

# Stocktake of Sustainability Standards and Initiatives for minerals and metals

Leveraging synergies between Sustainability Standards and Initiatives and public instruments to enhance environmental governance

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**The Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF)** supports its more than 85 member countries in advancing their sustainable development goals through effective laws, policies, and regulations for the mining sector. The IGF helps governments take action to develop inclusive and gender-equitable practices, optimize financial benefits, support livelihoods, and safeguard the environment. Its work covers the full mining lifecycle, from exploration to mine closure, and projects of all sizes, from artisanal mining to large-scale operations. Guided by its members' needs, the IGF provides in-country assessments, capacity building, technical training, publications, and events to advance best practices, peer learning, and engagement with industry and civil society. The International Institute for Sustainable Development (see below) has hosted the IGF Secretariat since October 2015. Core funding is provided by the governments of Canada and the Netherlands.

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# Key Messages

- **The number of Sustainability Standards and Initiatives has doubled over the past two decades.** The proliferation of SSIs—which can be very different in their governance, procedure, scope and substance—across minerals and metals supply chains is confusing to many and has triggered complex interplays between SSIs and public instruments, ranging from collaborative to conflicting.
- **Sustainability Standards and Initiatives can complement but not substitute regulation.** Well designed and properly implemented SSIs have the potential to promote better sustainability practices and help strengthen environmental governance. They can work alongside national laws by raising expectations on environmental and social performance, improving transparency and access to data and offering practical tools for monitoring and compliance, especially where regulations are still in development or capacities are stretched. They can also help test new ideas, bring different stakeholders together around shared goals and promote sustainability along the value chain across jurisdictional borders. But SSIs also face significant challenges and limitations for public governance, with the risk of paving the way for greenwashing and weakening public oversight.
- **Sustainability Standards and Initiatives with certain attributes are more likely to support public instruments towards positive environmental sustainability outcomes.** The report identifies 15 hallmarks that can serve as a reference tool for policymakers, standard setters and stakeholders to assess the credibility and effectiveness of SSIs and alignment with public governance objectives.
- **Independent assessments of the impacts of Sustainability Standards and Initiatives should be prioritised.** Few SSIs and their implementation have undergone independent assessments of their impacts, costs and trade-offs. The findings of such assessments would help accurately communicate the stated benefits of SSIs to different stakeholders, including Global South producer countries.
- **Extraneous new Sustainability Standards and Initiatives should be discouraged, and greater cooperation and inter-operability should be a primary future focus for Sustainability Standards and Initiatives.** A credible SSI strives to create value that fairly rewards the effort and resources that it takes for users to participate in the system.

# Executive summary

Global demand for minerals and metals is soaring, fuelled by the energy transition, digitalization and infrastructure growth. Alongside this expansion, Sustainability Standards and Initiatives (SSIs) have multiplied, with over 100 operating across the minerals and metals value chains, each promoting responsible practices and sustainability commitments.

## What SSIs refer to in this report

Although there is no strict definition, for the purposes of this report, “SSIs” refer to frameworks, systems, schemes or programmes (other than public instruments, such as local, national, regional and international laws and policy commitments) that are intended to help actors across the minerals and metals supply chains to meet and strengthen sustainability performance and outcomes.

The proliferation has created a confusing and fragmented landscape. Many stakeholders, particularly governments in the Global South, face challenges in evaluating the credibility of SSIs and integrating them into regulatory frameworks. Some question whether SSIs effectively deliver meaningful environmental benefits.

The United Nations Environment Programme (UNEP) and the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF) have responded by jointly preparing this stocktake, a synthesis of over 3,000 pages of literature, insights from the United Nations Environment Assembly (UNEA) resolution 5/12 intergovernmental consultations and survey data from IGF member countries.

The report examines how SSIs interact with public instruments, laws, regulations and policy commitments at local, national, regional and international levels. Additionally, it identifies ways to better align SSIs in order to enhance environmental governance. While the report primarily focuses on environmental issues, it also considers broader social, economic and governance dimensions.

SSIs can be powerful tools for sustainability, but only when they are credible, transparent, inclusive and aligned with one another and with public objectives. Without alignment, SSIs risk adding confusion, paving the way for greenwashing and weakening public oversight.

## Key findings

### Interplay between Sustainability Standards and Initiatives and public instruments

SSIs are increasingly referenced in public policy, due diligence legislation and multilateral trade agreements. The relationship between SSIs and public instruments is complex, ranging from collaborative and complementary to competitive and

conflicting. A recent IGF survey among member governments, that indicates growing interest in integrating SSIs into national frameworks, also highlights significant capacity and information gaps.

### Opportunities for governance enhancement

When well-designed, properly implemented and meaningfully aligned with public instruments, SSIs offer multiple opportunities to support and enhance environmental governance such as those indicated below.

- **Integration into regulation:** SSIs are increasingly used to inform laws and permitting processes, where appropriate, as benchmarks or tools for operationalizing sustainability goals.
- **Raising ambition:** Some SSIs go beyond legal baselines, incorporating higher standards for example on biodiversity, climate mitigation and community participation.
- **Supporting enforcement:** SSIs can complement State oversight where regulatory capacity is limited, offering structured monitoring and reporting mechanisms.
- **Improving transparency:** Globally standardized public reporting frameworks can provide accessible environmental data for regulators, investors and civil society.
- **Fostering inclusive governance:** SSIs can serve as multistakeholder platforms for dialogue among industry, government, communities (including women and youth groups) and Indigenous Peoples.
- **Accelerating innovation:** SSIs are testing grounds for technologies and methods—from geo-traceability to circular economy tools—that can inform future regulation.
- **Providing market-based incentives:** Certification and alignment with SSIs can unlock access to markets, finance and public procurement schemes.
- **Fostering cross-border oversight across supply chains:** Transnational standards help address sustainability challenges that extend beyond national jurisdictions.

### Risks and limitations

In practice SSIs present several limitations, examples of which are shown below, that constrain their ability to deliver meaningful change.

- **Fragmentation and overlap:** The proliferation of SSIs—over 100 in the minerals and metals sector alone—creates duplication, inconsistencies and confusion.
- **Compliance burdens:** High costs and administrative demands can obstruct SSI adoption and marginalize artisanal, small and medium-sized enterprises, especially in the Global South.
- **Greenwashing risks:** Weak verification, low thresholds and lack of enforcement can enable companies to misrepresent their sustainability credentials.
- **Lack of contextual fit:** Many SSIs are designed without sufficient input from producer countries, leading to limited legitimacy and local relevance.

- **Corporate dominance:** Business interests are often overrepresented in governance structures, risking regulatory capture and diluted ambition.
- **Limited public authority engagement:** Minimal involvement of governments and traditional authorities undermines alignment with national priorities.
- **False substitution for regulation:** In some cases, SSIs delay or displace needed reforms in public oversight and enforcement.
- **Incomplete issue coverage:** Gaps persist in some SSIs in key areas such as cumulative environmental impacts, gender equality, Indigenous rights and downstream supply-chain governance.

## Hallmarks of robust Sustainability Standards and Initiatives

To ensure SSIs strengthen rather than undermine environmental governance, the report identifies 15 hallmarks that define credibility, effectiveness and alignment with the public interest.

The hallmarks are intended as a practical reference for policymakers and stakeholders seeking to assess existing SSIs or design new ones aligned with public governance objectives. The hallmarks can be summarized under the five categories outlined below:

- **Governance:** Multistakeholder inclusivity, accountability including grievance mechanisms, and impartiality in decision-making;
- **Scope:** Relevance to environmental risks, coverage along supply chains, adaptability to the local context, alignment with other SSIs and with the relevant international norms;
- **Performance assurance:** Clear objectives and performance indicators, third-party conformance assessment and repercussions for non-conformity;

- **Review mechanisms:** Transparency including public disclosure of performance data, promotion of continuous improvement, and regular evaluation of impact; and
- **Viability:** Accessibility for a range of actors, particularly in the Global South, and incentives that encourage responsible behaviour across supply chains.

## Next steps

The identified hallmarks can serve as a reference tool for policymakers, standard setters and stakeholders to assess the credibility and effectiveness of SSIs and alignment with public governance objectives.

Comprehensive independent studies into the costs, impacts and trade-offs of implementing SSIs should be prioritized in order to provide evidence of and communicate the actual benefits to different stakeholders, including Global-South producer countries.

There is a need to avoid unilateral or siloed approaches by SSI bodies or supply-chain actors as this adds to the confusing patchwork and can clash with other SSIs or public instruments. Greater cooperation and interoperability should be a primary future focus for SSIs.

Multilateral platforms may offer further means to enhance SSI effectiveness, integration and interaction with governments and public instruments. The organizations authoring this report, UNEP and the IGF, intend to initiate a dialogue on these important topics with other stakeholders, including through an interactive community-of-practice discussion forum.

Governance	Scope	Performance Assurance	Review Mechanisms	Viability
Multistakeholder inclusivity	Relevance to environmental risks	Clear objectives and performance indicators	Transparency including public disclosure of data	Accessibility and incentives for range of actors
Accountability	Coverage along supply chains	Third-party conformance assessment	Promotion of continuous improvement	
Impartiality in decision-making	Adaptability to local context	Repercussions for non-conformity	Regular evaluation of impact	
	Alignment with other SSIs			
	Reflective of international norms			

Fig. 7: 15 hallmarks of an effective Sustainability Standards and Initiatives. (Source: this report)

# 1 Introduction

This report, jointly prepared by UNEP and the IGF, is a literature review and analysis that takes stock of the growing role of SSIs in the governance of environmental aspects of minerals and metals across their full life cycle, including through their interaction with public instruments (i.e. local, national, regional and international laws and policy commitments). While governments are its primary audience, the report includes insights and recommendations that may also serve as a useful resource for other stakeholders (such as SSI bodies, private sector, civil society and multilateral entities).

## i. Background and purpose

In response to growing demand for responsible mineral production and sourcing, often across complex, multijurisdictional global supply chains, SSIs have significantly proliferated over the last two decades [1–6]. For the purposes of this report, SSIs refer to frameworks, systems, schemes, programmes or guidelines (other than public instruments) designed to help actors across minerals and metals supply chains to meet and strengthen sustainability outcomes and performance. SSIs are also used across other sectors and can be initiated from a range of stakeholders, including industry actors, civil society, multilateral organizations, financial institutions and certification bodies.

By resolution 5/12 adopted in 2022, UNEA required UNEP to host a series of regional and global intergovernmental consultations to develop non-prescriptive proposals for improving the environmental sustainability of minerals and metals across their life cycle [7, 8]. The first non-prescriptive proposal recommended that UNEP compile a global collection of existing instruments and standards in the private and public sectors. The collection was to focus on the environmental sustainability of minerals and metals along their entire life cycle, building on existing work in this area, and taking care to look beyond instruments from industry and to include legally binding instruments. This 2023 UNEA-mandated intergovernmental process and more recent governmental consultations by the IGF highlighted one finding: government actors consider the multitudinous array of SSIs confusing and fragmented and wish to better understand the role of SSIs in the governance of minerals and metals [7, 9]. Many commentators have described the fragmentation of SSIs as a challenge that leads to competition and confusion among stakeholders and obstructs the implementation of environmental best practices (see Section 7(i)) [1, 6, 7, 10–21].

Against this backdrop, the report and collaboration between UNEP and the IGF aim to undertake a review of extensive existing literature. The goal is to provide further clarity and start a dialogue with decision-makers about the role of SSIs within broader regulatory frameworks, examining opportunities for SSIs to align with, and reinforce public instruments at all levels, as well as for environmental protection and the public interest.

While there is a clear need for greater integration among SSIs, and between SSIs and public instruments, this also presents an opportunity to enhance environmental sustainability across the life cycle of metals and minerals.

## ii. Methodology

The report provides a synthesis of existing academic literature and analysis to offer a high-level stocktake and structured overview of the SSI landscape relating to environmental aspects of minerals and metals. Although the environmental aspects are the primary focus of the report, broader sustainability considerations—such as socio-economic issues—are inherently connected and acknowledged throughout the analysis. The report does not comment on existing individual SSIs but instead summarizes trends and learnings about SSIs in the minerals and metals sector and particularly considers the relationship of SSIs with public instruments. Where the authors identify a need for more research on a topic, they highlight this throughout the report (with the  icon). More information on the methodology used to develop the report can be found in Annex I to the report.

## iii. Structure

The report first introduces SSIs, noting the varied terminology employed by literature, their diverse scope, and recent trends. This is followed by a high-level overview of the global landscape influencing the emergence of SSIs, including the growing demand for minerals and metals, the prevailing environmental and associated social challenges, the rising expectations for the minerals and metals sector and Environmental, Social and Governance (ESG) concerns across the supply chain—all of which have influenced the ongoing proliferation of SSIs. This leads into an overview of the range of public instruments relevant to the minerals and metals sector that operate alongside SSIs. The report showcases key findings from literature on the interplay between public instruments and SSIs, illustrating complex interactions and a general agreement among sources that SSIs are no substitute for strong government regulation.

Reflecting on the opportunities and risks that SSIs may pose for public governance, the report includes a list of suggested hallmarks of an effective SSI. It posits that SSIs which show some or all the hallmarks are more likely to support public instruments towards positive environmental outcomes across the life cycle of minerals and metals. The hallmarks encompass a range of themes, including, but not limited to, transparency, inclusivity, accountability, impartiality and adaptability.

Finally, based on the literature review and on UNEP and the IGF institutional expertise, the report includes recommendations for the next steps to strengthen and maximize the contribution of SSIs towards enhancing governance and environmental practices across the minerals and metals supply chains.

