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Green transition mineral supply risks:

Comparing artisanal and deep-sea cobalt mining in a time of climate crisis

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Abstract

In the context of a climate crisis and accelerating green transition, companies are scrambling to secure supply over the coming decades, including through artisanal mining (ASM) and deep sea mining (DSM). These modes of extraction create distinct yet related risks, with for example some of the social risks of ASM justifying the environmental risks of DSM. Upstream companies follow different risk management strategies in relations to ASM and DSM. Risk shifting transfers risk-related responsibility via contracts with other entities within the mining sector. Risk fixing creates the bureaucratic and technocratic tools to prevent or resolve risk-related liabilities. Risk outsourcing occurs when non-industry members are asked to autonomously follow ‘clean minerals’ practices. In addition, downstream companies follow risk emotionalizing strategies through which they aim to shape customers’ perceptions and emotions towards their products and the associated risks. Finally, corporate sourcing needs for minerals tend to result in risk perpetuating, despite or even because of the risk management strategies identified here.

Keywords: green transition, cobalt, deep sea mining, artisanal mining, risk perpetuating, risk emotionalizing, risk outsourcing, risk fixing, risk shifting

Introduction

Framed by mainstream ‘climate crisis’ discourses urging technological solutions, the dominant approach to the green transition away from fossil fuels is generally seen as necessitating immense amounts of raw materials (Wellmer et al. 2019; Carrara et al. 2020; Valero et al. 2018; Jones, Elliott, and Nguyen-Tien 2020). Such ‘climate extractivism’ – the justification of resource extraction for climate mitigation (Le Billon 2021) – can be identified in China’s 14th Five-Year Plan, the European Green Deal, the US Inflation Reduction Act, Japan’s Green Growth Strategy, and the Korean New Deal; all of which promote widespread and resource-intensive electrification of economies, including through electric vehicles (EVs) and battery energy storage systems (BESS). These technologies are tied to an increased supply of *critical* minerals including cobalt, nickel, manganese, and lithium (Agusdinata, Eakin and Liu 2022; Ballinger et al. 2019). In this article, we propose a comparative risks perspective in the sourcing of cobalt in two highly debated sectors, artisanal and small-scale mining (ASM) and deep sea mining (DSM). Despite many battery manufacturing companies seeking to reduce or eliminate cobalt use, most lithium-ion (Li-ion) batteries continue the use of nickel, manganese, and cobalt (NMC) cathodes, thereby ensuring continued demand for cobalt ore (Alves Dias et al. 2018). We identify strategies of transfer for companies involved in the cobalt supply chain to dissociate themselves from the risks that their industry is posing at extractive sites through ASM and DSM (see Table 1).

Cobalt mining, with its heavy concentration in the Democratic Republic of the Congo (DRC), where nearly 70 percent of the world’s current supply originates (Brown et al. 2021), has been at the center of critical sourcing risks, including child labor (Sovacool 2021; Amnesty International and Afrewatch 2016), poor working conditions (Mancini et al 2021), corruption (Resource Matters 2019), and environmental pollution (Cheyys et al. 2014; Nemery and Nkulu 2018; Smolders et al. 2019). ASM represents 15 to 30 percent of the DRC’s cobalt output (Baumann-Pauly 2020, 3) and faces serious allegations of human rights abuses. Companies’ attempt to reduce reputational risks have led to an increase in corporate social responsibility programming in the country¹ (Deberdt and Le Billon 2022) and, in some cases, decision was made to relocate cobalt supplies in lower-risk jurisdictions, including Australia and Morocco (Home 2020; Reuters 2019).

Increasing scrutiny of corporate raw materials sourcing practices in the past two decades favored the development of a profligate risk assessment and management community formed by non-profits, consulting companies, international organizations, industry associations, and companies all along the supply chains (Airike, Rotter and Mark-Herbert 2016; Deberdt 2021b).² The 2016 publication by Amnesty International and Afrewatch, tying corporate giants to child labor in

¹ While the in-country programs are being developed the spill over to global markets already happened. Bernards (2021) illustrates how when looking at cobalt, as a speculative asset inscribed in a heavy financialization process, we should still link the value from the underlying material form. Child labor in this example constitutes a prime example of the failure to divorce the two.

² For a discussion of similar concerns linked to conflict minerals, see Vogel and Raeymaekers (2016).

artisanal mines, placed cobalt at the core of responsible minerals sourcing risk mitigation. Throughout the years, additional risks, such as endemic corruption and poor working conditions were added to the list, prompting companies to develop corporate social responsibility (CSR) programs in the African Copperbelt.³ Google, Samsung Electronics, or BMW are only a few of the brand companies that scaled up their engagement to ensure the mitigation of reputational risks in partnership with their suppliers including BASF, Samsung SDI, or Huayou Cobalt (Krummel and Siegfried 2021; Chen 2021). In parallel, industrial miners outsource responsibility to artisanal operators through recruitment strategies, further blurring lines between mining operations and undermining possibilities of accountability (Calvão, McDonald and Bolay 2021).

Surfing on the risk mitigation narrative, including through supply relocation, DSM operators have positioned their nascent industry as a solution to sourcing risks associated with the DRC, and land-based mining more generally. The promise of unprecedented minerals wealth and the remote location of seabed mineral resources could drastically reduce the risks associated with ‘dry land’ mining operations.⁴ Branded as free of social and community risks (Interview with researcher, October 10, 2022) and as the most sustainable form of extractive endeavor (Paulikas et al. 2020b), DSM presents, at first, significant social risk management benefits. Yet, a closer look at the industry shows a shift to ecological and political risks.

