

SAMCA: a new tool to assess and improve performance in addressing the social aspects of mine closure

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Abstract

In the next decade, 1,000 mines around the world are expected to close. While the environmental dimensions of closure (and their accompanying governance instruments) are well established, the same cannot be said for the social aspects of closure. If not improved, the long-term sustainability of resource-dependent communities could be at risk, affecting the lives and livelihoods of millions of people. Comprehensive yet practical governance instruments are needed to support closure planning practice.

Drawing on the literature, international standards and guidance materials, we developed a preliminary framework social aspects of mine closure assessment (SAMCA) to enable mining companies to assess and improve their performance in addressing the social aspects of mine closure across 3 dimensions: mine closure governance, engagement on mine closure and post-mining transition. SAMCA was subsequently reviewed by 9 experts in mine closure (including mined land rehabilitation, transitions and/or the social dimensions of mining) using a 3-round Delphi process characterised by anonymity and controlled feedback. It underwent a further round of beta testing when it was used to assess the performance of an operational Australian mine in the conceptual closure planning stage, using qualitative data obtained from document review, interviews and site visits. SAMCA has 66 indicators and is aligned with closure planning stage gates (i.e. conceptual closure planning, pre-feasibility closure planning and feasibility closure planning). Achievement is measured across the 3 dimensions with a method previously used to assess closure preparedness.

This paper presents an overview of SAMCA and the findings from the assessment of the mine's performance. While we found some fundamental processes for managing the social aspects of mine closure firmly in place and examples of excellence, improvement was needed in integrating social data and community perspectives into the mine closure plan and closure planning into the mine's business plan.

Keywords: social aspects of mine closure, mine closure planning, governance, engagement, post-mining transition, assessment, mine closure planning stage gates

1 Introduction

In the next decade, 1,000 mines around the world are forecast to close (Everingham et al. 2022), with almost one quarter of them set to occur in Australia (CSIRO 2023). Despite the magnitude of expected change, questions remain about the readiness of governments, mining companies and host communities to manage closure impacts. The Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF), for example, reports that many governments do not have the policies, regulations, enforcement or capacity to manage, plan and regulate closure (Stevens & Brock 2021). State governments in Australia have sought to address these deficiencies through a series of regulatory reforms that have focused on environmental governance, such as progressive rehabilitation and improved financial assurance arrangements for mined land rehabilitation (Hamblin et al. 2022; Purtill et al. 2022; Cooper 2019).

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Few jurisdictions, however, have strong regulatory frameworks that address the social aspects of mine closure. These aspects refer to the socio-economic, political, cultural and institutional impacts that arise at the end of the mining life cycle; the planning and management processes that are required to mitigate these impacts; and an overarching emphasis on the post-mining future (Worden et al. 2022). Where social aspects are referenced in legislation, regulation and policy, they primarily appear as optional guidance and tend to focus on community engagement rather than social outcomes. In their review of 3 jurisdictions in Australia, Vivoda et al. (2019) note that regulation is heavily weighted towards project approval and permitting, and that regulators do not incentivise companies to prioritise local communities in their closure and transition planning. Holcombe et al. (2024) concur, explaining that in many jurisdictions mine closure regulations continue to overlook the need for socio-economic plans and clear objectives for social outcomes. They further contend that this deficiency hinders management of the ‘often devastating socio-economic effects’ of mine closure and the integration of community objectives into closure planning (Holcombe et al. 2024).

Normative frameworks, such as international standards and guidance materials, have emerged to fill these gaps in the mine closure governance system. The Integrated Mine Closure Good Practice Guide (2025) produced by the International Council on Mining and Metals (ICMM), for example, emphasises the importance of applying socially and culturally appropriate planning methods, and the integral role that communities should play in the development of closure goals, visions, success criteria and post-mining land uses (Holcombe et al. 2024). There is also a growing recognition of the need to address the social aspects of mine closure in the scholarly literature (see Section 2 for an overview of this literature). Digby (2012) acknowledges that addressing the social aspects of closure is difficult given the importance of incorporating human perspectives, hopes and expectations, as well as addressing skills, jobs, local benefits and sustained quality of life. She contends that ensuring community members are equipped for life after mining remains a major challenge. Adey & Whitbread-Aburatat (2013) agree, noting that good practice requires strengthening of local institutions and building local capability to enhance post-closure resilience, and, if appropriate, stimulating local economic diversification. O’Faircheallaigh & Lawrence (2019) highlight the absence of Indigenous closure perspectives in the literature, calling for greater systematic attention to the environmental, cultural, social and environmental significance of mine closure for traditional owners.