## 2 Introducing Sustainability Standards and Initiatives

### i. What are SSIs?

#### What SSIs refer to in this report

Although there is no strict definition, for the purposes of this report, SSIs refer to frameworks, systems, schemes or programmes (other than public instruments, such as local, national, regional and international laws and policy commitments) that are intended to help actors across the minerals and metals supply chains to meet and strengthen sustainability performance and outcomes.

Terminologies differ: literature about SSIs tends to employ interchangeably a range of different terms such as “voluntary sustainability standards”, “voluntary sustainability initiatives”, “sustainability schemes”, “self-commitments”, “industry initiatives”, “private standards”, “private sustainability standards” and “corporate social responsibility commitments” [5, 12, 15, 22, 23].

Depending on the context, different definitions of SSIs are used for different ends [6, 23]. Below are three examples:

- ‘Any multistakeholder, government-run or industry-led scheme or programme that provides tools, information, guidance, framework, capacity building or otherwise facilitates, sets requirements and/or expectations for, and/or assesses an organization’s operations, products, services, suppliers and/or other business relationships in relation to sustainability objectives [...] do not include national legislation or international binding, non-binding, and regional legal instruments’ [23].
- ‘Standards specifying requirements that producers, traders, manufacturers, retailers or service providers may be asked to meet, relating to a wide range of sustainability metrics, including respect for basic human rights, worker health and safety, the environmental impacts of production, community relations, land use planning and others’ [3].
- ‘Systems or schemes that establish sustainability standards, performance levels or pathways, enables measurement monitoring or verification, and allows for claims or communications about the results’ [24].

Our research showed that different studies of SSIs used different scopes and definitions. Some include global and regional normative frameworks and regulations produced by governments or multilateral organizations, where others included only voluntary or private-sector-led initiatives in their categorization of SSIs. Differences in understanding of the definition and scope of SSIs can present a challenge to constructive dialogue about SSIs. This paper aims to present findings and principles that can be applied broadly across the SSI landscape. Its focus is on how public instruments, as listed in Section 4, interact with SSIs, and as such, its definition of SSIs does not include public instruments.

SSIs aim to facilitate or promote sustainability performance by developing guidance, tools, information and/or training and capacity building (facilitation initiatives) and/or focusing on verifying claims through a monitoring, assessment or other type of process (verification initiatives) [1, 6, 23–26]. The scope of sustainability may include environmental, social and economic aspects or governance issues, with requirements ranging from respect for human rights (including Indigenous rights), health and safety considerations, the protection of the environment and economic development, among other things [1, 12, 14, 21, 23, 25–27].

Core elements of SSIs may include responsible practice performance levels, a process to assess and measure the implementation of such practices or performance levels, and a process to communicate and ensure the integrity of claims that a product or service complies with criteria (for instance conformity assurance systems, such as certification). They may also include a learning component to enhance the system or scheme and the associated impacts (for example

monitoring, evaluation and learning) [1, 23, 24, 26, 27]. SSIs may also incorporate a grievance mechanism to address complaints related to the SSIs and/or other relevant actors, such as employees, participating entities, suppliers, etc. [23]. Others may also involve policy and advocacy work through government engagement [27].

#### ii. Voluntary versus mandatory dimensions

Many SSIs are ostensibly voluntary in the sense that the actors involved can choose whether to opt-in—and the requirements are set independently from what is mandated by individual laws or regulations. At the same time, voluntary SSIs may include process requirements that bind members or can become de facto mandatory—for instance where the SSIs reflect legal obligations and where adoption is a prerequisite for membership to an industry association or access to funding, markets or purchasing companies [1, 3, 15, 22, 25, 27, 28].

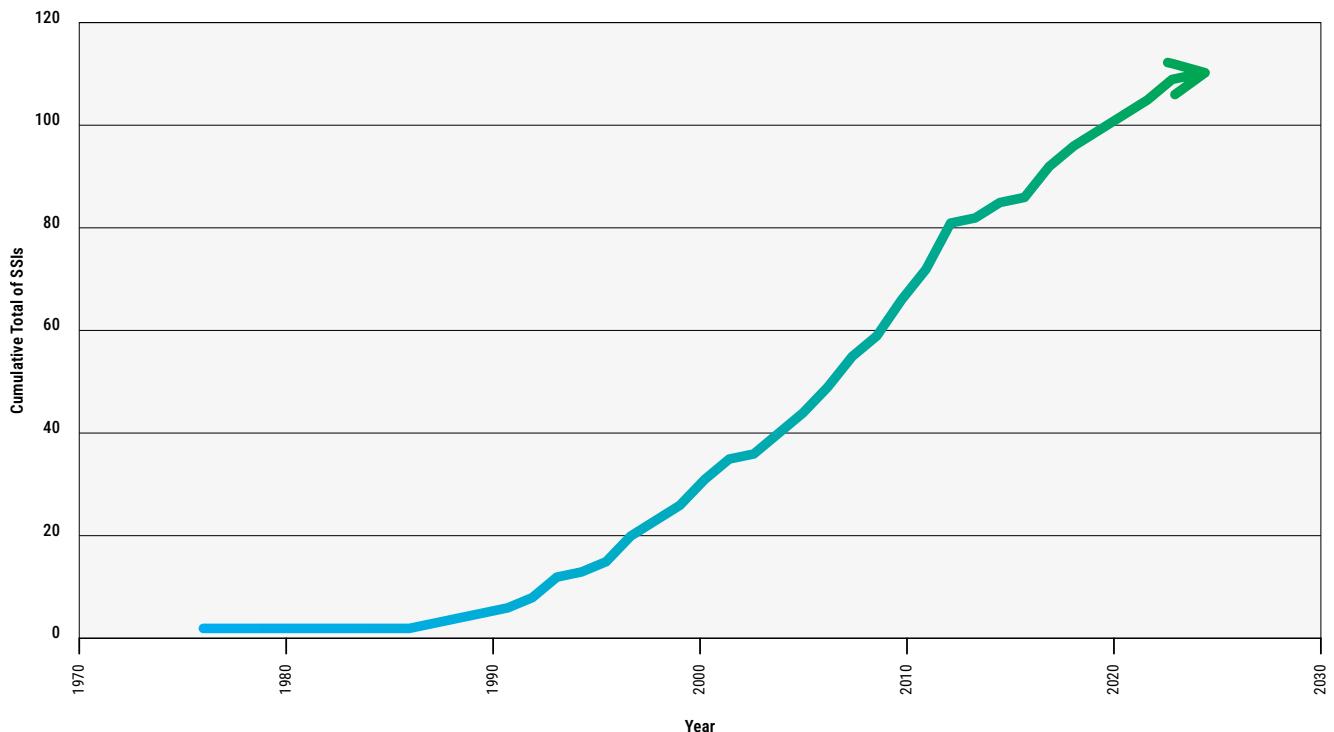


Fig. 1: Cumulative proliferation of Sustainability Standards and Initiatives over time (UNEP and the IGF, 2025: Authors' compilation based on literature review [4, 5, 20, 29, 30])

### iii. Diversity and proliferation of Sustainability Standards and Initiatives

In the minerals and metals sector, the composition, characteristics and compliance requirements of SSIs vary significantly depending on their context, rationale, aims and target audience [4, 5, 14, 14, 19, 25, 28]. SSIs can be led by industry, non-governmental organizations or backed by government or multistakeholder initiatives—although industry has most often taken the initiative in developing SSIs for the minerals and metals sector [1, 6, 15, 18, 20, 29]. In terms of scope, while some SSIs are broad in their focus, aim and aspiration, and may cover different steps in the supply chain, others target specific issues or stages of the supply chain, or focus strictly on processes [11, 30]. SSIs tend to be shaped by the actors developing them, who may have specific aims or ideas about what they are willing to be held accountable for [18]. The scope of SSIs can also vary between those that focus on a mine site and those that take a supply-chain systems perspective [28, 31].

Whatever the respective distinctions and slightly differing connotations between the terms used to define SSIs and the elements of SSIs, SSIs have undoubtedly proliferated over the past two decades [3, 32]. In 2018, a report by the IGF and the State of Sustainability Initiatives of the International Institute for Sustainable Development (IISD) identified 158 SSIs related to minerals and metals, using a broader definition than this report [5]. Within the more focused scope adopted for SSIs in this report, the number of SSIs has grown significantly in recent years (see Fig. 1, above). A non-exhaustive list

of examples of SSIs relevant to environmental aspects of minerals and metals can be found in Annex II to this report.

### iv. Categorisation of Sustainability Standards and Initiatives

A recent study considering the typology of SSIs recommended classifying them according to (i) the objective and scope of the initiative, (ii) practical aspects of implementing the initiative (e.g. assurance and grievance systems, monitoring and evaluation, etc.) and (iii) governance dimensions (i.e. looking at ownership and approaches to stakeholder engagement and information disclosure)[23].<sup>1</sup>

Fig. 2 shows examples of the range of ways that SSIs are categorized in the literature. While SSIs may be classified in different ways, the report does not address the application of a typology to the existing landscape of SSIs to identify the ratios of, and trends in, existing types of SSIs. This is an area that could benefit from further analysis. 

<sup>1</sup> The International Trade Centre also hosts a Standards Map which makes it possible to make side-by-side comparisons of specific Sustainability Standards and Initiatives, as well as to monitor trends.

Source	Recipient audience/subject	Supply chain mode	
<ul style="list-style-type: none"> <li>Industry</li> <li>Standards-setting organizations</li> <li>Financial sector</li> <li>Manufacturers</li> <li>Investors</li> <li>Consumers</li> <li>Intergovernmental organization</li> <li>Multilateral process</li> <li>Multistakeholder process</li> <li>Combination of entities</li> </ul>	<ul style="list-style-type: none"> <li>Governments</li> <li>Private sector</li> <li>Financial institutions</li> <li>Investors</li> <li>Civil society</li> </ul>	<ul style="list-style-type: none"> <li>Exploration and mine site (including tailings management)</li> <li>Processing and refining</li> <li>Trading</li> <li>Product design</li> <li>Manufacturing</li> <li>Trading and logistics</li> <li>Retailing</li> <li>Consumption</li> <li>End of life (including recycling, disposal)</li> <li>Entire supply chain</li> </ul>	
Geographical scope	Scale	Commodity	Framing
<ul style="list-style-type: none"> <li>International</li> <li>Regional</li> <li>Sub-regional</li> <li>National</li> <li>Company-level</li> <li>Mine site</li> </ul>	<ul style="list-style-type: none"> <li>Large-scale miners</li> <li>Medium-scale miners</li> <li>Artisanal and small-scale miners</li> </ul>	<ul style="list-style-type: none"> <li>Single mineral</li> <li>Group of minerals by theme</li> <li>Group of minerals by end-product</li> <li>All minerals</li> </ul>	<ul style="list-style-type: none"> <li>Responsible production</li> <li>Responsible sourcing</li> <li>Responsible consumption</li> </ul>
Risks addressed	Approach	Other	
<ul style="list-style-type: none"> <li>Environment</li> <li>Social (including human rights)</li> <li>Economic</li> <li>Governance</li> <li>Business ethics</li> <li>Anti-corruption and conflict prevention</li> </ul>	<ul style="list-style-type: none"> <li>Due diligence</li> <li>Principles-based</li> <li>Performance/compliance</li> <li>Reporting standards</li> </ul>	<ul style="list-style-type: none"> <li>Uptake pattern</li> <li>Stringency</li> <li>Stakeholders engagement</li> <li>Governance model</li> <li>Operations (e.g., assurance system, grievance mechanism, M&amp;E)</li> <li>Information disclosure</li> </ul>	

**Fig. 2:** Non-exhaustive and not mutually exclusive list of categorizations of Sustainability Standards and Initiatives (UNEP and the IGF, 2025: Authors' compilation based on literature review [2, 4, 6, 11, 14, 15, 18, 19, 21, 23, 25, 28, 32-36]).

### A question of size?

Most SSIs are best suited to large-scale companies. While artisanal and small-scale mining (ASM) is an important form of livelihood for millions, including growing numbers of women, and is known to involve serious environmental and social issues, significantly fewer SSIs target ASM than those focusing on large-scale mining [13, 14, 30, 32, 36].<sup>2</sup> SSIs developed with large-scale mining in mind may not work for the ASM sector, since ASM requires SSIs that are adaptable to local contexts (including remote locations), avoid prohibitive costs of participation and incorporate capacity-building [14, 37]. Furthermore, ASM encompasses a large variety of realities (including criminalization in some places) and scales, from individual artisanal miners to cooperative and medium-sized operations using mechanized tools [14, 29, 30].

SSIs do not specifically target medium-sized companies, and this group can be disadvantaged in their rating under SSIs compared to large-scale companies who have more resources and economy of scale to manage SSI requirements and reporting [3, 13, 22, 30, 32].

The misalignment between existing SSIs and the realities of ASM and mid-sized firms suggests a need for differentiated approaches in the design and implementation of SSIs to address the collective environmental footprint of such groups [22, 30].

<sup>2</sup> One exception is the Alliance for Responsible Mining's Fairmined Standard for Gold from ASM and the Code of Risk-Mitigation for Artisanal and Small-Scale Mining Engaging in Formal Trade (CRAFT Code) [14, 21, 29, 32]. The OECD's Alignment Assessment Methodology also assesses whether schemes at mid-stream and down-stream levels encourage companies to source responsibly from ASM mineral producers [6] and see also: <https://mneguidelines.oecd.org/>

# 3 Global context of the emergence of Sustainability Standards and Initiatives

This section aims to provide a brief and high-level overview of the global context influencing the emergence of SSIs.

