Mistra GEOPOLITICS

CLIMATE RISKS AND COMMUNITY RESILIENCE IN THE MINING SECTOR

CLIMATE RISKS AND COMMUNITY RESILIENCE IN THE MINING SECTOR:

HOW TO PROMOTE LOCAL SUSTAINABILITY?

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Isabella Strindevall[1]

Maria-Therese Gustafsson

Lisa Dellmuth

Stockholm University

KEY CONCLUSIONS

- Private corporations' initiatives to adapt to climate change have largely focused on climate impacts on business operations, and only rarely involve and benefit local communities.
- Domestic climate policies often reflect a tension between economic growth and ambitious climate adaptation and mitigation policies.
- Although public guidelines for integrating climate risks into sectoral policies have recently emerged, an analysis of four mining-dependent countries showed that climate risks are not systematically addressed in environmental impact assessments, water licences, closure plans or tailings standards.

EXECUTIVE SUMMARY

Mining plays an important role in the transition towards a low-carbon economy. At the same time, mineral extraction is associated with a wide range of sustainability challenges, many of which are likely to be exacerbated by climate change. For instance, mining requires large amounts of water, and water availability is likely to decrease due to climate change. Moreover, extreme weather events can damage critical infrastructure and increase the risk of mines contaminating land and water. How mining companies respond to climate risks is likely to have far-reaching impacts – both positive and negative – on local populations.

The overarching aim of this report is to provide practitioners, such as domestic and international policymakers, with a better understanding of how climate risks are currently being addressed in the mining sector. To this end, this report outlines the main findings from a recent study by GlocalClim and Mistra Geopolitics researchers on how private actors and states have addressed climate risks in the context of mining. In this report, we draw from this study by first outlining the private adaptation responses of the 37 largest global mining companies, and then by analysing extent to which climate risks have been integrated into key mining governance instruments. Our findings are based on a systematic analysis of corporate documents, semi-structured interviews and a review of policy reports and documents.

The key finding is that, despite an increasing awareness of the importance of addressing climate risks in the mining sector, important governance gaps remain. While most major mining companies have started to integrate climate risks into their risk assessments and water governance, the majority are lagging behind when it comes to ensuring that local communities are involved in and benefit from such initiatives. Moreover, our analysis of key governance instruments in the mining sector, such as environmental impact assessments, issuing of water licences, closure plans and tailings standards, indicates that there are few legal requirements to take climate risks into account in such instruments. Taken together, our findings suggest that the ways in which corporations integrate climate risks into mining operations rely on a narrow conception of climate change adaptation, focusing on improving business resilience and neglecting the needs of affected populations.

[1] *Corresponding author: isabella@strindevall.com*

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ABBREVIATIONS

EIA	Environmental Impact Assessment	PEM	Participatory environmental monitoring
GISTM	Global Industry Standard on Tailings Management	PEMC	Participatory environmental monitoring committee
ICMM	The International Council on Mining and Metals	SEIA	Strategic environmental impact assessment
MiCA	Mining Climate Assessment Data tool	UNGP	The United Nations Guiding Principles on Business and Human Rights

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1. INTRODUCTION

The mining sector plays a critical role in the low-carbon transition and the fulfilment of the UN 2030 Agenda. To meet the demand for clean energy technologies, the extraction of minerals and metals will need to be ramped up significantly in the coming years (Hund et al. 2020). While large-scale resource extraction has contributed to economic growth in some countries, it has also placed immense pressure on water supplies and livelihood assets, incited social conflicts, and caused environmental contamination in affected areas (cf. Bury 2005). The mining sector is, moreover, an important driver of forest cover loss and greenhouse gas emissions (Bebbington et al. 2018).

"We need to better understand how private companies actually address climate risks."

Mining companies, particularly large multinational ones, have started to engage in climate mitigation, and, more recently, address climate risks (Goldstein et al. 2019).

Given the importance of mining for the low-carbon transition and its impacts on livelihoods, we need to better understand how private companies actually address climate risks. This purpose of this report is to generate policy-relevant knowledge about the extent and the ways in which climate risks in the mining sector are being addressed. We also identify governance gaps pertaining to mining companies' accountability vis-à-vis public actors and local communities.

The findings are based on extensive desk research as well as insights from a recent study of how the 37 largest global mining companies address climate risks (Gustafsson et al. 2022). Using document analysis, we have identified and analysed the key instruments in mining governance in four countries in different world regions that are heavily dependent on mining: Canada, Mongolia, Peru and South Africa. This selection allows us to draw conclusions about private adaptation initiatives and existing governance gaps in a sample of countries that share a dependence on mining and a vulnerability to climate change, but differ in terms of their economic development. To complement the document analysis, we also conducted 46 semi-structured interviews with representatives of companies, state agencies and civil society actors.

This report is organized as follows. Section two briefly outlines the different linkages between climate change and mining. Section three first gives a brief overview of private climate governance in the mining sector, before outlining the private climate adaptation responses of the 37 largest global mining companies. Section four describes public governance responses to climate risks in the mining sector, drawing on examples from Mongolia, Peru and South Africa. Finally, section five concludes with a short summary of our findings and their implications for companies, domestic governments and international organizations. While recognizing the importance of the mining sector in debates about climate mitigation, this report focuses upon climate adaptation.