As Holcombe et al. (2024) argue, in the absence of suitable regulation and policy, management of the social dimensions of closure is often limited to ad hoc negotiations between companies, governments and mining-affected communities. Comprehensive yet practical governance instruments are needed to support closure planning practice at the subnational level and to facilitate local and Indigenous community participation in planning processes.

This paper contributes to closure governance literature and practice by introducing a new governance instrument – the social aspects of mine closure assessment (SAMCA) – and presenting the findings from its application in an Australian context. SAMCA was developed to enable mining companies to assess and improve their performance in addressing social closure dimensions. To test the instrument, an assessment was undertaken at an operational mine that was in the conceptual stage of closure planning.

The paper has 5 sections: an introduction, literature review, SAMCA overview, the application of SAMCA to a closure planning case and a conclusion.

2 Literature review

Prior to Bainton & Holcombe’s (2018) critical review, much of the scholarly and grey mine closure literature was focused on the physical and environmental dimensions while comparatively little attention had been given to the social domain. This section provides a scan of peer-reviewed publications in the scientific abstract and citation database, Scopus. Using the Boolean terms ‘mine-closure’ AND ‘social’, the scan

identified 179 articles[†] published since 1992 that explore the social aspects of mine closure. Prior to 2018 only a few articles were published each year on this topic. Scholarly interest has remained steady since then. Most articles (118) are case studies, while reviews (24) and presentation of analytical frameworks (13) are the next most common types of articles. Only 9 articles provide tools that closure practitioners can use to advance practice. The tools relate to integrated closure planning, closure risks, socio-economic impacts, post-mining transition, post-mining land use, repurposing and environmental impacts (with social implications). None were developed uniquely and comprehensively for the measurement of the social aspects of mine closure.

Scholarly and grey literature were critical to the development of SAMCA, particularly the conceptualisation of the framework structure across 3 dimensions: (1) mine closure governance, (2) engagement on mine closure and (3) post-mining transition. The following review is structured in line with these dimensions.

2.1 Mine closure governance

Mine closure governance has attracted significant scholarly interest, with the themes of regulatory inadequacies, social impacts, social disruption and participatory approaches featuring prominently.

Scholars identify significant regulatory shortcomings in addressing the social dimensions of mine closure across multiple jurisdictions. In Australia, Vivoda et al. (2019) observe that mine closure regulation remains predominantly focused on the physical and environmental aspects of mining, with limited consideration of social aspects. Similarly, in her analysis of mine closure practice and its intersection with Indigenous cumulative impact assessment (CIA), Holcombe (2022) argues that state and territory regulatory frameworks are still nascent, noting the absence of published methodologies for Indigenous CIA. At the state level, Everingham et al. (2018) find little evidence in Queensland, Australia, that stakeholder perspectives are meaningfully incorporated into closure planning processes, despite formal guidelines mandating consultation on the beneficial re-use of mined land. In Western Australia, Finucane-Woodman and Finucane (2019) point to a lack of publicly available guidance on tenement relinquishment, with relinquishment processes stalled by the regulator's focus on residual environmental, social and other risks.

In her analysis of mine closure regulation in South America, Gregory (2021) demonstrates that weak oversight of closure practices has resulted in enduring social, economic and environmental challenges across the Andean region. She further argues that narrow regulatory conceptions of mine closure have marginalised local consultation and participation, limiting community agency in post-closure transitions. Gregory therefore calls for regulatory institutions to play a more active role in equitably distributing benefits, services and opportunities after closure. Similarly, in the European context, Pactwa et al. (2021) observe that ambiguous access guidelines for the European Union's Just Transition Fund, combined with inadequate circular economy regulation in Poland, are constraining the transformation of post-industrial landscapes and negatively affecting local quality of life. They conceptualise post-industrial infrastructure as a valuable resource and emphasise the need for sustained social and environmental assessments to realise its potential in post-industrial redevelopment.

