope of this project but rather provide additional input for potential future engagement by the consortium, for instance to address issues that are important in our analysis but not currently receiving sufficient online attention.

Chapter 5 offers our **Vision** for the electronics sector towards 2050 by identified ideal responsible sourcing practices and targets. Our vision is based on three pillars:

- Businesses and States achieving full respect for and protection of human rights along the entire supply chain, including effective mechanisms for accountability and access to remedy for affected rights holders.
- Protection of the environment, including remaining within planetary boundaries, preventing global warming of more than 1.5°C above preindustrial levels, and preventing further biodiversity loss.
- The global eradication of poverty and a significant reduction in inequality, including a minimum social foundation and a fair distribution of costs and benefits along the supply chain.

Chapter 6 provides a **gap analysis** comparing current standards and initiatives for responsible sourcing with our Vision. This gap analysis is an important basis for future work towards a roadmap for responsible sourcing of minerals in the electronics sector.

We provide a recap and build on the main gaps that were identified in analysis of the renewable energy and mobility sectors. And we pay particular attention to gaps with regard to the **EU Conflict Minerals Regulation**, including its limited material scope, its exclusion of manufactured goods, and other shortcomings such as **a threshold that allows loopholes, insufficient sanctions, the different implementation per Member State, and lack of transparency**.

In the gap analysis we focus on **voluntary due diligence schemes** based on previous comparative studies evaluating their ability to provide rights holders with effective opportunities for protection. Our key findings include gaps with respect to:

- Lack of transparency on implementation.
- Limited scope of due diligence.
- Credibility of and overreliance on audits.

To protect human rights, international **mandatory due diligence regulation is crucial**. The growth of voluntary due diligence schemes has played an important part in terms of awareness raising, creating leverage, and setting new and higher standards in the sector. However, they do not ensure implementation of human rights due diligence, and authorities cannot transfer their responsibility to regulate companies to voluntary schemes.

When it comes to protecting the environment, fundamental systemic change is required, including revising business models based on the externalisation of costs and maximising shareholder value. An overall reduction of resource consumption is key, which will require profound changes in consumption and production patterns. Regulation that requires electronics products to be designed for longer use, reuse, reparability, and recyclability is also crucial.

Finally, a fair distribution of costs and benefits along the supply chain is important to address current levels of global inequality and poverty. Miners and workers deserve fair wages that capture a significant share of the value created along the supply chain. Initiatives that improve conditions on the ground, including formalisation of the artisanal and small-scale mining (ASM) sector and ensuring improvements in the livelihoods of local communities and workers, require further development and scaling up, in cooperation with local actors such as artisanal miners, worker-led cooperatives, and local businesses.

Keywords:

electronics, responsible sourcing, supply chains, minerals, human rights, environmental impacts

1 Introduction and focus

1.1 The RE-SOURCING project

Responsible sourcing (RS) is becoming a reality for more and more businesses and policymakers, and it is increasingly demanded by NGOs and civil society. Everyone is striving to keep ahead of rapidly evolving ecological and social needs, company practices, business models, government regulations, and initiatives spearheaded by civil society.

In response to the growing challenge of responsible sourcing, **the RE-SOURCING Global Stakeholder Platform was started in 2020**.

RE-SOURCING, funded under the European Union's Horizon 2020 programme, is a four-year project (November 2019 to October 2023) coordinated by the Institute for Managing Sustainability at the Vienna University of Economics and Business Administration. The project's consortium consists of 12 international partners in and outside the EU, working together to create the RE-SOURCING Platform. The project's vision is **to advance and establish RS as a minimum requirement among EU and international stakeholders**. The project fosters the development of a globally accepted definition of RS, facilitates the implementation of RS practices through direct knowledge exchange within its network and beyond, and advocate for RS in international political fora.

To guarantee a thorough and comprehensive RS framework, RE-SOURCING takes a holistic approach by integrating firms and industries (up- and downstream) **across the mineral value chains of three sectors:** renewable energy, mobility, and electronics – all of which play a decisive role in the EU Green Deal and the clean energy transition. RE-SOURCING equally takes into account traditional minerals, conflict minerals, and green tech minerals in its approach. The main target groups of the project are the EU and international industry stakeholders, EU policymakers, and civil society.

The RE-SOURCING project's actions will:

- facilitate the development of a globally accepted definition of RS;
- develop ideas for incentives facilitating responsible business conduct in the EU, supporting RS initiatives;
- enable the exchange of information and promotion of RS among stakeholders;
- foster the emergence of RS in international political fora; and
- support the European Innovation Partnership on Raw Materials.

RE-SOURCING will deliver:

- For EU and international business stakeholders:
    - *increased capacity of decision-makers to implement responsible business conduct;*
    - *better understanding and awareness of RS in three sectors: renewable energy, mobility, and electrical and electronic equipment; and*
    - *facilitated implementation of lasting and stable sectoral framework conditions for RS.*
- For EU policymakers:
    - *increased capacity for RS policy design and implementation;*
    - *innovative ideas on policy recommendations for stimulating RS in the private sector; and*

    - *better understanding and awareness of RS in three sectors: renewable energy, mobility, and electrical and electronic equipment.*
- For civil society:
    - *integration of sustainable development and environmental agendas into the RS discourse;*
    - *an established, global level playing field of RS in international political fora and business agendas; and*
    - *better understanding and awareness of RS in three sectors: renewable energy, mobility, and electrical electronic equipment.*

1.2 The electrical and electronic equipment sector (EEES)

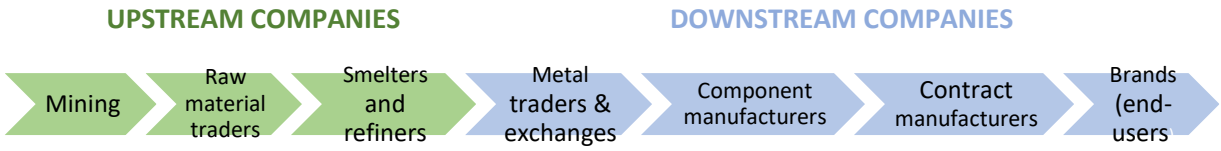
Electrical and electronic equipment (EEE) refers to items containing "circuitry or electrical components with power or battery supply".[1] Examples of *electrical* equipment include electric power generators and transformers; lightbulbs and lamps; domestic appliances; fibre optic cables; wirings and wiring devices, among other items. Some of the most common *electronic* items are computers, mobile phones, tablets, smart home products, and their components such as circuit boards and semiconductors.

The industry players and the supply chain of electrical equipment and of electronic equipment are each very different. For the purposes of this report we will focus our analysis on the electronics sector, which covers consumer electronics and electronic components such as semiconductors and circuit boards.

We focus on the electronics sector for several reasons. First, there is a long history of documented and alleged social and environmental impacts of the sector.[2] Second, the electronics industry is a major consumer of the minerals within the scope of this report (tin, tantalum, tungsten, gold, and mica). Third, due to emerging technologies such as artificial intelligence and big data processing, electronic products are increasingly embedded in other industries such as automotive, health, internet of things, and security, and they play a key role in digitalisation and the energy transition. Fourth, the supply chains of both sectors are different and we needed to narrow the analysis to keep it feasible within the scope of this report. However, the RE-SOURCING project acknowledges that further scrutiny of the policies and practices of the electrical sector is needed and that many of the recommendations arising from this report on electronics will also apply to the electrical sector.

While the electronics sector contributes to economic growth, it has been associated with human rights violations and environmental damage along its entire supply chain. From mining to recycling, workers in the electronics supply chain may face poor working conditions including exposure to chemicals, low wages, violation of freedom of association and collective rights, flexibilisation of labour, and in some cases even gross human rights violations such as child labour and forced labour.[3] Mining and processing of minerals and the recycling of electronics potentially result in pollution of water, soil, and air, and large-scale mining erodes landscapes and damages ecosystems.[4] At the end of life, e-waste has become "the world's fastest-growing domestic waste stream, fueled mainly by higher consumption rates of electric and electronic equipment, short life cycles, and few options for repair".[5]

The electronics supply chain is composed of **upstream** and **downstream** companies.



"Upstream companies" refers to the part of the supply chain that covers **mining** (both artisanal and large-scale), **raw material traders** such as local traders, international concentrate traders, and mineral re-processors, and **smelters and refiners**.

The "downstream" part of the supply chain includes **metal traders and exchanges** (involved in the trading of metals after refining), **component manufacturers**, **contract manufacturers,** and **brands.**

Component manufacturers specialise in producing specific electronics components to be used in electronics products. Key components include printed circuit boards (PCBs) and a myriad of components that are placed on PCBs such as capacitors, resistors, connectors, and notably memory chips and semiconductors. Examples of leading semiconductors producers are Intel, Qualcomm, Samsung, and Taiwan Semiconductor Manufacturing Company (TSMC).

Contract manufacturers are contracted by the lead firms to manufacture the final products (such as mobile phones, computers, and tablets) and provide manufacturing services. Manufacturing services include component purchasing, assembling, prototyping, logistics, testing, and export. Some contract manufacturers also provide design services.[6] Examples are Foxconn, Flex, Celestica, and Sanmina.

The **brands** in the diagram are lead firms engaged in the design, marketing, and sales of finished products to consumers. Examples include Apple, Samsung, LG, and Dell. They have leverage over suppliers due to their buying power.[7]

The electronics supply chain is highly complex and fragmented, looking more like a web than a chain. Electronic products are made of many different components that are themselves made from multiple parts. Brand companies often source their products from different contract manufacturers. Likewise, contract manufacturers supply to multiple brand clients, often from different production lines within the same factory. Contract manufacturers in turn often source from an immense network of smaller suppliers and sub-suppliers.

In this report we focus on three segments of the supply chain: **mining companies**, **manufacturers** (both contract and component manufacturers), and **brands**.

We focus on **mining** in order to understand the social and environmental risks associated with primary sourcing of the relevant minerals used to produce electronics and to review the due diligence **frameworks, legislation, and standards applicable to them**. It is important to review such instruments because downstream companies often rely on them for their auditing, certification, or due diligence efforts.

We focus on **manufacturers (contract and component manufacturers)** because these companies employ vast numbers of workers and are also often the ones purchasing the minerals (or components containing minerals) from the upstream companies. It is therefore important that their sourcing practices are responsible and sustainable.

And we focus on the **brands** because of their power and leverage within the supply chain. As leaders of the value chain, they have purchasing power over their suppliers. Further, the brands' policies and practices (such as relating to pricing, lead times, and technical specifications) have a direct impact on working conditions and sourcing practices along the entire supply chain.

Manufacturers and brands operate and conduct business activities within the EU and are therefore directly subject to EU policies and regulations. Contract manufacturers and brands, moreover, have the leverage and power to reduce the negative impacts of mining by reducing absolute mineral and energy demand, for instance by using recycled materials in production and by designing products that favour less mineral resource use, reparability, extended lifetimes, and recyclability.

2 Key players and challenges at selected steps of the supply chain

This chapter will analyse the key players that are part of the selected steps of the value chain (mining, contract manufacturers, and brands) and the risks that their operations pose for people and the planet along the entire value chain.

2.1 Mining: key players, social and environmental challenges

The material focus of this *State of Play* report is on 3TG minerals (tin, tungsten, tantalum, and gold) and mica. These minerals were selected by the consortium partners, the project's Advisory Board and the Platform Steering Committee as the focus for the electronics sector and confirmed at the Validation Workshop with external stakeholders held in March 2020.

The limitation of focus to 3TG and mica is to avoid duplication with the other two *State of Play* reports about the renewable energy and mobility sectors, which are focusing respectively on green technology minerals (cobalt, lithium, graphite, and nickel) and traditional minerals (copper, rare earth concentrates, and quartz). However, many of the minerals covered by the other two sectors are also relevant to the electronics sector, for instance all of the battery minerals.

An important reason to select 3TG was the long history of efforts to address the problematic mining of these *conflict minerals* at the major electronics brand companies, which led to the first due diligence legislation in 2011 and to the first voluntary industry schemes on minerals set up by downstream companies. A first wake-up call to the electronics industry came in April 2001 when the UN issued a report on the illegal exploitation of minerals such as coltan, which contributed to the worsening of the conflict in the Democratic Republic of the Congo (DRC).[8] Growing demand from the high-tech industry for tantalum was linked to the increase in coltan mining in the Congo region and increasing violence.[9] **Selecting 3TG offers the opportunity to look at the effectiveness of the established legislation and the voluntary schemes and to learn from and build on the gained insights**.

The focus on mica and the linkage with the electronics sector are of more recent date (2018),[10] while mica's use by the cosmetics sector is longer established. The violation of children's rights in mica mining has led to widely shared indignation and subsequently to the adoption of a Resolution of the European Parliament in February 2020, asking the European Commission to tackle it through EU policy, legislation, and funding, including new initiatives. [11]

The selection of mica provides an opportunity to look more closely at an example of an in-region initiative. These are often multistakeholder initiatives to improve responsible practices at and around mine sites of a specific mineral and to address root causes of the problems to bring about change "on the ground". As most of the world's mica production for electronics comes from a limited number of locations, this approach could be the most effective. The choice of mica is also relevant for the renewable energy and mobility sectors because mica is widely used in wires and high voltage cables and increasingly in shields for battery packs in electric cars.

However, the focus of responsible sourcing should not be solely on these minerals. On the contrary, the need to source responsibly extends to all minerals, and companies should conduct their due diligence accordingly. In fact, the limitation to specific minerals and geographical regions has been one of the main weaknesses of the EU's Conflict Minerals Regulation according to many commentators, as we will discuss later in this report.

For each of the selected minerals, we will review its use by the electronics sector, the key industry players and countries of origin, as well as common associated social and environmental challenges.

2.1.1 Gold

Gold is a key mineral for the production of electronics due to its excellent conductivity, malleability, and resistance to corrosion. Gold is used for a wide range of electronics such as mobile phones, laptops, calculators, computers, televisions, and game consoles. Major electronics components that use gold include light-emitting diodes (LEDs) for laptops, tablets, and televisions; RAM chips; components for wireless devices and infrastructure such as 5G, and printed circuit boards (PCBs).

Technology represent the largest industrial demand for gold. In 2020 and 2019, technology accounted for approximately 8% of total global gold demand. Within technology, electronics account for more than 80% of demand, which means that electronics account for 6% to 6.5% of annual global gold demand.

Table 1: Gold total demand 2020 and 2019. Source: World Gold Council, 2020.[12]

Gold demand	2020 (tonnes)	2019 (tonnes)
Jewellery	1,401	2,123
Investment	1,774	1,265
Central banks & other institutions	326	669
Technology	302	326
Total	3,803	4,383

In 2020, electronics production required 248.1 tonnes of gold, which was 5% less than in 2019 when it consumed 262 tonnes.[13] This reduction in demand was due to supply chain disruptions and lockdowns resulting from Covid-19; however, in Q1 2021 demand rose to pre-pandemic levels.

The research consultancy Metal Focus provides an overview of the countries where primary global gold production (for technology) is first processed into semi-finished electronics products. In 2019, most of such primary gold demand for electronics manufacturing was split between Japan (28%), China and Hong Kong (24%), and the United States (22%). South Korea (9%) and European countries Switzerland (4%) and Germany (4%) also had notable demand.

