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ORIGINAL ARTICLE

Grounding critical minerals in values-centred approaches for just sustainability transitions

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Abstract

Growing demand for critical minerals to accelerate a global energy transition presents new challenges and opportunities for responsible mine exploration and mine development. Social innovations have not kept pace with investment in mineral development, putting the wellbeing and rights of Indigenous peoples and local communities at risk. Historical and ongoing injustices mean that without pro-active attention to these issues, critical mineral development may cause social and environmental harm and exacerbate existing inequalities. The 2022 Values Assessment conducted by the Intergovernmental Panel of Biodiversity and Ecosystem Services (IPBES-VA) shows that transitions towards just and sustainable futures depend on recognising and embedding diverse values into decision-making processes across all domains, including mining. Values-centred approaches seek to identify diverse and under-represented values and activate values-centred leverage points to overcome barriers, shift power, and explore alternative pathways towards justice and sustainability. In this paper, we argue that the governance of critical mineral development can learn from values-centred approaches to inform responsible and inclusive mining and exploration. We outline how values-centred approaches might help to address current shortfalls in mineral resource governance, and identify promising examples of activating values-centred leverage-points drawing from global examples. We critically advance values-centred approaches by considering power, knowledge, and capabilities, while also acknowledging the need for pragmatism in improving mineral resource governance. We identify potential change mechanisms for integrating values into policy and practice and call for more attention to plural values in the exploration and development of critical minerals for just transitions.

Keywords Sustainability transition · Justice · Critical minerals · Values-centred approaches · Mineral resource governance

Introduction

The imperative to transform energy systems to reduce carbon emissions has captured attention in global economic and production systems. Global interest in decarbonisation is driving investments in technologies, policies, and regulatory frameworks to shift societies away from fossil fuels towards low-carbon renewable energy. Fundamental to this shift is the increased supply of minerals and metals required for renewable energy systems (Bazilian 2018; IEA 2021). Minerals such as lithium, nickel, cobalt, and rare earth elements are essential for renewable energy technologies, including batteries for electric vehicles, energy storage, and solar, wind, hydro, and geothermal energy production. These minerals and metals are broadly referred to as 'critical minerals', named for their insecure supply chains and importance in global economies (Hayes and McCullough 2018). The

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IEA projects a doubling to nearly tripling of demand for key energy transition minerals by 2030, based on scenarios ranging from current policies through to net zero emissions by 2050 (IEA 2024). Global production of some of these critical minerals is already increasing (Idoine et al. 2023). Some of these minerals have long-established production and supply chains, such as copper and aluminium, others are becoming increasingly important due to new technologies, such as graphite and Rare Earth Elements (REEs). Recognition of the criticality of these minerals has led to new governance arrangements to attract investment, expand production, and secure supply chains (Dou et al. 2023). Examples include Australian and Canadian critical mineral strategies, the European 2024 Critical Raw Materials Act, and the African Green Minerals Strategy. Intensifying competition to securing critical minerals is likely to play a significant role in geopolitics and international trade in the coming decades (Vivoda et al. 2024).

Accelerated mineral development (exploration, mining and processing) raises important questions for justice and sustainability (Bainton et al. 2021; Heffron 2020; Owen et al. 2022a, b). Social-ecological concerns of mining are widely documented (Gamu et al. 2015; Scheidel et al. 2020; Sonter et al. 2017). Despite decades of improvements in industry sustainability standards, problems of Free, Prior, and Informed Consent (FPIC) persist (Kemp and Owen 2017; Klein et al. 2023). While these issues affect many segments of society, they are most pertinent for Indigenous peoples and local communities (IPLCs), understood here as ethnic groups who self-identify as Indigenous or as members of distinct local communities descendent from and identifying with the original inhabitants of a given region, or with historical linkages with natural places (IPBES 2022a). For many IPLCs impacted by mining, concerns over social and ecological justice are at the core of discontent (Anaya and Puig 2017; Blesia et al. 2023). The vast majority of Indigenous Peoples have no rights to commercially viable resources, despite distinct recognition of rights to traditional lands and territories in international law (Sawyer and Gomez 2012). The Global Atlas of Environmental Justice records 767 cases of socio-environmental conflict involving mineral ores and building materials extraction (EJ Atlas 2025). Researchers have expressed concerns that critical minerals will enlarge and intensify these injustices, highlighting the need for institutions that mainstream fairness and reciprocity in decarbonization strategies (Bainton et al. 2021; Heffron 2020).

Governing critical minerals to deliver just and sustainable outcomes calls for a deeper understanding of values. Values encompass worldviews, ethics, and preferences, and are at the core of individuals identity, guiding choices, attitudes, and rationality (Rokeach 2008; Schwartz 1992). In mining landscapes, plurality and diversity of values have often led to tension and conflict (Dunlap 2020; Kemp et al. 2011; Saes and Bisht 2020). Decisions over whose values should be considered, and through what process, can result in some values being ignored or overlooked, which can be classified as injustice (Annandale et al. 2021; Pascual et al. 2023a, b). While some studies have helped to surface these value tensions in mining (Avcı et al. 2010; Kumi et al. 2023), decision-making systems across the mining life cycle continue to be exclusive (Klein et al. 2023; Urzedo et al. 2022). A dominance of colonial and neoliberal political, legal, and market systems means structural barriers prevent the recognition, articulation, and incorporation of IPLC values into decisions (Gould et al. 2023; Watson 2018). Yet failure to recognise diverse and marginalised values and the worldviews that guide them can lead to intractable conflicts, with costly consequences (Avcı et al. 2010; Franks et al. 2014; Manero et al. 2022; Özkaynak et al. 2023). As critical mineral demand intensifies, the societal and environmental costs of excluding values will shift far beyond financial implications.

In this paper, we argue that the political and environmental contexts of critical mineral development call for new approaches to governance that meaningfully incorporate diverse values and prioritize justice. In 2022, the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) released the Assessment Report on the Diverse Values and Valuation of Nature (IPBES 2022a, b). The Values Assessment (VA) provides guidance for designing and implementing valuation processes and embedding diverse values of nature into decision-making by activating value-centred leverage points (Pascual et al. 2023a, b). These 'values-centred approaches' involve making the full range of values more explicit and confronting systems of knowledge and power that underpin which (and whose) values are recognised. We outline how values-centred approaches might be applied in the critical minerals sector to address shortcomings in values-recognition in mining and respond to government and societal aspirations for a just energy transition. In doing so, we apply a critical lens to advance the praxis of value-centred approaches in settings characterized by structural injustices.

In the following sections, we explore values-centred approaches in the context of mining of critical minerals. We begin with a brief account of value-recognition in mining, and implications for justice in critical mineral development. We then draw from the IPBES values-centred leverage points to document emerging examples of values-centred approaches in mineral resource governance. We consider the complexity of activating values-centred leverage points in mining systems. Our critical analysis indicates a need for more explicit attention to power, capabilities, and knowledge when seeking to embed diverse values into decision-making. We aim to lay the foundations for further research and to

enrich collective understanding of how to integrate diverse values for responsible and just critical mineral development.