## i. Increasing demand for minerals and metals

Minerals and metals play a major role in numerous economies, providing millions of jobs and substantial contributions to gross domestic product [2, 36, 38]. In recent years the extraction of minerals and metals has risen significantly and is projected to continue growing, driven by the energy and digital transitions as well as broader societal needs. This fuels a rapidly growing global demand as well as supply concerns for certain raw materials considered critical by many countries and industries [4, 14, 16, 17, 38–41].<sup>3</sup>

## ii. Ongoing environmental and associated social challenges

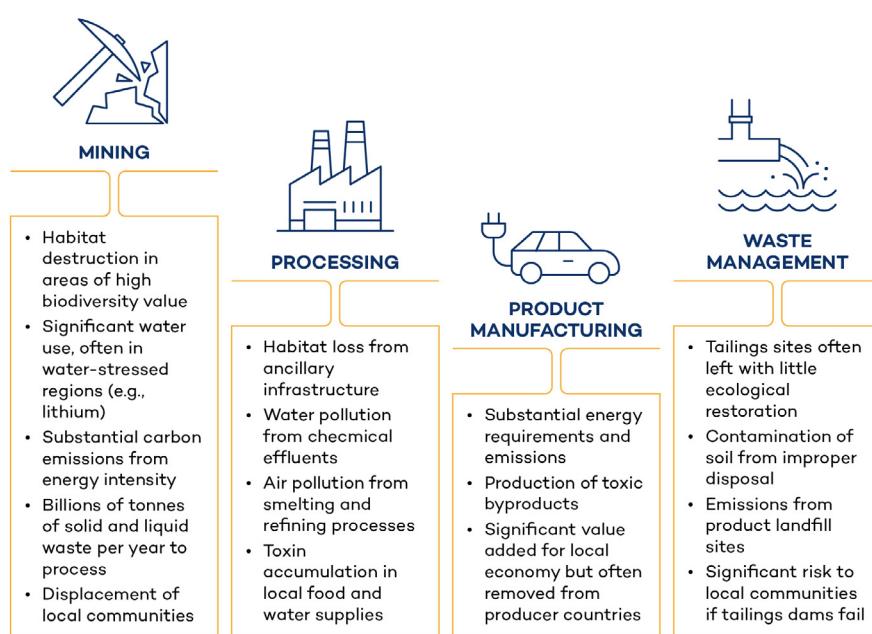
In parallel with rising demand, mining companies and downstream buyers have come under increasing pressure from governments, investors, civil society and consumers to demonstrate commitment to addressing the ESG challenges related to the industry [7, 14, 36, 41, 42].

In terms of environmental impact, mining is directly associated with, *inter alia*, air, water and soil pollution, noise and

vibrations, high water demand, deforestation and loss of biodiversity [13, 16, 32, 38]. The mining sector contributes to climate change through emissions of greenhouse gases, and environmental challenges associated with mining are themselves exacerbated by climate change, posing threats not only to the operations but also to surrounding ecosystems and communities [2, 19, 38].<sup>4</sup>

As illustrated by Fig. 3, the impacts can unfold at different stages throughout the minerals and metals life cycle, starting with mine site impacts that can last centuries or even millennia in case of heavy metal contamination or acid mining drainage, through to failed re-use and waste at the end of the life cycle [5, 15, 19, 38, 39].<sup>5</sup>

While the report focuses on environmental aspects it is important to recognize that the minerals and metals sector can also bring social challenges. They can, for example, contribute to conflict, corruption, gender inequalities, displacement, poor working conditions, lost livelihoods and violations of human rights, including forced and child labour and threats to environmental defenders and to the rights of Indigenous Peoples [2, 14, 28, 31, 35, 43]. Additionally, women disproportionately suffer the consequences of land loss, water



**Fig. 3:** Examples of environmental challenges and associated social risks of the minerals and metals sector at sections in the supply chain. (Source: [38])

3 See also: IGF (2024). What Makes Minerals and Metals 'Critical'? A practical guide for governments on building resilient supply chains. <https://www.igfmining.org/resource/what-makes-minerals-and-metals-critical/>.

4 See also: IGF (2022). The Impacts of Climate Change on the Mining Sector. <https://www.igfmining.org/resource/impacts-climate-change-mining/>.

5 See also: IGF (2021). Guidance for Governments: Environmental management and mining governance <https://www.igfmining.org/resource/guidance-for-governments-environmental-management-and-mining-governance/>.

pollution and food insecurity linked to environmental damage caused by mining. Meanwhile they reap fewer benefits from the economic advantages of mining projects [2, 14, 38].<sup>6</sup>

### iii. Evolving expectations for the minerals and metals sector

In the current context of rising demand for minerals and metals and the scrutiny of ESG performance, new challenges and expectations continue to evolve.

One particular global challenge over the coming decades will involve accelerating the energy transition while minimizing its material footprint. The aim will be to avoid creating new environmental harms while trying to address an existing crisis or exacerbating an ‘energy injustice’ where a conflict exists between those who benefit from renewable energy and those who are harmed by it [16, 32, 38, 39]. As an industry that is already energy-intensive, the mining sector faces a dual challenge. It is expected to scale up extraction and processing—expending energy on developing deeper and lower grade deposits—to meet the demands of the energy transition, while simultaneously facing pressure to reduce its own carbon footprint and waste streams [14, 18–20, 31, 38]. States experience regulatory tensions in their efforts to support the interests of their mining and metal sectors, while protecting the rights of those negatively impacted by the sectors. Meanwhile public regulation in some countries may be piecemeal or poorly enforced, *inter alia*, due to capacity constraints [14, 19, 42].

Increasing demand may push miners to deeper or declining deposits. New extraction technologies increase access to previously inaccessible regions such as the deep seabed.<sup>7</sup> Such new mining frontiers raise complex and controversial environmental issues that must be better understood for effective management [14, 15, 30, 38].

Various factors make minerals and metals governance particularly challenging in this context, including complex policy environments and political dynamics and rapidly-changing global supply chains [14, 15, 18, 39]. Minerals and metals are a long-term investment sector, and transitioning from a purely extractive model to one aligned with circular economy principles will take policy reform and time to materialize in practice, with reliance on the production of virgin raw materials continuing in the short-term.<sup>8</sup> Some actors may resist the shift,<sup>9</sup> but others are already stepping up to lead the way in process circularity (e.g. mining and processing technology aimed at zero waste or waste re-use), and

product circularity (e.g. the promotion of sustainable battery technologies) [36, 38, 42].

Approaches to supply chain due diligence have assumed greater prominence in recent years, initially driven by concerns around conflict and supply security, although latterly also influenced by a growing awareness of environmental issues [3, 28, 35, 37]. This can result in concepts developed by or for end-users largely in the Global North, but which apply in producer jurisdictions primarily located in the Global South—giving rise to equity concerns [3, 18, 37, 39, 44].<sup>10</sup> Further research could help deepen understanding of the implications of such trends, including workability and equity issues that emerge, as well as the potential role of government-to-government partnerships, especially between consumer and producer governments. This would help foster the implementation of responsible sourcing requirements.  For more discussion of such instruments see Section 4.

### iv. Proliferation of Sustainability Standards and Initiatives

The above context has led to a proliferation of SSIs, each one aimed at addressing a specific issue [1, 4, 6, 32, 45]. Factors triggering the introduction of new SSIs include new policies and legislation, governance gaps, moves towards sustainable consumption and production or sourcing, heightened consumer awareness, investor pressure, reputational risk management, lender requirements and market demand. They also include major environmental or social events, growth in campaigns by non-governmental organizations and the globalization of supply chains that need greater harmonization in reporting practices [2, 3, 5, 17, 20, 22, 29, 32, 42]. Motivations for companies across the supply chain to adopt SSIs are similarly diverse, and also include the potential to reduce operational risks and increase productivity or market access [1–3, 5, 11, 14, 21, 22].

SSIs can play a critical role in raising awareness of new sustainability issues, scaling up responsible mining practices and driving best practices across the supply chain [4, 6, 12, 21]. Nevertheless, it is generally difficult to measure actual impacts of SSIs on the ground (for instance due to timescales involved, a limited evidence base, lack of independent assessments, difficulty separating out SSIs from other factors as a cause of change, heterogeneity of designs and impacts) [1, 14, 22, 32, 41, 46].

Many sources agree that SSIs have the potential to bring about significant positive sustainability impact, but that this has become obfuscated in the current highly complex landscape of SSIs in the minerals and metals sector. Stakeholders, including governments consulted during the UNEA 5/12 process, complain of confusion at a patchwork of initiatives and seek simplification and harmonization [7–9]. SSIs vary widely in ambition, scope, geography and methodology, with governance mechanisms being rarely coordinated [6, 7, 11, 14, 20, 21, 26, 30]. That said, examples of coordination are starting to emerge (see Section 5).

6 See also Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF) “Integrating Gender into Mining Impact Assessments” <http://iisd.org/system/files/2022-10/integrating-gender-mining-impact-assessments.pdf>.

7 For more information, see UNEP’s 2024 Issues Note on Deep-Sea Mining. Available at: <https://www.unep.org/resources/publication/deep-sea-mining>.

8 See: Dominish, E., Teske, S. and Florin, N. (2019). Responsible Minerals Sourcing for Renewable Energy. Institute for Sustainable Futures. <https://earthworks.org/publications/responsible-minerals-sourcing-for-renewable-energy/>.

9 The International Institute for Environment and Development’s Mining, Minerals and Sustainable Development reported in 2012 that over the past decade mining companies had shown little evidence of commitment to recycling, re-using and re-manufacturing products, with some seeing such approaches as threats or competition [42].

10 See also: United Nations (2022). Resourcing the Energy Transition: Principles to Guide Critical Energy Transition Minerals Towards Equity and Justice. Report of the UN Secretary-General’s Panel on Critical Energy Transition Minerals

# 4 Public instruments for governing environmental aspects of minerals and metals

Most SSIs discussed in the literature reviewed for this report operate across different national jurisdictions, which leads to complex interactions with public instruments governing the minerals and metals sector. This section offers an overview of public instruments across international, regional, national and subnational levels which need to be taken into account in considering the role of SSIs in the minerals and metals sectors. The extent to which such public instruments address environmental aspects of minerals and metals falls outside the scope of this report. However, further analysis in this area would help clarify gaps and opportunities so as to strengthen the existing landscape of public instruments. 

## i. International level

Although the impacts of the minerals and metals sector transcend national boundaries, no global treaty exists for mining, and few international law norms address minerals and metals specifically [5, 7, 28]. Nevertheless, as summarized below, a myriad of international instruments and frameworks can apply and are relevant to environmental aspects of minerals and metals. Additionally, multilateral bodies play a key role in developing minerals and metals governance initiatives [5, 35, 42, 47]. Such instruments and frameworks include:

- multilateral environmental agreements, such as the 2013 Minamata Convention on Mercury, 1992 United Nations Framework Convention on Climate Change, 1992 Convention on Biological Diversity, 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, and the 1982 United Nations Convention on the Law of the Sea—whose Part XI is dedicated to the management of deep seabed mining beyond national jurisdiction [14, 36, 42];
- customary international law and other legal principles (e.g. the duty to prevent transboundary harm, to undertake environmental impact assessments and to apply the precautionary approach) [28];
- human rights instruments, among them the 1948 Universal Declaration of Human Rights, the 1979 Convention on the Elimination of All Forms of Discrimination against Women, the 1966 International Covenant on Civil and Political Rights, the 1989 Convention on the Rights of the Child, the 1930 Forced Labour Convention, the 1999 Worst Forms of Child Labour Convention, and the 1989 Indigenous and Tribal People's Convention [38, 48];
- international trade and investment treaties, which are relevant insofar as the goods and services captured include aspects of the minerals and metals supply chain. Such agreements have the potential to either impede or enhance

the implementation of environmental and social standards relating to minerals and metals. Some commentators find the impediments of trade and investment treaties to be more common than the advantages, noting also that power disparities between State parties can disadvantage low-income and lower middle-income producing countries when it comes to negotiating contracts and dispute settlement [1, 14, 28, 42].<sup>11</sup> Some trade agreements directly reference SSIs with the aim to advance sustainability goals (see Section 5) [26]; and

- non-binding policy instruments such as the UN Sustainable Development Goals, the UN Guiding Principles on Business and Human Rights, and more recently the Principles of the UN Secretary-General's Panel on Critical Energy Transition Minerals [3, 14, 35, 38, 42].

Additionally, multilateral bodies play an important role in developing frameworks (e.g. the World Bank's Environmental and Social Framework, the International Finance Corporation Performance Standards, and the Equator Principles) to manage environmental and social risks for projects seeking funding, and in providing multilateral mechanisms to foster cooperation and capacity building [21, 28, 35, 41, 42].

The IGF's Mining Policy Framework, formally adopted by its Member States, is a policy guidance tool to support countries strengthen the environmental, social and economic governance of their mining sectors [5].<sup>12</sup> Another example is the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas. It receives particular attention in the literature for its engagement of producer and importer countries in its development, its widespread endorsement and application by governments and companies and its integration into both SSIs and national laws [9, 18, 28, 37, 39, 49].<sup>13</sup>

11 One peer reviewer of this report also noted that affected communities and rights-holders often lack access to investor dispute settlement mechanisms, which exacerbates challenges with access to remedy.

12 IGF (2023). Mining Policy Framework. International Institute for Sustainable Development. Available at: <https://www.igfmining.org/resource/igf-mining-policy-framework>.

13 See: <https://mneguidelines.oecd.org/mining.htm>. The OECD has produced other relevant guidance, such as the OECD Guidelines for Multinational Enterprises and the OECD Due Diligence Guidance for Responsible Business Conduct – as well as the recent OECD Handbook on Environmental Due Diligence in Mineral Supply Chains. Available at: <https://mneguidelines.oecd.org/>.