DSM operations are associated with ecological risks on the seafloor (Washburn et al. 2019; Sharma 2015) and in midwaters’ ecosystems (Drazen et al. 2020), and governance limitations (Le Meur et al. 2018; Kung et al. 2021). While risks differ from ASM, we argue that DSM introduces new sourcing risks inherent to the offshore oceanic nature of the extraction. As the International Seabed Authority (ISA), with support from DSM operators, is instituting a framework to render the industry “profitable and knowable” (Childs 2020a, 207), this knowledge echoes existing aspirations (inspired by existing terrestrial mining) and remains concentrated in highly specialized circles (often ignored by downstream customers). This is supported by both interviews we conducted in the field, as well as the analysis of downstream activities surrounding DSM (Interview with researcher, March 7, 2022; Childs 2020b; Kung et al. 2021)

The unknowns of the prospective DSM industry positions it as a core risk sector in minerals supply chains. Recent research highlighted the potential benefits of DSM in addressing the climate crisis, in particular by decreasing the carbon footprint of extractives (Paulikas et al. 2022) and increasing the availability of much-needed raw materials. However, the potential to spur new risk types, including ecosystem destruction, sedimented carbon releases, expansion into methane hydrate extraction, and weak governance, has also been highlighted (Amon 2022; Childs 2022; Levin 2020; Thomas 2021). In a recent study, Paulikas et al. (2022) recognize the

³ The DRC Government has even established a public company with a monopoly in the buying and selling of ASM materials. While the *Entreprise Générale du Cobalt* (EGC) is not yet fully functional, this shows the high interest in ‘clean’ cobalt (Deberdt 2021b).

⁴ The Clarion Clipperton Zone (CCZ) located in the middle of the Pacific Ocean, for example, holds an estimated 44 million tonnes of cobalt, five times the identified terrestrial reserves (Petersen et al. 2016, 176).

lack of data on deep ocean’s ecosystems but still maintain that DSM’s significant impacts on ocean organisms are unlikely, and that their severity in case of occurrence would remain moderate. Despite limited public knowledge of the deep sea and environmental studies pointing at the *relative* insignificance of DSM impacts with regard to both the vast size of the global ocean and the terrestrial mining, many researchers consider DSM as a risky activity and express concerns about harming the deep sea (Kaikkonen and van Putten 2021).

Inspired by Ulrich Beck’s (2006, 329) ‘world risk society’ in which the “narrative of risk is a narrative of irony”, this article also echoes the notion of modernity through the highly technological extraction paradigm of the DSM. As Beck (ibid.) proposes, “the narrative [of risks] deals with the involuntary satire, the optimistic futility, with which the highly developed institutions of modern society [...] attempt to anticipate what cannot be anticipate.” In this context, we argue that when addressing responsible sourcing risks at the supply chain level, cobalt using and producing companies engage in five transfer strategies. While Calvão, Mcdonald and Bolay (2021) focus on the outsourcing of responsibility, from industrial miners to artisanal operators, we propose to address the supply chain as a whole. Hence, as brand companies compete for secured access to critical minerals, including cobalt, they too engage in a transfer of risk mitigation responsibility through a series of mechanisms. The push for more supply of raw materials is leading to new geographies of extraction marked by riskier (or less known) extractive processes – the Congolese ASM cobalt sector with occupational health and safety (OHS)⁵, child labor, and potential for corruption through elite capture, and DSM with ecological and political concerns. Throughout this paper, we use the five concepts of risk shifting, fixing, outsourcing, emotionalizing, and perpetuating to explain the strategies deployed by downstream purchasers of raw materials, and their upstream suppliers, to transfer their responsible sourcing responsibility in the strategic case industry.

Table 1 - Main risks associated with ASM and DSM cobalt mining

Artisanal and small-scale mining (ASM)	Deep sea mining (DSM)
<ul style="list-style-type: none"> ● Child labor ● Corruption ● Environmental pollution ● Human rights abuses ● Food and water contamination ● Labor exploitation ● Occupational health and safety (OHS) ● Land dispossession 	<ul style="list-style-type: none"> ● Compaction of seafloor ● Deep sea ecosystem destruction and species extinction ● Environmental disturbances including light, noise, and vibrations ● Potential release of ‘blue carbon’ and sequestered greenhouse gases ● Sediment plumes affecting aquatic life

⁵ For more information on the current inadequation between legal artisanal areas requirements and the mitigation of OHS risks, see Nkumba-Umpula, Buxton and Schwartz 2021.

Sources: Amon et al. (2022), Leal Filho et al. (2021), Sovacool (2019).

This study builds on a comparative approach between ASM and DSM, looking at the management of risks in both modes of extraction. Our analysis is informed by 37 interviews conducted between January 2021 and June 2022 with downstream companies, deep sea mining companies, governments, international organizations, international non-profits, local civil society organizations, and academic/independent researchers with expertise in the ASM and/or DSM sectors, as well as an in-depth assessment of the existing literature. Interviews with industry members were conducted with representatives of the companies, often at the CSR department while governmental interviews focused on representatives at the ISA or other high-level positions in international organizations. The interviews covered a wide range of issues, from responsible ASM sourcing to governmental involvement in DSM and a series of other topics. The study also draws on our long-term engagement with mineral responsible sourcing efforts in land-based extractivism and the wish to address future limitations that will arise with the establishment of the DSM framework by the ISA. We reconcile upstream extractive concerns with downstream efforts to source minerals responsibly and, while critical, this article acknowledges the continuous need for raw materials in the dominant green transition paradigm. We borrow from scholars engaging in studies on extractivism to understand the behaviors of downstream corporate actors in sourcing the raw materials key to the green transition. In this process, we recognize the embeddedness of risk categorization within social relations of power, from the (often) Western customer to the downstream company and all the way to its upstream supplier.