Value recognition in mining

The term values is used to refer to interests, preferences, principles, goals, needs, aversions, and what matters to people (Williams 1979). Values can be plural, temporal, and multi-dimensional, embedded in culture, language, and social–economic–environmental experiences (Kenter and O'Connor 2022). Values may be expressed as broad and transcendental, guiding life goals and principles, as well as specific, contextual values (Table 1) (Kenter et al. 2019; Özkaynak et al. 2023). In mining, values are considered through a range of different decision-making processes. Agreement-making between companies and IPLCs, regulatory approvals such as environmental and cultural heritage assessments, public consultation, materiality assessments, and cost–benefit analysis are examples of different ways that values are elicited and incorporated into mining decisions (Damigos 2006; O'Faircheallaigh 2015; Saenz 2019). In many cases, these decision-making processes fail to recognise the breadth of values that exist and engage meaningfully with people whose values are historically or socially marginalized (Annandale et al. 2021; Dunlap 2020; Owen and Kemp 2013). The causes of failure to recognise diverse values in mining is multi-faceted. Studies highlight cultural and structural barriers, such as colonialism and dominance of western thinking; economic and institutional barriers, such as the prioritization of financial gains to distant shareholders over values of IPLCs; and challenges in considerations of temporal or geographical dimensions of values, such as cumulative impacts and future generations (Foran et al. 2024; Langston et al. 2015; Lele et al. 2023; Satz et al. 2013; van Noordwijk et al. 2023a, b).

Large-scale mining has long been recognised as a colonial form of resource extraction, giving rise to social disintegration and conflict (Bainton 2020). Across all continents, IPLCs have suffered dispossession, cultural loss, livelihood deprivation, and in some cases armed conflict, labour abuses, and genocide (ibid). In many parts of the world, these harms have been part of broader colonial regimes explicitly intended to establish exploitative systems and disrupt Indigenous populations. The promotion and dominance of neoliberalism have extended and exacerbated these harms, reinforcing extractive regimes in political, economic, and legal systems (Sawyer and Gomez 2012). Within this context, the creation of western frameworks intended to incorporate IPLC values into mining and distribute benefits have little impact on deep historical and structural power imbalances. IPLCs have increasingly advocated for principles of FPIC to address institutional deficits, but FPIC remains contentious in mining (Southalan 2019; Tomlinson 2019). Some industry bodies such as the International Council on Mining and Metals (ICMM) have endorsed FPIC, but there are various interpretations on what to do if consent is withheld (ICMM 2024). While FPIC is still a fundamental concept, navigating deep power imbalances requires a much broader approach to shifting societal values and institutional reform (Klein et al. 2023).

Western and neoliberal dominance has also engendered the prioritisation of instrumental values over relational and intrinsic values in mining (Table 1). Mining has historically prioritized profit gains over other cultural and environmental values, with harmful consequences for local populations (Bury 2005; Langton and Mazel 2008; Nagar 2021). In many parts of the world, prioritization of financial values is enabled through a free-entry system, in which

Table 1 Value concepts described in the IPBES literature

Concept	Description	Examples
Broad values	Guiding moral principles or life goals, informed by worldviews and common beliefs	Prosperity, freedom, recognition, health, belonging, livelihood, security, self-realization, justice
Specific values	Broad values expressed in specific circumstances or contexts	Can be categorized into instrumental, relational, and intrinsic values
Instrumental	Values that are considered important as a means to an end. They tend to be associated with assets, capital, utility, and contributions to people	Nature as assets (capital, resources), usefulness for people, ecosystem services, satisfaction of needs (e.g. wild food plants or wild animals for nutrition and incomes in Yunan, China)
Relational	Refer to the meaningfulness of interactions, such as among people and between people and nature. Often framed as non-substitutable and difficult to aggregate	Sense of place and identity, reciprocal relationships, non-substitutable relationships (e.g., in Aotearoa New Zealand, the Te Awa Tupua River is connected with the Iwi and Hapu peoples' identity in an inalienable way)
Intrinsic	Something that is valued independently of people (in and of itself)	Nature has a right to exist, regardless of its benefits or relations to people, (e.g., Quechua communities in Perú consider Ausangate Mountain as a powerful earth-being)

Source: Authors, based on Abdurrahim et al. (2023), Anderson et al. (2022), IPBES (2022a, b) and Pascual et al. (2023a, b)

mining is assumed by governments to represent the best land use option, encouraging an 'ethic of exploitation' (Jenkins 2004; Owen and Kemp 2013; Peterson St-Laurent and Billon 2015). Free entry principles contribute to asymmetrical power structures that favour mining companies (Peterson St-Laurent and Billon 2015). Even with strict regulations, the 2020 destruction of a 46,000 year old Indigenous sacred heritage site at Juukan Gorge in Western Australia to expand an iron ore mine demonstrated the inadequacy of legal instruments in an uneven playing field (Kemp et al. 2023). IPLCs often have deeply held relational and intrinsic values which are given limited attention in conventional impact frameworks (Lele 2023; Manero et al. 2022). Examples are cultural identity, sovereignty, sense of place, security, and social cohesion, all of which are interconnected with community or individual well-being (Kumi et al. 2023). Lack of access and influence over information consistently puts communities at a disadvantage in negotiating agreements or having a voice in social and environmental impact assessments (Walsh et al. 2017; Zanini et al. 2023). While many IPLCs also seek economic self-determination through mining projects, the current asymmetries in decision-making systems rarely enable these opportunities (Boron and Markey 2020; Riggs et al. 2025). In some cases, conflict and resistance drives local communities towards artisanal mining systems that better deliver local values, but are often marginalized by the state (Langston et al. 2015; Spiegel 2016).

In addition to power asymmetries, the incorporation of diverse and marginalized values into mineral decision-making systems is complicated by temporal and geographic dimensions. The impacts of exploration and mine development are typically assessed at an individual project level. Cumulative impacts over time, or across aquatic and terrestrial systems, and their significance to communities outside the project area, may not be accounted for in standard assessments (Larsen et al. 2018). The long timeframe of mining, from discovery to production, or years of operation, can make it difficult to incorporate evolving values of communities into agreement-making (Odumosu-Ayanu and Newman 2020). There are also very few ways to consider values of distant populations or future generations in mining decisions. As minerals are often are part of global supply chains, consumers and geopolitics have a key role in shaping state and market decisions (Dou et al. 2023; Heffron 2020). Benefits of mining to distant communities may be given more value over local opposition, or vice versa (Suopajärvi et al. 2017). The decision to not mine in one landscape due to local cultural and environmental values could impact the decision to mine in another landscape. Consideration of these values adds complexities to mining decisions that institutions have not yet grappled with (Agusdinata et al. 2022). Framing decisions in terms of values and justice can help navigate these complexities, creating space for deliberation systems and consideration of different development scenarios (Davis 2021; Kenter 2016).