Despite the relevance of such instruments, the sources reviewed for this report characterize international law relating to minerals and metals as piecemeal [14, 19], containing gaps and not always well-implemented at the national level [28, 35, 40]. UN Member States have repeatedly expressed the need for enhanced collaboration at the international level on mineral resource governance [7, 8, 14, 38, 42]. The growth of the IGF since its origins at the UN 2002 World Summit on Sustainable Development, to membership of 86 countries in 2025,<sup>14</sup> and resolutions focused on mining and metals adopted by UNEP's 193 Member States in the last three UN Environment Assemblies,<sup>15</sup> reflect growing interest in this regard.

## ii. Regional level

In addition to international instruments, there is also a myriad of regional instruments relevant to environmental aspects of minerals and metals. Examples of regional binding agreements include the [36]:

- 1974 Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea Area;
- 1991 United Nations Economic Commission for Europe's (UNECE) Convention on Environmental Impact Assessment in a Transboundary Context;
- 1992 Convention for the Protection of the Marine Environment of the North-East Atlantic;
- 1992 UNECE Convention on the Transboundary Effects of Industrial Accidents;
- 1992 Bamako Convention on the Ban on the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa;
- 1998 UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters;<sup>16</sup> and
- 2018 Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean.

Mineral due diligence and circularity have become a key focus of regulatory developments in the European Union (EU), reflecting EU Member States' status as importing countries. Instruments such as Regulation 2017/821 on supply-chain due diligence for minerals from conflict-affected and high-risk areas, and Regulation 2023/1542 on batteries<sup>17</sup> (and a Circular Economy Act planned for 2026) have direct impact in EU Member States. They also affect midstream and upstream actors outside the EU. Additionally, there are EU rules that

Member States must implement via national laws. There is, for instance, Directive 2022/2464 on corporate sustainability reporting—which includes companies in minerals and metals supply chains in its scope, although like certain other EU rules, applies exclusively to large companies in terms of size and turnover. The EU also enacted the Critical Raw Materials Act in 2024 (Regulation 2024/1252) which aims to secure EU access to a reliable, diversified and sustainable supply of critical raw materials. One feature of the Act is to set sustainability criteria for companies applying for strategic projects to streamline the permitting process. It is notable for the purpose of this report that the EU Commission is empowered by the Act to endorse the use of SSI certification schemes that meet certain requirements as demonstration of compliance with those criteria [6, 20, 32, 36, 41, 48].<sup>18</sup>

The African Union's African Mining Vision,<sup>19</sup> the Organisation of African, Caribbean and Pacific States' position paper on Critical Raw Materials and the International Conference on the Great Lakes Region's Regional Certification Mechanism are other examples of coordinated action on mining governance at the regional and subregional level [35, 36, 44].

## iii. National level

At the heart of mining regulation is national law—including permitting and licensing systems and environmental management—underscored by the principle of State sovereignty over natural resources within a State's borders. Some producer countries also implement parts of their regime via contracts between government and mining companies, and community development agreements, which can include ESG requirements [14, 28, 36, 38, 47, 48]. Countries may also have national laws on due diligence and sustainable sourcing, covering mineral and metal imports or national companies working abroad [14, 28, 37, 49].<sup>20</sup> Some countries—spanning mineral producing, processing and importing jurisdictions—have integrated into their legal frameworks the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas<sup>21</sup> [6, 9, 28, 29]. Other countries, such as the People's Republic of China, have introduced their own initiatives [2, 18, 32].

Studies indicate that effective enforcement of laws and regulations is the most powerful tool to compel adherence to environmental sustainability standards [1, 16, 42, 43, 50]. However, sources also note a disparity in legal approaches across different jurisdictions, identifying some regulatory gaps

14 See: <https://www.igfmining.org/resource/history-of-the-igf/>.

15 UNEA-4/19 on mineral resource governance in 2019, available at: <https://digitallibrary.un.org/record/3982544?ln=en&v=pdf>. UNEA-5/12 on the environmental aspects of minerals and metals management in 2022, available at: <https://digitallibrary.un.org/record/3999177?ln=en&v=pdf>. UNEA-6/5 on the environmental aspects of minerals and metals in 2024, available at: <https://docs.un.org/UNEP/EA.6/RES.5>.

16 While the Aarhus Convention began with a European focus, it is open to global accession and has non-European parties.

17 The EU's Batteries Regulation requires disclosure about a battery's materials and sustainability. Work is under way for a new 'battery passport' Sustainability Standards and Initiatives led by the Global Battery Alliance, which would assist companies to meet the Regulations' requirements. More information can be found here: <https://www.globalbattery.org/media/publications/gba-batterypassport-2024-v1-web.pdf>.

18 For more on the Critical Raw Materials Act see: [https://www.europarl.europa.eu/RegData/etudes/BRIE/2024/766253/EPRI\\_BRI\(2024\)766253\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2024/766253/EPRI_BRI(2024)766253_EN.pdf). Peer reviewers of a draft of this report also noted that, at the time of writing, the relevant EU legislation was being streamlined or slowed, which may lead to (or indicate) a trend reversal with regard to ESG in the metal and minerals sector.

19 The African Union's African Minerals Development Centre has developed other tools pursuant to the African Mining Vision, e.g. Africa's Green Minerals Strategy, in 2025, available here: [https://au.int/sites/default/files/documents/44539-doc-AGMS\\_Final\\_doc.pdf](https://au.int/sites/default/files/documents/44539-doc-AGMS_Final_doc.pdf)

20 For examples of specific national laws on environmental sustainability and the minerals and metals sector, see sections 5 and 6 of the UNEP report, Sustainability Reporting in the Mining—Current Status and Future Trends: <https://wedocs.unep.org/bitstream/handle/20.500.11822/33924/SRMS.pdf>.

21 Supra footnote 12.



Photo: Matt Arellano/Pexels

in relation to environmental aspects, as well as implementation challenges [7, 14, 16, 40].

The national governance landscape is dynamic and evolving with regard to the full supply chain, particularly in response to the recent 'critical minerals' demand. The International Energy Agency's Critical Minerals Policy Tracker found over 100 new policies adopted by governments in just two years [38, 48].<sup>22</sup> Despite the demand for energy-transition minerals, related national frameworks for circularity and efficiency remain under-developed [38]. Sources note that the laws of mineral producing countries are generally developed independently from laws and SSIs that pertain to the imports and use of minerals and metals. Additionally, mandatory due diligence laws are generally being adopted by developed—but not developing—countries [3, 42, 44].<sup>23</sup>

The United States of America's 2014 Dodd-Frank Wall Street Reform and Consumer Protection Act, which requires companies listed on the New York Stock Exchange to report on the sourcing of conflict minerals from Central and East African countries, is cited as an early and influential example of an individual government influencing sustainability outcomes in other countries. However, studies identify inadvertent adverse impacts, which result in shifting—rather than solving—issues associated with conflict and criminality, and deepening local hardship and exclusion [13, 34, 37].

Overall, national regulatory landscapes are diverse and ever-changing, with efforts being made to increase transparency and encourage responsible mining. Meanwhile, governments face pressure to fast-track permitting procedures for new mine sites [38, 42].

#### iv. Subnational level

In federal and decentralized political systems, subnational regulation plays a critical role in shaping the environmental and social sustainability of mining operations. Provinces, states and territories, including traditional authorities, often hold jurisdiction over land use, permitting processes, environmental impact assessments, benefit-sharing mechanisms and local community engagement. This creates opportunities for innovation in the regulation and enforcement of sustainability aspects, along with complexities in aligning with national standards and global governance instruments [14, 16, 28].

<sup>22</sup> As of June 2025, the tracker showed over 400 policies from across more than 35 countries and regions worldwide: <https://www.iea.org/data-and-statistics/data-tools/critical-minerals-policy-tracker>.

<sup>23</sup> A peer reviewer pointed to possible capacity differentials between governments of producer countries in the Global South and consumer nations in the Global North.

# 5 Overview of the interplay between public instruments and Sustainability Standards and Initiatives

As explored in previous sections, SSIs have emerged against a backdrop of increasingly complex global supply chains and a variety of public instruments at all levels, some of which face implementation challenges [8, 14, 16, 17, 19, 40]. Without a common approach for how SSIs establish their relevance to governments and public instruments, SSIs risk creating further confusion [6, 17, 23]. This raises the question of how SSIs and public instruments currently interact with each other. Section 5 provides an overview of the interplay between public instruments and SSIs, while Sections 6 and 7 examine in more detail specific opportunities and challenges that SSIs present to public governance.

Commentators generally agree that SSIs are no substitute for strong regulation by governments [12, 14, 16, 21, 41, 43, 50]. The underlying objectives also differ between the public sector (e.g. motivated by supply chain security and public health) and the private sector (e.g. motivated by profitability) [18]. Studies that map SSIs against the Sustainable Development Goals find synergies in many—but also a lack of linkage in others [3]. At the same time, opportunities for positive interactions and mutual improvement between SSIs and public instruments are highlighted. SSIs can “provide a bridge between international regulations and national laws” [31] and can support policy making by convening stakeholders, driving innovation, and building legitimacy across sectors [1]. Equally, governments can play a key role in creating enabling conditions for SSIs to be widely adopted and effectively implemented [2, 3]. State-led due diligence initiatives (such as EU laws and

OECD guidance) can be a key driver for the development and implementation of SSIs, and many SSIs base their standards on international norms [1, 3, 5, 50]. In this regard, there is a need for further analysis on the extent to which internationally agreed environmental rules, norms and commitments are incorporated into SSIs. This would help gain a deeper insight into ways in which to leverage synergies between SSIs and public instruments and enhance environmental governance. 

It can be difficult for third parties to identify the extent to which SSIs converge on or diverge from public instruments [16]. Close to 90 per cent of public officials who responded to a survey carried out by the IGF in 2025 indicated that their government was considering integrating SSIs into mining regulation, but 65 per cent would require more information, training and other support. The survey also showed a particular interest in SSI integration and more accessible information and benchmarking of SSIs among mineral-producing countries in the Global South [9].<sup>24</sup>

Literature on SSIs generally (i.e. not mineral- and metal sector-specific) indicates that SSIs are increasingly integrated into trade policy frameworks, including public procurement, market access and due diligence regulations, export promotion strategies and free-trade agreements (FTAs) [3, 26, 27]. Regarding FTAs, research conducted by ISEAL and IISD identified five common typologies of rationale behind the integration of SSIs into free-trade agreements: cooperation, promotion, recognition, guidelines or support



Fig. 4: Nature of interaction between Sustainability Standards and Initiatives and public instruments (UNEP and the IGF, 2025: Authors' compilation based on literature review [3, 13, 17, 28, 39]).

24 The survey was sent to government officials of IGF member countries, and responses received were 12 per cent from Eurasian countries, 46 per cent from African countries and 42 per cent from Latin-American and Caribbean countries [9].

[26, 27]. The insight by ISEAL and IISD also notes that references to SSIs in trade agreements can be undermined by ambiguous terms, or by being promotional rather than enforceable. The inclusion of such SSIs in trade agreements may also encounter resistance where the implementation of SSIs is seen as a barrier to trade [26].

Table 1 summarizes key insights from two studies that provide specific case studies of producer State interaction with SSIs [9, 44]. The IGF's most recent analysis of SSI integration into public policy identified an interest from government officials

for more involvement in the governance, enforcement and creation of SSIs. It was also found that regulators in producing countries in the Global South are more likely to integrate SSIs' principles into public regulation if they are involved in the standard-setting process and that global standards are adaptable to context-specific requirements [9]. Beyond case studies, future research could focus on a holistic analysis of the types of interactions between SSIs and public instruments (i.e. on the collaborating, complementary, coherent, coexisting and competitive spectrum—as outlined in Fig. 4). 

**Table 1:** Examples of State Interaction with Sustainability Standards and Initiatives [9, 44].

SSIs	Country	Key insights on public policy integration
The OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas (OECD Guidance)	The Great Lakes region [9]	The OECD Guidance has been widely used and referenced in SSIs as well as national regulations and regional intergovernmental agreements. <sup>25</sup> The Lusaka Declaration signed by 11 Heads of State of the Great Lakes region in December 2010 required the processes and standards of the OECD Guidance to be integrated into the six tools of the Regional Initiative against the illegal exploitation of natural resources. The governments of the Democratic Republic of the Congo and Rwanda subsequently integrated the Guidance into their national regulatory frameworks.
Initiative for Responsible Mining Assurance (IRMA)	Indonesia [44]	This case study found IRMA supporting legal reform in Indonesia by working with the authorities to align mining regulations with international ESG standards. The SSI body was found to engage in capacity building and to provide inputs for legislative development, showing potential for SSIs to inform national policy frameworks. <sup>26</sup>
The Global Industry Standard on Tailings Management (GISTM)	Brazil [9]	The GISTM was developed in 2020 by a multistakeholder panel involving UNEP in response to the 2019 Brumadinho tailings dam failure in Brazil's state of Minas Gerais. The Brazilian authorities and industry experts were consulted in the drafting process, and they also used GISTM principles in strengthening their own national and state-level regulatory frameworks.
The Regional Certification Mechanism of the International Conference on the Great Lakes Region (ICGLR)	Rwanda [44]	The ICGLR's Regional Certification Mechanism is embedded in national legislation in Rwanda. As a result, national authorities are obligated to conduct inspections and participate in audit governance while also benefitting from collaboration in those functions from the ICGLR. In this way, the SSI stimulates due diligence laws and policy improvements and supports their enforcement.
The Extractive Industries Transparency Initiative (EITI)	Madagascar [9]	The EITI is directed primarily at governments and may require legislative change for the effective implementation of some of its standards. For example, Madagascar integrated wording from the EITI in its Mining Code of 2023, making mining companies' declaration of beneficial ownership and contracts public mandatory.
Global Reporting Initiative (GRI)	Sweden [9]	In 2007 Sweden issued guidelines mandating State-owned companies to use the GRI standard for their sustainability reporting. This requirement, where feasible, also applies to jointly-owned companies. The GRI framework remained central to Sweden's 2016 sustainable business policy, and the current State-owned enterprise policy (2020) mandates the use of GRI or equivalent standards. An annual summary of sustainability reports of State-owned enterprises is submitted to parliament to ensure transparency and accountability.