2. CLIMATE CHANGE AND MINING

The mining industry's position within the climate debate is highly relevant from the perspective of both mitigation and adaptation. The transition towards a low-carbon economy will substantially increase the demand for minerals and metals. Methods of cleaner energy production, such as solar and wind, require significantly more materials than their fossil fuel-based counterparts. A recent World Bank Group report estimates that the demand for graphite, lithium and cobalt could increase up to 500% by 2050, even if recycling rates were to increase significantly (Hund et al. 2020). Properly managed, resource extraction can help generate resources for development. However, mining may also have devastating social and environmental impacts.

The mining industry is a significant driver of forest cover loss and greenhouse gas emissions. Alongside more well-known land-intensive sectors, such as agriculture and logging, the mining sector contributes to forest cover loss by expansive mineral extraction and related infrastructure investments. The demand for minerals may stand in direct conflict with other land use, including forest conservation (Bebbington et al. 2018). The mining industry is also energy-intensive, contributing an estimated 4–7% of global greenhouse gas emissions via Scope 1 and 2 emissions, and 28% of global greenhouse gas emissions via indirect (Scope 3) emissions (Rüttinger and Sharma 2016; Delevingne et al. 2020). In many places, remaining mineral reserves are inaccessible and of declining ore grade, meaning that their extraction will require greater use of land, water and energy resources. To ensure that future demand for critical minerals can be met in a sustainable manner, the mining sector will need to step up mitigation efforts while simultaneously adapting to climatic change.

Finally, without robust adaptation measures, the mining sector is extremely vulnerable to different climate-related risks. Extreme weather events may cause floods or droughts which could damage mining infrastructure and lead to the contamination of land and water (Rüttinger and Sharma 2016). Water availability is also likely to decrease as a consequence of climate change. As mining requires large amount of water, companies need to adopt appropriate adaptation measures and ensure that scarce water resources are shared with other water users. Otherwise, conflicts are likely to arise with local communities over access to water resources (cf. UN Global Compact et al. 2015).

Adaptation is highly complex and adaptation strategies can lead to benefits for some groups while exacerbating the climate vulnerability of others. In other words, the adaptation strategies of mining companies can lead to maladaptation by having unintended consequences that could risk reproducing climate vulnerability or generate vulnerabilities in other sectors (e.g. Magnan et al. 2016). The risk of maladaptation is particularly evident in countries which are highly dependent on mining. Many mining-dependent countries, such as the Democratic Republic of the Congo and Mongolia, hold large deposits of minerals and metals needed for the low-carbon transition, such as cobalt, lithium and copper, and are simultaneously highly vulnerable to climate risks.[2]

Figure 1 shows a map of the intersecting risks of mining dependence and climate vulnerability. Climate vulnerability is illustrated using the Notre Dame vulnerability index. Low values indicate high vulnerability and are represented by darker shades of grey. Mining dependency is illustrated using the International Council on Mining and Metals (ICMM) mining contribution index. Higher values indicate higher mining contribution and thus greater mining dependency. This map indicates that an increased demand for minerals and metals required by the low-carbon transition can bring new challenges to countries which are already highly vulnerable to climate change. If mining companies fail to make their operations more resilient to climate risks, this could have adverse local environmental and social impacts. To address climate risks in a context of mining is thus critical.

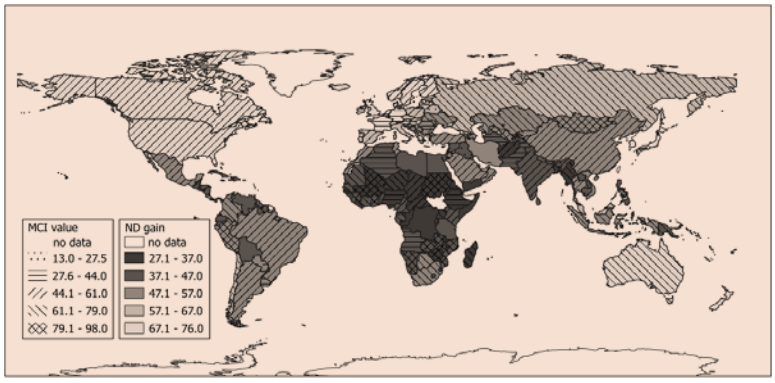

Figure 1: Intersecting risks of climate vulnerability and mining dependency. The map combines data from ICMM's mining contribution Index with Notre Dame climate vulnerability index. Source: ICMM (2020a) and ND-GAIN (2022).

[2] *As defined by the Notre Dame Global Adaptation Initiative Country Index (ND-GAIN 2022).*

3. PRIVATE CLIMATE RISK GOVERNANCE IN THE MINING SECTOR

As climate impacts become more severe, the need for climate adaptation is becoming ever more pressing. This has become increasingly central in the mining sector, where some mining companies have started to reduce their exposure to physical climate risks. Although industry leaders are becoming more aware of the need to address climate risks, many companies have just started to develop such responses (UN Global Compact et al. 2015). This section first gives a brief overview of private climate risk governance in the mining sector, before outlining the private climate adaptation responses of the 37 largest global mining companies.