Values and justice in developing critical minerals

Critical minerals cut across several dimensions of justice. Justice is often defined as fairness, held up by universal principles (Rawls 1971). However, what is accepted as justice, and what might be perceived as injustice, can differ substantially within society (Feather 1994; Sen 2009; Wijsman and Berbés-Blázquez 2022). For example, the acquisition of property by the state for mining under just terms is typically interpreted by the state as fair monetary compensation, but to landowners and communities, just terms might only exist if it includes the right to veto. Justice has procedural, distributive, recognition, epistemic, and restorative dimensions (Table 2). These dimensions are closely entwined, and when examined collectively, can help create a more complete understanding of what constitutes and produces injustice (Bell and Carrick 2017; Schlosberg 2007; Walker 2012). Restorative justice, often neglected in justice frameworks, is particularly relevant for critical mineral development in colonial states, where historical legacies and past harms are still prominent (Abram et al. 2022; McCauley and Heffron 2018). Procedural justice—broadly defined as fairness in decision-making—has also historically been overlooked in resource development, with more focus on distributive justice (Forsyth and Sikor 2013; Schlosberg 2007). Yet distributive justice often arises from procedural rights, which, if insufficient, also inhibit recognition of Indigenous knowledge and restorative pathways (Rioux-Gobeil and Thomassin 2024). In a global review of large-scale infrastructure projects, Lele (2023) finds that Environmental Assessments consistently fail to provide space for local representation, input, and dialogue in procedural elements. In contexts of colonization and marginalization, each of these dimensions may be considered forms of structural injustice, where political, social, and economic institutions systematically inhibit the freedoms of certain groups (Kuokkanen 2020; McKeown 2021).

A stronger, holistic approach to justice in critical mineral development requires meaningfully engaging with values. This might include attention to who has the freedom to articulate values, how and whose values are incorporated into decision-making (i.e. cultural values), the dominance of some values over others, and the recognition of values as part of worldviews, knowledge, and governance systems. All of these represent interrelated dimensions of justice. As noted above, diverse and marginalized values are often neglected in mineral resource governance. Exclusion or narrow assessments of values, worldviews, and knowledges can

Table 2 Dimensions of justice and examples of intersection with critical minerals

Dimensions of Justice	Description	Example of intersection with critical mineral development
Procedural	Concerned with decision-making processes, their inclusivity, and distribution of power. *How it's decided who gets what* (Bell and Carrick 2017)	Granting mineral rights: What provisions exist for consent and participation in decisions, grievance mechanisms, access to information
Distributive	Focusing on the distribution of goods, costs, and benefits within society and the principles of fair allocation. *Who gets what?* (Walker 2012)	Outcomes of negotiations and impact benefit agreements: how are benefits and burdens of mining distributed (revenue-sharing, royalties, loss of natural and cultural assets)
Recognition	How the rights of individuals and groups are acknowledged, valued, and respected in society. *Who counts? Who is ignored?* (Schlosberg 2007)	Recognition of customary and Indigenous rights through cultural authority for land management decisions, self-determination, maintenance of traditional knowledge and practices
Epistemic	The proper recognition of individuals and groups as communicators, creators, recipients, and sources of knowledge. *What knowledge counts?* (Fricker 2007)	Incorporation of diverse knowledge, worldviews, and values into social and environmental impact assessments
Restorative	Apologies, restitution, and acknowledgements of past harms and current impacts of those harms, and effectiveness of correctional actions for healing and recovery. *What harms need repairing and how?* (Menkel-Meadow 2007)	Compensation to IPLCs for cultural loss. Acknowledgement of mining legacies and healing efforts in the form of inclusive dialogue to regain trust and relationships

Source: Authors, based on Heffron (2020), Wijsman and Berbés-Blázquez (2022) and Williams and Doyon (2019)

deepen and reproduce procedural and distributive injustices (Fricker 2007; Lenzi et al. 2023; Williams and Doyon 2019). Yet unbalanced relationships resulting from colonization and neoliberal systems prevent fair processes (such as FPIC) that could enable the articulation of under-represented values (Rioux-Gobeil and Thomassin 2024). Indigenous peoples assert a relational approach to values and justice expressed through Indigenous knowledge systems, governance, and conceptions of justice (Fjellheim 2023; Gould et al. 2023; McGregor et al. 2020). Without deep consideration of structural justice and values-recognition, as well as openness to alternative models of decision-making, critical mineral development will likely reinforce existing power structures that result in uneven development and perpetuate injustice.

The rationale for greater attention to justice and values in critical minerals is manifold. Several studies have noted that increased mining activity due to demand for critical minerals will take place in areas of social-economic disadvantage, insecure rights, and weak institutions (Boafo et al. 2024; Burton et al. 2024; Carr-Wilson et al. 2024; Owen et al. 2022a, b). There are large gaps in understanding of the environmental costs of critical mineral development, such as energy needs, water depletion, environmental degradation, and climate risks (Carr-Wilson et al. 2024). As essential components of clean energy technologies, the just development of critical energy minerals is fundamental to broader aspirations for just energy transitions (Bainton et al. 2021; McCauley and Heffron 2018; Rioux-Gobeil and Thomassin 2024; Sovacool and Dworkin 2015). The growth of the critical mineral sector is also tied to broader shifts within the resources sector towards Environmental Social Governance (ESG), FPIC, and ethical consumption (Maybee et al. 2023). Governments are participating more in the sector to enable mining, claiming to place greater incentive and demands on companies for social performance (Berthet et al. 2024; Sinclair and Coe 2024). Downstream companies and investors are also adopting ESG standards as a strategy for risk- and market competitiveness (Deberdt et al. 2024). Together, geopolitical interests in critical mineral development and the intersection with IPLC territories suggest a window of opportunity to influence the critical mineral sector, disrupt dominant power structures, and enable more just outcomes.

The IPBES values assessment

The 2022 IPBES VA is the culmination of 9 years of science-driven investigation into the multiple ways that values towards nature are understood, made visible, and recognised in decision-making about nature (IPBES 2022a, b; Pascual et al. 2023a, b). The VA synthesizes the different ways that people understand and connect with nature, and the diverse worldviews and knowledge systems used to characterise and

document values (referred to as valuation). The VA articulates the different types of broad and specific values embedded within humanity's diverse ways of knowing. Broad values are defined as general moral guiding principles and life goals (such as justice, responsibility, health, prosperity). Values are grouped into instrumental, intrinsic, and relational values (Table 2). Using this values typology, the VA provides guidance on plural valuation to bring diverse voices and worldviews into decision-making (Termansen et al. 2022). The goals of the IPBES VA are to not only understand and make visible values towards nature, but to utilize innovative thinking and methodologies for justice and sustainability.