Following the introduction, the first section of this article highlights the conceptualization of risks in the responsible supply of cobalt. In Section 2, using the previously laid out risk management concepts, we examine the risk profile of the ASM sector through downstream companies' behaviors and their upstream responses. Finally, Section 3 explores the perpetuating and emotionalizing⁶ processes associated with deep sea mining, from a downstream perspective. Throughout this development, we propose a comparison of supply risks redistribution approaches by downstream companies to ASM operators and potentially DSM suppliers. Overall, we hope this research highlights some of the inherent inconsistencies of downstream

⁶ The concept of emotional risks in the case of cobalt sourcing is linked to the corporate responses to these risks, developed as a result of an emotional reaction from the public. This leads to targeted interventions that ignore root causes but focus on the effect of these emotional risks. An example of such emotionality of risks in the cobalt artisanal sector is child labor and to a lesser extent poor working conditions. The title of Dr. Siddarth Kara's book on the topic, *Cobalt Red: How the Blood of the Congo Powers Our Lives* (2022), exemplifies this trend.

companies' companies' engagement with responsible minerals sourcing and opens new avenues for research for more holistic approaches to responsible supply chains.

Conceptualizing supply risks within mineral supply chains

Since the mid-1990s, the development of sustainable supply chain management (SSCM) tools reflects on the risks that the extraction, transportation, and transformation of minerals entail (see Sauer and Seuring 2017). We introduce key concepts and literatures surrounding supply risks in the minerals sector. In particular, Table 2 defines five risks transfer strategies and provides examples for each conceptualization. As ESG risk management increasingly defines the commercial success of a client facing companies,⁷ conceptualizing risk management approaches can help better understand the strategies at play, and perhaps help identify some of their root causes and expose some of their ‘hidden costs’ (LeBaron and Lister 2021; Le Billon and Spiegel 2022).

Table 2 - Key concepts around corporate risk management strategies in mineral supply chains

Risk Concept	Definition	ASM examples	DSM examples	Concept's Source
Risk shifting	Risk is managed through the shifting of responsibility via outsourcing contracts for goods and services.	In the DRC's mining industry, the reliance on subcontracting from large scale mining companies constitutes a risk shifting strategy. Research showed that up to 68 percent of the workforce at selected industrial mines were subcontractors, hence limiting the mining company's exposure to risks and decreasing costs (RAID 2021).	In the DSM industry, the use of DSM operators and the definition of regulations based on their knowledge shifts the responsibility from downstream users to DSM operators.	McDermott and Hayes 2018

⁷ For an example on how ESG is becoming the new norm, see Robert Friedland, CEO of Ivanhoe Mines, describing how “companies that get [ESG] right will inherit the industry. Companies that don't, will die” (Bloomberg 2022).

Risk fixing	Risk is managed through the implementation of bureaucratic and technological processes and tools that define the boundaries of responsibilities as well as the criteria and means of compliance. These technical fixes suggest that any environmental, social, and governance risk can and should be tackled by technological solutions.	In the DRC, the use of quantitative measurements to devise technical solutions to address risks and promote responsible sourcing constitutes a risk fixing strategy. Audits, standards, and frameworks provide corrective action plans that are based on technical solutions.	In the DSM industry, the ISA and its bureaucratic apparatus serve to define the DSM code. Through the implementation of this technical document, DSM operators and their customers fix the risks.	Le Billon and Spiegel 2021
Risk outsourcing	Risk is managed through the outsourcing of supply to non-industry members asked to follow ‘clean minerals’ codes of conduct yet responsible for their own practices	The use of responsible sourcing programs to introduce ‘clean’ artisanal miners in global supply chains justifies the outsourcing of risks from the company originally in charge of extraction to individual, wage-less workers (artisanal miners).	In the DSM sector, the outsourcing of risks occurs at the state level when sponsoring states are held responsible for the ‘clean’ supply of private DSM operators.	Calvão et al. 2021.
Risk emotionalizing	Risk emotionalizing addresses the use of reputational risks for companies that are based on a deeply emotional reaction from their customers. These risks are often built on a narrative of intense inequalities and abuses that tarnish the final product and render the customer complicit in these abuses.	In the DRC’s cobalt industry, child labor has been the core risk that spurred the development of responsible sourcing programs. While important, it is however the emotionality of this risk that led to downstream companies’ actions in the DRC.	In the DSM industry the impact of the industry on ecosystems, and in particular fish and sea mammals is used as an emotionalization tool.	Deberdt 2022

Risk perpetuating	Risk perpetuating refers to rebound effects of the (supposed) mitigation of risks spurred by the activities of the same organization aiming to address them. As some of the worst risks are said to be addressed, the resulting increase in demand and push for supply aggravate risks.	In the DRC, issues linked to artisanal mining of cobalt are the result of a growing demand from downstream companies. To address these, companies established responsible sourcing programs, while at the same time increasing pressure on producers for more supply.	The nature of the DSM industry and its very existence is linked to the growing demand for minerals by downstream companies, including those having signed a moratorium on DSM.	Büscher 2015
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The emotionalization of risks refers to the use of reputational risks for companies that are based on a deeply emotional reaction from their customers. These risks are often built on a narrative of intense inequalities and abuses that tarnish the final product and render the customer complicit. The emotionality is shared by the ASM and the DSM industries, however in different forms, child labor in the artisanal sector, marine ecosystems in the deep seas. The emotionality is combined with a *risk perpetuation* process that reflects broader economic dynamics of neoliberal extractivism in a capitalist system.⁸ A paradox lies in the actions of downstream corporations that aim to address key risks while their needs for continuous growth through ever growing mineral supplies reproduce the same sourcing risks. Finally, the transfer of risks allows downstream companies to continue their sourcing practices while upstream actors are charged with shifting the risks to micro-entrepreneurs (artisanal miners) or other state and non-state actors (sponsoring states, DSM operators), fixing them with technocratic solutions (responsible sourcing standards and the ISA Mining Code), and outsourcing them by involving non-industry members (mining cooperatives and sponsoring states).