3.1 PRIVATE CLIMATE RISK GOVERNANCE IN THE MINING SECTOR

In the recent past, mining companies' adaptation responses have been shaped by an increasing number of private standards related to climate risks. Although these standards typically exceed national legislation and policy frameworks, they are voluntary and are thus prone to be selectively enforced by companies.

Since the early 1990s, the mining sector has been responding to shareholder and public pressure to make the industry more sustainable. The ICMM has played a critical role in promoting sustainability principles in the mining sector (Gustafsson et al. 2022; ICMM 2020b). In the area of climate adaptation, ICMM published guidance documents on adaptation in 2019, and on the integration of climate risk in mine closure plans in 2018. In 2016, ICMM launched their Mining Climate Assessment Data tool (MiCA), that allows member companies to assess climate risk exposure on both companies and host communities (ICMM 2016a). While MiCA reflects an emerging trend of private adaptation responses and increased climate risk awareness, soft policy instruments like it are only designed to encourage, rather than enforce, the uptake of policy (Rodgers et al. 2016).

In addition to initiatives focused on the mining sector, other private initiatives are a response to a demand for increased transparency. The Task Force on Climate-Related Financial Disclosures, established in 2015, has developed guidelines to disclose information about the financial implications of climate risks to investors (TCFD 2017). These guidelines constitute a robust framework for integrating climate into risk and vulnerability assessments. The most recent update of the Equator Principles, a financial benchmark for assessing and managing environmental and social risk, also indicates that large institutional investors are increasingly demanding that corporations disclose their exposure and responses to climate risks. The

updated version of the Equator Principles, which came into force in October 2020, requires all major projects funded by an Equator Principle financial institution to integrate climate change into their environmental and social impact assessment. The increased investor pressure to disclose climate risks is a promising trend (Gustafsson et al. 2022). However, community resilience could be deprioritized if companies respond to the investor community rather than civil society, host governments and local communities.

3.2 MANDATORY DUE DILIGENCE AND THE UNITED NATIONS GUIDING PRINCIPLES ON BUSINESS AND HUMAN RIGHTS

With the shortcomings of voluntary measures to ensure sustainability in global trade coming under increasing criticism, several European states have adopted mandatory due diligence legislation to hold companies with headquarters in Europe accountable for environmental and social risks in producing sites in the Global South. Several countries have already adopted legislation or are debating implementing legislation based on the UN Guiding Principles on Business and Human Rights (UNGPs).[3] The UNGPs build on the UN protect, respect and remedy framework and aim to help states and companies address human rights abuses within their operations. The UNGPs establish that all companies, regardless of the size and sector, should carry out human rights due diligence on their supply chains. These principles were endorsed by the UN Human Rights Council in 2011. However, a recent survey of major European companies revealed that only 37% carry out due diligence on all types of human rights and environmental impacts. This has fuelled criticism of the fundamental shortcomings of such voluntary measures (Smit et al. 2020).

Responding to such criticisms, mandatory due diligence regulations that build on the UNGPs have been adopted, among them the UK Modern Slavery Act, the EU's Conflict Minerals Regulation, and the French Law of Duty of Vigilance (LeBaron and Rühmkorf 2017; Partzsch 2018). These laws differ significantly with regard to their stringency and institutional design. Some laws, such as the UK Modern Slavery Act, is primarily a disclosing obligation, while other laws, such as the French Duty of Vigilance law, establishes legal liability, enabling civil society to initiate lawsuits against companies that contributes to social and environmental harm.

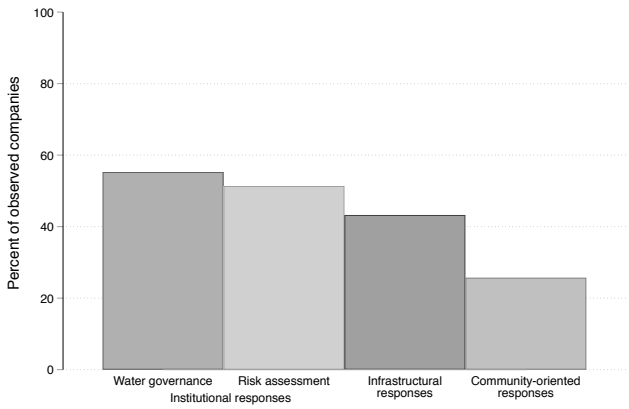

Figure 2: Percentage of companies adopting specific adaptation response types. Notes: N=37. Based on document analysis using company reports. Source: Gustafsson et al. (2022).

> ***"The UNGPs establish that all companies, regardless of the size and sector, should carry out human rights due diligence on their supply chains."***

However, the UNGPs have been criticized for insufficiently considering environmental issues, a limitation that is reflected in many mandatory due diligence laws. In the context of such limitations, laws that include both environmental and human rights issues, such as the French Duty of Vigilance law or the new German Supply Chain Due Diligence Act, are required to address climate risks in the mining sector.

As mandatory due diligence legislation is currently being adopted in different countries and debated at the EU level, it is important to evaluate to what extent such laws would contribute to enhanced private adaptation responses

3.3 CORPORATE RISK ASSESSMENTS AND ADAPTATION RESPONSES

Companies are, increasingly, recognizing climate change as a business risk, and have begun to integrate climate risks into their frameworks and practices. Based on a recent study, we analyse to what extent the 37 largest global mining companies have adopted institutional, infrastructural and community-oriented responses to climate risks (Gustafsson et al. 2022). In this study, we used a qualitative document analysis of company reports (annual reports, sustainability reports and climate change policies and reports) and semi-structured interviews with representatives of companies, state agencies and civil society actors.