An example of an IPBES VA contribution is the benefits of shifting from monistic (based on single worldview) to pluralistic valuation. IPBES defines plural valuation as considering several broad values, such as different worldviews, perspectives, and life frames within a valuation process (Termansen et al. 2022). For example, using participatory methodologies that make visible different worldviews and assumptions shaping values, such as participatory mapping, and/or, integrating tools and approaches to reconcile different mental models, such as deliberation and modelling (Kenter 2016; Zafra-Calvo et al. 2020). In contrast to narrow framings of value through elicitation, these inclusive methodologies encourage negotiation and dialogue as part of broader valuation processes, oriented towards identifying pathways for action and policy (Gorddard et al. 2016; Langston et al. 2024; Zafra-Calvo et al. 2020). Implementation of these methodologies involves integrating multiple concepts, methods, and frameworks alongside learning to co-produce such pathways (Colloff et al. 2021) (Table 1)

The IPBES-VA asserts that objectives of sustainability and justice can be advanced through better recognition and uptake of nature's diverse values in decision-making, and that this is 'well established' in the global science literature (IPBES 2022a, b:20). However, how to influence decision-making systems to enable this is less established. IPBES identifies four values-centred leverage points to support transformative change towards justice and sustainability (Fig. 1). These are (i) recognising the diversity of nature's values through undertaking relevant and robust valuation; (ii) embedding values in decision-making; (iii) reforming policies and stimulating institutional change; and (iv) shifting societal-level norms and goals to support sustainability-aligned values across sectors (IPBES 2022b). Values-centred leverage points build from the understanding of leverage points in systems thinking, first introduced by Donella Meadows (1999). Leverage points are parts of the system that can be influenced for a proportionally greater effect on the whole system (Abson et al. 2017; Linnér and Wibeck 2021). Each leverage point is connected, as part of nested, non-linear processes of change (Allen and Malekpour 2023; IPBES 2022b; O'Brien 2018). The IPBES VA proposes that achieving transformative change towards justice and sustainability requires a mix of strategies to activate the four leverage points (Pascual et al. 2023a, b). Context will influence the way that levers interact across spheres of change, informing the appropriate mix of strategies (O'Brien and Wolf 2010; Stadelmann-Steffen et al. 2021).

Towards values-centred approaches in mining

The values-centred leverage points offer different ways to consider how to centre values in decision-making systems. Building from Pascual et al (2023a, b), we define values-centred approaches as ***processes that seek to understand and make visible diverse values, and meaningfully incorporate underrepresented values into decision-making processes for more just and sustainable outcomes***. Values-centred approaches are

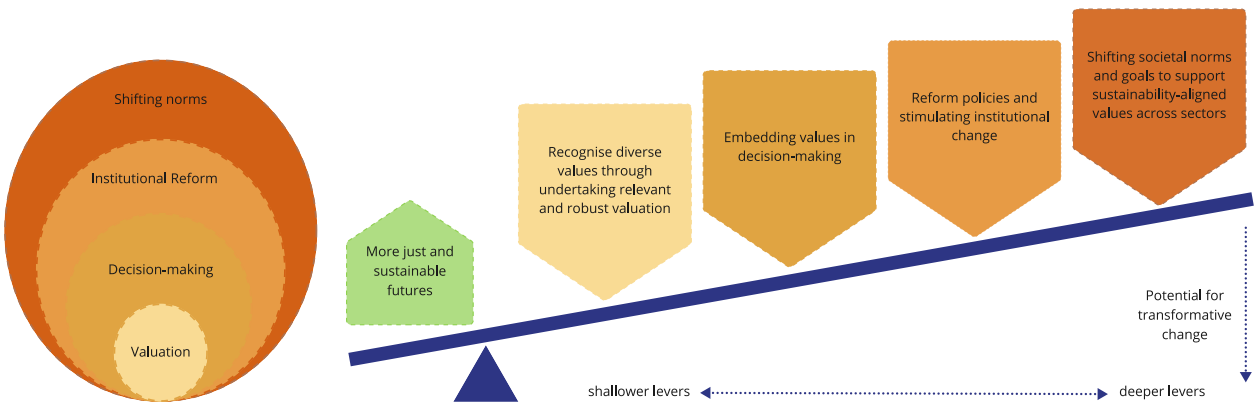

Fig. 1 Values-centred leverage points, as a nested hierarchy and positioned along a spectrum of deeper and shallower realms of leverage (adapted from IPBES 2022a, b)

not limited to valuation. Values-centred approaches include the full spectrum of actions that engage with value plurality to create space for diverse values and worldviews, increase recognition of under-represented values and temper dominant values linked to unsustainability and injustice, and promote values aligned with just sustainability. Recognition of diverse values is not enough—decisions must also consider the type of values, whose values, and how values are recognised and mobilised in decision-making and planning (Lele 2023; Lenzi et al. 2023).

Values-centred approaches in mining give increased attention to the incorporation of diverse and under-represented values into decision-making systems for more just processes and outcomes. Here, justice is not only about inclusion and representation of values, but enabling deliberation on value tensions, responding to shifts in values over time, and reconfiguring inhibiting power structures (Lenzi et al. 2023). By giving more explicit attention to dimensions of justice, values-centred approaches can serve as scaffolding for future-oriented mining decisions that temper dominant values and promote sustainability-aligned values. This might include using value tensions as an opportunity to deliberate on differences and restructure which values are given priority in decisions. For example, tempering dominant values could involve reducing the primacy of financial values in mining that construct injustice (c.f. Lenzi et al. 2023; Pascual et al. 2023a, b). Changes in the system might include willingness to reduce social and ecological externalities (which translate into reducing profit margins) to invest in landscape stewardship, re-orienting value assessments towards shared prosperity, or prioritising and incentivizing waste and resource recovery over-exploitation of new resources (Dong et al. 2019; Mayer 2018). Recognising that instrumental benefits may be vital to fulfilling the needs of many IPLCs, the question becomes how to shift current modes of production towards a more balanced and inclusive consideration of values (van Noordwijk et al. 2023a, b).

In this paper, we propose that values-centred approaches in mining requires expansion of concepts and frameworks proposed by the IPBES VA. The intersection between critical minerals and IPLCs globally, combined with systematic harms of resource development, indicate a need for deeper attention to structural injustices that exclude values. This moves beyond the framing of justice as a broad value (Pascual et al. 2023a, b), towards deeper conceptions and perceptions of injustice and its historical contexts. We elaborate on these considerations following the examples and critical discussion below.

Values-centred leverage points in mineral resource governance

To meaningfully incorporate diverse values into decision-making processes for more just and sustainable outcomes in critical mineral extraction, we can consider how values-centred approaches fit within the mining context. The leverage points in Fig. 1 are broad conceptualizations of how to drive systems-wide transformative change. Translating these into practice requires consideration of what actions can catalyze change, and how these actions challenge conventional practices of instrumental valuation and dominant values in decision-making. While valuation methods have a long history in mining (Damigos 2006), we consider where specific attention has been made to counter dominant narratives and advance procedural justice. The four examples of activating leverage points are: (i) inclusive valuation in post-mining transitions; (ii) Indigenous-led impact assessment to embed diverse values into decision-making processes, (iii) jurisdictional reforms to normalize and scale-up incorporation of values into institutions; and (iv) global forums and standards to shift paradigms and norms (Fig. 2). We describe each of these below, providing examples in Tanzania, Australia, New Zealand, Canada, and global forums. In each of these examples, we consider the specific approaches or actions to recognise diverse values (and temper dominant values), expressions of justice, and insights for dealing with power, capabilities, and knowledge. Emphasis is given to the approaches taken to centre values, rather than the specific values present within the example.