In the following parts, linking the geographies of DSM to the paradox of responsible sourcing investments in the Congolese’s ASM sector, we examine processes of risk mitigation through transfer from brand companies to extractive sites. Building on the well-established concepts of risk shifting, fixing, and outsourcing in the upstream level, we propose to analyze the behavior of downstream companies as they transfer risks management to other actors in their supply chains. We also address the lesser-investigated concepts of ‘risk perpetuation and ‘risk emotionalization’ to better understand the behavior of downstream corporate actors in sourcing battery minerals, in particular cobalt.

⁸ On the transformative and adaptive nature of neoliberalization, see Peck and Tickell (2002).

Cobalt artisanal and small-scale mining: Reconsidering risk emotionality and the irony of corporate social responsibility

Artisanal mining is defined as “formal or informal mining operations with predominantly simplified forms of exploration, extraction, processing and transportation, which is normally low capital intensive and uses high labor-intensive technology” (OECD 2016, 65). The ASM sector is also largely studied in light of its interaction with its industrial counterpart. Mobilizing the concept of justice (and its corollaries of fairness and responsibility), a rich literature explores the dynamics of formalization and legitimization of the sector. Childs (2012), for example, addresses the Fairtrade and Fairmined certification systems to reveal that the notion of fairness greatly evolves from its conceptualization to its practice. Similar conclusions were identified by Hilson (2009; 2012), in particular when exploring the notion of Corporate Social Responsibility (CSR) as developed to tackle risks linked to the artisanal sector. Beyond the notion of corporate-related risks, Hirons (2011) also investigates the impacts of ASM on forested areas, an approach embraced by Simpson and Geenen (2021) in the Congolese eastern provinces.

Of the global production, around 12 percent of cobalt ore is extracted manually by artisanal miners in the DRC (Panella and De Putter 2022, 13). In the DRC’s southern region, ASM supports hundreds of thousands of people (Prause 2020, 157). Al Barazi et al. (2017), citing Amnesty International 2016 numbers, estimates that between 110,000 to 150,000 people directly depend on cobalt ASM in the region. The sector is marked by significant risks that have spurred the development of responsible sourcing programs officially aimed at mitigating child labor, enhancing OHS, or limiting corruption. Focused primarily on overly visible risks impacting the reputation of client-facing companies, these programs have largely failed to address root causes, including endemic poverty, lack of wealth redistribution, and inability to access geologically and economically viable land for ASM.

In this section, we build on Deberdt’s (2022, 2) assessment that responsible sourcing programs focus on “emotional risks.” We also build on Büscher’s (2015) “investing in irony” framework to address downstream behavior in tackling risks in the artisanal sector. The latter provides a productive avenue through which these companies bridge the gaps between their needs as capitalistic entities and the contradictions their activities perpetuate. We brand this as *risk perpetuating*, itself supported by upstream risk outsourcing and shifting approaches that transpose risks away from the purchaser.⁹ In turn, the industry-wide fixing strategies bureaucratize and technocratize these core risks, making them quantifiable. Our theoretical

⁹ The concept of risk perpetuating thus relates to the rebound effect (or Jevons paradox), through which the environmental effect of new efficiencies in production methods or consumption are nullified through the volume increase resulting from cost reduction or changed behaviours (e.g. rebound effect of energy efficiency in mining, see Lin and Zhu 2022). We note that the concept of perpetuation does not take for granted assertions of effective initial risk mitigation, but rather their use in communication by extractive and brand companies.

approach highlights the direct linkages between downstream companies and upstream extractive sites. As such, we introduce a simplified version of supply chains' extensive length to replace the analysis on the role that brand companies hold in the definition of the conditions of extraction.

The emotionality of risks in the extractive sector echoes the devastating potential and the imaginaries of the scale and earthmoving nature of the industry in public opinion. The framework does not intend to undermine the significance of these negative impacts, but proposes to frame risks in terms of corporate response, driven by reputational concerns enmeshed in customers' reactions to risk reporting. We adopt a supply chain and customer-based approach, reflecting the role played by end customers' sentiments to drive brand companies' strategies. These "moral politics," as Rutherford (2020) describes them, and the focus on emotions, "infuse wider [...] proposals to amend social arrangements in regard to what is called 'artisanal mining'" (ibid, 1). These proposals result in responsible sourcing programs implemented by corporate actors aimed at amending social, economic, and political arrangements.