The literature is replete with articles that describe the adverse social impacts of mine closure. Impacts include: loss of jobs, income, social services, small businesses, and sport and cultural facilities; poor health and wellbeing; and outmigration resulting in population decline, loss of regional skills, and empty shops and houses (Nel & Mabale 2024; Esau et al. 2023; Pactwa et al. 2021; Warhurst et al. 1999). The scale of closure impacts in South Africa is highlighted by Esau et al. (2023), who explain that 6.5 million people are dependent on mining for jobs and local business. Their livelihoods are under threat from a series of forthcoming mine closures. Kovacs et al. (2021) draw attention to the employment dynamics in Romania's Jiu Valley, where unemployment among middle-aged residents, who have not benefited from vocational retraining, is increasing. Coupled with the outmigration of young people looking for work, the region is facing widespread

[†] After cleaning the dataset – i.e. removing duplicates and articles that do not focus on the social aspects of mine closure.

social ageing with subsequent implications for economic growth. In their examination of the social impacts of ‘boom-bust’ industrial cycles on the Québec-Labrador mining region of Canada, Rodon et al. (2022) find that continued reliance on mining keeps the remote communities tied to global trends in iron ore and steel production, although impacts are experienced differently across the region due to intraregional differences in local demography, economy and settlement.

Linked to the theme of social impacts is a substantial body of research undertaken by South African scholars on social disruption. Long associated with boom town research, social disruption theory has been increasingly applied to mine closure contexts where populations and economies are in decline (Marais 2025; Nel et al. 2023; Nel & Mabale 2024; Marais et al. 2021; Ntema et al. 2017). Social disruption relates to changes in normal social life and structures within a community, and can result in a breakdown of social cohesion, loss of cultural identity and trust, and rising crime (Marais et al. 2021). A focus of this work is the detrimental outcomes of the South African government housing policy on social disruption in mining communities. The policy encourages home ownership and increasing place attachment to homes in cities with limited long-term economic prospects (Marais et al. 2021). This, Ntema et al. (2017) contend, locks households into locations and inhibits their mobility to more economically prospective places. Marais et al. (2024) call for planners and policymakers to proactively plan for decline and to take specific planning contexts into account when considering the merits of open towns over mining towns.

Recent scholarship emphasises participation as central to socially legitimate and sustainable mine rehabilitation, closure and post-mining transitions. Participatory approaches enable the integration of community knowledge, values and ecosystem service priorities into technical planning, moving beyond purely expert-driven assessments. Methods used to facilitate participation include public participation geographic information systems (Kazłowska-Woszczycka & Pactwa 2024) and social impact assessment (Joyce et al. 2018). Svobodova et al. (2026) characterise effective participation as early, inclusive and sustained, requiring deliberate design that clarifies who participates in what decisions, how engagement occurs and when it takes place. They assert that closure planning and economic diversification require transparent justice-based governance. In their paper on a quantitative risk assessment of remediating the Giant gold mine in Canada, Christoffersen et al. (2019) develop a fit-for-purpose process to support the participation of 11 stakeholder groups in the assessment process, including 2 Indigenous groups (Yellowknives Dene First Nation and North Slave Métis Alliance). The assessment team used a number of innovative tools to allow workshop participants to meaningfully participate, such as the consequence criteria circle, probability poster, risk tolerance matrix and plain language report. Participant feedback confirmed the utility of these tools for enhancing their participation in the assessment.

2.2 Engagement on mine closure

Community engagement is increasingly recognised as a critical determinant of successful and sustainable mine closure, particularly in mitigating social and economic impacts and fostering long-term community resilience. Tarekegne et al. (2022) and Joiner & Brereton (2024) highlight that engagement processes which are meaningful, place-based and responsive to local priorities are essential for supporting equitable and just transitions in mining regions. Case studies demonstrate that involving communities in closure planning and implementation can enhance outcomes by building shared understanding, trust and legitimacy, while also supporting education, alternative livelihoods and regional socio-economic development. Cunha et al. (2025), for example, discuss community engagement for Kinross Brazil Mining’s progressive mine closure. Edwards & Maritz (2019) explain how co-production strengthens engagement by enabling communities to shape project design and closure strategies, fostering a sense of ownership, innovation and increased satisfaction among stakeholders. However, scholars also examine persistent shortcomings in engagement practice, particularly in contexts involving Indigenous lands. Monosky & Keeling (2021) find that, in these contexts, engagement can be superficial, inconsistently applied or marginalised in favour of technical closure considerations. Lawrence & O’Fairchellaigh (2022) assert that in some cases, such as the Ranger uranium mine in Australia’s Northern Territory, social impacts are actively obscured through institutional practices of ignorance, reinforcing social and environmental injustices, and undermining Indigenous rights and

knowledge systems. Collectively, these studies underscore the necessity of embedding robust, inclusive engagement at the core of mine closure planning.