Inclusive valuation in post-mining transitions

Mine closure and post-mining transitions involve decisions around feasible and preferred options for land rehabilitation and future land use. Depending on the minerals and mining process, post-mining landscapes may have complex hydrological and ecological features that constrain future land uses. Local people will also often have a vision for the landscape—what features might maintain cultural uses and connection, how rehabilitation might draw from local ecological knowledge, and what can sustain economic benefits. While it is becoming more common for mine closure to be integrated into pre-mining planning, there is very little systematic guidance at a regulatory or policy level on how this is best achieved through an inclusive process (Bainton and Holcombe 2018). There are ample cases where no rehabilitation has taken place and communities continue to be exposed to health and environmental risks (Hasheela et al. 2014; Ngole-Jeme

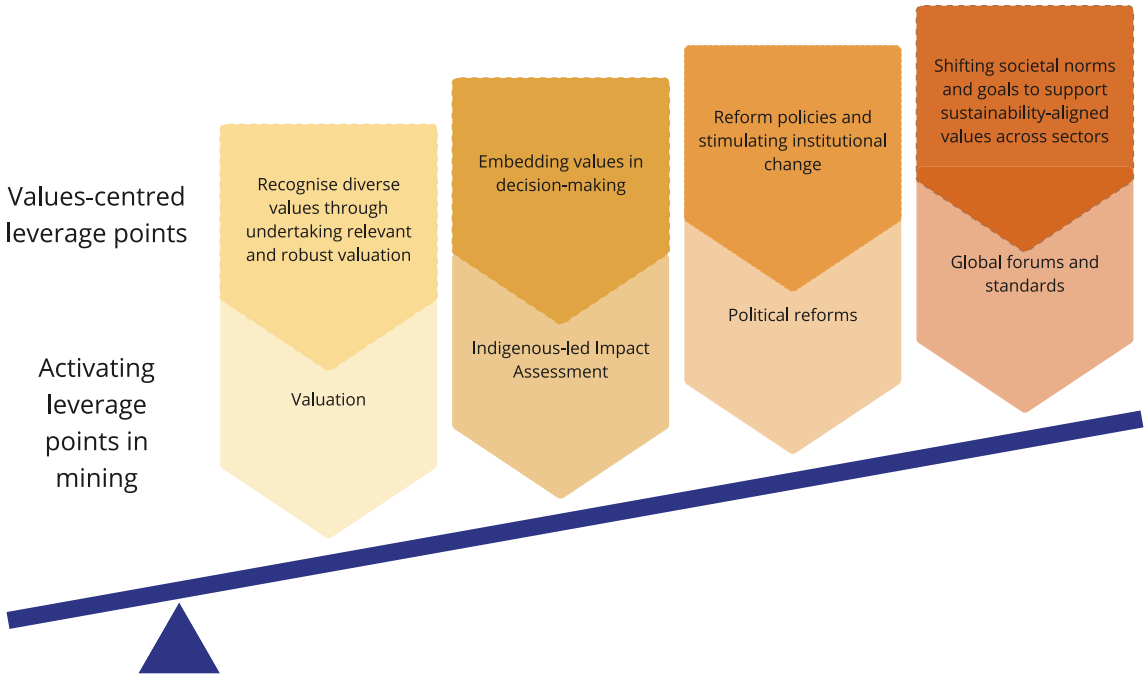

Fig. 2 Activating values-centred leverage points in mining contexts

and Fantke 2017). There are also cases where companies adhere to legal requirements, but engagement and transparency with IPLCs are insufficient, without recognition of Indigenous knowledge and stewardship capabilities (Urzedo et al. 2022). Exposure to harms and exclusion of local communities in post-mining transitions is often representative of broader structural injustices, evident by long-term impacts of post-mining sites that are often ignored (Horowitz et al. 2018).

Inclusive valuation in post-mining transitions can take a variety of forms, sharing common goals of procedural justice and articulating diverse values for post-mining landscapes. An example of this is the Golden Pride Mine (GPM) in Tanzania, in which government, mining, and community stakeholders engaged in a participatory gold mine-closure process (IGF 2022). Throughout the life of the mine, GPM facilitated participatory activities to identify funded projects, and prepare the community for a post-mining economy. Communities expressed values of water accessibility, leading GPM to change its original plans to instead provide stable water source for the local region. Early and regular engagement with community and stakeholders allowed for mine closure plans to be adapted through consultation, including trialling approaches to progressive rehabilitation. According to IGF (2022), a key part of the GPM process was establishing closure committees comprised of community and national actors, strengthening local authority and knowledge. The durability of these processes in establishing long-term sustainability within the landscape is yet to be determined (Shoo 2020). Previous studies on mining in Tanzania have highlighted longstanding tensions around gold-mining in Tanzania that warrant greater scrutiny on the justice dimensions of these processes (Carstens and Hilson 2009). For IPLCs, engaging in mine closure through environmental management and rehabilitation offers important recognition of cultural knowledge and responsibility, as well as employment opportunities (Barnes et al. 2020). Engagement should start before a mine is open, to ensure that different values are represented, and adequate valuation methods are used. The example of the GPM is incomplete, but highlights inclusive actions that pro-actively respond to diverse values, which are commonly overlooked in conventional mine-closure processes.

Indigenous-led impact assessment

Environmental impact assessments (EIAs) have long been integral to mining development. In some countries, EIAs have extended to include social impact assessments (SIAs), strategic environmental assessments (SEAs) and cumulative impact assessments (CIAs), providing a legally mandated forum for rightsholders and stakeholder engagement. Lele (2023) describes EIAs as value articulation processes, adding that on paper, EIAs recognise diverse values, but in reality, issues of procedural justice mean EIAs are unsatisfactory in how they integrate marginalized values into decision-making processes. Indigenous-led impact assessment (IIA) is an attempt to counter these injustices, providing a

way for Indigenous control to be meaningfully exercised (O'Faircheallaigh and MacDonald 2022). IIA is defined as having 'meaningful impact and a significant degree of control by affected Indigenous parties' (O'Faircheallaigh and MacDonald 2022: 221). IIA is therefore not only a values-articulation process, but also a specific mechanism to privilege Indigenous values and address epistemic injustices in assessing and managing the impacts of projects. Here, we use IIA to encompass IIAs and similar mechanisms (cultural or community-led) that seek to align impact assessment with Indigenous worldviews and rights (Jolly and Thompson-Fawcett 2021).

Awareness of IIAs is growing, but successful case studies are rare. In Aotearoa New Zealand, Māori-led cumulative impact assessments have been mainstreamed into resource development since the 1990s (Jolly and Thompson-Fawcett 2023). Legislated through the 1991 Resources Management Act, CIAs provide a mechanism for Māori worldviews, concepts, and values to be recognised in decision-making processes (Chua-oon Rinfret et al. 2022). This recognition has led to significant inclusion of Māori cultural values in impact assessments, such as criterion based on Māori concepts and articulated in language, and evaluating the spiritual and psychological impacts in addition to physical or environmental impacts (Chua-oon Rinfret et al. 2022; Jolly and Thompson-Fawcett 2023). However, these procedural and recognition dimensions of IIA do not guarantee positive outcomes for Māori people. Jolly and Thompson-Fawcett (2023) find that advances in procedural justice do not necessarily drive substantial improvements in managing cultural impacts, and at worst, can be a box-ticking exercise. Indigenous agency, capacity, and the willingness of external parties to meaningfully listen to Indigenous voices are needed to ensure recognition of values leads to concrete actions to avoid harmful impacts (O'Faircheallaigh and MacDonald 2022). IIAs are likely to be more successful if accompanied by broader systemic changes, such as those identified in the next section.