Institutional responses refer to the management of climate risks by way of developing new procedures for assessing and addressing climate risks and integrating

such risks into existing frameworks, including water governance. We distinguish between risk assessments and the integration of climate risks into water governance through monitoring procedures and water use targets. Infrastructural responses refer to investments to adjust technology and infrastructure to cope with climate risks (cf. Sovacool and Linnér 2016). Community-oriented responses refer to activities that primarily or partially aim at enhancing the adaptive capacity of local communities. There is growing awareness that community-oriented responses are necessary to ensure that private adaptation actions do not come at the cost of increased climate vulnerability of local communities (UN Global Compact et al. 2015).

With regard to *institutional responses*, Figure 2 shows that more than half (55%) of the observed companies report having integrated climate risks in their water governance. By contrast, only 19 (51%) companies included climate change in their risk management frameworks and business plans. Of these, 16 companies conducted risk assessments of climate impacts for each region where the company operates. For example, South32 conducts climate resilience assessments of its operations and considers climate-induced water risks such as water scarcity and increased risk of flooding (South32 2019a). Notably, six companies with operations in countries identified as vulnerable to climate risks lacked formal climate risk assessment frameworks. For example, four of the analysed companies operate in the Democratic Republic of the Congo, listed as one of the five most climate-vulnerable countries in the world (ND-GAIN 2022). The failure to address climate risks in such contexts is likely to increase the climate vulnerability of host communities. To avoid adverse outcomes, climate risks need to be systematically integrated in risk assessments.

With regard to *infrastructural responses*, 16 (43%) companies report having adjusted their technology and infrastructure to cope with climate risks. Indeed, many companies have a technical approach to climate risks, and describe investments in technology for treating and recycling mine-affected water,[5] desalination technologies,[6] technology for water sparse dust suppression[7] and water storage for sustained operations during periods of water stress.[8] As a technical issue, climate adaptation is typically managed by engineers at the company's environmental unit,[9] rather than the community relationship unit. Thus, companies are potentially overlooking the impacts of their adaptation interventions on local communities.

[3] E.g., the French Duty of Vigilance law, the German Supply Chain Act and the Norwegian Transparency Act.
[4] According to the ND-GAIN (2022).

It is important to distinguish between adaptation responses designed to enhance business resilience and those that aim to reduce the vulnerability of local communities (Averchenkova et al. 2016). While the former is increasingly required by financial institutions, the latter is lagging behind, not the least in regulatory frameworks. Indeed, our findings show that only 9 (26 %) companies report that they have engaged in community-oriented responses. The 2015 Caring for Climate report emphasizes the importance of companies going beyond the existing focus on company resilience, and also consider the climate vulnerability of local communities (UN Global Compact et al. 2015). Many company representatives claim that a lack of knowledge and concern among local communities impedes meaningful dialogue on climate-related risks, or that communities prioritize other issues over climate change, which reduces companies' incentives to engage communities in these processes.[10]

Taken together, our findings suggest that most observed companies are primarily focused on identifying risks to core businesses activities, building resilient infrastructure or finding new technologies to reduce water consumption in water-stressed areas. While these are important strategies to cope with climate risks, weak or non-existent community engagement increases the risk of trade-offs between corporate and societal resilience. The failure of companies to find sustainable ways to share scarce water resources could put local livelihoods at risk and spur social conflicts. Integrating community risks and adaptation needs in formal risk management frameworks and business strategies, therefore, provides opportunities to bring mutual co-benefits and avoid maladaptive responses (UN Global Compact et al. 2015).

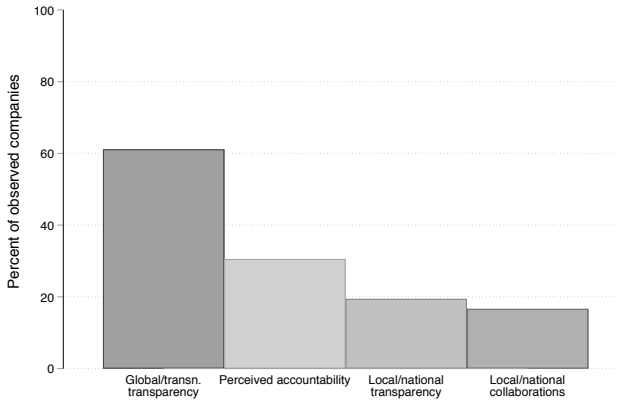

Figure 3: Percentage of companies adopting accountable and transparent responses.
Notes: N=37. Based on document analysis using company reports.
Source: Gustafsson et al. (2022).

TRANSPARENCY AND ACCOUNTABILITY OF PRIVATE CLIMATE RISK RESPONSES

Information asymmetries constitute a significant challenge for local communities to engage in dialogues with companies about how to address climate risks. Companies rarely disclose information on climate risks with local communities.

Figure 3 illustrates that 61% of the observed companies disclose climate-related risks towards investors and shareholders (e.g., through the Task Force on Climate-Related Financial Disclosures or the Carbon Disclosure Project). However, only 19% of the companies shared this information with local communities. Relatedly, 31% mention being

responsible for protecting local communities from exposure to climate risks, and 17% reported initiatives to engage with local and national stakeholders in adaptation planning.