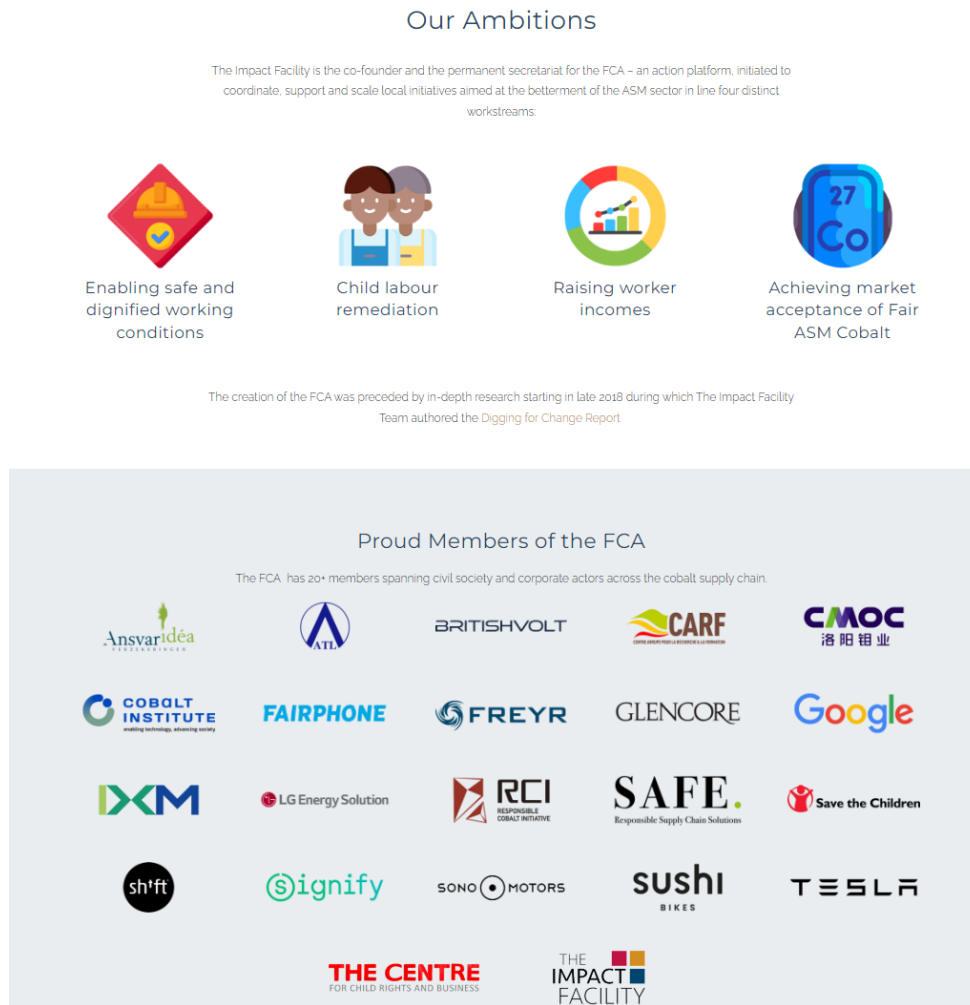
Moving from risk emotionalization to the risk perpetuation, we demonstrate that 'everyday-type ironies'¹⁰ are an important way in which tensions and contradictions of capitalist investments are expressed and rendered manageable (Büscher 2015). The ironies deployed by companies render visible the unpredictability of the accumulation process (2015, 727). The role of irony has already been described in the humanitarian sector by Chouliaraki (2011). Building on Silverston (2004)'s analysis of the "proper distance" to humanize the vulnerable other, she explores the vocabulary of space through which humanity is produced. As with our analysis of the ASM sector's engagement by corporate giants, the distance between the self and the other ensures that the suffering of the latter is disentangled from the final products. This distance is generated by the paradoxical responsible sourcing efforts that are combined with increased needs for minerals, hence leading to a risk perpetuation. This apparent opposition defines CSR programs geared towards artisanal cobalt miners. As a corporate representative for a mining company indicated, "how do we help ASM realize its potential [...] in very much a partnership approach", pointing to the willingness to source from artisanal mines to increase their feed. The combined forces of emotional responses to others' suffering with the imposition of a distance is "profitable: it 'offloads' investments' contradictions and thereby acknowledges tensions and gives them a place in the accumulation process" (Büscher 2015, 741), thereby contributing to risk perpetuation.

In Congo's artisanal cobalt sector, the requirement of *responsible extractivism* has become synonymous with sustainable development, at least in the narrative of corporate actors. Tying the investments in these projects to progress and improved communities is now a must for communication and public relations teams of service providers, international mining companies, and downstream brands (see Figure 1). Under pressure from their downstream clients, upstream companies outsource the risks to individual entrepreneurs (i.e. the artisanal miners) while in

¹⁰ In this article, we use the term irony(-ies) when reflecting on Büscher's framework. However, we argue that the term paradox(es) aligns better with our analysis.

parallel shifting responsibility through the signature of contracts between miners cooperatives and corporate actors. The increasing inclusion of non-waged workers, including artisanal miners, in global supply chains, is a way of not only redistributing supply and associated costs, but also risks. Companies like Chemaf (and indirectly Trafigura), through the Mutoshi Pilot Project and the involvement of local cooperative COMIAKOL (Johansson de Silva, Strauss and Morisho 2019), exemplify the outsourcing of extractive risks and the shifting of these risks through contractual documents.

Figure 1 – Membership in multi-stakeholder initiatives as communication strategy



Source: The Impact Facility (2022).

In these responsible sourcing projects, improvement in ASM sites' risk profile is described by masses of quantitative indicators informing audits aligned with international best practices and voluntary standards. These are embraced by the industry as a risk fixing strategy. On-the-ground monitoring initiatives, industry-wide standards, and the profusion of audit companies report on the progress made to date, compiling incidents in broader risks categories, and illustrating how

companies reach decisions (supposedly) informed by these measures. All this points to the establishment of an audit culture (Strathern 2003) that transforms livelihoods into measurable indicators based on Western conceptions of what it means to live well, and importantly allowing the industry to fix the risks. As a buyer of cobalt explained, “What I want to create is a standard [...] for responsibly sourced cobalt from ASM origins so that the market can accept that material without question on the basis of that standard being reached.” We coin these ‘*auditing fixes*’ by which the successful completion of a standardized assessment provides a technocratic resolution to an identified risk, often without supporting broad-based changes.

Emotional risks play a significant role in driving downstream corporate intervention. In particular, child labor has been the center of attention of responsible sourcing programs. The disconnect between the location of investment decisions and spaces where these investments express themselves defines emotional risks while ignoring deeply rooted causes. Importantly, Büscher’s analysis of a coal mining case in Mozambique complexifies the ‘distal investment’ as not only a physical distance issue, but also linking it to time and money (2015). Decisions to ‘invest in irony’, consequently leading to risk perpetuation, are made following the ability to control both resources and time, and in particular the turn-over time of investment capital.

We argue here that the social sustainability dimensions of investments in responsible ASM cobalt projects does not change their paradoxical nature as neoliberal accumulation processes. Securing a reputational standing through the avoidance of emotional risks both supports the company’s acceptance by customers and, indirectly, provides it with knowledge and access to clean supplies of critical minerals. In the complex environment of the DRC, downstream companies with knowledge (and personal connections) with extractive operators, and understanding of the structure of the cobalt sector, gathered through the establishment of responsible sourcing programs, benefit from significant advantages in securing supplies.