Table 2 Electronics manufacturing gold demand by country in 2019 (tonnes). Source: Metals Focus, 2020.[14]

Country	2019 (tonnes)	Percentage
Japan	72.7	28
China/Hong Kong	63.8	24
United States	58.3	22
South Korea	23	9
Switzerland	11.3	4
Germany	10.6	4
Singapore	8.1	3
Taiwan	5.2	2
Other	9.3	4
Global total	**262.3**	100

For the last 11 years, the gold demand for electronics has remained within the range of 248 to 327 tonnes per year.[15] Annual global gold supply has maintained a relatively stable level during the last five years. Around two-thirds of gold supply comes from primary mine production. Mine production in the last five years has averaged around 3,200 tonnes per year according to the U.S. Geological Survey or 3,500 tonnes per year according to the World Gold Council. The rest of the world's supply comes from recycling. Within recycling around 90% come from jewellery and 10% from electronics.[16]

Gold is mined on all continents of the world except Antarctica. Around 25% of gold mine production comes from Africa, while only 1% is mined in Europe.[17] The following table shows the 20 largest gold producing countries in the world.

Table 3: Largest 20 gold producing countries 2018-20 (tonnes). Source World Gold Council, 2020.[18]

Country	2018	2019	2020
China	404.1	383.2	368.3
Russia	295.4	329.5	331.1
Australia	313.0	325.1	327.8
United States	224.9	200.4	190.2
Canada	188.9	182.9	170.6
Ghana	149.1	142.4	138.7
Brazil	96.7	100.4	107.0
Uzbekistan	92.0	94.6	101.6
Indonesia	153.0	92.3	100.9
South Africa	128.0	111.3	99.2
Peru	162.6	143.3	97.8
Mali	88.3	96.8	93.8
Burkina Faso	78.0	83.1	93.4
Sudan	76.6	78.0	83.8
Kazakhstan	73.9	74.6	78.4
DR Congo	63.0	62.9	60.9
Guinea	50.8	57.6	56.9
Colombia	43.9	45.5	53.6
Papua New Guinea	67.1	71.1	53.1
Tanzania	46.3	46.5	45.9

Large-scale gold mining is dominated by a few companies, although there are many junior companies active in the field. The largest 10 mining companies in terms of production are shown in the next table.

Table 4: Gold mining production of the largest companies in 2020 (thousand troy ounces). Source: MINING.com, 2021[19]

Company name	Headquarters	2020 (kozt)	Company name
Newmont	United States	5,878.38	Newmont
Barrick Gold	Canada	4,837.40	Barrick Gold
Polyus	Russia	2,870.39	Polyus
AngloGold Ashanti	South Africa	2,803.46	AngloGold Ashanti
Gold Fields	South Africa	2,126.96	Gold Fields
Newcrest Mining	Australia	2,055.13	Newcrest Mining
Kinross Gold	Canada	2,363.10	Kinross Gold
Agnico Eagle	Canada	1,734.59	Agnico Eagle
Polymetal International	Russia	1,403.90	Polymetal International
Harmony Gold	South Africa	1,381.28	Harmony Gold

Artisanal and small-scale gold mining (ASGM) also plays a significant role in global production and supports the livelihoods of millions of people, particularly in Africa, Latin America and Asia. Estimates of production volumes and the number of miners involved are difficult, since mining is often unregulated, clandestine, or considered illegal. According to UNEP: "The sector produces about 12 to 15% of the world's gold. An estimated 10 to 15 million miners, including 4 to 5 million women and children, are involved in the sector."[20] Metals Focus estimates that nearly 550 tonnes of artisanal gold are produced yearly, representing 15% of global supply.[21]

Countries with the largest ASGM production include Colombia, Ghana, Peru, the Philippines, Indonesia, Burkina Faso, DRC, Tanzania, Madagascar, Ecuador, Mongolia, Sudan, Bolivia, and Nigeria.

Social and environmental challenges

Gold mining has been associated with serious social and environmental risks by numerous studies from scientists, academics, civil society, and affected communities. Issues include cases of child labour and forced labour, corruption, fuelling of conflict, land disputes, acid discharge, mercury pollution, exploitation, serious health impacts, deforestation, loss of biodiversity, and serious environmental harms.[22]

Further, gold mining is linked to organised crime in several parts of Latin America and Africa.[23]

Both ASGM and large-scale gold mining can result in adverse human rights and environmental impacts.

ASGM is often undertaken by impoverished and indebted miners who accept extremely low wages and poor working conditions in order to survive. The fact that ASGM is deemed informal or even illegal in some jurisdictions contributes to a lack of oversight, regulation, and social and environmental protection.

Child labour is one of the most egregious human rights violations related to artisanal gold mining. Thousands of children are involved in artisanal gold mining in Africa, Asia, and South America working under extremely dangerous conditions and deprived of education. The ILO has estimated that in Burkina Faso and Niger around 30% to 50 % of the gold miners are children. In 2015, SOMO revealed an increase of ASGM child labour in Mali, estimating more than 200,000 children involved representing 20% of all miners.[24]

ASGM is the leading cause of anthropogenic mercury emissions, contributing to 38% of global emissions.[25] The use of mercury in ASGM pollutes water sources and food chains and affects the health of miners and communities. A study by Steckling et al. estimates that between 25% and 33% of ASG miners (3.3 to 6.5 million people) suffer from chronic metallic mercury vapour intoxication.[26] A recent study found elevated levels of mercury in women of childbearing age in Latin American countries where ASGM is conducted.[27] The report identifies weaknesses in the Minamata Convention as a root cause of the problem.

Labour rights are often violated in the context of ASGM; for instance, poor health and safety conditions have led to many work-related illnesses, accidents, and deaths of both child and adult miners.[28] The Covid-19 pandemic has aggravated the situation of artisanal miners in many ways, including lost income, reduced oversight of government when it comes to labour rights standards, and an increase in child labour (as in the DRC and the Central African Republic).[29]

Large-scale gold mining is associated with environmental degradation and pollution of air, water, food, and soil. Such degradation results in violations of people's right to water, food, health, and a healthy environment. Tailings accidents and the release of chemicals into the environment are other recurrent results of large-scale mining.[30] Violations of land rights and of indigenous peoples' rights, including the right to free, prior, and informed consent (FPIC), have also been documented in connection with gold mining.[31]

Gold mining also has a long history of being associated with violations committed by state and private security forces and by state and non-state armed forces, in addition to fuelling conflict, money-laundering, and corruption.[32]

2.1.2 Tantalum

Tantalum is a rare metal that is very resistant to corrosion. The main application of tantalum is to produce capacitors. Capacitors are used by a range of industries including medical, aerospace, military, automotive, telecommunications, and electronics. The electronics and telecommunications industries are the main consumers. With the shift to electric cars, the automotive industry is also increasing its tantalum consumption.

Capacitators are used in electronic devices such as mobile phones, computers, and automotive systems (brakes, transmission, electric motors, and power steering). Tantalum is also used to produce tantalum chemical products and sputtering targets which are used in the manufacture of semiconductors, data storage, and mobile communication devices. Sputtering targets are used as thin films for coatings. Tantalum demand rose at a rate of 2.4% per year in the period 2010-19 and then declined in 2020 due to the Covid-19 pandemic. Commodity researcher Roskill forecasts that tantalum demand will grow at a rate of 4.7% per year from 2021 to 2025. Increasing demand is largely driven by electric vehicles and 5G networks.[33]

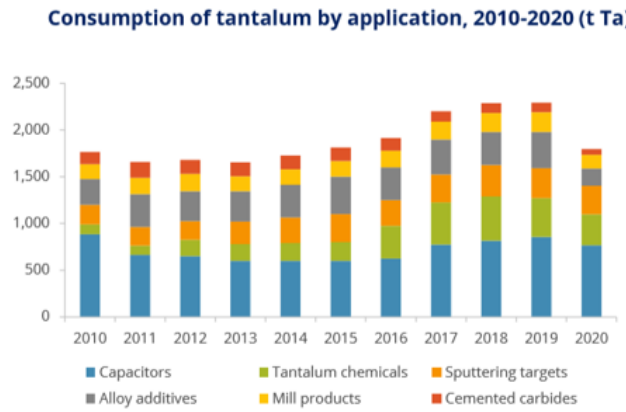


Figure 1: Tantalum demand by application (tonnes), Source: Wood Mackenzie group, 2021.[34]

Of all metals, tantalum has the highest share of artisanal and small-scale production. During the past 10 years, around 60% of tantalum was produced by artisanal and small-scale mining (ASM), mostly in the DRC and Rwanda. In 2020, artisanal mining in Central Africa produced 58% of total tantalum supply, mainly from the DRC and Rwanda, and to a much lesser extent from Burundi and Uganda. BGR estimates that from 2009 to 2019 half of global tantalum mine production came from the Great Lakes region. Other important locations for tantalum ASM are Brazil and Nigeria and to a lesser extent Mozambique and Ethiopia.[35]

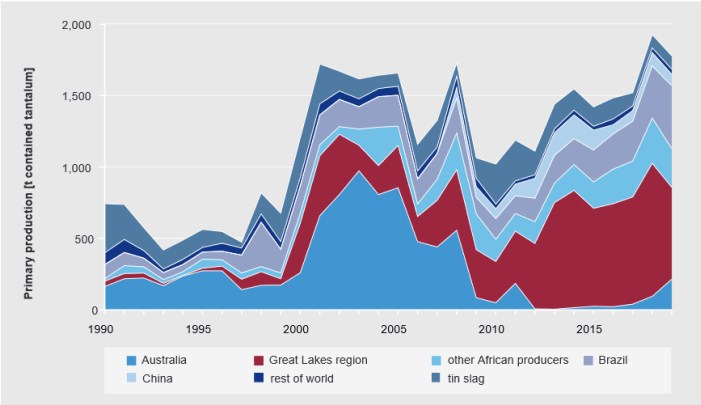


Figure 2: Tantalum mine production 1990-2019. Source: BGR, 2021.[36]

In 2020, industrial mining accounted for 28% of production. While industrial tantalum production is increasing as a by-product of lithium mining, ASM is forecast to continue to be the main source in years to come.

Main tantalum industrial mining companies include Global Advanced Metals Pty Ltd (United States), AMG Advanced Metallurgical Group (Netherlands), Pilbara Minerals (Australia), Ningxia Orient Tantalum Industry Co. Ltd (China), and Alliance Mineral Assets Limited (Australia).[37]

The following table shows the names of the main industrial tantalum mines, their location, ownership, and estimated annual production from 2017 to 2019.

Table 5: Major tantalum industrial mines producers 2017-19. Source: BGR, 2021.[38]

Mine	Location	Main owner(s)	Estimated annual production 2017-19 (tonnes)
Pitinga	Brazil	Mineração Taboca (Minsur)	175
Mibra	Brazil	AMG Mineração (Advanced Metallurgical Group)	99
Yichun	China	Ningxia Non-Ferrous Metals	83
Greenbushes	Australia	Talison Lithium* / Global Advanced Metals	60
Lovozero	Russia	JSC Sevredmet (Lovozersky GOK)	34

*Talison Lithium is owned by Tianqi Corporation/IGO Limited JV (51%) and Albemarle Corporation (49%).

Social and environmental challenges

ASM working conditions are a major risk and deserve consideration since ASM accounts for 60% of tantalum production and is often associated with poor working conditions and poor water management.

Accidents and fatalities are frequent and sometimes covered up to avoid inspections due to the fact that the mining is done illegally in some places such as the Great Lakes region, Mozambique, and Nigeria. Smuggling and financing of conflict related to tantalum in the DRC have decreased according to studies but remain an important risk to monitor.[39]

A BGR report states: "The tantalum sector is associated with a number of social and environmental problems including land use conflicts, soil erosion and deforestation as well as poor health and safety in the artisanal mining sector. The natural radioactivity of tantalum concentrates and processing waste presents a challenge for global supply chain logistics and waste disposal."[40]

2.1.3 Tin

Tin is one of the oldest known metals of humankind, used as early as 3,500 BC to produce bronze artifacts.[41] Tin's low melting point makes it ideal for solder, which is its main use. Other uses of tin include tinplate (used to can food), tin coatings, tin alloys such as bronze and brass, for glass production, and a wide range of chemical applications. The electronics industry's main use of tin is as solder, for instance for soldering electrical and electronics circuits. Tin is also used in coatings to produce solar cells and in lead acid batteries.[42]

The following figure shows the main applications for refined tin from 2016 to 2020.

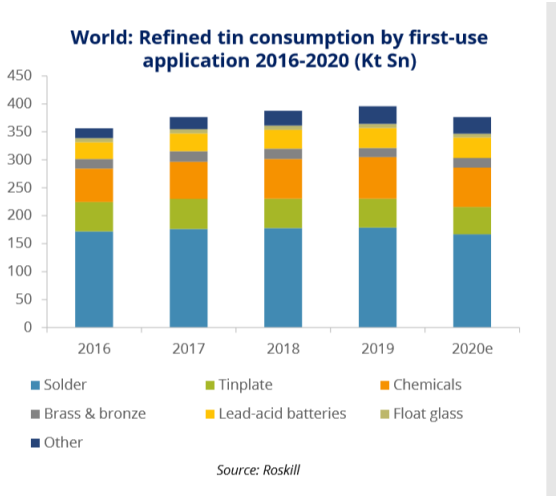


Figure 3: Refined tin consumption by end-use application. Source: Wood Mackenzie group, 2021.[43]

As mentioned above, solder is the main end-use of tin, representing around 40% to 45% of the total. Solder is used for both industrial and electronics applications; however, the vast majority is used for electronic applications, as can be seen in the next figure. Consumer electronics (mobile phones, smart home devices, computers, tablets, and wearables) result in strong and increasing demand for tin solder.

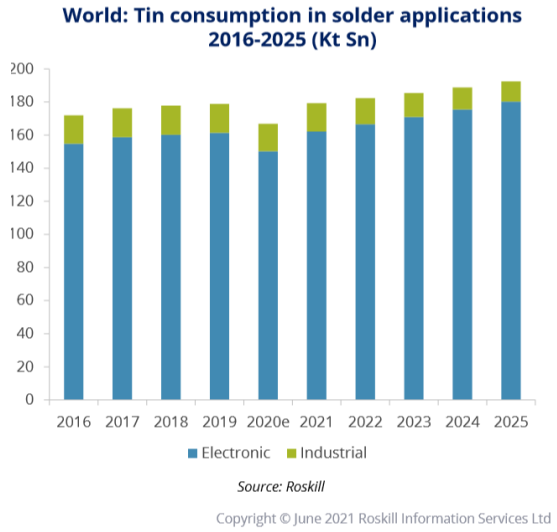


Figure 4: Tin consumption in solder applications. Source: Wood Mackenzie group, 2021.[44]

The main countries producing tin in 2020 were China (30%), Indonesia (24%), Myanmar (12%), Peru (7 %), the DRC (6%), Brazil (5%), and Bolivia (5%).[45] When it comes to tin refining, the main countries are China, Indonesia, Malaysia, Peru, Brazil, Bolivia, and Thailand as shown in the next figure, which also shows the 10 largest tin mining companies, which in 2020 produced around 70% of the global total.