Meaningful dialogues about the interconnected risks associated with the effects of climate change and mining expansion often require technical expertise that local communities may not possess. Hence, knowledge gaps are an important barrier to the development of community-oriented approaches.

3.4 STRENGTHENING COMMUNITY-ORIENTED APPROACHES

Although current risk assessment frameworks are largely lacking community perspectives, more cohesive frameworks have started to emerge among business associations, and a few companies have assumed leadership in this area. According to the ICMM, member companies are required to integrate community risks into formal risk assessments and engage in dialogue and collaboration with host communities around shared climate change risks.[11] Gold Fields includes community vulnerability in its climate risk assessments (Gold Fields 2019), and identifies information sharing on climate risks as an important component of establishing dialogues with local communities.[12] Freeport-McMoRan also includes community adaptation in its risk assessments (CDP 2018), and Grupo México has explicit goals of increasing community resilience in its climate change strategy (Grupo México 2019). These examples indicate an emerging trend within the mining industry to integrate community risks into climate risk frameworks. However, as these frameworks are still voluntary, ultimately leaving each individual company free to choose whether to consider community risks, public policies are needed to complement voluntary actions. It is also important to strengthen the capacity of local communities to assess risks associated with resource extraction and climate change.

OPPORTUNITY TO BUILD ON PARTICIPATORY WATER GOVERNANCE

Several interviewees highlight communities' concerns around water as a key issue, although they also see challenges of involving communities in dialogues about climate-induced water risks.[13] As elaborated by one interviewee, water management is often expressed in technical language to which climate change adds a layer of complexity, inhibiting communication with community members. However, water can also provide a possible avenue to enhance dialogue about climate impacts. In several ways, water resources are under dual pressures of mining activities and climate change (Odell et al. 2018). Climate risks could fruitfully be integrated in existing dialogues about mining-related impacts on water with surrounding communities (e.g., through participatory environmental monitoring programmes), which would also open up for a more general discussion about climate-related risks.

Responding to these challenges, there is an emerging trend within large multinational mining companies, of assessing the whole water catchment – commonly referred to as watershed – as opposed to restricting water management to the project level, which makes it difficult to assess the cumulative effects of different projects and economic activities (Hamilton 2019). Catchment water stewardship recognises water as a

shared resource and basic human right, and that sustainable water management must consider the risks of water users in the whole water catchment (ICMM 2022). When developed in collaboration with affected water users, catchment water stewardship creates opportunities to establish integrated land use planning that could help to reduce the risks for maladaptation (UN Global Compact et al. 2015).

Several of the observed mining companies report taking a catchment-based approach to water management. Gold Fields' Water Stewardship Policy mandates collaboration with all stakeholders in catchment areas, making catchment area management an integral part of its approach to water (Gold Fields 2020). Similarly, Rio Tinto have adopted a catchment-based approach in all its operations (Rio Tinto 2021). Indeed, its approach to water at Oyu Tolgoi in Mongolia (IFC and ICMM 2019a) and at its former La Granja mine in Peru (ICMM 2016b; Rio Tinto 2014) are often promoted as international best practice. Water management at La Granja was built on a participatory approach, designed to increase knowledge on climate change and reduce community vulnerability with respect to water scarcity. While company-led participatory water approaches are important, there are also examples of more autonomous forms of participatory environmental monitoring where local communities are given a greater role in assessing their adjacent environments. This could potentially be important in increasing the transparency and accountability of private climate risk responses.

PARTICIPATORY ENVIRONMENTAL MONITORING COMMITTEES

Participatory environmental monitoring (PEM) refers to initiatives where local communities are involved in collecting and assessing information about their adjacent environment.[14] Although typically described under the same label, the level of engagement and participation tend to vary between initiatives. Synthesizing insights from nine different PEM case studies across Latin America, Pareja et al. (2019) identified four types of participation scenarios: (1) externally driven, where design and monitoring is executed by an external party; (2) externally driven, but locally supervised; (3) collaborative design and monitoring between the external party and community; and (4) an autonomous process where the community themselves carry out the monitoring activity. Some of the industry-driven participatory water initiatives discussed above fall within the two first categories.

Externally driven projects have been criticized for limiting empowerment and the potential of PEM, and for reducing local community involvement to data collection (Turreira-García et al. 2018). By contrast, collaborative and autonomous processes may serve as a valuable tool to build trust among stakeholders, facilitate transparency and corporate accountability, and ultimately mitigate environmental degradation associated with mining (Turreira-García et al. 2018; Pareja et al. 2019).[15] Regardless of level of participation, it is crucial that participatory environmental monitoring committees (PEMCs) remain independent of corporate influence, and that there are robust communication channels between the committee, the company of interest and relevant governmental authorities so that observed impacts can inform mitigation measures (Pareja et al. 2019).