As cause and effect of capitalism’s accumulative destruction, companies establish programs to address ASM vulnerabilities that their own sourcing needs created, including dispossession (through displacement, commodification of land, etc.) (see also Perreault 2013). This is the ‘everyday’-type ironies that Büscher identifies, echoing Rajak’s (2011) analysis of CSR as a mechanism to strengthen and anchor corporate power (Himley 2013). Located at the center of this consolidation of capitalistic accumulation through responsible cobalt sourcing, child labor is the irony the corporate needed: powerful enough to generate emotions among customers, yet manageable enough through cost-effective responsible sourcing programs. The much higher costs of land accessibility, and broad-based wealth redistribution, and the focus on limited child labor programs, ensures that costs remain low.

Deep sea mining: Reconceptualizing risks in new geographies of extraction

Deep sea mining is increasingly placing itself as the new extractive frontier, moving beyond land to mine the riches of the ocean floor.¹¹ The industry has faced significant setbacks in the previous decades (Filer and Gabriel 2018) but the need for raw materials fueling the green transition, including cobalt, nickel, and manganese, has provided companies with a powerful narrative to pursue the extraction of minerals at depths from 200 to 6,500 meters (Teske et al. 2016). The International Energy Agency (IEA) estimated that the share of cobalt for use in clean energy technologies compared to the global demand would increase from 15 percent in 2020 to 69 percent in 2040 under a sustainable development scenario while nickel would jump from 8 to 61 percent (2021). In terms of tonnage, demand will rise by an estimated 30 percent between 2022 and 2025, equivalent to an additional 11,500 tons per year (S&P Global 2022). Russia's invasion of neighboring Ukraine and the reactions from many western countries have reinforced the need for securing supplies of raw materials (Ghilotti and Cook 2022).

To understand how downstream companies seek to address risks in relation to the extraction of battery minerals in the oceans' depths, we return to the concepts of perpetuation and emotionalization (downstream), in relation to the risk shifting, fixing, and outsourcing (upstream). Presenting DSM as a solution to the socio-environmental harms of land-based mining, and particularly ASM, faces significant limitations when accounting for the growth potential of the industry. While based on a concession model that accounts for a relatively small number and supposedly small size of operations at the bottom of the oceans, a look at the rapid acceleration of human activities in the oceans and a long-term perspective suggests a progressive commodification of the ocean floor, as well as the multiplication and expansion of extractive sites and both their proximate and distant impacts (Clark et al. 2020; Jouffray et al. 2020; Le Meur, et al. 2018; Simon-Lledó et al. 2019; Williams et al. 2022). DSM's cumulative impacts overtime would potentially involve significant environmental, social, and political disruptions.

The risk perpetuation is located within the industry itself, which promulgates a narrative of low environmental, social, and political impacts of the nascent industry. As a former governmental researcher argued, "As the resources are found away from land, the environmental impacts will be localized and not impact the land ecosystem. No infrastructure development such as roads, building, excavation, clearing of forest or rehabilitation of humans is required for deep-sea mining." (Interview with global non-profit representative, June 21, 2022) The tale is one of decreased GHG emissions and net environmental benefit compared to land-based mining. It does not account for the colonizing character of extractivist logics fueled by capitalist 'green growth', which, will seek to expand DSM throughout our oceans, multiplying its long-term impacts. The perpetuation of risks is also achieved through the establishment of the ISA Mining Code that reproduces land-based concepts of mining risks without a fundamental reconceptualization of

¹¹ Importantly, we do not argue that the development of deep sea mining will inherently lead to the replacement of artisanal mining by DSM. This inquiry should be the topic of an in-dept research that goes beyond the scope of this article.

this new industry. While the products are identical, the practices are different, requiring a new conceptualization of the scientific approach to its risk profile.

The risk emotionalization by the DSM industry's opponents also delineates the narratives around the new extractive frontier. A moratorium signed by some downstream actors (WWF 2021) is criticized by the DSM industry as being too reductive and raising issues already being addressed by the ISA Mining Code (Interview with DSM company representative, February 25, 2022; Interview with DSM company representative, April 12, 2022). The (at least) perceived moralization of the risks as Rutherford (2020, 2) suggests regarding gendered labor in ASM – the “imputations of the appropriate and the inappropriate, the good and the bad, [...] influence understandings and the configuration of [...] mining in policy circles as well as in mining zones.” In the case of oceanic mining and aligned with the growing public awareness around overfishing and other extractive practices in the ocean (Easman, Abernethy and Godley 2018), this emotional risk center around the destruction of ecosystems.

Deep sea mining is now in the final stages of a long drawn international regulatory approval process, with a mining code expected to soon be finalized¹² (Willaert 2021). The definition of this code answers in part to a technocratic and bureaucratic risk fixing strategy through which the DSM industry addresses (mainly) environmental issues through quantifiable and measurable tools. The definition of this code in a proactive (but we argue partly flawed) approach is a source of pride for the industry. As a DSM company representative argued “what makes me feel very good is that this is an industry that is heavily regulated and hasn't begun to operate. This just hasn't happened in human history.”

In parallel to these efforts to secure a mining framework, the DSM industry has invested millions of dollars into research and communication to strengthen perceptions of low social and environmental risks (The Metals Company, n.d.). The Metals Company (TMC), for example, invested USD 75 million in its Environmental and Social Impact Assessment (ESIA) program, and released a white paper assessing the differential impact between DSM and land-based mining (Paulikas et al. 2020).¹³ As respondents from international organization and research institutions explained, ESIAAs, as well as the draft mining code by the ISA, draw heavily from terrestrial mining risk assessments,¹⁴ which could lead to flawed assumptions (Interview with civil society representative, May 18, 2021; Interview with downstream company representative, March 7, 2022; Interview with international organization representative, March 30, 2022). As

¹² The code is defined by the ISA as “rules, regulations and procedures issued by ISA to regulate prospecting, exploration and exploitation of marine minerals in the international seabed Area” (n.d.) and aligns with the legal frameworks established by the United Nations Law of the Sea Convention (LOSC) of 1982.