Political reforms

Globally, national mining sectors have been subject to numerous reforms with the intention of broadening benefits flows and improving environmental responsibility, with varying degrees of success (Cisneros 2020; Jain 2016; Klopppers and du Plessis 2008). Reforms may emerge from decades of confrontation and resistance, triggered by international conventions or community-led legal actions. They may be targeted towards specific mining practices, or cut across resource domains, tenure, human rights, cultural heritage, and environmental protection. For political reforms to succeed in leveraging transformative change, they must meaningfully confront dominant power structures in design and implementation (Kelemen et al. 2023). Rights-based approaches that legitimize IPLC cultural authority and governance structures, such as British Columbia's Declaration on the Rights of Indigenous Peoples Act (DRIPA), might sit at the deeper end of a political reform spectrum. The development of Indigenous land tenure regimes designed to fit within existing postcolonial structures (i.e. limited bundles of rights), such as Australia's 1993 Native Title Act, might sit at the shallower end. Reforms that seek to weave diverse values into policy instruments may also inspire systems-wide change through feedback interactions. As noted by Skocpol (1992), "as politics create policies, policies also remake politics". Institutions can internalize values-centred approaches by bridging boundaries between rightsholders and stakeholders, encouraging learning to strengthen capabilities, and weaving diverse knowledge systems for integrative-adaptive governance (Kelemen et al. 2023).

Recent jurisdictional reforms in British Columbia, Canada to shift decision-making power towards First Nations provides an example of activating this leverage point. In 2019, DRIPA established a legal framework for reconciliation with First Nations. Developed in collaboration with First Nations to enshrine the United Nations Declaration on the Rights of Indigenous People (UNDRIP) in provincial legislation, DRIPA signified a momentous shift towards recognition of First Nations governance, territory, and rights. DRIPA enables agreements between the Government and Indigenous governing bodies, and explicitly allows the co-exercise of statutory powers of decision-making (Allard and Curran 2023). If implemented effectively, it would enable First Nations to assert their rights in resource development in accordance with their local values, articulated through laws, ontologies, and relational responsibilities (Kelly et al. 2024). Progress has been slow, creating uncertainty and legal challenges, but DRIPA has also opened up meaningful pathways to systemic change at multiple levels.

In December 2019, a new Environmental Assessment Act came into effect in British Columbia (2018 *Environmental Assessment Act*), providing new avenues for First Nations involvement, including participation in project assessments, emphasis on Indigenous knowledge and governance processes, and the need for projects to seek consensus with First Nations throughout the assessment process (Nishima-Miller 2022). The British Columbia reform aligns with the recent federal Canadian Impact Assessment Act 2019, which requires that Indigenous knowledge be taken into account in assessment processes. First Nations in British Columbia released the First Nations Critical Minerals Strategy in 2024, providing guidance on how critical mineral projects can respect and adhere to Indigenous governance and values (First Nations Leadership Council 2024). It is important to note that these reforms emerged from a long history of cultural and environmental loss and legal battles, many

of which continue today (Manuel and Derrickson 2021). Responding to First Nation's values of self-determination and FPIC requires a long-term ongoing relational approach, not simply a transactional response to meet contractual or legal obligations (Martin et al. 2025). Ultimate power continues to lie with the state, which will influence the effectiveness of implementation (Allard and Curran 2023; Nishima-Miller 2022). Nonetheless, British Columbia's recognition of First Nations rights and governance will help to create space for the integration of values across all levels of decision-making, setting precedence for other jurisdictions seeking transformative change.

Global forums and standards

Shifting societal norms, values, and beliefs for profound system-wide change towards justice and sustainability is the deepest and most difficult leverage point to activate. In the mining context, it requires redirecting the core goals of political economic systems away from the prioritization of instrumental values. Such profound change calls for integrative transformations across sectors and society—setting the conditions under which companies operate. There is unlikely to be a single progenitor for change; enduring cultural shifts are non-linear, activated by narratives, political movements, and disruptions felt across spatial and temporal scales (Horlings 2015; Stadelmann-Steffen et al. 2021). Extracting minerals and metals for decarbonization is already closely linked to a paradigm shift under the global energy transition (Ali et al. 2017; Sovacool et al. 2020). Looking back at how industry norms began to evolve towards sustainability offers insights into deep leverage points within global mining systems, and how to embed justice aligned values into these systems.

In the decades prior to the 1990s, high-profile cases of environmental devastation dominated global perceptions of mining (Franks 2015). Rather than proactively engage in sustainability, the mining industry and advocacy and conservation groups acted in opposition, fuelling public sentiment towards mining as a cause of conflict, social and environmental injustice, and the natural resource curse. In 1991, the International Council on Metals and the Environment was formed, comprising 27 companies and representing 16 countries, with the objective of promoting sound environmental and safety practices (Hodges 1995). In 2000, a group of 10 major companies formed the Global Mining Initiative (GMI), who launched the Mining, Minerals, and Sustainable Development Initiative (MMSD) in anticipation of the 2002 World Summit on Sustainable Development. The MMSD led a participatory multi-stakeholder dialogue to develop a report titled *Breaking New Ground*, establishing a set of sustainability principles and recommendations for the mining industry (Segura-Salazar and Tavares 2018). The MMSD led to the creation of the International Council on Mining and Metals (ICMM), which continues to be the most prominent voice for mining and sustainability today. The ICMM does not cover the whole mining sector, however, the leadership of multinational companies in this period, in partnership with global organizations, set a new precedence for sustainability in mining (Franks 2015).

Overtime, the ICMM has helped to establish principles for responsible mining, gradually improving awareness of good social and environmental practices. An example is the gradual shift in language in public reports. The 2008 ICMM Statement on Mining and Indigenous Peoples did not acknowledge an Indigenous community's right to say "no" to a mining project (MacInnes et al. 2017). Over time, ICMM has shifted towards a more explicit embrace of FPIC. The 2024 ICMM Position Statement on Indigenous Peoples includes a description of FPIC in which "Indigenous Peoples can collectively grant or withhold their consent (demonstrated in an agreement) for a specified activity as part of a given decision-making process" (ICMM 2024). However, ICMM also notes that "states might determine that a project should be authorised even without consent" (ibid). This ambiguity reflects the dominance of financial values in mining systems, upheld by political and economic institutions. Indigenous representatives have criticised the 2024 ICMM Position Statement for lack of consultation with Indigenous Peoples and failing to meet international standards of FPIC (such as UNDRIP), noting that the language of intention does not commit ICMM members (AIPNEE 2024). It is widely recognised responsible and sustainable exploration and mining practices are still lacking in implementation (Kemp et al. 2023; Rathobei et al. 2024). Critical minerals risks widening these gaps, accelerating due-diligence processes in order to enable sectoral growth (Owen et al. 2022a, b). Notwithstanding, the period of change beginning in the 1990s shows that deep cultural shifts are possible, especially if given the imperative to change (Dashwood 2012; Franks 2015; Segura-Salazar and Tavares 2018).