The following sections will discuss opportunities and challenges for SSIs generally to inform or support public instruments, as identified in the literature.

25 Peer reviewers provided as additional examples, laws of the European Union, Switzerland, Türkiye and the United Arab Emirates.

26 Further examples of use of IRMA standards by Governments can be found in a recent brochure produced by IRMA, available here: [https://responsiblemining.net/wp-content/uploads/2024/12/The-Case-for-IRMA\\_Governments-and-Policymakers\\_24April2025.pdf](https://responsiblemining.net/wp-content/uploads/2024/12/The-Case-for-IRMA_Governments-and-Policymakers_24April2025.pdf)

# 6 Sustainability Standards and Initiatives-related opportunities for the governance of the minerals and metals sector

## i. Sustainability Standards and Initiatives used by governments to assess or support national regulatory frameworks

Governments can use SSIs directly with the aim of improving environmental outcomes, for instance by referencing specific SSIs in national regulation—either as a mandatory requirement or a recommendation, or by emulating SSI language in national rules [1, 2, 9, 16, 19, 21, 44]—see Fig. 5, below.

Other sources note that SSIs can also indirectly influence national regulation by setting benchmarks, raising expectations in terms of performance, informing civil society advocacy for stronger government regulation, promoting continuous improvement, conveying stakeholder consensus or informing non-mandatory guidelines, while States develop or reform their policies and laws [18, 21, 22, 32, 44]. SSIs have led to principles such as public participation, transparency, effective adjudication and accountability being socialized and adopted into national practices [1, 5].

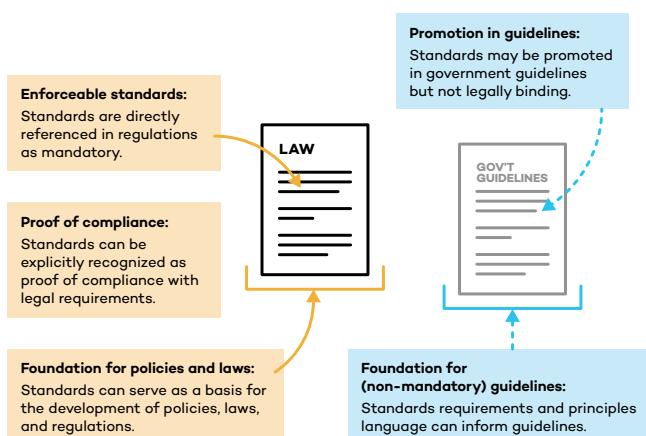


Fig 5: How standards can complement regulations. (Source: [21])

## ii. Elevating environmental performance beyond national regulatory requirements

The emergence of SSIs is often attributed to perceived or actual gaps or update-delays in government regulation [1, 8, 13, 14, 16, 21, 35].<sup>27</sup> Some SSIs can impose additional

<sup>27</sup> A counter-argument is made by Kramarz: "We find little evidence of a significant regulatory governance gap that justifies the need for private governance standards. This is an important finding given the vast proliferation of private initiatives that are promoted as filling a regulatory gap." [17]

standards or more precise requirements in relation to ESG performance matters than are included in national laws in some jurisdictions [3, 4, 16, 17, 32, 34, 44, 51]. SSIs may be more readily amendable and adaptable than national laws [14, 21, 22, 51]. Principles of international law that are cited as having been incorporated more swiftly in SSIs than in national laws include climate change mitigation, protection of biodiversity, procedures and requirements of stakeholder participation and the inclusion of Indigenous rights in decision-making [16, 17, 19, 51]. SSIs can constitute a kind of 'soft law' that works in parallel with the formal mining code or other national laws and regulations targeting the supply chain [44]. At the same time, there is a need for further research into the costs and environmental, social and economic impacts and trade-offs of implementing SSIs, to better understand and leverage opportunities for public governance. 

## iii. Providing additional avenues for compliance, monitoring, auditing and enforcement

The literature notes a potential role for SSIs to supplement (but not substitute) government monitoring and enforcement or to provide evidence of an operator's compliance with legislation, particularly where States may lack capacities or face other obstacles to regulate companies [14, 21, 32, 44]. SSIs can support their members by providing templates, sharing best practices and compiling public repositories of conformance reports [49]. Studies note that SSIs are well equipped to support compliance with due diligence regulations [3, 27].

In some instances, State enforcement showed improvements attributed to the co-existence of SSIs with government regulatory programmes, and to the leverage of external oversight [1, 44]. However, the consequences for non-compliance are considerably different between SSIs (for instance a poor score rating for SSIs) and SSIs complementing government regulation (for example fines or failure to obtain permits) [16, 17].

Alternatively, SSI bodies – or independent entities engaged with SSIs – can serve as an additional mechanism for affected stakeholders to raise concerns and seek redress, especially where little transparency and knowledge gaps amplify an implementation or capacity gap [42].

#### iv. Providing new data flow and enhanced transparency

Some SSIs have a specific function to share information, which may include the dissemination of knowledge and best practices [18]. If made public, reporting of company performance against SSI requirements can provide valuable data [2, 25]. Sources describe the potential, and some observed examples, for governments to use reporting from SSIs as information to guide their regulation, either in relation to specific operators or thematic trends [22, 44].

SSIs can enhance transparency more broadly by providing structured frameworks for assessing and reporting on environmental performance beyond those in national law. This can enable external actors (such as consumers or pressure groups, as well as investors) to hold companies accountable and determine alignment with responsible investment-screening criteria [11, 19, 21, 51]. Governments could take a lead in compiling public repositories of company reporting under SSIs [49]. However, a “tick-box” approach or lack of clarity between corporate-level reporting and site-specific reporting and impacts can frustrate this opportunity ([29, 31, 42] and also see Section 7(iii)).

#### v. Bringing diverse stakeholders into governance models

Several sources find that SSIs can bring significant benefit to national governance by convening different stakeholders for dialogue towards common ground on minerals and metals [1, 13, 22, 32]. SSI committees can test ideas and build relationships on relevant topics prior to government policy and law development [14]. SSIs can benefit from multistakeholder groups in the countries in which they are implemented [9]. SSI processes can also help build the capacity of local communities, who may be at risk of adverse social and environmental impacts of mining activities, to engage in policy development around environmental aspects of mining [1]. Additionally, greater cooperation between policymakers and SSIs can also strengthen the design of SSIs, their implementation and their credibility [26].

#### vi. Innovative and dynamic approaches

SSIs may adapt and adjust more quickly than government regulation to address evolving challenges [14, 21, 22, 51]. Competition among SSIs, and referencing SSIs in public instruments (such as trade agreements), can spur innovation and raise ESG performance ambition [10, 26]. Current examples of innovative practices explored by SSIs include:

- non-conventional methods of tailings management [19];
- ‘geo-traceability’ (for instance using finger printing, bar codes, GPS, mobile phones, real-time site information and crowd-based monitoring) [4, 11, 14, 44];
- blockchain technology as a decentralized ledger for the chain of custody [14, 32, 37, 41, 44, 52];
- artificial intelligence (e.g. predicting equipment failure before it occurs) [47];
- the internet of things (e.g. sensors measuring water or emissions) [11, 47]; and
- the circular economy approaches [47].

While the literature recognizes that SSIs can be effective mechanisms for testing standards, systems and technology in practice, and revising based on learning, it also reflects considerable debate on whether this happens effectively and accountably in practice [1, 37, 41].

#### vii. Applying additional economic incentives and sanctions for better performance

Adherence by companies or projects to SSIs can seem to de-risk investment and help open or retain markets in developed countries or jurisdictions considered risky [1, 3, 11, 21, 44]. Anticipated price premiums, public funding or tax breaks can also influence the uptake of SSIs, and SSIs can be incorporated into public procurement requirements [1, 3, 27, 49]. SSIs that are accompanied by assistance for producers, such as capacity building and financial support, can achieve higher uptake and impact [3, 27]. The market-based approach of SSIs can incentivize more sustainable practices, in a non-adversarial way, outside of producer State influence [22, 41]—although the extent to which this happens in practice is a key point of debate (see Section 7(iii)).

#### viii. Full life cycle approach across jurisdictions

Noting that many minerals and metals supply chains are multi-tiered and transnational, various commentators identified an important added value of SSIs, which is that they are ‘de-territorialized norms’ that apply consistently, regardless of national government change or borders, throughout a supply chain [1, 14, 18, 22, 32, 40, 41]. The transnational nature of SSIs brings transparency across a supply chain, making it possible to take into account global cumulative environmental (and associated social) impacts that reliance on domestic governance alone can overlook. It also facilitates the comparison of performance across regions or materials owing to the uniformity of data [2, 18, 21].

#### Examples of coordination between Sustainability Standards and Initiatives

In the face of governance challenges posed by the multiplicity and fragmentation of SSIs (see Section 7(i)), it is useful to note examples of coordination between SSI actors (for instance equivalency benchmarking and cross-recognition procedures between different SSIs) [14, 32, 44, 53]. Barriers to SSI cross-recognition efforts may include the time and resources required for assessments, competition concerns and potential legal or reputational risks [53]. Nonetheless, several examples exist of ongoing efforts to cross-recognize, harmonize or converge multiple frameworks (such as the Consolidated Mining Standard Initiative, the M3 Integrated Assessment Protocol, and use of the OECD’s alignments assessments) [19, 21, 32, 53]. There are significant differences in SSI cross-recognition methodologies and stringency [53]. Moves towards the interoperability of SSIs generally seek to increase uptake, reduce reporting fatigue and costs, expand an SSI’s scope and expertise, improve data comparability and make responsible sourcing easier for downstream actors [32, 53]. However, some commentators note possible adverse outcomes from consolidation or cross-reliance, and find the field of SSI harmonization itself to be incoherent and complex [32, 53].

# 7 Sustainability Standards and Initiatives-related challenges and limitations for the governance of the minerals and metals sector

As noted in Section 6, while opportunities exist for SSIs to cohere with and support public instruments, sources also point to the potential for SSIs to be at odds with or undermine public instruments. This can limit the potential for SSIs to bring about positive change, and can even obstruct the path towards more effective environmental sustainability in the minerals and metals sector. This section explores relevant factors in this regard.

## i. Fragmentation of standards across multiple instruments

As previously noted, a report by the IGF identified 158 SSIs related to minerals and metals in 2018 [5]. A study that focused exclusively on transnational initiatives relevant to renewable energy metals developed between 2010 and 2023 found 68 relevant SSIs [18]. Many commentators have described such 'proliferation' of SSIs and resulting 'fragmentation' of global environmental governance as a challenge that leads to competition over market share, and confusion or distrust among companies, regulators and consumers. This has hindered rather than promoted the implementation or visibility of environmental best practices [1, 6, 7, 10–21]. The rate of multiplication of SSIs has been described as outpacing the capacity to study them [29].

According to a study focusing on trade policy, given that not all SSIs are equal, the use of SSIs (in this case within trade policy) must be supported by 'credibility criteria' [27].

While a narrow thematic or sectoral focus can make specialization possible, it can also cause an overlapping of multiple SSIs across a value chain, for instance in cases where many different metals may be combined into an alloy product [14, 16, 20]. In addition to overlaps, gaps persist in the collective SSI coverage of certain issues [11, 21] where standards are low in ambition (see Section 7(iii)) or because particular topics are overlooked (see Section (6)(vi)).

Some commentators report an absence of cross-communication or strategic linkage between various SSIs and public instruments, as well as limited transparency about cross-recognition [6, 10]. Recent reports caution against further duplication [4, 8], with some calling for more central guidance and technical exchange at the global level [7, 10, 19]. One commentator posits that regular comparative review of SSIs by a range of experts and stakeholders could help harmonize SSIs towards what might be considered best in class [13]. However, others caution that attempts to harmonize standards may add a new layer of complexity to existing SSIs, lower ambition, drive down performance levels and

accountability or dilute the specialization of individual SSIs [20, 32, 44]. In a 2018 report on interoperability, the German agency for international cooperation, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), highlighted the risks of "stakeholder fatigue of serving on multiple standard committees", indicating that regular coordination alone may not solve the fragmentation problem [45].

## ii. High burden on operators to adhere to multiple compliance regimes

Compliance with SSIs may be expensive and even render products uncompetitive in price-sensitive markets or for smaller operators [3, 14, 37, 41].<sup>28</sup> Yet many reports raised an overriding issue, noting that the costs (and effects) of implementing SSIs were inadequately studied [1, 3, 14, 19, 22, 41].<sup>29</sup> It may be difficult for stakeholders such as affected communities, workers and Indigenous rights holders to participate in a range of SSIs, and such engagement may require support (for instance capacity building, expenses, translation and technical assistance) [4, 14, 24, 34, 54, 55]. SSI bodies themselves may lack adequate resources to conduct core activities and help member companies meet minimum standards, let alone to increase ambition [32].

The multiplicity of SSIs, which (alongside national regulation) may impose duplicate or even contradictory compliance burdens on a company, can cause 'reporting fatigue.' This can deter operators from engaging in sustainability efforts owing to confusion or concern about the cost of compliance or even divert time and resources away from environmental sustainability to administrative and reporting processes [6, 11, 16–18, 21, 44]. Companies may thus choose schemes based on the lowest anticipated burden rather than more meaningful metrics [11, 20]. ASM and medium-sized companies particularly in the Global South are likely to struggle with the resource implications of SSIs that require memberships, which in turn can affect their access to markets [4, 14, 41, 46].