2.3 Post-mining transition

Social transition planning in mining contexts has historically been operator-led and focused on closure compliance and impact mitigation, yet mounting evidence highlights the limitations of this approach in delivering positive post-mining outcomes. Wilson-Clark et al. (2024) argue for a shift towards collaborative, multi-stakeholder transition planning that distributes responsibility among operators, governments and locally embedded institutions, with particular prioritisation of Indigenous peoples as landowners, governance actors and custodians of culture. In their case study of the socio-economic impact assessment for the Gove bauxite mine (Northern Territory, Australia) closure, Wilson-Clark et al. (2024) demonstrate how data-driven socio-economic studies, co-governed and critically interrogated by traditional owners and local organisations, can support shared visioning and adaptive planning, albeit requiring operators to relinquish conventional control. However, O’Keefe’s (2024) broader comparative analysis finds no clear example of communities left better off through planned pre-closure mining activities. Studies from India, southern Africa and Zimbabwe show that when closures occur without land security, transferable skills or sustained institutional support, communities experience livelihood precarity, downward mobility and contested notions of ‘just transition’ (Oskarsson et al. 2025; Mafuku & Matamanda 2025). While targeted legacy strategies – such as eco-tourism transitions at Tshikondeni coal mine (South Africa) – suggest potential pathways, their success hinges on early integration of social transition objectives, institutional continuity and genuine power-sharing beyond mine closure (Nxumalo & Field 2025).

2.4 Performance

Recent scholarship highlights a growing convergence around the need for systematic, maturity-based approaches to mine closure that integrate technical, regulatory and social dimensions while also exposing persistent gaps in practice. Comparative assessments of operational mines in Latin America, for example, demonstrate that alignment with ICMM guidance remains uneven. Vivas & Oyarzo (2025) report that strengths are typically found in technical closure measures and cost estimation, while weaknesses persist in social transition, community participation and long-term land-use definition; underscoring the challenge of achieving closure that is both technically effective and socially responsible. The Brazilian experience illustrates how nationally endorsed assessment frameworks – such as the Brazilian Mining Industry’s (IBRAM’s) maturity-level indicators and sustainability criteria – can institutionalise consistent governance, transparency and decision-making across the mine life cycle when embedded in regulatory processes (Ursini Muniz et al. 2025). When regulatory processes are inadequate or absent, tracking a mining company’s performance in addressing the social aspects of mine closure is challenging.

2.5 Planning timeline

None of the scholarly literature in this review incorporates timelines for undertaking social activities across the closure planning life cycle. ICMM’s (2025a) Integrated Mine Closure Good Practice Guide includes a social transition tool with a checklist of activities that should assist planning for social transition from the early stages of design and permitting through to closure. Note that this guide was not included in the review as it is considered grey literature.

Our literature review confirms the utility of incorporating indicators for mine closure governance, engagement on mine closure and post-mining transition in the SAMCA framework. The review highlights the dearth of guidance on how to assess a mine’s performance in addressing the social aspects of mine closure and what social activities should be undertaken at which stage of the closure planning life cycle.

3 SAMCA overview[‡]

SAMCA was developed to enable mining companies to assess and improve their performance in addressing the social aspects of mine closure.[§] It was designed to encourage excellence in addressing these closure aspects and the indicators were developed in line with leading practice.

Drawing on the literature, international standards and guidance materials, we developed a preliminary version of SAMCA, which was subsequently reviewed by 9 experts in mine closure (including mined land rehabilitation, transitions and/or the social dimensions of mining) using a 3-round Delphi process characterised by anonymity and controlled feedback. Delphi is a structured method of achieving consensus among a panel of experts through multiple rounds of anonymous questionnaires. Controlled feedback is provided between rounds to refine opinions and converge toward agreement. A further round of beta testing was undertaken to assess the performance of an operational Australian mine in the conceptual closure planning stage.