ENHANCING THE TRANSPARENCY AND ACCOUNTABILITY OF PRIVATE CLIMATE RISK RESPONSES

PEMCs could play an important role in addressing some of the shortcomings that currently characterize mining companies' responses to climate risks, specifically the lack of transparency and participation of local communities. For instance, PEMCs could increase the awareness of climate vulnerability and its relationship to mining activities, and generate alternative knowledge that reflects local communities' needs and interests in relation to climate risks. This, in turn, could enable local communities to engage in dialogues with companies and pressure them to disclose how they assess and deal with climate-related risks.[16]

Such knowledge can also enable local communities to participate in a more meaningful way in state-led formal participatory spaces, such as prior consultations, environmental impact assessments and climate adaptation planning. In cases where harm has occurred and can be traced back to companies' failure to develop appropriate responses to climate risks, such knowledge can also be used to demand remedy. Since climate risks are context dependent, it is particularly important to strengthen PEMCs in areas highly vulnerable to climate risks. In these areas, PEMCs can strengthen community-oriented approaches by actively participating in processes of assessing and addressing climate risks.

Although incorporating climate risk assessments into PEM holds great potential, climate-related impacts are complex challenges that transcend spatial and temporal boundaries. Whereas environmental monitoring is by necessity context dependent, measuring local manifestations of climate change is demanding and requires knowledge and often technical equipment that may not be available in remote and rural areas. Moreover, the localized nature of PEM implies that monitored parameters need to respond to the priorities and concerns held by community members, which differ between countries and across mining jurisdictions. Overcoming this challenge will require resources, capacity and training to expand and deepen community knowledge of climate change and the technical knowledge required to measure its impacts.

Establishing training programmes and technical assistance for PEMCs has been identified as a key component in ensuring their long-term success (Xavier et al. 2017). This will likely be especially relevant when considering climate-related impacts. For this purpose, the international and scientific community can play an important role in providing training and opportunities for networking and knowledge exchange (Pareja et al. 2019; Xavier et al. 2017).

[5] Interview with World Bank representative, 14 May 2020.
[6] Interview with Corporate representative, Newmont, Ghana, 21 April 2020. See also: Teck Resources (2019) and South32 (2019b:43).
[7] Interview with Environmental Consultant, South Africa, 5 May 2020; interview with World Bank representative, 14 May 2020.
[8] Interview with Corporate Representative, Newmont, USA, 23 April 2020.
[9] Interview with Environmental Consultants, South Africa, 30 June 2020.
[10] Interview with Corporate Representative, Antamina, 22 April 2020.
[11] Interview with ICMM representative, 24 April 2020. See also: ICMM (2019a).
[12] Interview with Corporate Representative at Goldfields, 18 June 2020.
[13] Interview with Corporate representative at Newmont, 23 April 2020; interview with World Bank representative, 14 May 2020.
[14] Abbot and Gujit (1998), referenced in Turreira-García et al. (2018).
[15] Bianchini, F. (2021) Personal communication, June 30 2021
[16] Xavier, A. (2021). Personal communication, July 07 2021.

4. INTEGRATING CLIMATE RISKS IN PUBLIC MINING GOVERNANCE

Improving public regulatory frameworks and building capacity among national and subnational institutions is widely recognized as critical to achieving sustainability in the context of mining (Gustafsson and Scurrah 2019). With examples from Canada, Mongolia, Peru and South Africa, this section outlines entry points to integrate climate risks into key mining regulation instruments: environmental impact assessments, closure plans, tailings standards and water use licences.

4.1 ENVIRONMENTAL IMPACT ASSESSMENTS

Environmental impact assessments (EIAs) are the most common, and in many countries the only, governance instrument for environmental protection (Robinson 1991). Although EIA practice differs slightly between institutional contexts, it is based on the principle of providing foresight, specifically of the potential positive and negative impacts a proposed project will have on the surrounding environment, rather than the impacts of the environment on the proposed project.

However, in the context of climatic change this focus appears insufficient. Climate change may have significant impact on present and future infrastructure projects as well as on the surrounding environment. High intensity rainfalls and thawing permafrost may impact drainage systems and exceed storage capacity. As both the frequency and intensity of such events is likely to increase due to climate change, a failure to address these changes at the design stages may have adverse environmental and social impacts. Furthermore, mining developments may aggravate climate risks, such as in forested areas where mining poses direct and indirect risks to climate mitigation and adaptation. There is thus an opportunity to improve the EIA framework so that it can address both the impacts on and by climate change due to mining and infrastructural developments.

This could be done by ensuring that climate impact assessments are carried out as part of the EIA process, which is rarely the case globally. There have been successful attempts to broaden the scope of EIA by integrating other types of assessments, typically focused on the social impacts of mining. For instance, in several countries, such as Mongolia and Kenya, there have been attempts to carry out human rights impact assessments in conjunction with EIA processes (Byambajav et al. 2018). It is important to learn from such experiences of adapting and broadening the scope of EIAs to incorporate a wider range of environmental and social risks.

An important limitation with existing EIAs is that they are carried out at the project level and tend to focus on the immediate impact of a single project on its surrounding environment. The project-specific nature of EIAs makes it difficult to assess cumulative impacts and interactions of risks from different activities that affect the same territory. Strategic environmental impact assessments (SEIAs), on the other hand, are adopted at earlier stages of decision-making and tend to include a cumulative impact assessment (UNEP 2018). An interesting example comes from the government of El Salvador, which commissioned a SEIA to scientifically investigate the effects of mining expansion in a context of increased climate-related disasters and water scarcity. The assessment identified important risks associated with continued mining expansion, leading to the adoption of a law that banned metal mining in the country (Odell et al. 2018). Hence, to get a more comprehensive picture of the impacts of mining in the context of climate change, it is important to strengthen SEIAs and related land use planning processes.