28 An impact assessment of EU Regulation 2017/821 (on supply chain due diligence for EU importers of tin, tungsten, tantalum and gold originating in conflict-affected and high-risk areas) estimated that for large companies the initial cost would be around 0.010 per cent of turnover and the recurring cost drop to 0.007 per cent of turnover, compared to 0.154 per cent and 0.127 per cent, respectively for small and medium enterprises [37].

29 One source quoted research showing that the cost to a mining company of implementing one Sustainability Standards and Initiatives was estimated to be 2–4 per cent of the mineral export value (in 2014) or US\$130 to US\$180 per tonne (in 2019) [37].

### iii. Greenwashing and the Ineffectiveness of Sustainability Standards and Initiatives

'Greenwashing' is a term used to describe a situation where 'sustainability' is leveraged as a public relations tool bereft of meaningful and positive changes to business operations [13, 15, 42]. Critics view some SSIs membership as industry's pragmatic, prolific but superficial response to business risk, with an agenda limited to accommodating societal expectation to the minimum extent necessary, to avoid reputational damage or disruption to operations and appease consumer conscience—while overall prioritizing financial returns [13–15, 17, 32, 37].

The adoption of SSIs does not guarantee compliance with desired norms, and over-reliance on specific SSIs may give a false impression of outcomes in practice [6, 17, 19, 22, 41]. SSI certification or reporting without independent third-party oversight may be perceived as misleading the public about the actual sustainability performance of certified companies [1, 6, 10, 14, 49]. Some SSIs may also set low compliance benchmarks and enable lax companies to make claims about responsible mining or supply chain conduct without having to make significant investments to change operations in practice [13, 14, 22, 32, 41, 42, 44].

The voluntary nature of SSIs can also result in low compliance [2, 14, 19, 42]. Few SSIs have the means to enforce compliance, or sanctions for non-compliance [18]. Experts describe how SSIs often compromise to the lowest performance standards—codifying existing practice but not functioning to lift performance levels [13, 14, 22, 42, 46]. Deadlock or power imbalance between interest groups involved in SSIs can lead to a focus on procedural rigour in SSIs rather than substantive stringency [19, 39, 46]. Despite corporate commitments on environmental issues becoming the norm, progress on responsible practices on the ground is observed as slow even among the largest, best resourced and most-media exposed companies [19, 42].<sup>30</sup> Studies either describe difficulties assessing the impacts of SSIs [1, 14, 22, 31, 41, 53], challenges associated with distinguishing the impact SSIs have from other implemented changes [11, 22] or observe no change to sustainability outcomes after implementation of SSIs [42, 46, 56].

### iv. Failing to consider the local context and national interests

An all-encompassing approach to SSIs will not address the diverse set of issues within profoundly different geographies, social and political contexts [5, 37]. Overlap in or divergence between SSIs and individual countries' legal requirements add to companies' compliance burdens and, ultimately, to costs [16, 17].

A barrier to SSIs addressing the local context arises with SSIs developed in the Global North, by experts removed from the communities, local ecological and socio-economic contexts and national legal frameworks in producer countries [1, 3, 16,

18, 29, 32, 42, 44]. Studies note that even multistakeholder SSIs often exclude producers or other representatives from developing countries [3, 32]. SSIs developed or governed without involving the countries where mining takes place are problematic; SSIs may lack buy-in where their approach clashes with the political or regulatory systems on the ground [3, 14, 28, 39]. Uptake of SSIs is also seen as geographically skewed towards developing countries [3, 29]. In other sectors, higher conformity rates have been observed in producers who freely join an SSI, compared to those who have had it imposed on them for instance by powerful upstream actors [3].

Moreover, lack of attention to local conditions may also lead to selection biases regarding producers, privileging those that are already compliant and acquainted with certification processes. This can exclude smallholders from the outset and thereby lessen the potential of sustainability transformation.

Local insights may reveal on-the-ground limitations to implementation of SSIs, such as geography or conflict hindering oversight, constraints to applying technology-based solutions or local adaptations needed to appropriately engage with women, youth, Indigenous Peoples or local communities [16, 37]. SSIs may not be applicable to pre-existing mine sites [19]. SSIs imposed externally on localized complex circumstances may even have unintended effects, causing adverse social conditions and conflict [14], on the Dodd-Frank Act]. Indeed, a Global North-based scheme may bring inherent limitations related to lack of on-the-ground understanding, reinforcing existing power imbalance and raising questions of sovereignty and cultural relativism [3, 37]. Tensions may also arise if SSIs across multiple sectors create barriers to free trade or—the opposite—barriers to the development of public policies [10].

Further research could examine what local characteristics may support or obstruct SSI engagement and whether trends exist that could be identified for producer regions (including systematically comparing and identifying potential region or country-specific engagement patterns and related challenges).



### v. Corporate capture

SSIs are mostly created and enforced by industry (including industry associations) and non-governmental organizations; as such, they constitute a form of private governance at risk of corporate capture [40, 46]. Private actors have different 'logics of action' and accountabilities from governments, and this shapes the goals of the governance systems they promote [18]. Studies show a possible imbalance between multistakeholder governance of SSIs and stakeholder input into SSIs, with business interests significantly over-represented and more influential in comparison to non-industry participants, who may be co-opted or repeatedly overruled to protect industry interests [42, 46, 50]. This strengthens the position of industry with vested interest in the design and management of SSIs, which can diminish democratic channels of participation,

<sup>30</sup> According to the IEA's 2025 Critical Minerals Outlook (<https://www.iea.org/reports/global-critical-minerals-outlook-2025>), despite increased ESG reporting, actual environmental performance in the mining sector remains limited, with continued increases in waste, water use and biodiversity risks.

public regulation and accountability and access to information [21, 22, 37, 41, 42, 46]. Industry stakeholders can use their influence to lower the bar set by SSIs or cherry-pick standards to reduce compliance costs or legitimize business as usual [17, 22, 46].

A general lack of transparency and public trust in the quality and impartiality of third-party audits is among the most frequent criticisms levelled against the use of SSIs as a complement or even alternative to public governance [43, 45, 50].

SSIs emanating from manufacturers or consumers towards the end of a supply chain move the governance of natural resources even further away from the mineral producing State's control [14, 17, 37]. Investor-led SSIs may be limited by one primary objective: to achieve strong financial performance [18, 42].

The private sector should respect the rights of affected communities and protect ecosystems in the rush for critical minerals; however, it is the State's responsibility to ensure those rights and protections are upheld [17]. Public instruments aim to hold companies accountable to national citizens, while SSIs focus on accountability to different stakeholder groups including shareholders [16, 44].<sup>31</sup> Additionally, there can be dissonance across boundaries, for example if extractive companies engage in SSIs for their

international reputation while lobbying against sustainability measures at the local level, or where upholding of SSIs gives other countries an incentive to apply lower environmental standards to obtain a competitive advantage [14].

#### **vi. Minimal interaction between Sustainability Standards and Initiatives and public authorities**

While some SSI organizations collaborate with government authorities during different stages of the development of SSIs, many do not. Additionally, engagement with public authorities in mineral producer States, as well as traditional authorities (such as chiefs) who have strong legitimacy and trust in some countries, is often overlooked [14, 44, 56]. The majority of the 15 SSIs examined in a 2015 study were found to publish information only in English, despite operating globally [25]. Sections 3(ii) and 7(iv) above describe concerns about the effectiveness of SSIs developed based on the interests of mineral end-users rather than producer countries [1, 14, 16, 28, 29, 37, 39, 42, 44].

While some commentators noted arguments in favour of retaining State independence from SSIs, public officials surveyed expressed frustration at not being invited to participate in SSI consultations [44]; and most government respondents to the 2025 survey by the IGF, particularly those from mineral-producing countries in Africa and Latin America, expressed interest in participating in future discussions on SSIs [9].



<sup>31</sup> It can also be argued that the evolution of Sustainability Standards and Initiatives that concentrate on human rights and environmental due diligence shifts the focus from risk to the company (shareholder-based corporate governance) to risk to potential victims of corporate action (stakeholder-based corporate governance) [3].

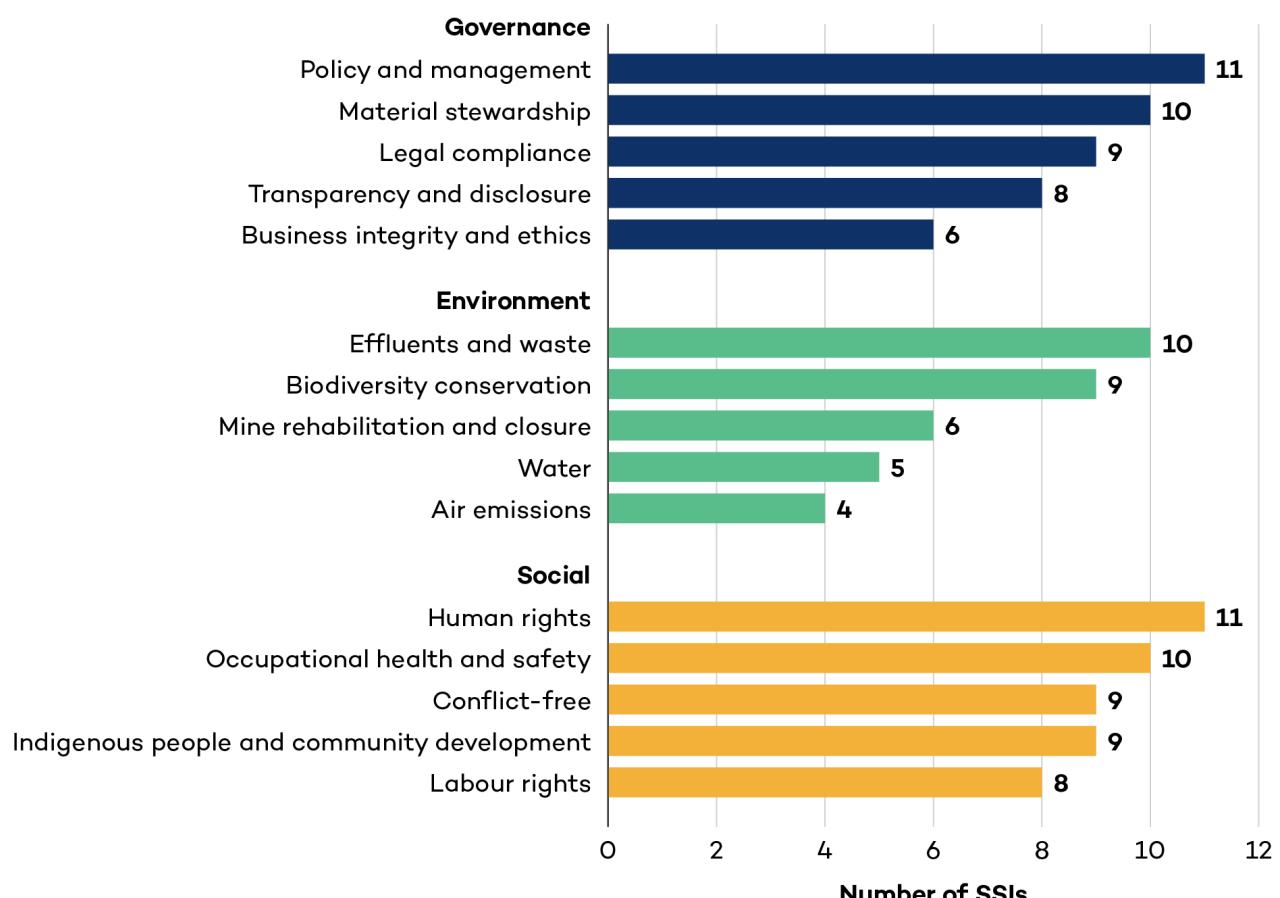
## vii. Perpetuating gaps in regulatory frameworks

Some researchers do not justify regulatory gaps as a need for the development of SSIs [15–17]. Others query whether existing SSIs do fill key gaps. One study found the environment to be the least addressed theme in SSIs. Others highlight deficiencies in SSIs content in relation to life cycle assessment, community health, stakeholder participation, equitable distribution of cost and benefits, gender, human rights abuse, tackling corruption, climate change, deep seabed mining, and downstream areas of the supply chains including recycling, traceability, circularity and resource efficiency [4, 11, 15, 20, 25, 31, 32, 42, 50]. Studies suggest that SSIs have greater effect and uptake in countries that already have a strong regulatory governance system, which data suggest skews towards higher income countries [3]. Several commentators note a risk that SSIs—which may not be sufficiently rigorous nor universally adopted—are taken as a substitute for regulation, frustrating rather than supporting efforts to strengthen legislation [1, 10, 21, 40, 50]. Where the key governance gap is enforcement of regulation by governments, the use of SSIs (with weak enforcement regimes) does not solve the problem [16, 50].

## viii. Undermining public instruments

SSI may cover the same topics as relevant public instruments but set different requirements and responsibilities [31]. Reliance on SSI (privatised governance, and self-regulation) can serve to dilute or undermine government monitoring and enforcement and institutional strengthening [2, 23b, 27, 33, 37]. One source posits that use of SSI in this way could be perceived as a purposeful strategy to evade regulation [27], others note that SSI can deflect the appropriate accountability to citizens away from governments [13, 31].

There is agreement across the sources that SSI cannot substitute government regulation: SSI oversight and enforcement may be weak, opaque or lack independence, and non-membership or non-compliance generally does not give rise to tangible sanctions – let alone liability, redress or criminal law proceedings in national jurisdictions [1, 13, 22, 23, 27, 31, 33, 35, 37a, 39]. Lack of consistency between different SSI, and between SSI and public instruments, can limit the usefulness of the data for monitoring industry's performance [5, 41, 33, 43].