Table 6: Largest tin producers. Source: International Tin Association,2021.[46]

2020 Top 10 Refined Tin Producers				
Refined tin production (tonnes)				
	Company	**2019**	**2020**	**YOY change (%)**
1	Yunnan Tin (China)	75,900	74,800	-1.4
2	PT Timah (Indonesia)	76,400	45,700	-40.2
3	Malaysia Smelting Corp (Malaysia)	24,300	22,400	-7.8
4	Minsur* (Peru)	19,600	19,600	0.0
5	Yunnan Chengfang (China)	19,100	16,500	-13.6
6	Thaisarco (Thailand)	10,900	11,300	3.7
7	Guanxi China Tin (China)	8,200	10,100	23.2
8	Jiangxi New Nanshan (China)	7,200	10,100	40.3
9	Metallo (Belgium)	9,300	8,100	-12.9
10	Gejiu Zi-Li (China)	8,000	*7,000*	-12.5
Provisional data reported to the International Tin Association and rounded to the nearest 100t. *One company excluded from the top 10 on request.* ** Excludes production from Minsur's Brazilian subisidary Taboca.*				

Bolivian company EM Vinto is usually in the top 10 list; however, in 2020 its production decreased due to extended closure because of the Covid-19 pandemic.

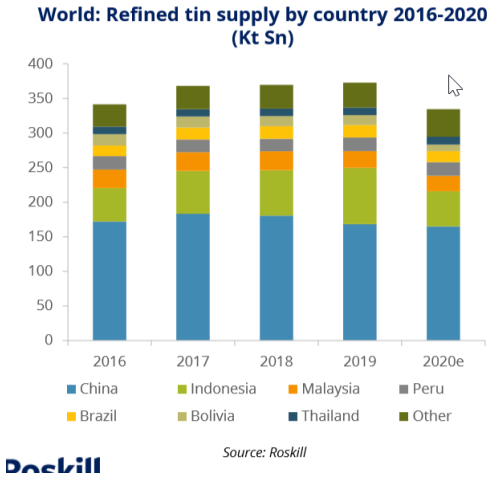


Figure 5: Refined tin supply by country 2016-20. Source: Wood Mackenzie group, 2021.[47]

ASM plays an important role in tin production, with many livelihoods dependent on it. BGR estimates that more than 250,000 people work in tin ASM and produce around 27% of total global production.[48] The main countries where tin ASM takes place include Indonesia, Myanmar, Rwanda, Burundi, the DRC, Brazil, and Bolivia. According to the International Tin Association, 30% of refined tin production comes from recycled sources. However, tin solder used by the electronics industry is only recycled to a small degree.[49]

Social and environmental challenges

Both ASM and large-scale tin mining present serious social and environmental impacts.

Most tin production comes either from underground mining (approx. 56%) or from on- and offshore placer mining (38%).[50] Tin placer mining is land-intensive and often affects and erodes "riverbeds or former riverbeds, economically used land or valuable natural habitats".[51] Placer tin mining often results in damaged land that can no longer be restored or cultivated.

Industrial mining on the Indonesian islands of Bangka and Belitung has devastated terrestrial and marine ecosystems, affected the livelihoods of fishers, and left behind abandoned mines and mining waste. The Indonesian Forum for the Environment (Walhi) reports that "tin mining in Bangka has degraded 5,270 hectares (13,022 acres) of coral reef and 400 hectares (988 acres) of mangrove forest".[52]

Offshore tin mining plays a significant role in total production and involves dredging or excavation of the seabed, resulting in large disruptions of the sea floor. Impacts on coral reefs and biodiversity are widely documented. For instance, a study by the University of Bangka found that half the corals around the island of Bangka have been damaged.[53] Ore containing tin can also pollute the environment through the generation of acid mine water and radioactivity.

A 2015 factsheet by GoodElectronics on tin mining in Indonesia highlighted the following risks: health and safety risks, particularly for unlicensed miners; degradation of coastal ecosystems, including coral, sea-grass, and mangrove; tailings disposal into the ocean and the spread of mud and sediments; stockpiling at smelters of rare earths and waste that may contain radioactive elements; unpaid taxes by unlicensed miners; damage to the livelihood of fishers.[54]

With ASM, one of the most serious concerns is poor working conditions with regard to health and safety. Common accidents include collapse of tunnels, people falling into abandoned mines, lack of protective equipment, landslides close to open pits, and exposure to other dangers such as noise, vibrations, water, and residues.

While income from tin mining can be an important source of income for artisanal miners, most of the added value is passed from the smelters to the mining sector, with only 10% remining at the location of the smelter.[55]

Myanmar is the third largest global producer of tin, accounting for around 12% of production in 2020. Several regions of the country have been affected by conflict in recent years.[56]

Bolivia is another major producer. Research by the NGO CATAPA found that cooperative workers experienced poor health and safety conditions, in particular with limited use of respirators, which results in many cases of silicosis. Cooperative workers were also exposed to toxic chemicals affecting their eyes, nervous system, and internal organs. Other findings included the release of acid water and mining waste and the discharge of chemicals.[57]

2.1.1 Tungsten

Tungsten has the highest melting point of all metals and is used as an alloy to strengthen other metals. Tungsten and its alloys are used in a wide range of industries including steel production, industrial engineering, mining, oil and gas, aerospace, defence, lighting, electronics, automotive, and chemicals.[58]

The largest end-use of tungsten is as tungsten carbide. This is extremely hard and wear-resistant and is used as a cemented carbide (also known as hard metal) to produce tools for cutting and drilling, some of which are utilised for the manufacture of electronics. It is also used in the vibration motors of mobile phones. In the automotive industry tungsten is used for car wheels, chassis, brakes, and motor crankshafts.

China is by far the largest producer of tungsten, accounting for 82% of production in 2020. Other producer countries include Vietnam (5%), Russia (2.6%), Mongolia (2.2%), Bolivia (1.6%), and Rwanda (1.2%).[59]

In China, tungsten production is concentrated in Jiangxi, Hunan, and Henan provinces, and mining licences are held mostly by state-owned enterprises. The largest companies producing tungsten in China are Xiamen Tungsten, China Minmetals Corporation, Jiangxi Tungsten Holding Group, China Molybdenum, Chongyi Zhangyuan Tungsten Company, and Jiangxi Yaosheng Tungsten Company. [60]

Social and environmental challenges

While tungsten itself is non-toxic to humans, occupational exposure to tungsten can result in serious health impacts such as pulmonary fibrosis.[61]

Mine waste from tungsten poses serious threats to the environment, in particular due to heavy metals and contaminants present in tailings. Acid mine drainage from tungsten tailings facilities and heavy metal pollution from tungsten mining also present serious health and environmental risks.[62]

2.1.2 Mica

The extraordinary qualities of mica explain the wide use of this mineral across many sectors. It is a perfect insulator in several ways due to its low thermal and electrical conductivity, high dielectric strength, and chemical inertness. This means that it is resistant against extremely high temperatures up to 1,000°C and very high voltages, and it does not react to chemicals. Mica is named after its ability to reflect and refract light and is used to make cosmetics and paints glittering and sparkling. Mica is also very light, has a crystalline and layered structure, and can be split into very thin sheets.

A main application of mica is to produce pearlescent pigments. Pearlescent pigments are added to paint coatings, cosmetics, plastics, and ink, with the main purpose of creating a sparkling effect. For this, mainly mica flakes are used. Sheet mica and splittings are used for electrical appliances and electronics.[i]

[i] Electrical appliances include electrical devices, radio receivers, TVs, radars, light systems, household appliances (toasters, hairdryers, coffee machines), monitoring systems, mechanical applications (heart-lung machines, respirators), industrial applications (e.g. heating systems). Source: Schipper and Cowan, *Global Mica Mining and the Impact on Children's Rights*.

Electronics components containing mica include capacitors, resistors, insulators, encoders, and DRAM, which are all small components mounted on printed circuit boards.[63] The electrical insulation of wires and cables is also a main application of mica, and its application in electronic components is very broad, including sensors, semiconductor systems,[64] batteries, LCDs, LEDs, card sockets, adaptors, and power modules.[65]

The use of mica in the automotive sector is also very broad, including use in paints, coatings, brake and clutch pads, batteries, compounds in the motor and cylinders, compressors, plastics, LED lamps, commutators, pumps, and various electronic parts.[66] The use of mica in the protective shields around battery packs can increase demand enormously.[67]

Mica is also used as a functional filler in products in the construction sector, such as plasterboard and fibre cement, and in oil well drilling fluids.

A market report in 2016 identified the electronics industry as the largest buyer of mica, representing 26% of global demand in 2015, followed by the paints and coatings sector (24%), construction (20%), and cosmetics (18%).

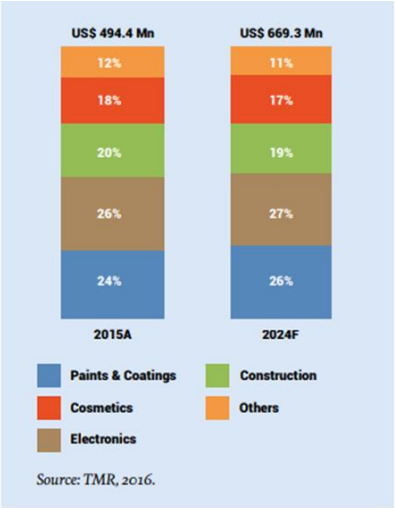


Figure 6: Global mica market, value share by end-user 2015 and 2024 (forecast). Source: Transparency Market Research, 2016.[68]

Worldwide the main types of mica traded are muscovite and phlogopite. Muscovite is by far the most frequently mined and has better electrical properties than phlogopite. Glistening pigments used in cosmetics are usually made of muscovite. Phlogopite, the type that Madagascar mostly produces, is more resistant to high temperatures and used in products that require both thermal stability and electrical properties, such as electrical cables.[69]

The biggest mine production of mica is in China, followed by India, Canada, Madagascar, and France. Sheet mica is the grade especially used for electrical appliances and electronics, with the main exporting country Madagascar, followed by India, China, and Brazil.[70]

Social challenges

The mining of mica is associated with extremely low wages, poor and unsafe working conditions, child labour, limited education and health facilities in the area, abuse, and exploitation. An estimated 22,000 children work in mica mining in Jharkhand and Bihar alone in India, and 10,000 children in Madagascar.[71]

Mica mining, especially sheet mica, is a labour-intensive process and not economically viable in countries with high labour costs. But mica is still a cheap mineral, costing in Madagascar only $ 0.03 to $ 0.05 per kilo at the mine and $ 0.01 as scrap. Mining is undertaken by the very poor in the setting of ASM. An aggravating factor for the mining conditions is the mines' illegality. In India, all mines are illegal and therefore not subject to regulation, inspections, or organising. Illegality increases risks of abuse and exploitation. In Madagascar, some mines have licences. Illegal mining is also suspected in Malaysia, Pakistan, Sri Lanka, and South Africa.[72]

Common accidents include collapse of tunnels and landslides close to open pits. Health and safety issues include lack of protective equipment and exposure to dust. Many workers cough and contract lung diseases. Cuts, head injuries, abrasions, and broken bones are part of life in mica mines. Scorpions and snakes are also a problem. In 2016, an Indian NGO reported 20 child deaths in the month of June, while usually they hear of about ten fatalities a month.[73]

After mica is mined, cobbing and sorting take place. Cobbing is the process of manually hammering minerals from mined rocks. Other processing can include splitting with knives and cutting to remove ragged edges with scissors. For some electrical applications, the mica will be cut and punched with a simple machine. When mica is to be used as flakes and powders, the cobbed mica will be crushed/pulverised and cleaned.[74]

Environmental impacts are not currently known to be an issue with mica production at the time of writing .

2.2 Manufacturers

2.2.1 Contract manufacturers

Consumers rarely know the name of the companies manufacturing electronics; however, such companies have become large multinationals and employ millions of workers.

Contract manufacturers make and sell components or products to their brand clients. Broadly speaking, there are two types of contract manufacturers. The first type are companies that engage in **electronics manufacturing services** (**EMS**), consisting in manufacturing, assembling, prototyping, logistics, and export, among others. The second type are called **original design manufacturers (ODMs)**, which in addition to providing EMS also engage in designing and developing products, often in collaboration with the brands. EMS and ODMs share more similarities than differences, with some manufacturers operating both as EMS providers and ODMs towards different clients. For the purposes of this report, we refer to both as contract manufacturers.

Contract manufacturers are sometimes referred to as a one-stop shop for brands due to the wide array of services they provide besides the more labour-intensive manufacturing of products. Such services include **raw material acquisition in order to produce the products for their clients,** which makes them a key player when it comes to sourcing of minerals and thus for the purposes of this report.[75] Contract manufacturing is labour intensive, with some manufacturers employing hundreds of thousands of workers. These manufacturers often operate with small profit margins. The following figure shows the largest manufacturers by revenue, including their number of employees and operating margins.

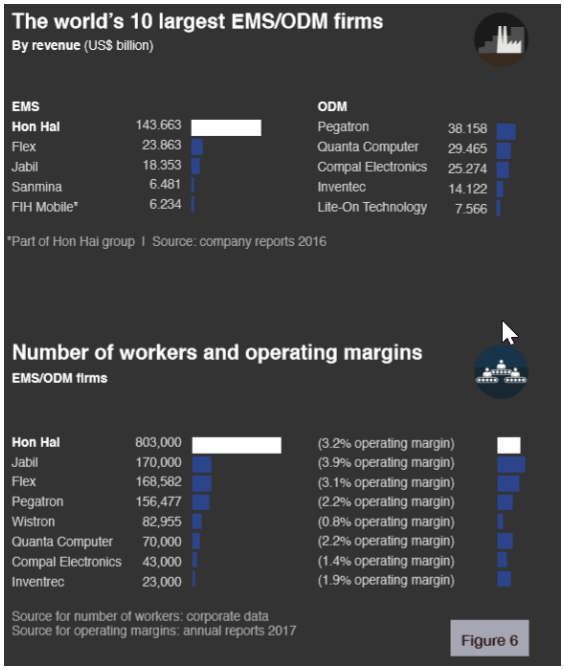


Figure 7: Contract manufacturers, number of employees, and operating margins. Source: Make ICT Fair, 2021.[76]

China continues to be the world's largest electronics manufacturing hub. In 2018, China dominated the global exports of mobile phones (57%), computers and tablets (49%), and household electrical goods (43%).[77] Other important manufacturing hubs include Vietnam, Indonesia, the Philippines, Malaysia, India, Mexico, and Brazil. Some contract manufacturers also have significant production facilities based in Europe, including in Hungary, Poland, Romania, Slovakia, and the Czech Republic.

According to a recent report by consultancy firm DECISION and the electronics association IPC, "electronics manufacturing services (EMS) represents a significant activity in the European territory with approximately €43B in annual revenue in 2020 and around 2,150 companies".[78] The same report states that Europe accounted for 14% of global production of both stand-alone and embedded electronics, following China with 37% and North America with 15%.

Two-thirds of the largest contract manufacturers are Taiwanese with global operations, concentrating around 80% of the total market.[79] The largest is Hon Hai, better known as Foxconn.