SAMCA has 66 indicators organised across 3 dimensions – mine closure governance, engagement on mine closure and post-mining transition – and 22 subdimensions. Each indicator is rated using a 6-point scale ranging from very low achievement (0–20%) to excellent achievement (100%). This scale was adapted from a closure preparedness assessment developed by de Barros Galo et al. (2022). A weighted average is then calculated for each of the dimensions, with a final rating provided for each dimension: either low, moderate or high. This rating enables mining companies to benchmark their performance. Contextual feedback is provided to support scoring results.

During the Delphi process, Worden & Harris recognised that the SAMCA framework would be enhanced by the addition of temporal dimensions. After further interviews with subject matter experts, conceptualisation and testing, the SAMCA indicators were categorised according to their optimal time for implementation in terms of closure planning stage gates (i.e. conceptual closure planning, pre-feasibility closure planning and feasibility closure planning).

3.1 SAMCA dimensions

This section defines the 3 SAMCA dimensions: mine closure governance, engagement on mine closure and post-mining transition.

3.1.1 *Mine closure governance*

Mine closure governance is the system of authoritative institutions, instruments, principles and practices by which mining companies, regulators, rightsholders and stakeholders make decisions that enhance the positive outcomes from closure and avoid or mitigate the adverse impacts (adapted from ICMM 2025a; Tennberg et al. 2022; Ruggie 2014). In the SAMCA framework, mine closure governance comprises instruments and practices. Practices are the activities undertaken to address the social aspects of mine closure while instruments are the mechanisms used to enable and support the governance of closure and post-mining transition.

3.1.2 *Engagement on mine closure*

Engagement is the process of building ongoing relationships and trust with rightsholders, host communities and other stakeholders which starts early in the mining life cycle and extends throughout the mine life. Not all engagement is meaningful; that is, ongoing, two-way, conducted in good faith and responsive (Kujala et al. 2022; OECD 2017; Wilson et al. 2016; IFC 2007). It can range from people being ‘informed’ and ‘consulted

[‡] Note that this conference paper does not provide a comprehensive description of SAMCA and all its indicators and subdimensions as that is the subject of a forthcoming publication. Appendix (at the end of the paper) lists the dimensions and subdimensions.

[§] SAMCA could also be used by mining stakeholders and rightsholders.

with' to collaborative co-design and their involvement in final decision-making. Mining sector leading practice is to conduct meaningful engagement. In the context of mine closure, engagement practices are the activities a company undertakes to engage with rightsholders and stakeholders on closure opportunities and risks, consider their perspectives and share its planning progress.

Rightsholders are individuals or social groups who have legal or customary rights in relation to land, water and other natural resources (Borrini-Feyerabend & Hill 2015). The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) defines Indigenous rights as “the right to the lands, territories and resources which they have traditionally owned, occupied or otherwise used or acquired”; and “to own, use, develop and control the lands, territories and resources that they possess by reason of traditional ownership or other traditional occupation or use, as well as those which they have otherwise acquired” (United Nations 2007).

According to Freeman (2010 p. 46), a stakeholder is: “any group or individual who can affect or is affected by the achievement of the organisation’s objectives”. In mining, stakeholder groups include the company’s leadership team, managers, employees and shareholders; local mining companies; proponents of other proximate industrial activities (e.g. hydro, forestry, tourism); local businesses; residents; community groups and organisations; local, state and federal governments (including regulators); and non-government organisations. Host communities are the communities directly impacted by mining (Cole & Broadhurst 2020) and which host mine employees. For mines that have fly-in, fly-out (FIFO) or drive-in, drive-out (DIDO) workforces, companies also need to engage with source communities where FIFO/DIDO workers live when they are not on roster.

3.1.3 Post-mining transition

A community or region’s ability to transition to a post-mining future is dynamic and multidimensional. Influencing factors include: economic diversity and the degree of dependence on mining, human and social capital (e.g. education, skills level and community cohesion); the existence of robust governance procedures and processes; the extent of landscape modification, remoteness and population density; and the range of regional infrastructure (ICMM 2025b; Everingham et al. 2022; Panetti et al. 2018; Boschma 2017, 2015). Successful transitions depend on the ability to harness or adapt local assets and to cultivate new competencies that enable a region to survive and prosper after mining activities cease (Everingham et al. 2022). Many mining regions continue to lag socially and economically decades after mining has ceased (Haggerty et al. 2014) while others demonstrate greater resilience to closure and transition more smoothly and successfully. Understanding the contextual factors that enable or constrain a community’s or region’s ability to transition to a post-mining future is critical for closure planning and decision-making (Everingham et al. 2022), noting that the future is likely to be different from when mining occurred. While mining companies may not lead economic diversification activities, they have a role to play in supporting early planning and the commission of relevant studies.