**Fig 6:** Range and commonality of topics covered by a sample of 15 Sustainability Standards and Initiatives studied. (Source: [25])

# 8 What is needed: hallmarks of robust standards

## 8.1 Rationale behind suggested hallmarks

The synthesis in Sections 6 and 7 highlighted opportunities and pitfalls regarding the interaction between SSIs and public instruments. This section sets out a series of suggested hallmarks of an effective SSI, based on the literature review. We posit that SSIs that show some or all these attributes are more likely to support public instruments towards positive outcomes for environmental (and associated social) sustainability aspects of minerals and metals across supply chains than SSIs that do not. As noted in the report's recommendations and conclusion, decision-makers interested in understanding the role and efficacy of SSIs operating in their jurisdiction or supply chains can use the hallmarks as a framework against which to assess individual SSIs.

The suggested hallmarks, summarized in Fig. 7 and explained in more detail below, encompass factors relevant to governance and stakeholder engagement, scope and interoperability, reporting and audit, transparency and review. Viability and incentive for uptake are also considered, given that, for SSIs to succeed, they must first be accepted [3, 13].

Principal sources for this section include those from the ISEAL Alliance, a globally recognized membership organization that brings together leading sustainability standards and certification systems.<sup>32</sup> The ISEAL framework works across two components (i) a Code of Practice for Sustainability, which includes criteria on crosscutting topics such as due diligence, stakeholder engagement, monitoring and evaluation and remediation and (ii) Credibility Principles, which provide an international reference point for the core values of credible and effective sustainability systems [[24, 55] —as also discussed e.g. in [4, 10, 29]].<sup>33</sup> Other useful references include the World Trade Organization's Principles for the Development of International Standards, Guides and Recommendations,<sup>34</sup> the OECD's Methodology for OECD Alignment Assessments of Sustainability Initiatives<sup>35</sup> and Mercedes-Benz's Guidance for Suppliers: Navigating Quality and Effectiveness of Mining and Supply Chain Standards [54]. The latter document applies criteria relating to SSI governance and process to score and rank eight individual supply-chain SSIs.

Governance	Scope	Performance Assurance	Review Mechanisms	Viability
Multistakeholder inclusivity	Relevance to environmental risks	Clear objectives and performance indicators	Transparency including public disclosure of data	Accessibility and incentives for range of actors
	Coverage along supply chains	Third-party conformance assessment	Promotion of continuous improvement	
	Adaptability to local context	Repercussions for non-conformity	Regular evaluation of impact	
Accountability	Alignment with other SSIs			
	Reflective of international norms			
Impartiality in decision-making				

Fig 7: 15 hallmarks of an effective Sustainability Standards and Initiatives. (Source: this report)

32 As a meta-governance system for credible and effective Sustainability Standards and Initiatives, ISEAL has two types of memberships: code compliant members (Sustainability Standards and Initiatives that have been the subject of independent reviews against the ISEAL Code) and community members (those who have not).

33 Also informative to section 6.2 are the 63 objective criteria applied by an ISO expert working group in their recent review of 30 mineral-sector Sustainability Standards and Initiatives, (see <https://standards.iso.org/iso/iwa/45/ed-1/en/>) [4].

34 See also: [https://www.wto.org/english/tratop\\_e/tbt\\_e/principles\\_standards\\_tbt\\_e.htm](https://www.wto.org/english/tratop_e/tbt_e/principles_standards_tbt_e.htm).

35 See also: [https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/11/methodology-for-oecd-alignment-assessments-of-sustainability-initiatives\\_5fd70573/b533c060-en.pdf](https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/11/methodology-for-oecd-alignment-assessments-of-sustainability-initiatives_5fd70573/b533c060-en.pdf).

## 8.2 Suggested hallmarks

### i. Multistakeholder inclusivity

The commentaries stress the importance of having governance mechanisms that ensure the participation of diverse stakeholders in designing and implementing SSIs (e.g. [1, 3, 4, 11, 12, 14, 21, 22, 24, 29, 32, 37, 41, 44, 51, 55]). The literature praises SSIs that share multistakeholder governance and decision-making equally among, and sustain consensus-seeking collaboration with a wide spectrum of interest groups, subject matter experts and rights-holders from the early stages of design (or revision) through to implementation [4, 11, 29, 44, 54]. The direct involvement of the industry subjected to the SSIs is considered important for buy-in [22], while the involvement of civil society, including workers and trade unions, Indigenous rights-holders and impacted communities (including women and youth) is important for legitimacy, conflict-reduction and grounding [4, 14, 21, 32, 37, 41]. SSIs should seek avenues to incorporate current scientific evidence [55] and local and traditional knowledge [30, 34]. Some sources also note that government bodies are under-represented in SSI design and governance [1, 21].

Stakeholder engagement in SSI development and operation must be meaningful and balanced; and should not be limited to one-off open consultations [4, 46]. Mechanisms that can support effective partnership in designing and operating SSIs include stakeholder analysis, targeted strategies to engage and amplify under-represented voices, timely and accessible feedback procedures, funding and capacity building to support engagement, use of independent third-parties to conduct consultations, accessible grievance processes, flexible means of communication and consolidation of consultation to reduce the burden on stakeholders [4, 14, 24, 34, 54, 55]. It is crucial for stakeholders to have a meaningful opportunity to influence decisions, be able to see all inputs received and to get an explanation of how these were processed [4, 24].

### ii. Accountability

SSIs should host complaint-handling processes and investigation and dispute resolution mechanisms as well as providing opportunities for whistleblowing. Such processes and mechanisms should be impartial, accessible, documented, timely, fair, rights-compatible and transparent (while protecting the identity of complainants where appropriate) [4, 13, 24, 25, 29, 34, 55]. Local stakeholders should participate in the design, operation and review of the mechanisms [42, 54], which should be broad in scope, for instance by applying to the SSI itself as well as to individual members' implementation of the SSI [24, 34]. There is a need for clear assignment of accountability at the executive and site levels [57].

### iii. Impartiality in decision-making

The importance of impartiality and reliable safeguards against the capture of SSIs by particular interests is a cross-cutting theme [8]. This applies inter alia to the SSI design [22], conduct of consultations [14], SSI accountability systems (for example [4, 24]), and audit management [1].

It is vital to use specific mechanisms to identify and transparently manage conflicts of interest in decision-making

[1, 4, 55]. Failure to do so may affect an SSI's credibility and limit stakeholder appetite to engage [11, 55].

### iv. Scope: relevance to environmental risks

SSIs often focus on selected aspects of sustainability [1, 14] and thematic scopes of SSIs seem dominated by social, and not environmental, issues [25, 30]. Studies also show wide variations in the level of comprehensiveness and specificity of environmental requirements across SSIs [4, 30, 32]. In their scope, SSIs may overlook locally used minerals and ASM [35], immediate impacts of the project on the local environment (for instance water use and quality and deforestation) [14, 18, 30, 32], and topics touching on the circular economy [4, 29]. There may be a preference for SSIs that take a more universal approach to sustainability, which could be achieved by updates over time [1, 30].

#### Important environmental topic areas to consider in critical mineral supply-chain SSIs include:

- **climate and air quality** (greenhouse gas emissions and climate change, air pollutants, dust emissions and loss of carbon sinks such as from deforestation or wetland destruction);
- **water and soil management** (water quality, use, reuse, treatment and pollution, soil quality and contamination);
- **waste and hazardous materials** (management of tailings, safety of tailings storage facility, management of waste rock and non-tailings waste, management of hazardous and radioactive materials, pollution control and management);
- **resource efficiency and the circular economy** (resource and energy use, recycling, recovery and reuse, durability, repairability and reusability of products and circular economy strategies);
- **land use and biodiversity** (baseline data collection, environmental permitting, wider site development impacts such as land clearing and deforestation, loss of habitat, invasive species, settlements and transport infrastructure and increased human impacts due to greater access to sites);
- **mine closure and post-closure** (closure planning, reclamation, long-term environmental monitoring and risk mitigation);
- **physical and operational impacts** (noise, vibration, erosion, transport-related environmental impacts, physical hazards and mine-site security); and
- **cross-cutting assessment tools** (environmental impact assessment, environmental cost-benefit analysis and life cycle assessment).

(Source: Authors' compilation based on [4]).

### v. Coverage along supply chains

As noted in Section 6(viii), one benefit of SSIs is their ability to operate across borders. Many sources see value in SSIs that require a chain of custody, tracing minerals and assuring practice along the supply chains from mine site to end-product [1, 5, 11, 13, 21, 22, 49]. Gaps noted in supply chain-focussed SSIs include applicability to smaller companies [22], the management of tailings [19], midstream processors (at the smelting or refining stages) [11, 13, 14], life cycle assessment and circularity (for instance product design, repair, re-use and recycling) [4, 25, 29, 31, 41]. There is a need to explore opportunities to spread SSI implementation costs equitably along the supply chain [37].

## vi. Reflective of international law

Given the dispersed nature of international norms that apply to environmental aspects of minerals and metals (see Section 4(i)), SSIs can play a helpful role in collating and reflecting them [18, 44, 55]. Specific recommendations from the literature suggest that SSIs should reflect: the UN Guiding Principles on Business and Human Rights [4, 11, 44]; Indigenous rights and Free, Prior and Informed Consent [11, 15, 17, 18]; gender rights and climate change [8]; international biodiversity commitments [14, 15, 32]; and international best practice standards for environmental impact assessment and public participation [14, 17]. Additionally, while many SSIs have adopted the OECD's 2011 Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas, few have integrated the OECD's more recent 2023 Handbook on Environmental Due Diligence in Mineral Supply Chains [32]. SSI reporting can also support the tracking of mineral projects' or supply chains' alignment with international commitments to sustainability, especially where key parameters are prioritized in reporting requirements, for instance gender-disaggregated data.<sup>36</sup>

## vii. Alignment with other Sustainability Standards and Initiatives

Most sources recommend stronger integration, coordination and interoperability between the different SSIs, both to strengthen their impact and buy-in and to introduce efficiencies that reduce costs and burden for all stakeholders, thereby also addressing the related problems of redundancy and certification fatigue [1, 5, 6, 11–14, 21, 25, 29, 30, 35, 41, 45, 51, 55].

Specific suggestions to achieve better efficiency and alignment include:

- building upon or cross-referring to existing SSIs in a new or revised SSI [6, 24, 25];
- cross-recognition of information and reports gathered for another SSI [6, 29];
- shared reporting via digital ledger technology [7];
- acceptance of certification from other SSIs [25];
- shared auditor registration, training and mechanisms [1, 4];
- bilateral SSI-to-SSI collaboration and learning [14, 25, 55];
- unified complaints-handling [6];
- consolidation and modularity between different SSIs [11, 30]; and
- avoiding the introduction of new SSIs [4, 5].

## viii. Adaptability to local context

One size does not fit all, and credible SSIs should be adaptable to local conditions [8, 12, 14, 55]. Methods for SSIs to achieve this may include: work to understand different local stakeholders such as their cultural context and their inter-relationships [14]; paying particular attention to political contexts including the role of traditional authorities and other institutions in shaping community acceptance and trust in mining projects, as well as to gender roles [14]; holding

local consultations to identify possible unintended effects of the SSIs [24, 54]; and developing a cadre of auditors with a good understanding of local social and ecological contexts [1]. Adaptability to local conditions is also an important, recurring demand from governments of producing countries, whose perspectives may be underrepresented in global multistakeholder frameworks [1, 3, 8, 12, 37, 44].

## ix. Clear objective, theory of change and performance indicators

SSIs should clearly communicate their purpose towards driving positive environmental (and associated social) outcomes and set specific short, medium- and long-term aims and performance requirements, along with related strategies (the SSIs' theory of change) [4, 6, 22, 24, 55]. Several sources argue that SSIs require an outcome-based approach (i.e. focused on achieving specific, desired results) to successfully deliver on environmental (and associated social) sustainability impact. They do not merely require a systems-based approach (i.e. focused on specific processes expected to achieve a desired outcome) [1, 14, 22, 31, 46].

## x. Third-party conformity assessment

SSIs should incorporate conformity assessment, which may include activities such as testing, inspection, validation, verification, certification and accreditation [4]. To be credible, verification-oriented SSIs require audits carried out by truly independent third parties [1, 4, 11, 19, 21, 24, 34, 44, 54, 57]. Otherwise, in the words of a mining executive that was interviewed, "it's just natural for people to assess themselves favourably" [22]. This excludes facilitation initiatives which by design do not include audits in their scope.

Some sources further observe that third-party assessments should not be a one-off but tied to a step-by-step process of continuous improvement [37, 44], and should include site inspection, spot-sampling, worker interviews and the participation of the people affected. Additionally, the assessments should be managed in a gender-sensitive manner [1, 4, 13, 34, 37, 44, 50, 54]. Rules should preclude reliance on the same auditor to always analyse the same company [34]. The competence of auditors is critical and can require a team to contain a significant range of skills and technical expertise; this may be achieved through qualification requirements, training, professional development, testing, certification, supervision or peer review [1, 4, 24, 25, 54].

## xi. Repercussion for non-conformity

Although SSIs are inherently voluntary, commentators agree that credibility and effective implementation are achieved by setting minimum requirements and imposing consequences for non-conformity (e.g. a corrective action plan, public scorecard, reporting to local authorities) and tangible sanctions for failure to act (e.g. ultimately exclusion from the SSIs) [4, 14, 19, 22, 24, 25, 34, 37, 56].<sup>37</sup>

36 See for example, <https://www.iisd.org/system/files/2023-04/women-mine-of-the-future-global-report.pdf>; <https://sdg-action.org/data-on-gender-seizing-the-true-picture/>; [https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/05/gender-and-the-environment\\_016cf67/3d32ca39-en.pdf](https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/05/gender-and-the-environment_016cf67/3d32ca39-en.pdf).