Large US contract manufacturers include Jabil and Flex. US and European contract manufacturers tend to focus more on "higher-mix/lower-volume manufacturing, whose customers are typically active in the medical and auto industries".[80]

2.2.1 Component manufacturers

As mentioned in the Introduction, there are a myriad of different components that connect into the PCBs of electronics, such as capacitors, resistors, and connectors. Many of these components are standardised and traded in bulk on a market that resembles commodities.[81] A notable exception is semiconductors, which are highly specialised products driven by fast innovation.

We focus particularly on semiconductor companies because they are a cross-cutting industry essential not only for electronics but for many other industries including renewable energy and mobility.

Furthermore, due to the fast-paced and high-tech nature of the chips, production is dominated by a few well-established companies with large power and leverage within the electronics production network. Major companies include the Taiwan Semiconductor Manufacturing Company, Intel Corporation, and Texas Instruments. The following table shows the largest 10 semiconductor producers in terms of market value.

Table 7: Largest semiconductor companies in 2021. Source: Forbes, 2021.

Name	Country	Sales	Profit	Assets	Market value
Intel	United States	$ 77.9bn	$ 20.9bn	$ 153.1bn	$ 263.7bn
Taiwan Semiconductor	Taiwan	$ 48.1bn	$ 18.7bn	$ 98.3bn	$ 558.1bn
Broadcom	United States	$ 24.7bn	$ 4bn	$ 77bn	$ 195.5bn
SK Hynix	South Korea	$ 27bn	$ 4bn	$ 65.5bn	$ 84.2bn
Qualcomm	United States	$ 26.7bn	$ 6.7bn	$ 37.5bn	$ 157bn
Micron Technology	United States	$ 23.5bn	$ 3.2bn	$ 54.1bn	$ 101.7bn
ASML Holding	Netherlands	$ 15.9 B	$ 4.1 B	$ 33.4 B	$ 267.6 B
NVIDIA	United States	$ 16.7bn	$ 4.3bn	$ 28.8bn	$ 396.1bn
Applied Materials	United States	$ 18.2bn	$ 3.9bn	$ 23.3bn	$ 122.7bn
Texas Instruments	United States	$ 14.5bn	$ 5.6bn	$ 19.4bn	$ 177.2bn

Source: Forbes.[82] Samsung is also an important semiconductor producer; however, Forbes lists the company under Technology Hardware & Equipment.

2.2.2 Social and environmental challenges associated with (contract) manufacturers' activities and business relationships

Besides operating with very low margins, contract manufacturers are extremely dependent on their clients. Their main client can represent more than half of their total revenue, which causes a power imbalance that forces them to accept the terms imposed by the buyers, often detrimentally to their own profits and their employees' working conditions.

Civil society, trade unions, and academics have documented serious violations of human rights in electronics contract manufacturing. [83] The following is a non-exhaustive list of violations occurring in electronics hotspots including China, India, Indonesia, Mexico, Vietnam, Malaysia, and the Philippines: forced labour; excessive working hours; breaches of social security obligations; health and safety hazards; unlawful termination of employment contracts; violation of freedom of association and collective bargaining rights; child labour; payment below living wage; forcing student interns to work regular shifts; union busting; harassment; exposure to chemicals and noise; and health issues including fainting, fatigue, dizziness, and miscarriages.

Besides the fact that brands' purchasing practices are designed to maximise profits and transfer the risk to contract manufacturers, another factor contributing to poor working conditions is that production has shifted to countries where basic labour rights (such as freedom of association and collective bargaining) are not respected. For instance, China, India, Malaysia, Thailand, the US, and Vietnam have not ratified ILO Convention C087 on Freedom of Association and Protection of the Right to Organise.[84] In many countries, even where unions exist they are often aligned with the State or with employers. There are other specific limitations to labour rights in certain countries, such as: protection contracts; limitations to organising in special economic zones; legal prohibitions against forming unions; and blatant intimidation, harassment, and criminalisation. Some electronics companies have been accused of entrenched anti-union policies and practices.[85]

An important gap found during this research is that there is very scarce public information and analysis about the practices of contract manufacturers with regard to sourcing of minerals. Most of the literature focuses on either mining companies or end-user brands when it comes to analysing the social and environmental challenges related to the use of minerals.

With regard to semiconductors, the industry's particular challenges include the use of vast amounts of energy and water, generation of hazardous waste, and carbon emissions.

Researchers Gupta et al. quantified the carbon emissions of information and communications technology (ICT) companies and concluded that the manufacturing of hardware (such as integrated circuits), rather than energy consumption or operational use, dominates the total carbon emissions output. For instance, they highlight that manufacturing accounted for 74% of Apple's total emissions, while hardware use represented 19%. More specifically, manufacturing of integrated circuit boards accounted for 33% of Apple's emissions. In another example, looking at the production of 12-inch wafers by semiconductor company TSMC shows that energy consumption of manufacturing accounts for 63% of the emissions.[86]

Semiconductor manufacturing also requires copious amounts of water. In 2019, Intel used more than three times as much water as car maker Ford.[87] As chips become smaller and more advanced, the energy required to manufacture them increases. In the last 10 years, TSMC's consumption of water has almost quintupled, reaching almost 200 million cubic metres. According to estimates by Greenpeace, TSMC consumes almost 5% of Taiwan's entire electricity, and this is predicted to rise to 7.2% once planned new production facilities start operations. TSMC has pledged to use 100% renewable energy by 2050.[88]

2.3 Brands or end-users

2.3.1 Industry players

Electronics brands design, brand, and sell the finished products (for instance mobile phones, tablets, or computers) to the public. Popular brands include Apple, Samsung, LG, Dell, and HP, etc.

While a few electronics brands remain vertically integrated to a certain degree (especially South Korean and Japanese companies such as Samsung, LG, and Panasonic), most outsource manufacturing to contract manufacturers. According to some estimates, around two-thirds of production is outsourced.[89]

Popular electronics brands are among the largest companies in the world in terms of sales and market value. The following are the largest 10 electronics companies by market value:

Table 8: Largest electronics companies in 2021. Source: Forbes, 2021.[90]

Name	Country	Sales	Profit	Assets	Market Value
Apple	United States	$ 294bn	$ 63.9bn	$ 354.1bn	$ 2,252.3bn
Samsung Electronics	South Korea	$ 200.7bn	$ 22.1bn	$ 348.2bn	$ 510.5bn
Cisco Systems	United States	$ 48bn	$ 10.1bn	$ 95.6bn	$ 222.9bn
Dell Technologies	United States	$ 94.3bn	$ 3.3bn	$ 123.4bn	$ 77.4bn
Xiaomi	China	$ 35.7bn	$ 3bn	$ 38.8bn	$ 84.5bn
HP	United States	$ 57.7bn	$ 3.2bn	$ 34.7bn	$ 42.6bn
Ericsson	Sweden	$ 25.2bn	$ 1.9bn	$ 33.1bn	$ 46.9bn
Fujitsu	Japan	$ 34bn	$ 1.6bn	$ 29.4bn	$ 30.3bn
Murata Manufacturing	Japan	$ 14.8bn	$ 2bn	$ 23.3bn	$ 52.9bn
Lenovo Group	Hong Kong	$ 55.7bn	$ 961 M	$ 38.6bn	$ 16.8bn

2.3.2 Social and environmental challenges associated with brands' activities and business relationships

For many years, civil society organisations, trade unions, and academics have documented cases and allegations of electronics brands causing, contributing to, or being directly linked to serious social and environmental impacts along the entire electronics supply chain

In 2020, the Corporate Human Rights Benchmark assessed 44 of the largest ICT companies against core indicators based on the UN Guiding Principles, including the companies' governance and policy commitments, human rights due diligence, remedies, and grievance mechanisms.[91] The average score of the ICT companies was a low 7.9 out of 26. Other important findings were that only 14% of the companies had commitments to the ILO core labour standards; only 23% committed to providing remedy for adverse impacts; and no company demonstrated commitments to work with suppliers and partners and not to obstruct access to remedy. Sixteen companies scored 0 with regard to disclosure of human rights due diligence. And 21 of the assessed companies were subject to at least one serious allegation of human rights abuse.

The following table includes a non-exhaustive list of recurrent issues in the electronics supply chain: exposure to hazardous substances, low wages, violation of freedom of association and collective bargaining, forced labour, child labour, excessive overtime, poor health and safety conditions, harassment, and gender discrimination.

Table 9: Social and environmental risks in the electronics supply chain.

Social	Environmental	Governance
• Poor working conditions • Excessive hours • Poor occupational health and safety • Exposure to chemicals and toxic substances • Violation of collective rights (FoA and CB) • Flexibilisation of labour • Migrant and student labour abuses • Contribution to conflict • Child labour • Corruption	• Water depletion and pollution • Waste generation • Heavy metals and toxic chemicals • Pollution of air, water, soil • GHG emissions • E-waste	• Super-voting power of founders • Anti-trust issues • Excessive executive compensation

The scope of impacts is too broad to detail in this research. We will, however, describe some of the root causes of such abuses (lack of transparency and purchasing practices) and elaborate further on a few selected impacts (exposure to hazardous substances and e-waste) in order to provide more detailed examples to help contextualise the relationship between brands' practices and impacts along the supply chain.

Lack of transparency

At the root of many of these abuses (and contributing to perpetuate them) lies the issue of lack or inadequacy of information. The right to information is both a right in itself and also a precondition for the enjoyment of other rights such as health and collective bargaining. Therefore, when there is a lack of information a wide array of human rights is affected. For instance, when workers are denied their right to know the names and properties of hazardous substances to which they are exposed at work, several rights are curtailed including rights to health, to a safe working environment, and to effective remedy.

Purchasing practices

The purchasing practices of brands have a direct impact on working conditions in the supply chain. A global survey conducted by the ILO on global supply chains (including electronics) identified five business practices between buyers (in this case electronics brands) and suppliers that may influence wages and working conditions. Such practices include **contract clauses**, technical specifications, **order placement (and lead times)**, **prices** and **market power**, and requests for social standards.[92]

When contracts between brands and suppliers are not clear or are incomplete (for instance with regard to who incurs the costs of changed orders, or by failing to include minimum labour standards), workers' security may be affected. Likewise, brands can also use their leverage to include high standards in their contracts that require suppliers to uphold decent working conditions.

When electronics brands give short lead times for manufacturers to produce large volumes (for instance during peak selling periods), this often results in manufacturers relying on excessive overtime, stressful production conditions, and use of temporary workers.

Price and market power are one of the most relevant issues that affects workers' conditions in the electronics industry. Electronics brands operate with a business model of "*maximis[ing] profits and transfer[ring] risk down the supply chain to the contract manufacturers*".[93] Electronics brands operate with large profit margins (30% to 40% margins are common), while contract manufactures have low profit margins (2% or 3%).

In order for companies with low profit margins to remain competitive, they often push down operating expenses, which include labour costs. This results in a situation whereby, while also coping with large volumes and strict quality requests from brands, contract manufacturers may revert to a low-cost labour system that represses labour rights.[94]

Exposure to toxic chemicals

Toxic substances are used along the entire electronics lifecycle, including mining, manufacturing, and recycling. Cases from around the world have been documented of workers' exposure to chemicals resulting in acute poisoning, serious health impacts, and death. Hazardous substances are used along the electronics supply chain, and workers often lack sufficient information on important issues such as the name of the chemicals being used (including in combinations), their toxic properties, the associated health risks, and the necessary protection measures.

A report by Tuncak et al. observed: "In various cases of workers harmed by toxic substances, the information provided to workers has been grossly insufficient regarding the hazards and risks they face. This has been further compounded by efforts made to manipulate, obscure and conceal the evidence of actual or potential health impacts. This lack of transparency is especially ironic when practised by the 'Information Technology Industry', which claims to facilitate information sharing."[95]

The same report concluded that when workers are not provided with the relevant information on the chemicals used in the workplace and their hazardous substances, this could constitute a form of exploitation (exploitation by deception) actionable by law.[96] However, the right to information continues to be violated under claims of confidentiality and corporate secrecy even though health and safety information should never be confidential.[97]

The right to information is not limited to hazardous substances at work. Rather, "such right encompasses all information that affects or may affect the working lives and livelihoods of electronics workers, and the information that electronics workers, their families and communities need for the full enjoyment of their human and labour rights. This includes information on corporate structures, policies, procedures and practices; production, trading and purchasing conditions and workplace conditions."[98]

E-waste

Increasing consumption of electronics, paired with products designed with short life spans, planned obsolescence (of hardware and software), or difficult to repair, has resulted in electronics and electrical equipment waste (e-waste) becoming the fastest growing waste stream.[99]

In 2019, 53.6 million metric tonnes of e-waste were generated according to the UN Global E-Waste Monitor, representing an increase of more than 20% in five years. According to estimates from the same source, of such e-waste only around 17% was collected and recycled.

In the EU, it is estimated that less than 40% of e-waste is recycled.[100] A public opinion survey conducted in the EU shows that almost 80% of respondents "would like to oblige manufacturers to make digital devices easier to repair".[101]

3 Standards and initiatives

3.1 Introduction to this chapter

This chapter discusses the relevant standards and initiatives for the electronics sector that are related to responsible sourcing of minerals. As explained in section 2.1, the 3TG minerals (tin, tantalum, tungsten, and gold) and mica were selected by the project partners for the electronics sector, and thus standards and initiatives discussed here relate to these minerals specifically or generally (by covering all minerals).

The present chapter presents an overview of relevant standards and initiatives divided into the following categories:

- International frameworks.
- Laws and international instruments .
- Voluntary schemes (standards).
- Initiatives.

At present, the due diligence principle has been embraced by governments, industry, and civil society as the cornerstone for responsible sourcing of minerals. We therefore start with an introduction of the most authoritative international frameworks for due diligence. These often serve as reference for legislation, voluntary standards, and initiatives.

The section on laws and international instruments makes a distinction between laws that are linked to mineral supply chains and general laws that are also relevant.

The voluntary schemes (standards) are presented in two groups: those that are aligned with the OECD Due Diligence Guidance and those that make no specific reference to it.

3.2 International frameworks for due diligence

UN Guiding Principles on Business and Human Rights
ILO Tripartite Declaration of Principles Concerning Multinational Enterprises and Social Policy
OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas
Chinese Due Diligence Guidelines for Responsible Mineral Supply Chains (CCCMC)

The most authoritative international frameworks for due diligence that outline the responsibilities of businesses to address business-related human rights abuses are the UN Guiding Principles on Business and Human Rights (2011),[102] the ILO Tripartite Declaration of Principles Concerning Multinational Enterprises and Social Policy (1977),[103] and the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas (2011; hereafter the OECD DDG).[104]

The third edition of the OECD DDG was published in April 2016 and clarifies that the framework is global in scope and applies to all mineral supply chains. The OECD has developed special supplements, annexes, and evaluations for mineral supply chains and extractive industries to help companies implement due diligence:

- Supplement on tin, tantalum, and tungsten (2011).[105]
- Supplement on gold (2013).[106]
- Responsible supply chains in artisanal and small-scale gold mining, FAQ.[107]
- Practical actions for companies to identify and address the worst forms of child labour in mineral supply chains (2017).[108]
- Due diligence guidance for meaningful stakeholder engagement in the extractive sector (2017).[109]
- How to address bribery and corruption risks in mineral supply chains, FAQ (2021).[110]
- Trends in stakeholder reporting: mineral supply chains (2021).[111]

Another relevant due diligence guidance document co-developed by the OECD is the Chinese Due Diligence Guidelines for Responsible Mineral Supply Chains (2015).[112]

The OECD DDG is referenced in several regulations and declarations, including the EU Conflict Minerals Regulation,[113] the final rule implementing section 1502 of the US Dodd-Frank Act,[114] the EU proposal for mandatory human rights due diligence (HRDD), and the proposed EU Batteries Regulation (these regulations will be discussed further below). Also, many industry actors indicate that their standards and programmes (hereafter called voluntary schemes) are based on the OECD DDG.