Activating leverage points

The case studies reveal useful entry points for values-centred approaches across mineral resource governance. However, in the examples above, there is no simple set of relationships or external force placed upon a system inducing the change. Instead, drivers of change are complex and interlinked, involving governance mechanisms and a variety of interventions enacted to meet specific goals (Linnér and Wibeck 2021). Evidence on how to leverage diverse values for transformative governance is still emerging (Horcea-Milcu et al. 2023; Kelemen et al. 2022). The IPBES VA focuses on the *potential* for transformational and incremental change,

noting that "synergistic and concerted actions are needed from all actors in society upon a wide range of values-centred action points" (Kelemen et al. 2022: 508). In the mining context, deep and historical injustices created through colonial and neoliberal systems suggest a need to consider the interlinkages between shallow and deep leverage points in breaking down structural injustices (Riechers et al. 2021). We interpret this as a call for a multi-actor approach to activating leverage points for systems-wide change (Avelino and Wittmayer 2016).

A multi-actor approach to activating leverage points aligns with the critical mineral context. Critical minerals development occurs in complex systems, exhibiting multiple system phenomena, influenced by countless actors. The case studies above focus on IPLC values that are historically marginalized in mining systems, but activating system-change involves different forms of agency, exercised through different roles over time. For example, early progress towards sustainability in the mining industry highlights how individuals in their emergent communities of commitment were often at the heart of driving change (Franks 2015). However, the supply chains of critical minerals may mean that the values held by distant consumers are also mobilizers of change (Liu et al. 2022). Similarly, the actions of mining companies are highly influenced by the values of investors and shareholders (Lokuwaduge and Heenetigala 2017; Rathobei et al. 2024). A multi-actor approach would entail engaging with both endogenous change agents and with powerful yet geographically distant consumers and shareholders to reorient societal and industry discourses towards sustainability and justice (Scoones et al. 2020). Engagement should be informed by contextual understanding of how actors (and their interactions) shape agency and behaviour for systems-wide change (Avelino and Wittmayer 2016). Agency emerges from the intersection of the intentional actions of many actors, contributing to a networked and integrated understanding of how change happens (Grillitsch et al. 2022; Grillitsch and Sotarauta 2020).

Figure 3 describes examples of actions that could contribute to activating values-centred leverage points, highlighting the different roles of actors within landscapes, jurisdictions, and in global forums. All actions will require a multi-actor approach, with key actors identified in bold. The examples are not prescriptive, but illustrative of the change mechanisms at different scales. In practice, the identification of actions would be preluded with a deep understanding of historical and current context, and how justice is conceived within that context (Wijsman and Berbés-Blázquez 2022). Research partnerships with IPLCs undergoing critical mineral development could help to improve understanding of the relative power of different actors in bringing about coalitions of change, and the mechanisms that allow for mobilization of values within emerging critical mineral governance systems.

Values-centred leverage points	In landscapes	Jurisdictions (sub-national and national)	Global
Shifting societal norms and goals to support sustainability aligned values across sectors	**All actors** can showcase and celebrate partnerships and successful mining projects that prioritize inclusion of diverse values	**All government sectors** establish and uphold internal principles of justice and recognition of diverse value. **Society** can advocate for justice, educate **decision-makers** to learn from and address cases of injustice	**Multi-national companies, multi-lateral organizations, inter-governmental bodies, finance institutions** can set and refine agendas that encourage adoption of principles and norms
Reform policies and stimulate institutional change	**Researcher** can work with **multi-actor partnerships** to document and communicate jurisdictional constraints on values-centered approaches, create local guidelines and policies	**Governments** and **regulatory bodies** can embed FPIC into institutions and establish requirements for incorporating IPLC knowledge and values in approval processes. **NGOs** can strengthen the voice of **civil society** movements	**NGOs, consumers**, and **companies in supply chains** can advocate for, and increase awareness of IPLC rights and recognition of values, including monitoring and accountability
Embedding values in decision-making	**Companies, local governments, NGOs, IPLCs** can co-design decision-making processes and platforms that encourage early engagement in line with community protocols	**Governments** can regulate or incentivise inclusive valuation practices in mining exploration, development, and closure (i.e., critical mineral funding or permit requirements). **NGOs** can hold them accountable and ensure ongoing transparency	**NGOs, researchers, and networks** can increase awareness of FPIC and Indigenous-led impact assessment through global forums, publications, convening dialogues
Recognise diverse values through undertaking relevant and robust valuation	**Companies, IPLCs, NGOs,** and **local governments** can co-develop capabilities for locally-led inclusive valuation (i.e., cultural and FPIC capabilities, articulation and mapping of diverse values, scenarios and trade-offs)	**Governments** and **NGOs** can provide funding, capacity-building, and resources to enable locally-led valuation prior to mining exploration or other land-use, and facilitate dialogue on value tensions	**Researchers, professional networks**, and **IPLC representative bodies** can exchange knowledge on valuation, including guidelines, lessons, and enabling environments

Fig. 3 Examples of actions that illustrate how actors and change mechanisms could contribute to activating values-centred leverage points within mining landscapes, national and sub-national jurisdictions, and in global forums. Source: Authors

Critical considerations for values-centred approaches in critical mineral expansion: power, knowledge, and capabilities

Values-centred approaches invite a new way of considering sustainability and justice in an industry where engaging in value plurality and concepts of justice is still nascent (Hodge et al. 2022). Enabling values-centred approaches in critical mineral development will necessitate direct engagement with these power structures, and contributing to capabilities and knowledge that counter dominant and harmful values.

Across society, power relations determine which and whose values are recognised, how benefits are distributed, and how equitable decision-making procedures are (Avelino et al. 2024; IPBES 2022b). Values themselves can also shape power in the ways that societal values often determine status, trust, and loyalty. Many theories of power exist (Avelino 2021; Morrison et al. 2019). In the IPBES VA, power is understood as 'the capacity of actors to mobilize agency, resources, and discourses to achieve their goals' (Arias-Arévalo et al. 2023). Actors exercise different types of power to achieve their goals, such as discursive power, through language, discourses, and epistemological privileges, and structural power—acting on positions in societal structures to design, interpret, and implement rules (ibid). Values-centred approaches attempt to shift power by increasing recognition of diverse values in narratives and issue-framing (discursive), and influencing decision-making processes (structural). For example, by framing impact through the lens of Indigenous values, knowledge, and methodologies, IIAs shift the centre of decision-making away from proponents and towards communities (O'Faircheallaigh and MacDonald 2022). Without structural power legislated in the form of FPIC, Indigenous Peoples lack the resources and legitimacy to exercise their cultural authority (Carter et al. 2022). Making these types of power seen, and the implications of these asymmetries known, is a critical precondition to activating the appropriate leverage points to achieve systems transformations. Reaching this pre-condition will require improving our respective capabilities to do so.