¹³ TMC is so far the first company having released an ESIA document. Experiences in Germany with BGR and Belgium could provide important future learnings.

¹⁴ Here we do not argue that ESIAAs and the ISA code are completely divorced from realities of the deep ocean. However, the structures and core notions of these documents are based on a land-based approach that does not reproduces the oceanic fluidity, hence raising concerns.

discussed below, the industry needs to go beyond the ‘traditional’ assessment of impacts and better account for the nature of the deep sea environment, the unexplored geographies and ecosystems of deep pelagic zones, the conceptually different ecological systems of the depth, and the perceived absence of social impacts will likely not be accounted for if integrated in a land-based-inspired ESIA. As the DSM industry is likely to become a strategic supplier of battery metals, reputational risks will grow, clashing with the responsible sourcing paradigm. Building on Childs’ (2020; 2022) exploration of the new geographies of deep sea mining we propose a reconceptualization of the sourcing risks that could impact the responsible and secured supply of minerals in order to better account for DSM’s ‘future realities.’

Childs highlights the complex political, environmental, and social nature of DSM, at the intersection of global and national regimes. Arguing for the need to engage with both human and nonhuman actors when developing the framework for DSM extractivism, Childs introduces what Szerszynski (2017) defined as a “geo-spiritual formation”. This approach questions the feasibility of mining in the deep ocean, the need for the Anthropocene to reach the depths, and inscribes the industry within a broad process of capitalistic expansion. Child argues that by “scripting the seabed as a visible site of the blue economy” and by inscribing the industry in an “oceanic turn’ that [...] embraces the sea’s vibrant and dynamic ‘geopolitical, biopolitical, environmental and ontological dimensions” (2022, 9), new geographies shall be uncovered to effectively engage with the many dimensions of the seabed. This approach differs from most of the existing research on deep sea mining. Recognizing the specificity of the deep ocean, its uniqueness in terms of environmental structure, the collective imaginations around the seabed, and the intersection of geopolitical tensions at the bottom of our oceans, Child tells us that we need to “allow conceptual and policy space for alternative and multiple geoimaginaries of the seabed to be seen as legitimate.”

Building on this critical perspective, we recenter attention from the technocratic findings of (often corporate-sponsored) EIAs, based on a risk fixing approach, to a more critical analysis of ‘supply risks’ within the broader context of the green transition. The previously mentioned moratorium signed by downstream actors, recognizes the deep ocean as a ‘common heritage of humankind’.¹⁵ Unlike interpretations given to this concept in LOSC, it opposes the instrumentalization of this legal principle as a justification for an imperative to “rush to mine the ocean floor” (The Action Network, n.d.). While on one hand the moratorium provides a temporary fix to delay commercial exploitation through demands for further research on the potential impacts of this new extractive practice. On the other, DSM proponents point out that it is the first extractive industry to be preemptively internationally regulated (through the International Seabed Authority, ISA) and that a vast amount of research already points to its benefits, in particular in terms of climate change mitigation. Hence neither opponents nor

¹⁵ According to Article 136 of LOSC the Area is the "common heritage of mankind". The term Area refers to "the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction" (Article 1 of LOSC), therefore not to the open seas in the sense of the ocean's surface and the water column (Taylor 2019).

proponents appear to address what Childs defined as “‘fixing’ [...] the seabed into a singular imaginary” (2022) in the context of a four-dimensional extractivism of deep sea mining (Childs 2020a). In this part we propose to reconceptualize sourcing risks in light of these concerns, and the potential impacts of the industry on (ir)responsible sourcing.

Corporate centering on visible risks, by opposition to conceptual risks questioning the need, structure, and philosophical appropriateness of establishing extractivist practices in the deep pelagic areas of our oceans, reflects a short-term approach. Largely based on land-based best mining practices, the efforts to address DSM risks are based on a flawed assumption that the industry, while differing in its methods, does not present significant *conceptual* and *ethical* distinctiveness from terrestrial mining. We argue, in line with Childs, that the specificities of DSM are overlooked, obstructed by traditional geopolitical, ecological, and social perspectives hiding the industry’s extreme location and materialities. The risks in sourcing from DSM then evolve from existing ones to future, unidentified ones, driven by the structure of the seabed, its inherent fluidity, and the unknown ecologies that flourish in the deep ocean. Moving beyond known terrestrial risks to consider the broader dimensions of DSM thus questions the structure of due diligence and risk mitigation in the context of the increasing focus on responsible sourcing. How will downstream purchasers then address the geological forces that govern DSM risks, from geopolitics to technical extraction in mostly inaccessible areas? As Childs (2020, 207) argues, deep sea miners “might, in fact, be amongst the most attuned to the vibrant materiality and temporalities of the oceans in which they work”; yet, DSM’s end customers will face significant knowledge and imaginary barriers to adequately address their supply chain risks. In this sense, we contend that the geographies and conceptual structure of DSM will inevitably transfer responsibility for its supply chain risk management from downstream companies to deep sea mining companies. Hence, DSM areas of responsibility differ from those of land-based mining for which responsible supply is driven by downstream actors and focused on issues such as GHG emissions, OHS, corruption, or child labor.

In other words, from a downstream sourcing perspective, DSM diversifies and complexifies the set and geographies of risks well beyond those generally considered for land-based mining. While frameworks are being developed to address environmental, social, and political risks, these structures remain anchored in existing risk management systems used by terrestrial operations (see Kung et al. 2021). Additionally, and contrary to existing dynamics of downstream corporate involvement in terrestrial cobalt responsible sourcing, the nature of the technical knowledge developed by DSM companies (and to some extent by the ISA) is often not fully grasped by downstream actors. This situation, combined with the growing thirst for minerals to ensure a supposedly ecological ‘green transition’, supports the shifting and outsourcing of risks.