It is stressed by the OECD that individual companies continue to bear the primary responsibility for implementation of due diligence in their mineral supply chains; the fact that a company participates in a voluntary scheme does not release it from this responsibility.[115] To put it differently, "*a company cannot simply rely on a supplier's participation in an industry programme"*, because it is not certain that the supplier actually implements due diligence practices according to the industry standard it participates in. This means that a company still needs to actively undertake due diligence on the supplier. [116]

The development of the OECD DDG involved a multistakeholder process with OECD and non-OECD countries and representatives from business, trade unions, and civil society and international organisations.

Due diligence needs to be understood **as both a process and a duty of care**. Due diligence as **a process** is used by businesses to "*actively identify, prevent, mitigate and account for how they address and manage their potential and actual adverse human rights impacts*".[117] Due diligence as a **duty of care** refers to a legal standard (of care) which is expected of a duty bearer (in this case businesses) to discharge an obligation (in this case the obligation to respect human rights).

The UNGP and the OECD Guidelines for Multinational Enterprises refer to both components of due diligence interchangeably, which has generated some confusion. Importantly, both components of due diligence are increasingly recognised by legislative proposals at national and EU level.

3.3 Laws and international instruments

This section starts with an overview of legislation for mineral supply chains and a review of the EU Conflict Minerals Regulation,[118] followed by relevant cross-sectoral legislation and international instruments.

3.3.1 Legislation for mineral supply chains

Table 10: Legislation for mineral supply chains

2010 Dodd-Frank Act, section 1502, conflict minerals
2017 EU Regulation 2017/821 laying down supply chain due diligence obligations for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict-affected and high-risk areas (Conflict Minerals Regulation)
2019 EU Supplementing Regulation for the recognition of supply chain due diligence schemes concerning tin, tantalum, tungsten and gold[119] (supplement to the Conflict Minerals Regulation)
2011 International Conference on the Great Lakes Region (ICGLR) Regional Certification Mechanism (RCM) Regional Initiative against Illegal Exploitation of Natural Resources (RINR)[ii]
2013 UNEP Minamata Convention on Mercury 2013
1995 ILO Safety and Health in Mines Convention C176/R183
1989 ILO Indigenous and Tribal Peoples Convention 169

Conflict mineral regulation in the EU and the US

In 2010, the US introduced binding legislation on supply chain due diligence: the **Dodd-Frank Act**, the landmark US law requiring responsible minerals sourcing (albeit with a very limited geographical and material scope).[120] In essence, the US conflict minerals legislation was the first mandatory human rights due diligence legislation. The Dodd-Frank Act was passed in 2010, a year before the UN Human Rights Council endorsed unanimously the non-binding UN Guiding Principles on Business and Human Rights (UNGP), in which the due diligence principle was introduced, and a year before the OECD DDG, which set out due diligence in a five-steps framework.

The Dodd-Frank Act requires companies that are publicly listed on a US stock exchange to check their supply chains for 3TG minerals originating in the DRC or its neighbouring countries and take steps to address any risks they find. Every year, these companies need to report on their efforts to the US Securities and Exchange Commission (SEC).

Civil society organisations, including SOMO, have argued for legally binding international regulations for corporate accountability and supply chain responsibility for decades, because in their opinion voluntary initiatives and soft law guidelines fall short of achieving impact on the ground and fail to achieve access to remedy for people who are harmed by business- related human right abuses. Despite their efforts, CSOs did not reach their goal of making the UN Guiding Principles legally binding. A new attempt is currently ongoing with discussion of a UN binding Treaty on Business and Human Rights.[121]

[ii] This is a compulsory regional standard for certification of the 3Ts (tin, tantalum, tungsten) and gold sourced from or transiting across an ICGLR Member State, that is, Angola, Burundi, Central African Republic, Republic of Congo, DRC, Kenya, Rwanda, Republic of South Sudan, Republic of Sudan, Tanzania, Uganda, and Zambia.

Since 2015, the UN has facilitated a process enabling States and civil society organisations to discuss concrete provisions to regulate transnational corporations and other business enterprises with regard to human rights in international law, and to provide access to justice and effective remedy to affected people.[122]

In this line, the EU followed with the **EU Conflict Minerals Regulation** in June 2017.[123] With the adoption of the Conflict Minerals Regulation for the responsible sourcing of tin, tantalum, tungsten, and gold (3TG) from conflict-affected and high-risk areas (CAHRA), the EU aims to disrupt the links between mineral mining and trading, on the one hand, and violent conflicts, corruption, and human rights abuses, on the other. The Regulation tries to achieve this by improving the compliance of downstream 3TG importers in the EU ("Union importers") and their upstream suppliers with the existing five-steps due diligence framework of the OECD DDG. It is estimated by the European Commission that 600 to 1,000 EU importers fall under the due diligence obligations.[124] Indirectly, the Regulation applies to around 500 smelters and refiners globally.[125] Under the Regulation, EU importers are legally required to identify all the smelters and refiners in their supply chains and to check whether they have the correct due diligence practices in place.

An important difference between the Dodd-Frank Act and the Conflict Minerals Regulation is that the first had a clear geographical scope: the DRC and its nine neighbouring countries. The EU Regulation in article 2 defines 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*". In principle, the EU Regulation delegates the decision of what is a CAHRA to the EU importer, thereby compelling every importer to perform wider due diligence. However, at the same time the EU has published an "indicative, non-exhaustive" list of CAHRAs,[126] which probably limits due diligence efforts by companies to these 27 countries.[127]

An accompanying measure to the EU Conflict Minerals Regulation is the European Partnership for Responsible Minerals (EPRM)**.** This multistakeholder partnership has the purpose of improving responsible sourcing from CAHRAs. The aim is to support ASM sites in complying with the OECD DDG standards and to stimulate trade involving ASMs, because the legislation alone is not enough to make a real change on the ground. The EPRM also includes calls for proposals and financing of projects, supporting producers directly. It focuses on tin, tantalum, tungsten, and gold (3TG) and is governed by a board that consists of three members representing governments, companies, and CSOs.[128]

By 1 January 2021, each EU Member State should have completed transposition of the EU Conflict Minerals Regulation into domestic law.

Supplementing Regulation to recognise existing voluntary schemes

The EU has adopted a supplementing Regulation for the implementation of the Conflicts Minerals Regulation. This establishes methodology and criteria to be used by the European Commission to recognise existing voluntary supply chain due diligence schemes (voluntary DD schemes) that use third-party audits as schemes sufficient to facilitate implementation of the Regulation.[129] This means that some existing voluntary DD schemes, with the same or similar objectives as the Regulation, can be officially recognised by the Commission as in line with the OECD DDG. EU importers of minerals or metals that effectively implement such a scheme will be exempt from having to submit individual third-party audits to the competent authority of the Member State to which they belong. Also, to compose the "white list" of global smelters and refiners that source responsibly, the Commission will likely select smelters and refiners that participate in a recognised voluntary DD scheme.

However, according to the Regulation, the participation of an EU importer in a recognised DD scheme, or sourcing from a smelter on the "white list" is not in itself sufficient to comply; importers retain individual responsibility to comply with their due diligence obligations. According to the Commission, this is "*an on-going, proactive and reactive process through which companies put in place systems and processes to make sure they are able to identify, manage and report on risks in their supply chain*".[130]

As at November 2021, the Commission had still not announced which voluntary DD schemes will be recognised. One of the applicants is the Responsible Business Alliance (RBA) with its Responsible Minerals Initiative (RMI). The RMI applied in 2019 for European Commission recognition of its Downstream Assessment Program (DAP)[131] and Responsible Minerals Assurance Process (RMAP)[132] to help companies meet their due diligence obligations under the Regulation. The Initiative for Responsible Mining Assurance (IRMA) has also applied for Commission recognition.[133] Final determination from the Commission on recognition was initially planned for October 2020 but has been delayed.

Other voluntary DD schemes thought to have applied for recognition are the London Bullion Market Association (LBMA) Responsible Sourcing Programme, the Responsible Jewellery Council (RJC) Chain of Custody Certification, and the ITRI Tin Supply Chain Initiative (ITSCI).

For companies, it is important that the new EU Regulations rely on existing and used frameworks, because policy coherence is crucial to enable long-term investment in sustainable supply chains. Comprehensive legislation referring to the same frameworks is necessary to make a difference on the ground.[134]

For industry actors, the limited scope in terms of minerals and regions was helpful at the starting point, because it created focus and direction. It created an opportunity for companies to galvanise and share similar objectives. However, this is not sufficient to solve the challenges in mineral supply chains. Therefore, some industry actors indicate that they are now in a next phase, where they look at more commodities and different kinds of issues that are broader than human rights abuses and the well-being of workers and communities at mining site level, including environmental, social, and governance issues.[135]

3.3.2 Cross-sectoral legislation

Table 11: Cross-sectoral legislation

2010 California Transparency in Supply Chains Act
2014 EU Non-Financial Reporting Directive
2016 UK Modern Slavery Act, transparency in supply chains clause
2017 French Law on Duty of Vigilance
2019 Dutch Child Labour Due Diligence Law
2021 German Supply Chain Due Diligence Act
2021 Norwegian Transparency Act on business transparency, human rights, and decent working conditions
All ILO Conventions

The EU Non-Financial Reporting Directive (NFRD)

The EU Non-Financial Reporting Directive (2014) belongs to the first EU legislation with due diligence obligations.[136] It imposes on undertakings with more than 500 employees the obligation to report on the policies they pursue in relation to environmental, social, employee-related, and anti-corruption and bribery matters and respect for human rights, including due diligence.

Highly relevant for this section about conflict minerals is to mention that the published guidelines for the NFRD include requirements related to 3TG. Companies are expected to disclose relevant information on due diligence to ensure responsible supply chains for tin, tantalum, tungsten, and gold from conflict-affected and high-risk areas. Reporting KPIs should include information about "*the proportion of responsibly-sourced tin, tantalum, tungsten or gold originating in conflict-affected and high-risk areas; and the proportion of relevant customers contractually requiring conflict minerals due diligence information under the OECD Due Diligence Guidance"*.[137]

As part of the European Green Deal, the European Commission intends to replace the NFRD. In April 2021, the Commission presented the proposal for a Corporate Sustainability Reporting Directive (CSRD), which aims to strengthen and revise the NFRD and to bring sustainability reporting on a par with financial reporting.[138]

Legislation for mandatory HRDD in supply chains

Several national governments in Europe either have already introduced or are currently discussing mandatory human rights due diligence (mHRDD) legislation. The countries that have already adopted laws include **France** (law on duty of vigilance of parent and outsourcing companies), **Germany** (law on the corporate duty of care in supply chains), and **Norway** (law on business transparency and human rights and decent working conditions). Other laws have also introduced certain elements of mandatory due diligence obligations for particular issues such as child labour (**Dutch** child labour due diligence law) or slavery (**UK** Modern Slavery Act). An early law to eradicate slavery and human trafficking from supply chains was passed in 2010 in the US (**California** Transparency in Supply Chains Act).

In many other countries, there are currently ongoing political processes in that direction, including in **Austria** (parliamentary proposal for a supply chain law), **Belgium** (parliamentary proposal on the corporate duty of vigilance and care in value chains), **Finland** (Government commitment to due diligence legislation), **Luxembourg** (Government commitment to due diligence legislation), and the **Netherlands** (Parliamentary proposal on responsible and sustainable international business conduct).[139]

Proposal for EU legislation for mandatory HRDD

In March 2021, the European Parliament passed a landmark resolution calling on the European Commission to urgently submit a legislative proposal on mandatory supply chain due diligence following a set of recommendations. [140]

The recommendations of the European Parliament with regard to the content of the requested proposal state that there are currently many international due diligence frameworks (such as the UNGP, OECD and ILO), but "***their voluntary nature can hamper their effectiveness and their effect has proved limited****, with a restricted number of undertakings voluntarily implementing human rights due diligence in relation to their activities and those of their business relationships*" (note 4 to the proposed text of the recommended proposal).

The European Parliament also states: "***Existing international due diligence instruments have failed to provide victims of human rights and environmental adverse impacts with access to justice and remedies because of their non-judicial and voluntary nature*** *… the lack of public judicial mechanisms to hold undertakings liable for damages occurring in their value chains should not and cannot adequately be compensated by the development of private operational grievance mechanisms"* (note 5 to the proposed text of the recommended proposal).

The European Parliament has also called for the **introduction of a liability regime** that enables victims to obtain an effective remedy and stressed the importance of **comprehensive transparency requirement**s as a crucial element of due diligence.

The proposal should build on and be aligned with preceding due diligence legislation for specific sectors, "*such as the Conflict Minerals Regulation, the Timber Regulation, the Forest Law Enforcement, Governance and Trade (FLEGT) Regulation and the Anti-Torture Regulation"* (resolution, paragraph Z), as well as the preceding due diligence reporting legislation, the Non-Financial Reporting Directive .[141]

The resolution also highlights that "*compliance with the due diligence obligations should be a condition for access to the internal market and that operators should be required to establish and provide evidence, through the exercise of due diligence, that the products that they place on the internal market are in conformity with the environmental and human rights criteria set out in the future due diligence legislation"* (resolution, paragraph AA 10) . This would outstrip the Conflict Minerals Regulation and repair one of its major shortcomings, namely that it does not apply to the import of manufactured goods (such as electronics and cars) into the EU despite high-risk sourcing practices in these supply chains.

It could be claimed that the non-binding OECD DDG may in the end become binding due to the fact that several regulations, including the EU Conflict Minerals Regulation, the European Parliament's proposal for EU mHRDD, and the proposed EU Batteries Regulation, are based on the OECD DDG. Also, ground-breaking recent case law has given the OECD DDG and the UNGP legal status: in the Dutch Shell case the court based its verdict to a large extent on these two soft law standards in interpreting the content and scope of the duty of care of Shell.[142]

3.3.3 Legislation concerning the EEES

The following table provides an overview of EU Regulations and Directives that have the most relevance for the EEE sector in the context of this report.