37 According to a peer reviewer of this report, another challenge related to Sustainability Standards and Initiatives proliferation is the likelihood of sanctioned companies going 'SSI shopping', which could be avoided if sanctions regimes were better coordinated and market mechanisms disciplined blacklisted companies effectively.

## **xii. Transparency**

Transparency was emphasized as a key characteristic throughout the source material. SSIs that emphasize transparency are seen as more credible and more likely to attract civil society participation [11]. Transparency requires public access to core information about the SSI, including its legal ownership, scope of operations, purpose and methodology, ways of identifying and reporting results and impacts, how decisions are taken and about income source [4, 6, 13, 21, 22, 24, 54, 55]. It is vital to be transparent about the constitution of SSI governing boards and how they were selected [25].

SSIs should also publicly disclose the results of assurance processes, including complete audit reports [11, 21, 31, 34, 42, 43, 49, 54, 56], thereby “adding stakeholders as another assurance entity”[25]. Furthermore, any claims made by SSIs about their own impacts must also be backed up with publicly available and verifiable data to ensure the scheme’s own transparency and accountability to external stakeholders [55]. Information should be presented in plain and understandable language, and in a timely and accurate way [8, 14, 55].

## **xiii. Promoting continuous improvement**

To avoid indicators that encourage low performance (see Section 5(iii)), SSIs should be progressive, meaning they should provide an appropriate level of assurance while helping in a stepwise manner to build capacity towards better practices and outcomes [1, 3, 13, 21, 32, 54]. SSIs can also incentivize leading practices and a “gold standard” for best performance [1, 4, 11]. On the other hand, tiered systems that reward continuous improvement at different grades, and not only best-in-class performance, can facilitate up-take by the ASM sector, medium-sized companies, low environmental performers and pre-existing mines [3, 4, 11, 13, 14, 30]. Continuous improvement requires the production of regular and user-friendly datasets that make it possible to assess the impact of interventions, ensuring that lower-performing actors do not use them as an excuse for continuously lagging behind [1, 14, 55]. SSIs can also provide a platform for peer-to-peer learning, with the aim of speeding up progress among less advanced actors [44].

## **xiv. Periodic review and evaluation of impact**

As noted in Section 6(vi), one of the benefits of SSIs (unlike national laws) is the flexibility to respond to new evidence, stakeholder input, emerging issues and changing external conditions [1, 4, 22, 42, 55]. SSIs should do this via a strong monitoring and evaluation system, which supports the assessment of their performance and learning to ensure continuous improvement in terms of the efficiency of the process, relevance and impacts [1, 4, 25, 54, 55]. It is important to make information about the review framework and findings available to all stakeholders, with adequate time allowed for participants to adapt operations to any required changes, and to use the opportunity at review points to integrate more stakeholders and their views [13, 24].

## **xv. Viability and uptake**

SSIs can only be effective insofar as they are adopted and workable. Implementation costs are a barrier to adoption, particularly for smaller enterprises [1, 11, 27, 34]. SSIs should consider incentives and the ‘value proposition’ for participation for all stakeholders [1, 3, 4, 11, 22]. For industry this may include: establishing a clear relationship between SSI participation and higher productivity and employee satisfaction; a reduced cost of capital, finance or risk insurance [1, 11, 14]; and designing the SSI in a way that ensures that its implementation does not cause disproportionate diversion of resources from other areas of operation (including sustainability performance) [55, 56]. Opportunities to spread costs of SSI implementation equitably along the supply chain should be explored [37]. SSI organizations should commission studies to assess the cost/benefit ratio for participants [41].

Technical assistance, training material for SSI participants, targeted financial support, burden-sharing and a proportionality approach to assurance are other tools that SSIs can employ to assist participants, and may be necessary for ASM in particular [11, 22, 25, 32, 33]. Put another way “a credible SSI strives to create value that fairly rewards the effort and resources that it takes for users to participate in the system” [55].

# 9 Conclusion and recommendations

## i. Summary of key points

This stocktake has synthesized a variety of sources to examine the range and role of SSIs in the governance of the environmental (and associated social) sustainability aspects of minerals and metals. From Sections 1–5 (above), it is evident that the recent rapid expansion of SSIs across minerals and metals supply chains is bewildering to many and has given rise to complex interplays between SSIs and public instruments—from collaborative to conflicting.

The literature review also reveals that SSIs can be very different in their governance, procedure, scope and substance. Sections 6 and 7 (above) reveal that well-designed and properly implemented SSIs present opportunities for governance enhancement, otherwise SSIs face significant limitations and may be ineffective in practice—as summarized in Fig. 8, below. Section 8 synthesizes attributes of SSIs that may lead to greater positive impacts (see Fig. 7, above).

Overall, SSIs have great potential to support public instruments aimed at ensuring environmental sustainability across minerals and metals supply chains. But in practice, few if any SSIs have been the subject of comprehensive independent studies into the costs, impacts and trade-offs of implementation. This

hinders evidence-based and accurate communication around the purported benefits of SSI implementation to different stakeholders, including Global South producer countries. Unilateral or siloed approaches by SSI bodies or downstream supply-chain actors add to the confusing patchwork and can clash with other SSIs or public instruments. To harness fully the positive contribution that SSIs offer, it is vital to understand, address and mitigate the risks identified in this report, and maximize the opportunities.

Towards this objective we recommend that:

- the hallmarks identified in Section 8 (above) be used as a practical reference for policymakers, standard-setters and stakeholders to assess the credibility and effectiveness of SSIs;
- independent studies on the impact of SSIs, and where their benefits and costs fall, be prioritized and communicated; and
- extraneous new SSIs be discouraged, and greater cooperation and inter-operability be a primary future focus for SSIs—engaging with all stakeholders, including governments.



Fig 8: Summary of opportunities and challenges to public governance presented by Sustainability Standards and Initiatives, as discussed in Sections 6 and 7 of this report. (Source: this report)



Photo: Vlad Chetan /Pexels

## ii. Next steps

This report, the proposed community of practice and the UNEP–IGF collaboration reflect the shared mandate of UNEP and the IGF to promote environmentally sound resource governance. They also echo the call from governments for enhanced collaboration at the international level and between multilateral bodies on mineral resource governance [7, 8, 14, 38, 42]. The report supports efforts to align minerals and metals management with the 2030 Agenda for Sustainable Development and the principles of the UN Secretary-General's Panel on Critical Energy Transition Mineral. Additionally, it builds on UNEA resolution 6/5 and outcomes of consultations held under UNEA resolution 5/12 and 4/19.

Given the increasing complexity and strategic significance of the global landscape of SSIs, it is imperative that public and private stakeholders engaged in environmental matters across the life cycle of minerals and metals come together to understand the scope, objectives and operational implications of SSIs within their respective domains. There is a clear need for greater integration or interaction both between SSIs and between SSIs and public instruments. This challenge to integrate can also be an opportunity to advance towards more holistic, full life cycle sustainability measures that promote effective multistakeholder governance.

The report is intended to kick-start and inform a dialogue and further studies on these important topics. Looking ahead, UNEP and the IGF hope to initiate a community of practice, supported by UNEP's Global Digital Knowledge Hub.<sup>38</sup> This will be an interactive discussion forum where stakeholders can work together to address the role SSIs can play to help public instruments improve environmental management.

<sup>38</sup> See: <https://www.greenvaluechains.org/mineralsandmetals>.

# Annex I:

## Report methodology

The report was developed following a literature review and expert consultation. This process included a comprehensive review of existing literature, including academic publications, international policy documents and analyses of existing SSIs and government frameworks. The literature was the product of commissioning and/or funding by multilateral bodies, standard-setting organizations, governments, as well as academics and other SSI experts. The materials were sourced from expert reviewer recommendations, publicly available resources identified from internet searches and academic databases, such as ScienceDirect (a full-text database offering journal articles and book chapters from more than 2,500 peer-reviewed journals and 11,000 books). The report also draws from UNEP and the IGF's institutional expertise.

Relevant literature was selected through searches using keywords like "voluntary standards", "sustainability standards", and "sustainable mining", along with a snowballing citation research technique. The collected literature was analysed thematically to identify common patterns and key divergences. In total, 57 documents published between 2007 and 2025 were analysed in full. A complete list of the reviewed documents is set out in the References section, below Annex III of this report. In a few instances, additional source documents—cited in footnotes—were used to support individual points in the paper or identified as useful complementary resources.

While the research team aimed to draw upon sources from a broad range of authors and regions, limitations encountered in the research process included: an imbalance in the regional distribution of funding or authorship of relevant studies, and paywalls or membership requirements to access documents. While English was the primary language of source material, papers in French and Spanish were included in the source material reviewed. In particular, the literature identified included few authors from the Global South. The authors of this report acknowledge that there remains a clear bias in the available literature towards documents produced by international organizations as well as scholars, consultants and institutions from industrialized countries. Truly local perspectives from mineral-producing countries and Indigenous communities were still underrepresented despite efforts to diversify the report database. Additional studies prepared by and commissioned from authors from producer countries in the Global South would significantly strengthen existing research and analysis. 

A group of external experts and interested stakeholders were invited to review a first draft of this report to provide feedback on the source material used and how it had been interpreted and reflected.

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# Annex II: Examples of Sustainability Standards and Initiatives

Mineral- and metal-specific sustainability standards	
Initiative	Organization developing the standard
Aluminium Stewardship Initiative Performance standard	Aluminium Stewardship Initiative
Artisanal and Small-Scale Cobalt Framework	Responsible Cobalt Initiative, the Global Battery Alliance's Cobalt Action Partnership and the Fair Cobalt Alliance
Bettercoal Code 2.0	Bettercoal
Chinese Due Diligence Guidelines for Responsible Mineral Supply Chains	China Chamber of Commerce of Metals, Minerals and Chemicals Importers and Exporters
Cobalt Refiner Supply Chain Due Diligence Standard (Version 2)	Responsible Cobalt Initiative and Responsible Minerals Initiative
Copper Mark Assurance Framework	The Copper Mark
CRAFT Code	Alliance for Responsible Mining
Environmental, Social and Governance Standard	Responsible Minerals Initiative
Extractive Industries Transparency Initiative Standard	Extractive Industries Transparency Initiative
Fairmined Standard	Fairmined
Fairtrade Standard for Gold and Associated Precious Metals for Artisanal and Small-Scale Mining	Fairtrade
Global Industry Standard on Tailings Management	UNEP Principles for Responsible Investment, and International Council on Mining and Metals
Global Precious Metals Code	London Bullion Market Association
Guidelines for Social Responsibility in Mining Investments	China Chamber of Commerce of Metals, Minerals and Chemicals Importers and Exporters
International Cyanide Management Code	The International Cyanide Management Institute
Kimberley Process	Kimberley Process Certification Scheme
Mining Principles	International Council on Mining and Metals
Responsible Gold Mining Principles	World Gold Council
Responsible Minerals Assurance Process and Mineral Supply Chain Due Diligence	Responsible Minerals Initiative
Responsible Steel International Standard	Responsible Steel
Responsible Jewellery Council Code of Practices and Chain of Custody Standard	Responsible Jewellery Council
The International Tin Supply Chain Initiative (ITSCI)	ITSCI Joint Industry Traceability and Due Diligence Programme
The Standard for Responsible Mining V1	Initiative for Responsible Mining Assurance
Tin Code	International Tin Association – Tin Code
TN CERA 4in1 Certification System	DMT GmbH & Co. KG
Towards Sustainable Mining Standard	The Mining Association of Canada, Towards Sustainable Mining
United Nations Resource Management System	The Expert Group on Resource Management

General sustainability standards	
Initiative	Organization developing the standard
GRI Sustainability Reporting Standards (GRI Standards)	Global Reporting Initiative
International Finance Corporation's Performance Standards on Environmental and Social Sustainability	International Finance Corporation/World Bank Group
International Financial Reporting Standards (IFRS) S1 General Requirements for Disclosure of Sustainability-related Financial Information; IFRS S2 Climate-related Disclosures	International Financial Reporting Standards Foundation
Sustainability Accounting Standards Board Standards	International Sustainability Standards Board
Task Force for Nature-related Financial Disclosure	Task Force for Nature-related Financial Disclosure
Task Force on Climate-Related Financial Disclosures	Financial Stability Board

Source: [21]

## Annex III: Opportunities for further study

The research for this report identified the following areas that would benefit from further future discussion or study:

- applying a typology to the existing range of SSIs, to identify ratios and trends of types of SSIs;
- questions of impact, workability and equity that arise from concepts developed by or for downstream actors and end-users largely in the Global North, but which apply to upstream actors and producer jurisdictions primarily in the Global South;
- the potential role of government-to-government partnerships (particularly between consumer and producer governments, respectively) to foster the implementation of responsible mineral and metal sourcing requirements;
- analysis of the extent to which environmental aspects of minerals and metals are covered (or not) in the public instruments described in Section 4 of this report;
- analysis of the extent to which internationally agreed environmental rules, norms and commitments are incorporated into SSIs;
- a holistic analysis, beyond case studies, of the types of interactions between SSIs and public instruments (i.e. on the collaborating, complementary, coherent, coexisting and competitive spectrum);
- further research into the costs and environmental, social and economic impacts and trade-offs of implementing SSIs;
- examination of local characteristics that may support or obstruct SSI engagement and whether any trends can be identified for producer regions (for example systematically comparing and identifying potential region or country-specific engagement patterns and related challenges); and
- more studies prepared by and commissioned from authors from producer countries in the Global South.

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