Risk shifting, as we defined it previously, refers to the use of contractual tools to transfer, manage, and mitigate identified potential risks while outsourcing refers to the management of

supply by non-industry members asked to follow ‘clean minerals’ codes of conduct yet responsible for their own practices. In both cases, the sponsoring states, through their legal responsibility regarding the behavior and practices of the DSM companies operating under their mandate, concentrate the risk exposure. This is linked to the nature of the concessionary model under LOSC which confers states with the responsibility to ensure compliance.¹⁶

Conclusion

This article addresses the corporate management of cobalt supply risks linked to cobalt mining in the almost technology-free artisanal production and the technologically-intensive emerging DSM sector. We propose to conceptualize cobalt responsible sourcing risk management through five approaches. The first two – perpetuating and emotionalizing – are the results of downstream companies’ actions to protect themselves against reputational risks. The last three –outsourcing, shifting, and fixing – define the risk mitigation of upstream companies to address risks in their supply chains of critical minerals, and under concerns from their downstream clients. While we do not argue that these strategies are always conscious, we found that the narratives promote an outsourcing of the risks to other actors through different dynamics. We propose to conceptualize the transfer of risks as a strategy embraced by companies using the five strategies highlighted above. Through the use (or boycott) of artisanally-mined materials, downstream companies are transferring the responsibility of risk mitigation to the upstream part of the supply chain.

The cobalt market is currently one of the most pressured mineral commodities and the ASM sector remains an important (while often invisible) actor. Completely suppressing ASM supply accounting for 15 to 30 percent of the production would have devastating effects on the battery industry. From a downstream perspective, the emotionalization of risk, through the focus on highly visible issues (child labor) requires addressing a targeted issue. Artisanal miners are then required to act and mitigate these risks. They are expected to act as ‘non-industry’ (risk outsourcing) ‘subcontractors’ (risk shifting), and following ‘responsible sourcing requirements’ (risk fixing) to achieve a risk profile allowing for the sale of their materials in global supply chains. However, as we discussed, the immense demand for cobalt creates a risk perpetuating as companies require more and more minerals. Responsible sourcing projects, such as the now defunct Mutoshi Pilot Project implemented by Trafigura and Chemaf (Deberdt and Le Billon 2022), attempt to formalize artisanal mining. Nevertheless, these micro-entrepreneurs are neither employees of the company sourcing minerals from them nor of the company owning the land on which they operate. The artisanal miners are then responsible for the auto-implementation of responsible sourcing standards and regulations, aiming to eliminate the reputational risks for companies. This strategy can be identified in all responsible sourcing projects in the region, from Mutoshi, to Better Mining, or the Fair Cobalt Alliance and feeds on the persistence of

¹⁶ These states include Nauru, Kiribati, or Tuvalu.

““informal”, “precarious”, and “non-standard” employment [...] and the decentering of waged and salaried employment as a presumed norm or telos” (Ferguson and Li 2018, 1). The outsourcing of risks in the ASM sector allows for the continuous sourcing from sanctioned responsible sourcing sites while *de facto* maintaining an ‘illegal’ artisanal production that, officially, does not reach the supply chains of brand companies.

In the DSM industry, a similar risk transfer strategy occurs, however at a different level. The industry is a highly complex and technologically advanced endeavor necessitating a high level of expertise in very specific fields. Focusing on supply chain sourcing risks, including reputational ones, from a downstream brand company perspective, a dual knowledge-based risk transfer and legal risk transfer occur. Downstream companies’ perspectives on DSM are shaped by a limited understanding of the technology and scientific knowledge of the deep ocean. The current strategy deployed by some of these companies, including Google, BMW, or Philipps, is based on a short-term risk outsourcing strategy based on emotionality. This wait-and-see narrative does not preclude the establishment of a DSM sector, but favors the production of institutional knowledge highly reliant on the industry (Moses and Brigham 2021; Interview with downstream company representative, March 7, 2022; Interview with downstream company representative, March 9, 2022). Hence, it shifts responsibility for potential risks from the purchaser to the knowledge producer, in this case the DSM companies and the ISA. At the second level, risks are outsourced legally by the downstream sector to the DSM industry and to the states through the sponsoring model. In a 2011 Advisory Opinion, the Seabed Disputes Chamber stated that liability of the states resides in two obligations under the LOSC and its related instruments: ensuring compliance by contractors and direct obligations. In particular, this opinion stated that sponsoring states are liable for (a) failure to carry out its responsibilities under the Convention; and (b) occurrence of damage (Freestone 2011). The outsourcing of damages, otherwise described in this article as risks (environmental, social, economic ...) is then outsourced to states that, in the case of small insular Pacific countries such as Nauru, Kiribati, or Tuvalu, might lack the political and economic power to fully implement their obligations (Anton, Makgill and Pain 2011; Svendsen 2020).

If accepting the current paradigm of a green transition powered by a resource intensive electrification of our livelihoods, then booming raw materials needs will spur new risks. The ASM and the DSM sectors are only two of the many sectors that are likely to impact the ways in which global supply chain risk management is conducted. Throughout this article, we argue that supply chain actors, under stricter legal and customer requirements, will increasingly engage in a risk mitigation responsibility transfer to their suppliers and other actors involved in the extractive process (ASM operators, sponsoring states, ...). Tracing the geography of risks transfer is of particular importance when considering the flurry of legal due diligence requirements that are being implemented in Europe, North American, Australia or even China. The ability to effectively address ESG concerns will depend on the mitigation of these transfer strategies or their close management at all levels of the supply chains.

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