Table 12: EU instruments concerning electronics

Year	Legislation	Description
2007	**EU REACH Regulation**[143] Registration, Evaluation, Authorisation, and Restriction of Chemicals	To protect people and the environment against hazardous substances in products. Companies must identify and manage the risks linked to the substances they manufacture and market in the EU. Manufacturers selling electronic parts on the EU market must be REACH compliant.
2009	**Ecodesign Directive**[144]	Provides "CE" marking for energy-related products, such as household appliances, ICT, or engineering, that comply with the ecodesign requirements leading to electricity savings.
2011	**RoHS Directive**[145] Restriction of Hazardous Substances in Electrical and Electronic Equipment	EU rules restricting the use of hazardous substances, such as mercury and lead in electrical and electronic equipment, to protect the environment and public health.
2012	**WEEE Directive**[146] Waste from Electrical and Electronic Equipment	EU rules on treating waste from electrical and electronic equipment, to contribute to sustainable production and consumption.
Upcoming	Proposed Regulation: Designing mobile phones and tablets to be sustainable – ecodesign.[147]	This is part of the Circular Economy Action Plan 2020 and in line with European Green Deal objectives on efficient use of resources. The public consultation was closed on 23 August 2021, with adoption planned for 2022.
Upcoming	Proposed Regulation concerning batteries and waste batteries, 2020[148]	Also called the Batteries Regulation

Circular Electronics Initiative

In February 2021, the European Parliament adopted a resolution on the New Circular Economy Action Plan.[149] The Action Plan has been developed under the European Green Deal, whose objective is to implement the Paris Agreement on climate change. The plan includes the announcement of the Circular Electronics Initiative. This concerns a non-legislative initiative; however, the actions include regulatory measures under the Ecodesign Directive. For electronics and ICT including mobile phones, tablets, and laptops, this includes:

- implementation of the "right to repair", including a right to update obsolete software;
- regulatory measures on chargers for mobile phones and similar devices (including the introduction of a common charger);
- improvement of the collection and treatment of waste electrical and electronic equipment;
- review of EU rules on restrictions of hazardous substances in electrical and electronic equipment.[150]

This EU initiative is very relevant in the context of resource efficiency and the reduction of resource consumption, which was identified as a gap in the earlier *State of Play* reports of the RE-SOURCING project. At present, electronic products are discarded because they are not reparable, the battery cannot be replaced, and the software is no longer supported. Yet about two in three Europeans would like to keep using their devices for longer, provided performance is not significantly affected.[151]

The regulatory measures under the Ecodesign Directive are ongoing (Commission adoption is planned for 2022). One of the measures is the proposed Regulation "Designing mobile phones and tablets to be sustainable – ecodesign", with the objective to ensure that mobile phones, tablets, and laptops are designed to be durable and energy efficient. This means that the devices can be easily repaired, upgraded, and maintained and that it is possible to reuse and recycle the devices.[152]

Electronics waste continues to be one of the fastest growing waste streams in the EU, with current annual growth rates of 2%. It is estimated that less than 40% of electronic waste is recycled in the EU. The Circular Electronics Initiatives foresees the improvement of recycling infrastructure for waste electrical and electronic equipment in the EU. It asks for a mandatory certification scheme for recyclers of electronics waste to guarantee efficient material recovery and environmental protection.[153]

Proposed EU Batteries Regulation

The proposed EU Batteries Regulation is an integral part of the EU's Green Deal and strongly relates to the clean energy transition and the automotive sector.[154] Batteries are also crucial for electronics devices. Mandatory supply chain due diligence is one of the 13 preferred measures in the Regulation and will probably follow the EU proposal for mHRDD. It will be based on the OECD DDG. A consultation took place among stakeholders for input on the batteries proposal. Responsible sourcing and reducing environmental and social impacts throughout all stages of the battery life cycle were among the main concerns expressed by representatives from civil society. The main needs expressed by industry representatives were for "*(i) a stable regulatory framework that ensures investment certainty; (ii) a level playing field that enables the sustainable production of batteries; and (iii) the efficient functioning of recycling markets to increase the availability of quality secondary raw materials*"[155]

3.4 Voluntary due diligence schemes

There is a wide array of schemes that have been created to address social, environmental, and governance risks in global supply chains. A large number of them focus specifically on sourcing of minerals. Government regulations have been an important driver, including the US Dodd-Frank Act and the EU Conflict Minerals Regulation.

As was concluded in the preceding *State of Play* reports,[156] such schemes overlap with regard to the specific minerals, thematic coverage, stages of the supply chain, and geographical regions. Therefore, calls for the schemes to recognise[iii] one another or harmonise[iv] have increased.

[iii] Recognition: "One standard may recognise a specific result like certification or assurance results of another standard. Recognition can be unilateral, partial, or full. It can be challenging to accept the systems of another standard and requires trust in the credibility and rigour of that standard." Source: ISEAL Alliance, "Learning from Collaboration in the Metals, Minerals and Mining Sustainability Sector," ISEAL Alliance, accessed November 30, 2021, https://www.isealalliance.org/sustainability-news/learning-collaboration-metals-minerals-and-mining-sustainability-sector.

[iv] Harmonisation is the alignment of language by eliminating major differences and creating common minimum requirements. Examples include aligned due diligence requirements or alignment with the OECD DDG:

This trend is already current among scheme owners and industry actors in mineral supply chains; they have started to work towards scheme "interoperability" to make use of the strength of the diversity of stakeholders and the expertise, coverage, and approaches of individual schemes to realise more responsible sourcing of minerals.[157]

In this section we will first focus our attention on schemes that are (partly) aligned with the OECD DDG. The reason is that due diligence is considered to be the cornerstone of responsible sourcing with the OECD DDG as the leading standard.

It is beyond the purpose and scope of this report to review and assess the different schemes individually. In the gap analysis (chapter 6), we will highlight considerations that should be taken into account by companies relying on such schemes and by policymakers considering recognising them. There too we will not assess or endorse schemes individually but only highlight gaps based on previous comparative studies.

The following list of due diligence schemes is primarily based on two studies. The OECD's *Alignment Assessment of Industry Programmes with the OECD Minerals Guidance* assessed five leading industry schemes against the OECD DDG detailed criteria. During the initial assessment in 2016, three schemes were found not to be aligned with the OECD DDG and two partially aligned. In 2018, the five schemes were reassessed, and the report concluded that most of the standards from all the schemes were now "in, or close to, full alignment with the recommendations of the OECD Guidance".[158] The five schemes covered by the study were:

- Dubai Multi Commodities Centre (DMCC).
- International Tin Supply Chain Initiative (ITSCI).
- London Bullion Market Association (LBMA).
- Responsible Jewellery Council (RJC).
- Responsible Minerals Initiative (RMI-RMAP).

The second main source used for identifying due diligence schemes was the BGR report *Sustainability Schemes for Mineral Resources: A Comparative Overview*. The BGR report reviewed 19 sustainability schemes "based on their relevance for the mining and metal business based on their current dissemination or recognition by stakeholder participation in the scheme development process".[159] Of the 19 schemes, only those that according to the BSR either "*require supply chain due diligence on conflict risks and human rights violations"* or have "*implementation of sustainability requirements beyond commitment and reporting and which may include due diligence on conflict risks and human rights violations"* are selected here. From the resulting list only those covering either all minerals or any of the 3TG minerals are included below. Also included is a scheme worth mentioning due to recent developments since publication of the above referred studies: the London Metal Exchange's responsible sourcing requirements.

The following table provides an overview of the selected due diligence schemes, including information on who developed and oversees them. For more detailed information on these schemes, we refer to the OECD *Alignment Assessment* report, the BGR report and the schemes' webpages, which provide extensive and useful descriptions per scheme.

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https://www.isealalliance.org/sustainability-news/learning-collaboration-metals-minerals-and-mining-sustainability-sector

Table 13: Voluntary due diligence schemes (partly) aligned with the OECD Due Diligence Guidance

Abbre-viation	Brief description of DD scheme	Developer/governance	Mineral	Supply chain coverage (DD requirements)
CTC BGR	Certified Trading Chains standards, developed by BGR; implementation in Rwanda and DRC; update in 2019: beyond 3TG and alignment with the OECD DDG; focused on ASM	Multi-stakeholder steering structure, public sector	3TG and beyond (copper-cobalt, galena, and semi-precious stones)	Mining and processing.
DDMC[160]	Dubai Multi-Commodities Centre Rules for Risk Based Due Diligence in the Gold and Precious Metals Supply Chain; independent governance committee; adherence is certified by an independent panel of DMCC-approved international audit firms	Government of Dubai Authority	Gold and associated precious metals	Metal traders and exchange
Fairmined/ CRAFT	Fairmined standards for gold from ASM; also CRAFT Code of Risk-mitigation for Artisanal and small-scale mining engaging in Formal Trade	Alliance for Responsible Mining (ARM). MSI approach including CSOs, private sector, public sector, and industry associations	Gold and associated precious metals	Mining and processing (due diligence); requires traceability for the rest of the supply chain
Fairtrade	Fairtrade Gold Standards for ASGM	MSI approach including CSOs, private sector, public sector, and industry associations	Gold and associated precious metals	Mining and processing (due diligence); requires traceability for the rest of the supply chain
IRMA	Initiative for Responsible Mining Assurance standard; civil society and trade unions in the audit process, full audit reports published; global scope	Developed and governed through MSI approach, including CSOs, trade unions, and private sector	All minerals	Mining and processing (industrial-scale mines)
ITSCI[161]	International Tin Supply Chain Initiative, project led by International Tin Association and Tantalum-Niobium International Study Center (TIC); not for profit basis; minerals from DRC, Burundi, Rwanda, and Uganda	Industry associations	Tin, tantalum, tungsten (3Ts)	Due diligence requirements for downstream actors; mining and processing, traders, smelters, and refiners; downstream actors can join as associates and receive information

LBMA[162]	London Bullion Market Association Responsible Sourcing Programme	Industry association	Gold and silver	Refiners producing "Good Delivery" products and selling into the London Bullion Market
LME[163]	London Metal Exchange Responsible Sourcing; mandatory for LME -listed brands	Industry association	Minerals traded on the LME, including gold and tin	Metal traders and exchange
RJC[164]	Responsible Jewellery Council Chain of Custody certification; global scope.	Non-profit organisation	Diamonds, gold, and platinum group metals	Entire supply chain
RMAP[165]	Responsible Minerals Assurance Process; a programme of the Responsible Minerals Initiative (RMI), part of the Responsible Business Alliance; RMI does not issue certificates, but its Validated Audit Report (VAR) is valid up to two years; smelters found to be compliant are listed publicly	Industry associations, Cross-sectoral	3TG, Cobalt, Copper, nickel, zinc, tin, and mica	Smelters and refiners
WGC[166]	World Gold Council Conflict-Free Gold Standard and Responsible Gold Mining Principles (RGMPs); standard developed through consultation process involving governments, civil society, and supply chain participants	Industry association	Gold	Mining

There are other mineral supply chain standards that are relevant for the electronics sector; however, these are not at all aligned with the OECD DDG and therefore not included in the above table. The following table is a non-exhaustive list of standards often referred to in the context of sustainable mineral supply chains. They are included for information purposes only, as their review and analysis are beyond the scope of this report.

Table 14: Voluntary standards (other)

Abbre-viation	Brief description	Developer/governance	Mineral	Supply chain coverage
EITI	Extractive Industries Transparency Initiative; disclosure standard, strengthening governance along the value chain; main focus on revenues	MSI approach; EITI board is made up of governments, companies, and civil society	All	Entire supply chain
ICCM GPG and ICCM SDF	International Council on Mining and Metals: Good Practice Guidance for Mining and Biodiversity (ICMM GPG) and Sustainable Development Framework (ICMM SDF); global scope	Industry association; developed in partnership with International Union for the Conservation of Nature (IUCN)	All	Mining
IFC EHS[167]	International Finance Corporation Environmental, Health and Safety Guidelines for mining	Part of World Bank Group, a UN-affiliated organisation; World Bank Group requires borrowers to apply relevant levels of EHS Guidelines.	All	Cross-sectoral
GRI[168]	Global Reporting Initiative environmental, social, sustainability standards (Mining and Metals Sector Supplement)	Global Sustainability Standards Board (MSI approach) in partnership with industry association ICMM	All	Mining
MAC TSM[169]	Mining Association of Canada Towards Sustainable Mining standard; scope is Canada (mandatory for MAC members); national chambers of mines of Finland, Argentina, and Botswana have formally adopted TSM	Industry association; overseen by MSI group.	All	Mining
R2 and e-Stewards recycling standards[170]	Responsible Recycling (R2) standard for electronics recyclers and e-Stewards® standard for Responsible Recycling and Reuse of Electronic Equipment	US Environmental Protection Agency (EPA) developed standards to safely recycle and manage electronics. The e-Stewards standards was developed by the Basel Action Network.	All	Recycling

3.5 Initiatives

In the context of this report *initiatives* often involve "in-region" or so-called on-the-ground projects. Initiatives are an important addition to the international frameworks, laws, and standards because, as was emphasised in the context of the Conflict Minerals Regulation, legislation alone is not enough to make a real change on the ground. To be able to comply with laws and standards, ASM communities especially need to be supported. A distinction that we see between the voluntary due diligence schemes listed above and the following initiatives is that many of these latter, especially those that cover ASM, are focused on impact on the ground and support transformation on the ground. These initiatives do not certify companies. They concentrate on root causes, on formalisation of the mines, and on supporting upstream companies. Two initiatives particularly highlighted in this report are the Responsible Mica Initiative and the European Partnership for Responsible Minerals (EPRM).

Table 15: Initiatives

Abbre-viation	**Description and governance**	**Mineral**	**Supply chain coverage**
Artisanal Gold Council[171]	Not for profit organisation, working with ASM gold mining communities to build environmentally sound, socially responsible, and formalised ASGM sector effective at transferring wealth from rich to poor	Gold	Mining (ASM)
CEP	Circular Electronics Partnership: **industry actors** in electronics sector and waste management, using a lifecycle approach, reducing waste from design stage through to product use and recycling; founding partners include GeSI, PACE, RBA, WBCSD, World Economic Forum, and Global Electronics Council	All	Entire supply chain
EPRM	European Partnership for Responsible Minerals supports mine sites in conflict-affected and high-risk areas (CAHRAs); the aim is to increase responsibly produced minerals from these areas while contributing to local development; **MSI approach**, including governments and institutions, supply chain actors, and CSOs	3TG	Mining (ASM)
FPIC Solutions Dialogue	FPIC Solutions Dialogue: multi-sector initiative helping communities and companies work together to implement free, prior, and informed consent in community processes relating to mining, oil, and gas projects; **MSI approach**, including CSOs and companies; flagship is FPIC *Guide*; secretariat provided by RESOLVE (an NGO)	All, cross-sectoral	Mining

Global Tailings Review[172]	ICMM, UNEP, and PRI have launched the Global Industry Standard on Tailings Management	All	Mining
Responsible Gold Agreement	Dutch initiative (IMVO-Convenanten): **multistakeholder** coalition consists of goldsmiths, jewellers, recyclers, NGOs, electronics companies, trade unions, and government; working to prevent abuses such as exploitation and environmental damage in gold chain (2017-22)	Gold	Entire supply chain
RMI-mica[173]	Responsible Mica Initiative: **MSI approach**; aims to establish a fair, responsible, and sustainable mica supply chain, improve working conditions, and eradicate child labour by 2030	Mica	Mining (ASM) and processing
PlanetGOLD[174] **(previously Better Gold Initiative)**	Led by UNEP in partnership with UNIDO, UNDP, and Conservation International and with 19 government agencies, the private sector, and ASGM communities in nine countries; aims to significantly improve production practices and work environment of ASGMs; execution by Natural Resources Defense Council	Gold	Mining (ASM)
PPA[175]	Public-Private Alliance for Responsible Minerals Trade, led by RESOLVE: multi-sector **multistakeholder initiative** that improves conflict-free mineral supply chains in DRC and Great Lakes region; uses CRAFT schemes	3TG	Mining (ASM)
RAGS Forum[176]	Responsible Artisanal Gold Solutions Forum: **multistakeholder coalition,** led by RESOLVE; aims to enable production of legal artisanal gold in DRC; coalition include NGOs, governments, and industry actors.	Gold	Mining (ASM)

3.5.1 Responsible Mica Initiative

The Responsible Mica Initiative (RMI-mica) started officially in 2017 after a conference in India that brought together the government, companies from different sectors using mica, NGOs, and upstream actors (like processors in India). The conference had gathered to work on a joint understanding and action plans with the mission to eliminate unacceptable working conditions and to eradicate child labour by 2022, starting in India. Recently RMI-mica extended the programme to Madagascar.