4 Applying SAMCA to a closure planning case: key findings

In 2025 SAMCA was used to assess the performance of an operational Australian mine in addressing the social aspects of mine closure using qualitative data obtained from document review, interviews and site visits. The mine was in the conceptual closure stage at the time of the assessment, although some pre-feasibility studies had been undertaken. In keeping with the SAMCA requirements for the conceptual closure planning stage, the mine was assessed against 54 of the 66 indicators (18/22 mine closure governance indicators, 18/30 engagement on mine closure indicators and 8/14 post-mining transition indicators).

The mine’s performance in addressing the social aspects of mine closure was rated moderate in each of the 3 dimensions (50–75%). This rating indicates that some instruments and/or practices are applied adequately and others are in progress. There are, however, instruments and/or practices that are not applied or should be better developed.

Table 1 presents the overall assessment findings.

Table 1 Assessment findings

	Mine closure governance	Engagement on mine closure	Post-mining transition
Rating	Moderate	Moderate	Moderate
Score	0.50	0.52	0.63
Comment	Some instruments and/or practices are applied adequately and others are in progress. There are, however, instruments and/or practices that are not applied or should be better developed.		

Given that SAMCA was designed to encourage excellence in addressing the social aspects of mine closure, the mine's rating of moderate across the 3 dimensions indicates good performance with opportunities for improvement. The research team recommends that a more strategic, integrated approach is taken to mine closure planning to support the existing good tactical but siloed approach.

The research team found that some fundamental processes for managing the social aspects of mine closure are firmly in place, such as stakeholder mapping and management, the use of the grievance mechanism to manage closure-related grievances and the multistakeholder group (MSG).

Examples of excellence, particularly at the conceptual closure planning phase, include the community team's capability-building work with members of the MSG; for example, starting to shift focus from dependence on the mine to agency and the development of business literacy skills. Other examples of excellence are the community visioning work, commissioning of a social transition management plan, the 5-yearly updating of the social baseline and the completion of a closure social impact assessment, enabling a pathway forward for post-mining transition.