Capability is defined as the combined ability and agency to exercise freedoms and pursue what is valued (Sen 1993). When structural injustices inhibit these freedoms, capability gaps, including knowledge-based capability gaps, are created and sustained. For IPLCs, these capability gaps might include mobilizing opposition to mining, participation in monitoring impacts, adapting to impacts of mining, and building local governance (Brunet and Longboat 2023). In addition to these gaps, attempts to initiate plural valuation may be hampered by lack of institutional capabilities, such as capabilities to carry-out plural valuation, mobilize and liberate suppressed values, and negotiate and facilitate value-tensions (Horcea-Milcu et al. 2023; Kelemen et al. 2022). These capability and knowledge gaps contribute to a vicious circle, where the lack of recognition and integration of diverse knowledge systems contributes to the visibility and prioritization of dominant instrumental values (Turnhout 2024).

If mining of critical minerals is to contribute to a just transition, initiatives to support the sector should nurture the emergence of these capabilities. This requires targeted actions at multiple levels, aimed at both incorporating values into mining decisions and addressing structural injustice. For example, government or investor requirements for Indigenous knowledge in impact assessments can provide a lever, but alliances between communities and trusted non-government actors may be necessary to develop local technical capabilities for IIAs and recognition of Indigenous knowledge (O'Faircheallaigh 2004; Walsh et al. 2017). In addition, professionals carrying out EIAs with concentrated expertise in technical science need guidance to improve understanding and ability to deal with relational aspects of mining projects and their impacts (Arnold et al. 2023). While these capabilities can go some way to addressing power asymmetries, they must be accompanied by structural change. This would bring legitimacy and advance the justice embodied in the "common yet differentiated responsibilities and respective capabilities" principle enshrined in the foundational UNFCCC treaty (Voigt and Ferreira 2016). Governments can work through the critical mineral sector to respond to scalar effects of mining, such as redistributing mining revenues to benefit impoverished mine-affected communities, and removing barriers to economic self-determination (Gamu et al. 2015).

Pragmatic pathways and transformative change

In current mining systems, there are limits to value plurality. Some values are incommensurable and cannot be made compatible or compensated for (IPBES 2022b). Values-centred approaches can help to make these value-tensions explicit, drawing from principles of recognition and procedural justice to navigate trade-offs. When deliberative approaches are not conducive, value articulation through resistance, disruption, and social movements may be necessary to influence decision-making (Özkaynak et al. 2021; Zachrisson and Beland Lindahl 2019). Trade-offs also exist in valuation processes—more precise approaches that demand technical capability and resources may be forfeited in favour of opportunistic or culturally appropriate approaches (Horcea-Milcu et al. 2023). Indigenous-led valuation may help to

reconfigure power asymmetries, but may not be received as legitimate in policy-making where Western thinking prevails (Urzedo and Robinson 2023). The current context of critical mineral development calls for a pragmatism in navigating these trade-offs and tensions, balancing short-term priorities with long-term goals. Companies exploring critical minerals are likely to have limited capacity and resources for IPLC engagement due to their small size and low operating budgets (Castillo et al. 2023). For IPLCs with values in competition with mining, the first concern is likely to be capabilities for political and legal negotiation, rather than plural valuation (Jacobs et al. 2023). Change coalitions will need to be anticipatory and adaptive, working directly with mining proponents and communities to expand place-based capabilities, while shaping value systems to expand future possibilities (Ahvenharju et al. 2018; Keys et al. 2024).

Pragmatic pathways to enable incremental change should not limit possibilities for values-centred approaches in mineral resource governance. Transformative change does not unfold neatly, and it is important to allow for plural, messy processes of change to emerge (Stirling et al. 2023). Values assessments can be part of exploring scenarios that reveal what collective values are associated with just and desirable futures, influencing which direction values-centred approaches could take (Harmáčková et al. 2023). Scenarios might include how intrinsic and relational values are likely to evolve in the future, and how risks and benefits are distributed across different mining stages. In this paper, we have focused on countering challenges in mineral resources governance arising from a proponent-led model of industrial mining and the marginalization of values held by IPLCs. Broader imaginations of values-centred approaches could also entail new ways of organizing the mining sector. For example, mining cooperatives are emerging as an innovative business model for integrating plural values, improving information sharing and balancing power dynamics (Alves et al. 2019). Shared equity arrangements and Indigenous (co-)ownership of mines offer ways for communities to exercise greater control, if undertaken with sound understanding of risks involved (Kung et al. 2022). These innovations represent a shift away from the prevailing model of benefit sharing agreements, which may lock communities out of strategic decisions (Söderholm and Svahn 2015; Wilson 2019). Transforming mineral resource governance to better enable these models requires regulators, policy-makers, and industry leaders to be willing to explore and imagine pluralistic futures beyond business as usual (Muiderman et al. 2020). Practical shifts in one sphere of society can spread towards deeper cultural changes for systems-wide change (O'Brien and Sygna 2013). Critical minerals provide fertile ground for cultivating transformative futures—beginning with recognition that change is not only feasible, but necessary (Cloete et al. 2023).

Conclusion

Escalating demands to expedite the global supply of critical minerals pose perilous or transformational futures for communities and their environments. Government interest in supporting the critical mineral sector to meet security and clean energy needs, combined with growing ESG demands, provides an opportunity for innovation in mineral resource governance. Yet without explicit attention and support for incorporation of diverse and marginalized values, IPLCs will continue to bear the costs of mining with minimal benefits. Addressing structural injustices requires reframing dominant value systems that guide the policies and practices that shape how decisions are made in the mining sector. Values-centred approaches offer a novel framing for centering values and advancing justice in mining decision-making systems. By incorporating diverse and marginalised values and making justice dimensions explicit, values-centred approaches deliberately acknowledge politics and power and promote inclusive methodologies to co-create pathways for transformative change (Arias-Arévalo et al. 2023; Avelino et al. 2024; Colloff et al. 2021). Navigating these pathways will require mobilizing capabilities and shifting power at multiple levels and with multiple actors (Sturman et al. 2022).

The IPBES VA provides a germane set of concepts, evidence, and guidance for strengthening justice and sustainability through values-centred approaches in mining systems. There is work to be done to build from and integrate these concepts into discourses, practices, and worldviews within mineral resource governance, and create an evidence base for transformative governance. Current conceptualizations of values-centred approaches are largely limited to values towards nature, and do not go far enough in articulating the complexity of systems-wide change. Experimentation with methodologies for plural valuation are also limited in the mining context, contributing to a need for critical discussion on how to advance learning and practice in the critical mineral sector. We attempt to open a dialogue with this paper: what does it mean to develop and apply values-centred approaches in political economies shaped by prospective green transitions and past mining legacies? Taking a values-centred approaches to mining is demanding—it requires changes in valuation (what is valued, how, and by whom), in institutions regulating the mining life cycle, and in social and political contexts in which valuation and regulation are embedded. We have identified discrete examples which may constitute leverage points for creating change agency within multi-actor coalitions. We hope to inspire future empirical research on transforming and expanding values in critical mineral development and systemic enablers of justice in decision-making systems.

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