RMI works on three levels:

- To support upstream companies to implement responsible workplace practices. This includes the mica pickers and the mica processors in meeting workplace standards.
- Community empowerment for communities that pick mica. The idea is to address the root causes of child labour including access to education, health care, and additional sources of income.

- Legal frameworks. Working with local governments and at the international level to convince governments to enforce the needed regulation to protect mica communities and to govern all aspects of the mica industry and establish a responsible and sustainable mica supply chain.

Practically all members of the initiative are companies in the mica supply chain and industry associations whose members use mica in their products. Founding companies are mostly cosmetics companies, but the following sectors are also represented: automotive; paints, coatings and printing inks; pigments and ingredients; plastics and chemistry; mica processing and export companies. The electronics sector is not represented, and representation of CSOs is also low.

3.5.2 European Partnership for Responsible Minerals

The European Partnership for Responsible Minerals (EPRM) says in it is introduction: “Legislation is not enough to make a real change on the ground.” So this initiative has been set up to complement the EU Conflict Minerals Regulation and is an accompanying measure to the Regulation.[177]

The EPRM supports mine sites in conflict-affected and high-risk areas (CAHRAs). The aim is to increase responsibly produced minerals from these areas while contributing to local development.

The three ambitions of EPRM are: to support artisanal and small-scale mines to produce more responsibly and enable them to get access to formal markets; to support mid- and downstream companies to source 3TG in a responsible manner; and to stimulate trade from ASMs in CAHRAs.

The EPRM is a multistakeholder initiative with members from three pillars: governments and institutions; supply chain actors; and CSOs. The EPRM is governed by a board consisting of three members from each pillar.[178]

The EPRM has projects in eight countries in Africa and three countries in Latin America, mostly concerning gold.

4 Narrative analysis

4.1 Methodology

In September 2020, the RE-SOURCING consortium commissioned Significance Systems to conduct a narrative analysis. Significance Systems is an external service provider that specialises in analysing online content of selected narratives (key words and phrases). The consortium partners selected general narratives to be analysed related to responsible sourcing, and specific narratives for each sector: renewable energy, mobility, and electronics and electrical equipment.

The objective of such external analysis was to determine if the selected narratives were under discussion in online media, to determine the main actors driving the online discussion, and to analyse the type of reactions that the topic generates in the viewers. The results can potentially shed light on narratives that are not yet receiving enough attention despite being considered important by the consortium partners.

Significance Systems analyses and classifies the narratives based on four categories: timeless, transformational, tribal, and transient.

Significance systems defines each of such categories as follows:

> ***Timeless**: Timeless narratives are the most powerful type of narratives, creating long-term and deep engagement. This applies to about 5% of all narratives in the Significance Systems database. These timeless narratives are characterised by being predictive of future behaviour; namely there is a high likelihood the narrative will remain powerful over time and thus significantly influence those who engage with it.*
>
> ***Transformational**: The smallest group of narratives, only 2%, are transformational narratives. These generate a lot of engagement with a large group of people and represent a transformation in global opinion with respect to the narrative tested. Transformational narratives are in a state of movement, e.g. to become more important or negative.*
>
> ***Tribal**: Tribal narratives are narratives that relate to a very specific issue that creates a lot of engagement, but only from a very small number of people. About 8% of narratives in the Significance Systems database are tribal.*
>
> ***Transient**: Around 80% of all narratives ever tested in the Significance Systems database are transient. Transient means they are not often addressed in media and they do not have the power to engage*.[179]

The results of this analysis were not meant to guide or determine in any way the focus of the consortium's work. The fact that a particular narrative receives more or less attention in the media, or the kind of emotions it generates, is not relevant to assess the salience or scale of social and environmental risks. The authors are also aware that online content is driven unequally by different stakeholders and that some key rights holders are often excluded or have limited access to the internet (let alone driving the content). The focus on narratives (and online content) in the English language is another important limitation.

The consortium partners selected 43 narratives for responsible sourcing in general, and the authors of this report selected 17 narratives for the EEES based on our knowledge of the sector and our previous work. The selection of narratives for responsible sourcing in general were presented and discussed in the *State of Play* report on the renewable energy sector.[180]

The following table shows the 17 narratives that the authors selected for EEES.

Table 16: Selection of narratives for EEES

"conflict minerals" gold	"right to say no" mining
"conflict minerals" tantalum	3TG
"conflict minerals" tin	electronics and 3TG
"conflict minerals" tungsten	mica "child labour"
"electronics industry" chemical exposure	Samsung "chemical exposure"
"electronics industry" chemicals	toxic "electronic manufacturing"
"electronics industry" hazardous substances	"electronics manufacturers" worker OHS
"electronics industry" low wages	"GoodElectronics Network"
"electronics industry" toxic chemicals	

4.2 Results

The results of the analysis of the narratives of responsible sourcing in general were discussed in the *State of Play* report on the renewable energy sector.[181]

The following table shows the results for the EEES whereby the ***transformational*** narratives are highlighted in green, the ***transient*** ones in yellow, and the ***tribal*** ones in blue.

Table 17: Results narrative analysis EEES

"conflict minerals" gold	"right to say no" mining
"conflict minerals" tantalum	3TG
"conflict minerals" tin	electronics and 3TG
"conflict minerals" tungsten	mica "child labour"
"electronics industry" chemical exposure	Samsung "chemical exposure"
"electronics industry" chemicals	toxic "electronic manufacturing"
"electronics industry" hazardous substances	"electronics manufacturers" worker OHS
"electronics industry" low wages	"GoodElectronics Network"
"electronics industry" toxic chemicals	

The first observation is that none of the selected narratives were found to be ***timeless***; these are the most powerful narratives that create long and deep engagement according to Significance Systems. An explanation for this could be that some of the most popular terms related to sourcing of minerals were included under the responsible sourcing in general section (discussed in the *State of Play* report on the renewable energy sector) and not under the EEES section. Examples include ESG mining, supply chain transparency, sustainable procurement, and responsible sourcing.

Three narratives of the EEE sector resulted to be ***transformational***: "conflict minerals" tungsten; "right to say no" mining; and 3TG. According to Significance Systems, transformational narratives are fast-changing and have the potential of generating lasting transformation in the world. They can also be characterised by experiences that are felt intensely.

Another three narratives resulted in being ***tribal***: "conflict minerals" tantalum; electronics and 3TG; and "GoodElectronics Network". According to Significance Systems, the vast majority of tribal narratives have no impact and are driven mostly by personal experiences or commercial perspectives. The authors of this report disagree with such assessment.

The rest and majority (11) of the terms were found to be ***transient***, which is in line with the historical results of all narratives ever tested by Significance Systems.

5 Vision

The Vision of the EEES refers to the goals we want to achieve by 2050. In other words, the Vision would be the ideal practices of the EEES value chain actors and its governance and regulation by 2050 when it comes to responsible sourcing. The Vision for the EEES is focused on three main pillars. **First**, businesses and States achieve full respect for and protection of human rights across all entire value chain operations including effective mechanisms for accountability and access to remedy for affected rights holders. **Second** is the imperative of protecting the environment, including remaining within planetary boundaries, preventing global warming of more than 1.5°C above preindustrial levels, and preventing further biodiversity loss. **Third** is the global eradication of poverty and a significant reduction of inequality that includes a minimum social foundation and a fair share of costs and benefits among the value chain actors.

Based on the above, we have identified a set of targets for the Vision of the entire EEE sector, as well as for each of the selected steps of the value chain. These targets are meant to provide an initial guide for the development of the Roadmap and will be reassessed and further elaborated during the building of the Roadmap at a later stage. The Vision targets are classified according to the traditional pillars of sustainability – environmental, social, and economic – and are to a certain extent based on, and aligned with, the targets identified by the Vision of the renewable energy and mobility sectors of the RE-SOURCING project. The targets are shown in the next figure.

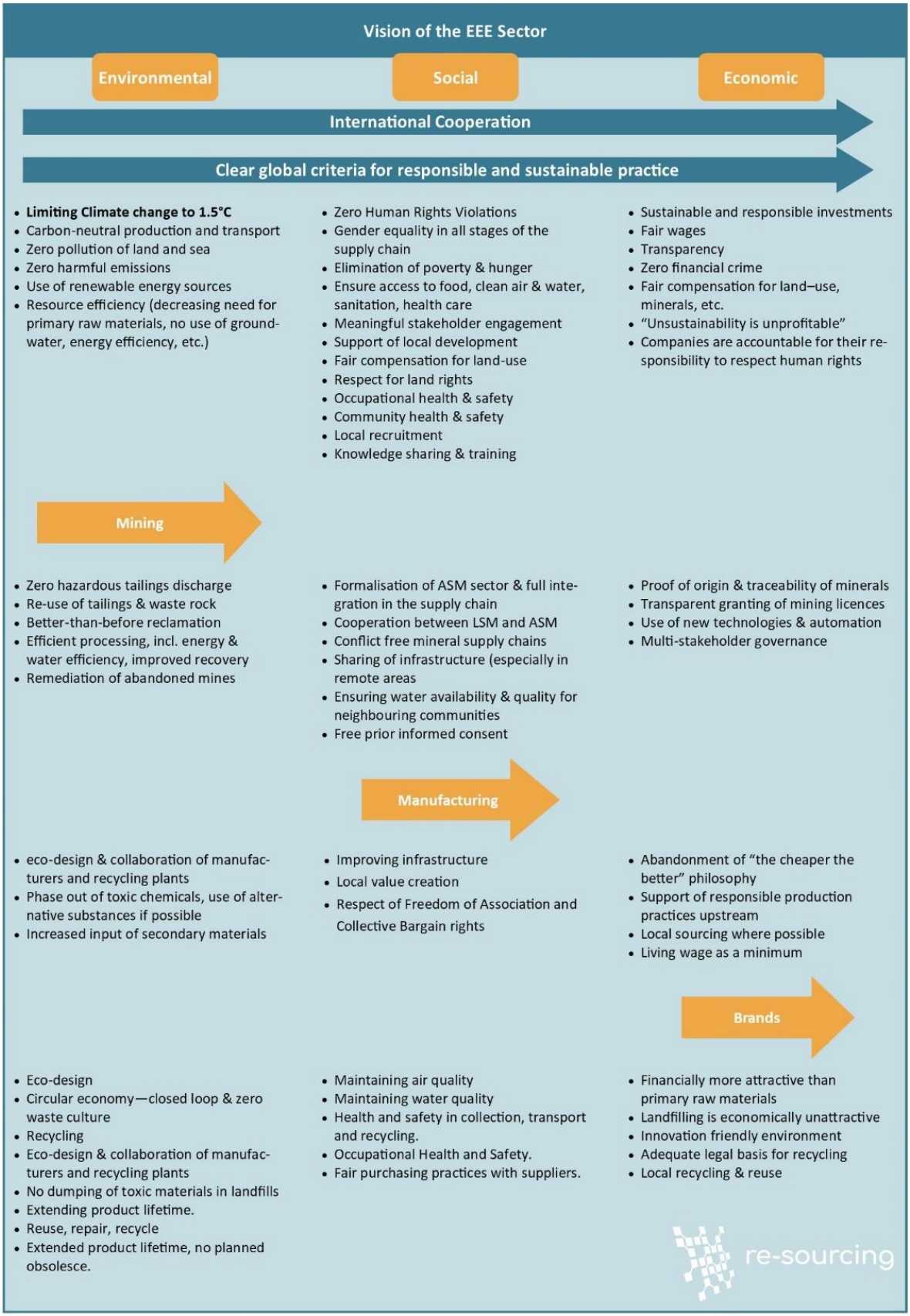

Figure 8: Vision of the EEE sector by 2050. Based on *State of Play and Roadmap Concepts: Renewable Energy Sector*.[182]

6 Gap analysis

This chapter starts with a recap of the main gaps identified in the *State of Play* reports on the renewable energy and mobility sectors that are equally valid for the EEE sector. This is followed by an evaluation of the gaps between our Vision (chapter 5) of responsible sourcing and existing standards and initiatives (chapter 3) in order to identify priority areas and next steps for building the Roadmap.

6.1 Recap of main gaps from renewable energy and mobility sectors

In the *State of Play* report on the renewable energy sector, the focus of analysis of the relevant standards is on the coverage of the issues by the different standards, and the report provides per standard a short description of the approach and points of focus.[183] The mobility sector report clusters the standards based on the specific phases in the supply chain, including mining and processing, production, disposal, and recycling. [184]

One of the most prominent observations in the earlier published *State of Play* reports regarding the standards and initiatives was that the **many existing standards on mineral supply chains are to a large part overlapping, and none of the standards covers all issues**. Some are stronger on the social issues, others stronger on environmental or economic issues. A standard that covers most of the issues is that of IRMA. Some issues are not covered by any of the mainstream standards.[v] Also, **many of the standards cover only certain stages of the minerals supply chain –** mining and processing, for example, or smelting and refining, or disposal and recycling. However, **the overwhelming majority of the standards cover the mining phase only**. Further, while some standards cover all minerals, most cover only specific minerals. And some standards focus on certain regions. All these different focus areas create a challenge to navigate in this fragmented field of standards and initiatives. The preceding *State of Play* reports conclude that an **overarching international framework is missing and that harmonisation and/or mutual recognition of schemes** is needed.

Another observed gap reported in the preceding reports is that the current standards do not sufficiently address the increasing demand for raw materials, and more attention is needed for environmental sustainability and resource efficiency. Reduction in resource consumption and decoupling from economic growth are considered essential for the preservation of natural capital and the achievement of the climate goals.[185] In the case of electric cars, for example, the enormous sales increase and associated increase in demand for raw materials need to be addressed. Proper collection, transport, storage, and recycling of spent batteries is essential.[186]

[v] Issues not addressed include: (i) women's rights, (ii) alluvial mining, (iii) conflict with agriculture, (iv) conflict with LSM, (v) conflict with indigenous peoples, (vi) extortion, (vii) money laundering, (viii) mergers and acquisitions, (ix) divestment, (x) pricing and price premia, (xi) production practices.