"Climate change may have significant impact on present and future infrastructure projects as well as on the surrounding environment."

In most countries, climate risks are seldom systematically integrated into EIA procedures through binding legislative requirements. This includes countries that depend heavily on mining. For example, the Canadian Impact Assessment Act of 2019 requires consideration of how a proposed project will impact the country's commitments on climate change.[17] The related guidance document, prepared by the Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment, includes information on how to integrate climate risks considerations into a major project (Gustafsson et al. 2022). However, the emphasis in the law is on mitigation. In Peru, the Ministry of Environment has developed voluntary guidelines on the integration of climate risks into EIAs. Although the guidelines require EIAs to include a climate change study, there is no requirement to provide information on how

climate risks are managed. Similarly, South Africa does not have climate legislation or policies that requires consideration of climate risks in environmental impact assessments for either public or privately funded projects.

Overall, the aspiration to integrate climate risks into the EIA process has yet to be translated into formal policy and binding legislative requirements. In some cases, there are voluntary guidelines on how to factor climate impacts into the assessment, design and development phases of mining operations (cf. ICMM 2019b; MAC 2021). Given current criticisms of the weak performance of voluntary approaches (Dauvergne and Lister 2012), however, it is important to further improve these approaches, for instance by strengthening strategic impacts assessments and land use planning processes.

4.2 MINE CLOSURE PLANS

Mine closure is associated with a broad array of sustainability challenges which may become more severe due to more frequent and severe climate change impacts. Weak environmental legislation has resulted in a legacy of abandoned and orphaned mines whose environmental and social impacts come at a great cost to governments (UNDP 2018). Against this background, in recent years there has been an increase in regulatory requirements regarding mine closure and land reclamation. However, there is great national variation of legislative requirements, and in many countries, legislation is still limited or completely absent (ICMM 2019c).

Most reclamation and closure plans are designed on the assumption of stable biophysical conditions, an assumption which is challenged by climate change. Changing climatic conditions may impact mine closure in several ways. Shifting rainfall patterns may lead to mine sites becoming wetter or drier, which can damage critical infrastructure such as dams and water management systems (APEC 2018). Rising temperatures may impact crop suitability for reclaimed land, and a warmer climate will have significant impact on permafrost cover.

Mining-dependent countries such as Peru and South Africa have not ratified legislation requiring companies to consider climate risks in mine closure plans, despite interviewees consistently highlighting mine closure as key sustainability issue.[18] Again, industry-led initiatives are much more progressive. For example, ICMM's good practice guide for mine closure outlines 12 tools for sustainable mine closure and post-closure activities, one of which concerns considering climate risks in closure design (ICMM 2019c).

The Mining Association of Canada has integrated closure objectives as part of its sustainability framework, in which companies commit to work with communities when developing mine closure plans, and to consider social aspects in relation to post-closure development (MAC 2008). However, only five of the 37 companies analysed report that climate risks are taken into consideration in closure plans. Hence, although guidelines are currently being developed for the integration of climate risks into closure planning, these voluntary frameworks still need to be translated into public policy and binding legislation.

4.3 TAILINGS STANDARDS

Tailings are waste materials produced during mineral and metals extraction. In the mineral processing stage, metals and minerals are typically separated from the waste rock by mechanical or chemical means, for example by using cyanide, which is prohibited in most countries in the Global North. The material left over from the mining process is stored in tailings storage facilities. This material is often highly acid and may contains various levels of toxic materials, such as arsenic and mercury. It is thus paramount to prevent breaches or leakages from such facilities to limit the risk of catastrophic failures and related impacts on human health and environmental sustainability.

The risks of climate change on tailings storage facilities and tailings dams in many ways mirror those regarding sustainable mine closure. Changes in intensity and frequency of rainfall and storm events may impact the integrity of tailings storage facilities, and a failure to consider these risks during the entire lifecycle of the facility may have detrimental environmental or human health impacts. Despite this, our findings suggest that, in several countries, legal instruments requiring companies to consider climate change impacts in tailings management are often missing.

Although Peru and South Africa do not have any regulatory requirements regarding climate considerations for tailings dams construction and design, Canada has voluntary industry standards, such as the Canadian Dam Safety Guidelines (Gustafsson et al. 2022; Rodgers et al. 2014). Although these guidelines provide no specific details on how climate risks should be addressed, they require the owner of a mining project to consider all relevant factors, including climate risks, that may impact dam safety. Hence, as with other governance instruments, voluntary standards seem to exceed domestic legislation.

An important initiative in this regard is the Global Industry Standards on Tailings Management (GISTM). Launched in 2020, the initiative was triggered by the catastrophic failure of Vale's tailings storage dam in Brumadinho, Brazil, in 2019, which cost the lives of over 250 people and caused significant destruction of the surrounding environment and communities. Principle three of the GISTM encourages companies to "evaluate, regularly update and use climate

change knowledge throughout the tailings facility lifecycle in accordance with the principles of Adaptive Management" to enhance resilience to climate change (GTR 2020).