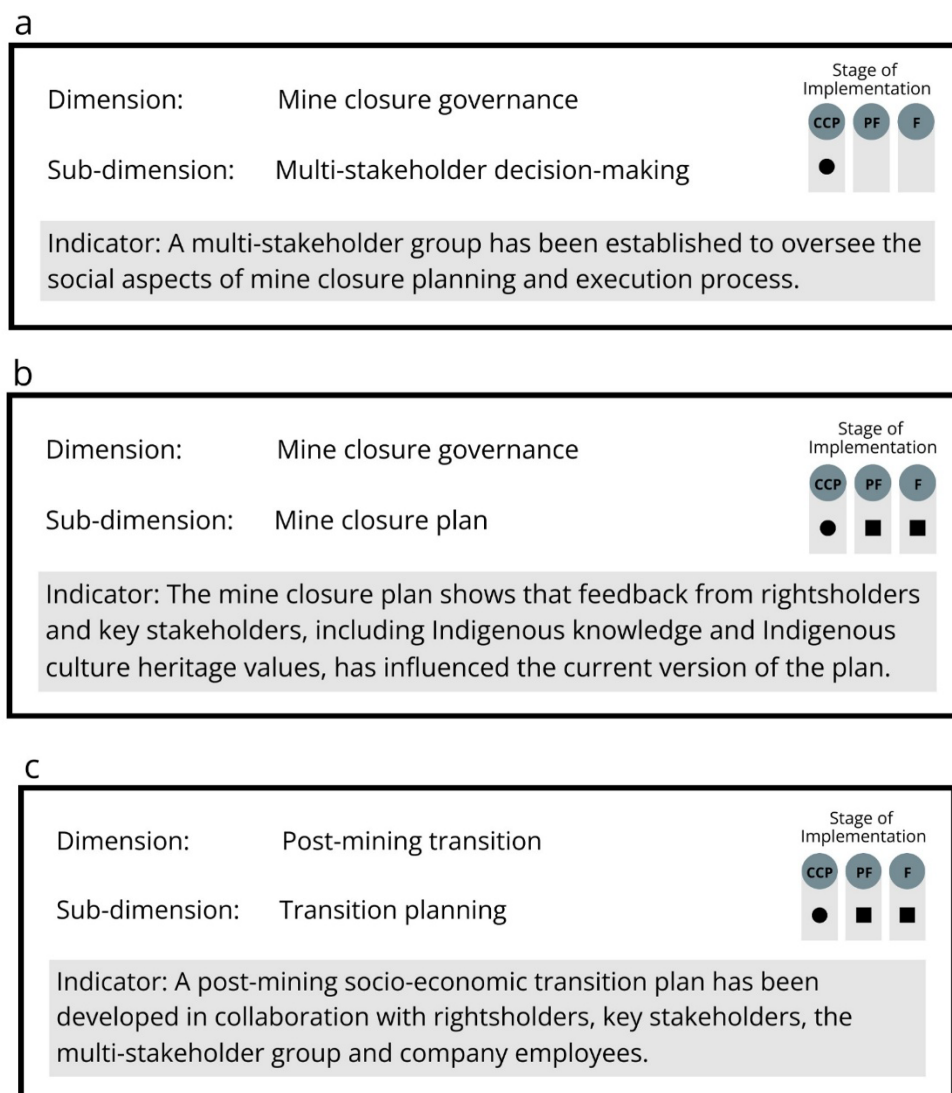
Areas of improvement relate to data integration, including poor integration of social data and community perspectives into the mine closure plan and closure key performance indicators (KPIs) into the business plan. While the mine collects significant social data as acknowledged in the preceding paragraph, the data is not actively used to inform closure planning. Engagement with the community around post-mining land use is another area for improvement.

A factor that appeared to influence the nature of the interactions between the mine closure teams and the local community was repeated mine-life extensions. Many internal and external factors (e.g. availability of resources/reserves, commodity prices and corporate strategies) make it difficult for mines to predict the closure date with any level of certainty. Managing this uncertainty can make community engagement challenging as Keenan (2020) found in her interviews with social performance practitioners. Practitioners reported that perpetual closures led to cynicism and disbelief among community members. In these circumstances, closure preparations may be inadequate, increasing vulnerability to sudden closure and amplifying social and economic disruption.

In the following sections we expand on the assessment findings by highlighting an observation from our literature review, site visits and assessment process; an example of an opportunity for improvement; and an example of a strength in the company's closure planning practice. An example of a SAMCA indicator used to map company performance in each of the areas (and their fit within the SAMCA hierarchy) is shown in Figure 1. For further context, Table 2 provides information about the benefits and challenges in each of the areas.

Table 2 Benefits and challenges of case study topics

Topic	Benefits	Challenges
Establishing and supporting a multistakeholder group	- Enables collective understanding - Develops more innovative or integrated solutions - Gains support or buy-in from important stakeholders and/or community - Engagement methods co-designed by the multistakeholder group are likely more tailored to local cultural, historical and socio-political contexts	- Forecasting and managing change are difficult - Diverse stakeholder expectations and objectives - Recruiting and maintaining group membership in small communities - Community's dependence on mine - Internal and external capability building
Integrating social data into the closure plan	- Integration of closure strategies and key performance indicators into the mine's business plan - Guides the development of a schedule of activities for addressing the social aspects of mine closure - Guides the assessment and continuous improvement of activities for addressing the social aspects of mine closure - A range of different closure perspectives is captured and used to inform the mine closure plan	- Change in management implications - Demonstrating business value - Bringing together the many people from various units
Social transition plan	- Identifies opportunities for local/regional economic diversification at different scales from small business to sector scale - Identifies collaborators and funding mechanisms for economic diversification initiatives - Assists with the development of an action plan to address risks and prioritise and pursue opportunities - Helps to identify regulatory challenges and plan discussions with the regulator - Guides community capability building	- Community and government complacency from repeated life extensions - Diverse stakeholder interests, expectations and objectives - Internal and external capability building - Actioning the plan in complex social environments