6.2 EEES gap analysis related to standards and initiatives

In section 6.2 we analyse if more gaps in the relevant standards and initiatives can be distinguished when taking the EEE sector as a point of departure. Due to their high relevance for the sector, we pay particular attention to the EU Conflict Minerals Regulation and voluntary due diligence schemes.

6.2.1 Gaps related to the EU Conflict Minerals Regulation

In June 2021, a coalition of European NGOs working on conflict minerals published a review paper on the implementation of the EU Conflict Minerals Regulation which criticises two shortcomings:

- **The focus on 3TG minerals is too limited,** because there are also other minerals that tend to support conflict financing, including cobalt, graphite, lithium, and nickel.
- The **Regulation does not apply to the import of manufactured goods** (such as electronics and cars) into the EU, despite high-risk sourcing practices in these supply chains.

The NGOs recommend that the 2023 review process of the Regulation should serve as an opportunity to address these shortcomings.[187] Other criticism of the Regulation relate to: **the set threshold that allows loopholes; insufficient sanctions; the different implementation per Member State; and lack of transparency**. The **lack of transparency is the biggest obstacle** that negatively affects the effectiveness of the Regulation. The fact that the names of EU importers that fall under the Regulation will not be published hampers monitoring of implementation. This also applies to the criteria and assessment process used for making the *"white list" of smelters and refiners*[vi] and the assessment process for recognising existing voluntary supply chain due diligence schemes as implementation schemes; these assessment procedures are also not considered transparent by representatives of CSOs.[188]

Another recommendation for the 2023 review process is that **the Regulation needs to be aligned with the upcoming cross-sectoral EU mandatory human rights due diligence (mHRDD) legislation.** For example, if provisions for civil liability are included in the mHRDD legislation, then these should also apply to 3TG mineral supply chains, which should not be subject to a lower standard.[189]

6.2.2 Gaps in voluntary due diligence schemes

To analyse the gaps in the current voluntary DD schemes we have not assessed schemes individually but rather relied on previous comparative studies and input from consultations with experts. Based on a selection of studies, we highlight what in our view is needed to make a voluntary scheme effective and what is currently missing (the gaps). The focus is on implementation aspects, not on the content in terms of coverage of the issues in the standard. The publishers of the selected studies include the OECD, IISD, BGR, the European Commission and Germanwatch.

[vi] To help companies, the European Commission will create a so-called "white list" of global smelters and refiners that source responsibly.

We take as a starting point of our assessment the effectiveness of the relevant voluntary DD schemes. In alignment with one of the studies among the selected literature (the study undertaken for the European Commission), in this section effectiveness means that **a scheme should provide rights holders**[vii] **with effective opportunities for protection**. This section will capture what is key to a standard's effectiveness and what is observed by the selected studies as currently insufficient (the gaps).

Looking at the effectiveness of voluntary DD schemes is more relevant than ever now that there is a process of scheme recognition for implementation of the EU Conflict Minerals Regulation (see also section 3.3.1). A recognised scheme facilitates a company's compliance with the Regulation. The development whereby a mandatory framework, such as the Regulation, makes use of voluntary DD schemes gives these schemes a new and more powerful status. This can offer opportunities for even more companies to implement sustainable standards, making them much more effective because more leverage is created. At the same time, care must be taken to ensure that rights holders are protected by the schemes and that stakeholders are not sidelined in the implementation.

The five studies that form the basis of the gap analysis are:

- BGR, *Sustainability Schemes for Mineral Resources: A Comparative Overview*, 2017.[190]
- Germanwatch, *Governance of Mineral Supply Chains of Electronic Devices*, 2018.[191]
- IISD, *State of Sustainability Initiatives Review: Standards and the Extractive Economy*, 2018.[192]
- OECD, *Alignment Assessments of Industry Programmes with the OECD Minerals Guidance*, 2018.[193] From 2016 to 2018, the OECD assessed five industry schemes and checked the extent to which the schemes align with the OECD DDG. [194]
- EC-commissioned *Study on Due Diligence Requirements through the Supply Chain*, 2020.[195]

A review of the key findings follows.

Lack of transparency regarding implementation of voluntary scheme by companies

Just over one-third of business respondents (334 in total) in the EC study indicated that their companies undertake due diligence that takes into account all human rights and environmental impacts. The OECD study showed that most researched schemes were close to full alignment on paper with the OECD DDG but that **implementation had showed the biggest gap**. The Germanwatch study points out that there is a lack of transparency regarding the degree of implementation by scheme members. This prevents schemes from showing that they ensure that each member implements the standards, as opposed to those that fail in terms of implementation and therefore excluded from membership.

Both the OECD DDG and the supplement to the EU Regulation[196] emphasise that simply the participation in a recognised voluntary DD scheme is not sufficient to comply; companies retain individual responsibility to comply with their due diligence obligations. The reasoning behind this is also that participation does not guarantee implementation in the company. This shows a gap, and there is acknowledgement that authorities cannot transfer their responsibility to regulate companies to voluntary schemes because it is unclear if the companies really implement the schemes, and due

[vii] From a human rights perspective, individuals who can make legitimate claims are rights holders. States and companies that have their respective obligations to respect, protect, and fulfil the rights of rights holders are known as duty bearers.

to the lack of transparency there is no way of knowing this. At the same time, the schemes have been assigned a major role in the implementation of the EU Regulation.

Scope of due diligence too limited

Conclusions in the OECD study include that **due diligence was often limited to the first tier** of suppliers of smelters and refiners, and there was a lack of *on-the-ground due diligence.* There were **insufficient supporting programmes to strengthen supplier capacity** to implement due diligence. Smelters and refiners tended to disengage if risks were identified.

In the EC study the majority of business respondents are undertaking due diligence that include first tier suppliers only. Due diligence practices beyond the first tier and for the downstream value chain were significantly reduced. The most frequently used due diligence actions include contractual clauses, codes of conduct, and audits. Business respondents indicated that currently reputational risk is their top incentive to undertake due diligence. There is a negative impact on effectiveness when **many companies do not perceive due diligence requirements to prioritise risks to rights holders but rather prioritise risks to the company**.

However, the scope of due diligence as defined by the OECD DDG is also not without criticism. Stakeholder consultations for this report showed an issue with its segmented approach. The OECD DDG places responsibility for downstream compliance on the downstream companies excluding the smelters and refiners, and then puts responsibility for upstream compliance on the smelters and refiners only.[197] In practice, this suggests to downstream companies such as electronics brands that auditing the smelters and refiners upstream is enough – whereas most human rights violations are not at the smelters/refiners' level but at the mining level. **Because of the segmented approach of the OECD DDG it is difficult to engage downstream companies and have them take responsibility for issues and contribute to the protection of right holders at mining level**.

According to the EC study, companies do not currently undertake exclusive environmental and climate-related due diligence.

Credibility of audits

According to the OECD study, **many audits were over focused on documentation checks, and auditors lacked critical analysis competencies**. There was **too much reliance on audits** as enforcement mechanism. Instead, ongoing monitoring and beyond-audit due diligence activities are needed.

While the OECD study is critical of the quality of the audits, the study also highlighted that a strength of the voluntary DD schemes is the coordination of audit activities, which includes aspects such as the independence of the auditors and processes for corrective action plans. However, there is an issue of potential bias of the auditors – conflict of interest – due to financial dependencies, because auditors are paid by the companies that have an interest in achieving what they would consider "successful" outcomes from the audit. Often, there is also a lack of involvement of stakeholders in the audit process, and the results are kept secret from rights holders.

Germanwatch researched the independence of auditors with the following questions: Do auditors rotate? Is there a multistakeholder group involved in the process of the audit and/or the financing of the audit? There was twice a yes on the rotation question out of 18 voluntary DD schemes for mineral supply chains, and there were none on the involvement of a multistakeholder group. This shows that **the showpiece of the voluntary schemes – that is third party audits – can also be the weak point concerning schemes' credibility**. Germanwatch concludes that audits alone, even if independent and high-quality, are not sufficient to ensure that a scheme is credible and benefits rights holders.

It is important to note that at least one voluntary DD scheme, IRMA, does have participation of civil society and trade unions in the governance of its audit process. IRMA also actively seeks input from diverse stakeholders in advance of an audit, and during audits civil society and workers provide input on mine site performance. Further, IRMA publishes the full audit reports.[198]

6.3 EEES gap analysis related to the Vision

Protection of human rights

International mandatory due diligence regulation is crucial to protect human rights in the mineral supply chain, including effective mechanisms for accountability and access to remedy for affected rights holders, but this is still lacking. The US conflict minerals legislation adopted in 2010 had a great effect and has catalysed numerous standards and initiatives that indicate greater awareness among companies and across sectors. The legislation led to dialogue and has made it a necessity for companies to undertake action. Companies have more strongly encouraged shareholders to invest in responsible sourcing and have made stronger demands in the supply chain. The growth of voluntary DD schemes has played a very important part in terms of awareness raising, creating leverage, and setting new and higher standards in the sector. However, the schemes do not ensure implementation of HRDD, and authorities cannot transfer their responsibility to regulate companies to voluntary schemes.

Planned EU legislation for mandatory human rights due diligence is urgently needed, and it is important that it goes beyond current national mandatory HRDD legislation, which is too vague and not comprehensive enough. Next to the EU legislation, the UN binding Treaty on Business and Human Rights needs to become reality. This treaty aims to regulate transnational corporations and other business enterprises with regard to human rights in international law, and to provide access to justice and effective remedy for affected people. Together these two measures will create the much-wanted level playing field.

Protection of the environment

The externalisation of costs – when the price of a product does not take negative externalities such as pollution or greenhouse gas emissions into account – can lead to high private returns and at the same time costs for society as a whole.[199] When the sole purpose of a company is shareholder value, growth, and profit maximisation, the externalisation of costs is only logical. However, this hampers a long-term perspective on environmental sustainability and the fundamental changes needed. These necessary fundamental systemic changes are currently not sufficiently on the agenda of businesses and policymakers as they require new business models.

For instance, business models that allow for the production and sale of smaller volumes of electronics (based on sharing rather than individual ownership), or that allow production based on circular sources only, could be developed, incentivised, and required by regulation. Similarly, business models based on the sharing economy model instead of on selling products. Reduction in resource consumption is key to protect the environment, including preventing global warming of more than 1.5°C above preindustrial levels and preventing further biodiversity loss. A transition to an environmentally sustainable sector should include slowing down and reducing the demand for electronics.[200] Electronic products should no longer be discarded because they are not reparable, the battery cannot be replaced, or the software is no longer supported.

The design of new electronics products should be focused on longer use, reuse, and recyclability. Electronics brand companies should make it a priority to develop products with minimal use of newly mined minerals. The EU could stimulate mission-oriented science to make sectors such as electronics resource efficient and reduce the resource consumption. The EU can set take-back and recycling targets or create consumer demand for circular electronics products. An interesting initiative in this respect is the Circular Electronics Partnership, which is developing an industry strategy for a coordinated transition towards an economically viable circular industry, aiming to rely only on circular resources and using safe and fair labour to make electronics.[201]

The fight against poverty and inequality

There are several observations in this report that show the gap between current due diligence efforts and the *rights holders* who are still insufficiently protected, and the lack of impact on the ground, for instance at artisanal mining sites. Some explanations in summary:

- Often companies perceive due diligence as a risk to the company and not to the affected people.
- Legislation alone is not enough to make a real change on the ground. For this reason, the EU supported accompanying measures to the EU Regulation such as the European Partnership for Responsible Raw Materials (EPRM) as an *on-the-ground project*.
- The due diligence efforts by downstream companies often lack on-the-ground due diligence, and there are insufficient supporting programmes to strengthen upstream supplier capacity. Downstream companies are not taking enough responsibility for the issues at mining level.

The European Network for Central Africa (EurAc) evaluated the implementation of accompanying measures to the EU Regulation.[202] Important reasons why improvements on the ground are limited is that too few resources are invested in supporting initiatives on the ground that aim to formalise the ASM sectors and in certification of artisanal mining sites. Another gap concerns the lack of attention paid to local actors. EurAc states: "*EU seems to have adopted a 'top-down' approach, prioritising international agencies (OECD, ICGLR, UN agencies) rather than local actors (administrations … businesses, artisanal miners and mining cooperatives, civil society), for development cooperation funding*".

The last gap is confirmed by a recent study by researchers at AfreWatch, which concludes that local actors are not sufficiently represented in international supply chain initiatives. The report argues for "*a structural change, along with cultural shifts in private and public sector policy making, that recognise artisanal miners as legitimate players in the sector whilst ensuring their livelihoods and rights are supported*".[203] The need to formalise the artisanal mining sector, in cooperation with all earlier mentioned local actors, is also a main point brought forward by a consulted expert working in a multistakeholder initiative: "the most important problem to overcome is the formalisation of the ASM sector". Based on this, work can be undertaken to achieve better protection, decent working conditions, better prices, and fair wages.

7 Conclusions and next steps

The gap analysis in chapter 6 indicates where the RE-SOURCING project needs to focus on in developing the Roadmap. The preceding *State of Play* reports concluded that an overarching international framework is missing and that harmonisation and/or mutual recognition of schemes is needed. Also, it was concluded that the reduction of resource consumption and its decoupling from economic growth are essential for the achievement of the climate goals. And both previous reports conclude that more needs to be done on the traceability of raw materials through supply chains.

When it comes to the voluntary schemes, this *State of Play* report concludes that to provide rights holders with more effective opportunities for protection, the schemes need to provide more transparency on implementation. Further, the scope of due diligence needs to be broadened, and there has to be more focus on continuous monitoring and beyond-audit due diligence activities to avoid overreliance on third-party auditing as an enforcement mechanism.

To protect human rights, international mandatory due diligence regulation is crucial. The planned EU legislation for mandatory human rights due diligence is urgently needed, but in addition the UN binding Treaty on Business and Human Rights needs to become reality. Together these two measures will create the much-needed level playing field.

When it comes to protecting the environment, fundamental systemic change is required including revising current business models to move away from the externalisation of costs and maximising shareholder value. An overall reduction of resource consumption is key, which will require profound changes in consumption and production patterns; the brand companies can play a leading role in this. The brands that design and market electronic products have enormous leverage along the entire supply chain due to their purchasing and economic power. Regulation that requires electronics products to be designed for longer use, reuse, reparability, and recyclability is also crucial.

Finally, a fair distribution of costs and benefits along the supply chain is important to address current levels of global inequality and poverty. Miners and workers deserve fair wages that capture a significant share of the value created along the supply chain. Initiatives that improve conditions on the ground, including formalisation of the ASM sector and ensuring improvements in the livelihoods of local communities and workers, require further development and scaling up, in cooperation with local actors such as artisanal miners, worker-led cooperatives, and local businesses.

The next steps for the electronics sector in the RE-SOURCING project are the development of a roadmap towards 2050 and a good practice guidance document based on a multistakeholder consultation process in 2022. The aim of the Roadmap 2050 is to provide guidance for companies, policymakers, and civil society on how to address the identified sustainability challenges in the electronics sector. In parallel to developing the Roadmap, Flagship Cases (good practice examples) with transferrable approaches will be identified. A selection will be presented within a peer-learning process involving other actors. Based on the results, the good practice guidance document will be developed, and its content will be integrated in the final Roadmap.

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