Since its launch, all ICMM members are committed to implement the GISTM and are expected to be in conformance within five years of implementation (ICMM 2020c). Non-ICMM members, such as The Mosaic Company and Polymetal, have committed to comply with the standard (Mosaic 2020; Polymetal 2021), and the Mining Association of Canada's Towards Sustainable Mining standard aligns with the GISTM (MAC 2020). Given that climate change poses significant threats to the integrity of tailings dams, this is an important step towards the integration of climate risks in tailings standards.

4.4 WATER USE LICENCES

Whereas there are few legal requirements to integrate climate change into mining legislation and policy, climate-related water risks appear to be further ahead on the agenda. Companies are becoming increasingly aware of how climate change may exacerbate water scarcity, which in some countries has led to restrictions in granting water use licences to mining companies. In the case of El Salvador, there has even been a legal ban on further mining expansion due to severe water scarcity. In Mongolia, water usage is highly scrutinized and mining companies must pay high fees for the water they use.[19] This creates incentives for companies to engage in more efficient water management by recycling and conserving water, and thus potentially mitigating impacts on water stress.

However, state agencies can lack the capacity to assess the possibilities and limitations of developing mining in situations of hydrological stress. A key barrier is insufficient or missing climate data at the national level. For example, the National Water Authority in Peru, which is responsible for granting water use licences, does not have disaggregated data on future climate change impacts, or how climate may affect water availability in different parts of the country. There is thus no reliable way of granting water use licences based on current or predicted water availability, which increases the risk of overallocation of water in already stressed regions. With a lack of publicly available climate data, companies who operate in Peru report using existing climate models to develop their own datasets on rainfall patterns, evaporation and filtration, among others.[20]

Similarly, in South Africa there are no explicit requirements to consider climate change impacts when granting water use licences. Water scarcity is, however, widely recognized as a current and future threat in climate legislation and policy documents, and in accordance with the National Water Act of 1998, the responsible authorities are required to consider water availability when granting water

use licences in water-stressed areas.[21] Moreover, South Africa's 2018 National Water and Sanitation Masterplan outlines ambitions to consider climate impacts on water security in the country (DWS 2019).

However, compliance is an important problem in South Africa. As one interviewee from a mining company operating in South Africa states, water use licences are generally granted on an ad hoc basis. Despite formal requirements, the responsible authority does not take water availability into consideration when granting water use licences.[22] Another interviewee from South Africa speaks of "systemic non-enforcement and non-compliance,"[23] and that, despite robust legislative frameworks and ambitious climate policy, previous environmental violations are repeated. This further supports the importance of strengthening institutional capacity to uphold and enforce environmental legislation aimed at ensuring sustainability in mining regions. Civil society plays an important role here in monitoring and in holding the government and companies accountable when granting water licences.

[17] *Section 22 (i) of the Impact Assessment Act, 2019 states that the impact assessment must consider "the extent to which the effects of the designed project hinder or contribute to the Government of Canada's ability to meet its environmental obligation and its commitments in respect of climate change".*
[18] *E.g., Interview with Corporate Representative, Anglo American, 3 July 2020; interview with consultancy agency, South Africa, 30 June 2020.*
[19] *Interview with Corporate Representative, Oyu Tolgoi Mine, Rio Tinto, 27 April 2020.*
[20] *Interview with Corporate Representative, Barrick Gold, Peru, 22 April 2020.*
[21] *National Water Act, 1998, Section 43. Compulsory License Application.*
[22] *Interview with Corporate Representative, Anglo Coal South Africa, 03 July 2020.*
[23] *Interview with NGO Representative, South Africa, 11 May 2020.*

5. CONCLUSION

This report has explored the current climate adaptation strategies of the largest global mining companies and elaborated on the integration of climate in key mining regulation instruments in four countries. This report argues that climate risks are mainly addressed by voluntary frameworks and need to be integrated in sectoral policies and regulatory frameworks, such as environmental impact assessments, closure plans and water licences. Whereas companies, largely motivated by private standards and voluntary guidelines, have started to address the risks that a changing climate poses for their operations, the impacts on local communities are largely overlooked in existing private initiatives.

There are three specific implications for mining companies, domestic governments and international organizations. First, our findings suggest that mining companies need to significantly improve their assessment and responses to climate risks in the coming years. In particular, companies need to consider broader societal impacts of their adaptation (in)actions, and develop mutually beneficial adaptation strategies with local stakeholders, for example by building on existing participatory water management frameworks and to more systematically integrate community needs into formal risk management frameworks. Second, while the literature indicates that public regulations play a key role in enhancing companies' responses to climate-related risks, significant gaps remain in the existing regulatory frameworks. Domestic governments could play a key role in incentivizing and facilitating private sector adaptation by providing information on climate risks, establishing public-private partnerships and by adopting legislation which requires companies to assess and address climate risks in a way that helps to improve societal resilience. Finally, international organizations should reflect on how they can support the abilities of developing states to improve domestic climate adaptation regulation. For example, the UN Framework Convention on Climate Change could request information about the private sector's impact on climate vulnerability, and the UN Development Programme could strengthen the capacity of domestic governments to engage the private sector in adaptation efforts and support civil society actors in their efforts to scrutinize private sector initiatives. To conclude, it is high time for the private sector to broaden its perspective on climate risks and start to consider the broader societal impacts of its adaptation actions.

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