Note. CCP = Conceptual closure planning, PF = Pre-feasibility closure planning, F = Feasibility planning, ● = optimal time to implement, ■ = indicator to be measured at this stage but at a different level than at the time of optimal implementation

Figure 1 Example of social aspects of mine closure assessment (SAMCA) indicators used in case study (a) 4.1, (b) 4.2, and (c) 4.3 topics

4.1 The importance of establishing and supporting a multistakeholder group (an observation)

Global leading practice encourages mines to establish an MSG to oversee the social aspects of mine closure planning and the execution process. MSGs usually comprise mining company representatives, rightsholders and representatives from key stakeholder groups. Collaboration within such groups involves actors of diverse points of view working together to implement collective action and sharing risks, resources and responsibilities (Ayala-Orozco et al. 2018). For these reasons, maintaining an active MSG can be difficult in practice, particularly in cases where communities have remained highly dependent on the mine (lack of agency) and limited numbers of community members are able to participate due to population demographics (i.e. population size, ageing population, outmigration of young people).

The mine has an MSG and aspires for it to be autonomous and able to manage the mine's social investment program. However, this aspiration has yet to come to fruition. The community team is working to overcome a legacy of dependence, and a key focus has been to empower and build capability among MSG members.

4.2 Social data not integrated into mine closure plan (opportunity for improvement)

The mining company commissions specialist consultancies to update its social baseline every 5 years and a closure social impact assessment has been completed. In addition, the mine undertakes regular engagement with the local community and regulators and uses a variety of engagement methods to enhance inclusivity. It tracks engagement outcomes using stakeholder management software. The mine has conducted community workshops for post-mining visioning, and to assess its local assets and constraints to economic diversification. There is little evidence, however, that this social data is used to inform and update the mine closure plan. Furthermore, apart from some ad hoc activities (e.g. consideration of remining a domain and its implications for closure planning and progressive rehabilitation of one of the mine's waste rock dumps), closure planning is primarily undertaken in isolation from operations. This means that there is limited integration of closure strategies and KPIs into the mine's business plan.

4.3 Social transition plan (strength)

Although the mine is at the conceptual closure planning stage, a post-mining socio-economic transition plan has been developed in collaboration with key stakeholders, the MSG and company employees. The community's strengths and constraints have been analysed. In parallel to this work, a significant program of community capability building is underway, including: business management planning; development of a business case for significant capital investment from the social investment fund; and heritage centre management training (curating, archiving, cataloguing, exhibiting and writing policies). Also, building employment opportunities beyond mining through collaboration with a regional support hub is being sought.

5 Conclusion

This paper contributes to closure governance literature and practice by introducing a new governance instrument – the social aspects of mine closure assessment (SAMCA) – and presenting the findings from its application in an Australian context undertaken at an operational mine that was in the conceptual stage of closure planning. We provide a snapshot of this assessment highlighting an observation, an example of an opportunity for improvement and an example of a strength in the company's closure planning practice. While we found some fundamental processes for managing the social aspects of mine closure firmly in place and examples of excellence, improvement was needed in integrating social data and community perspectives into the mine closure plan and closure planning into the mine's business plan.

The authors plan to publish a comprehensive description of SAMCA, its 66 indicators and temporal dimensions (aligned with closure planning stage gates) in a forthcoming journal article. Once published, mining companies and their consultants will be able to apply SAMCA across jurisdictions, mine types and commodities.

Development of comprehensive yet practical governance instruments for guiding and assessing the social aspects of mine closure, like SAMCA, are vital to the long-term sustainability of resource-dependent communities.

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Use of artificial intelligence disclosure statement

In the preparation of this work, the authors used Microsoft Copilot to support the literature review and synthesis. The authors have reviewed the content and edited it where required, and take full responsibility for said content.

Appendix Social aspects of mine closure assessment (SAMCA) dimensions and subdimensions

SAMCA dimension	SAMCA subdimension
Mine closure governance	Policy Standard Mine closure plan Unplanned (contingency) closure plan Grievance mechanism Resourcing Organisational structure Key performance indicators Integration Multistakeholder decision-making
Engagement on mine closure	Resourcing Meaningful engagement Engagement methods Closure perspectives Agreements Monitoring Data transparency
Post-mining transition	Transition planning Economic diversification Socio-economic knowledge base Capability building Monitoring

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