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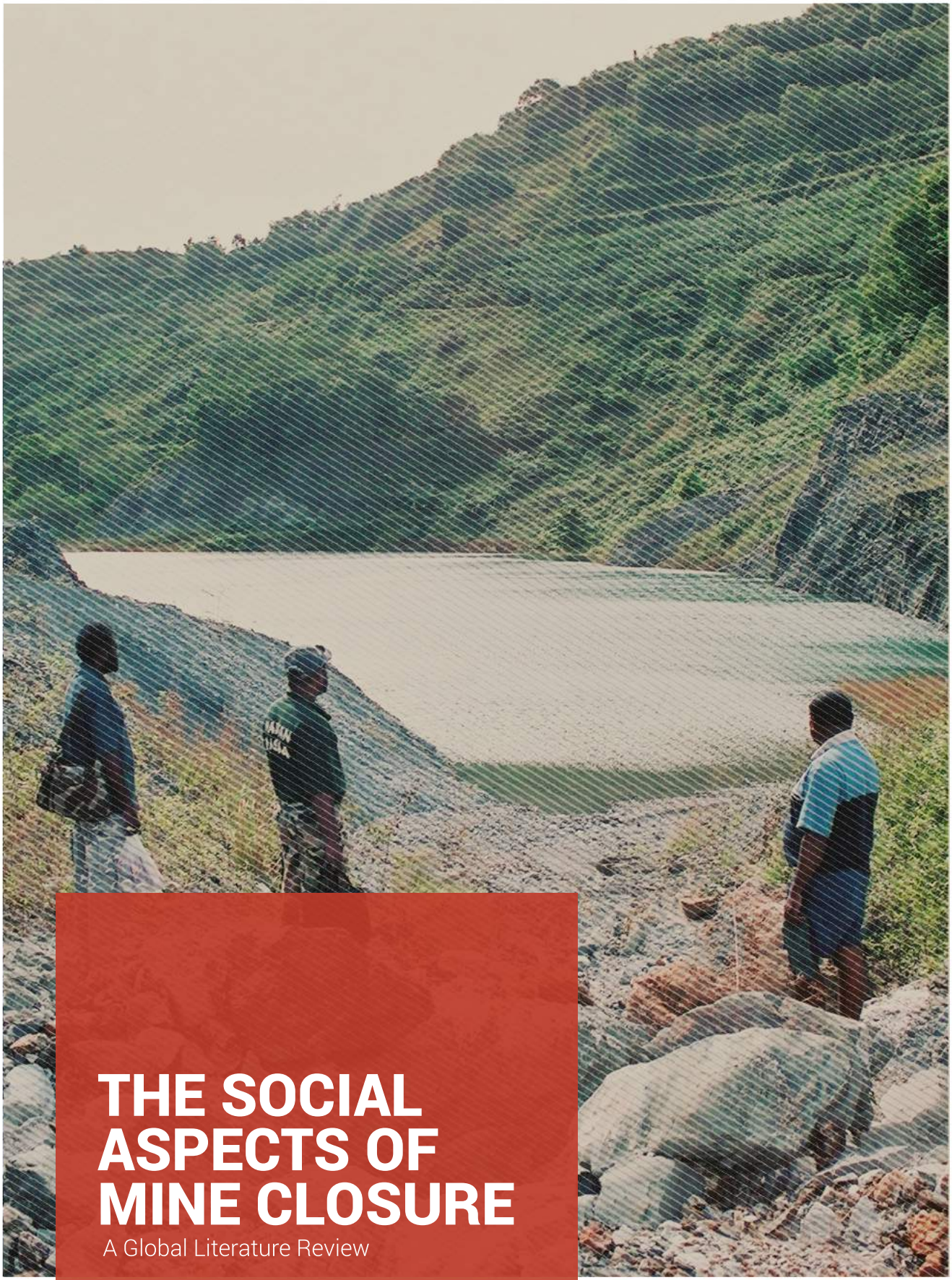

THE SOCIAL ASPECTS OF MINE CLOSURE

A Global Literature Review

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SMI CSRM
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Contents

Executive Summary

This paper provides an overview of the publicly available literature on the social aspects of mine closure. We examine the themes that have been the focus of both industry and research attention. This then enables a gap analysis and suggestions as to future research priorities.

The social dimensions of resource extraction have always presented a major challenge for the extractive industries. These dimensions include social and economic impacts, human rights, gender considerations, cultural heritage and human development, among others. These challenges and risks are particularly acute towards the end of the project life-cycle when multiple pressures align. These include financial constraints as production rates decline, unfulfilled socio-economic development expectations, and increased complexity surrounding legacy issues, to name but a few. Mine closures can, therefore, have significant adverse effects on local economies, contribute to impoverishment, trigger the loss of key services, and lead to out-migration. Poorly managed closure processes exacerbate these impacts and can damage corporate reputations, where operators are held responsible for the impacts that they have left behind.

It is increasingly the case that stakeholders expect mining operators to proactively manage the multi-dimensional impacts of closure, just as they would manage impacts at other stages of mine life. There is a significant need to better understand the social aspects of mine closure because, to borrow the title of a recent World Bank mining report, 'it's not over when it's over'.

The publicly available literature tends to focus on two broad areas, which we have identified as '**process and procedural themes**' and '**topical issues**'. The former includes integration and sustainability; stakeholder engagement; baselines, risks and impact assessments, and; governance processes and the state. The latter includes housing and town normalisation; infrastructure and service provision; economic linkages and transitions; Indigenous engagement in post-mining land use; local level agreements with communities and affected land-holders, and; mining infrastructure as cultural heritage. We provide a synopsis of the literature for each of these themes.

The final sections of this review summarise key findings and outlines future research agendas. **We draw four key conclusions from the literature review**:

a) **The knowledge base on the physical aspects of mine closure is significantly deeper and more developed than the social aspects.** Unlike environmental closure processes, the standards, guidelines, regulatory frameworks, knowledge and tools for managing the social aspects of mine closure are at an early stage of development, while implementation is inconsistent.

b) **There is limited technical literature on the social aspects of mine closure.** The shortage of innovative case studies and policy guidelines indicate a dearth of expertise in this field. Mine closure experts typically focus on issues such as mined land rehabilitation, mine water management, topsoil replacement, groundcover monitoring, vegetation management, post-closure land use, and physical decommissioning.

c) **There are multiple barriers preventing mining companies from optimising the social aspects of mine closure.** These barriers can be grouped in terms of those that are external to the company, those that exist at the interface between the company and other parties, and those that exist within the company. They are however, mutually reinforcing in a variety of ways.

d) **Active industry, and government, engagement with the social aspects of mine closure** is required in order to address the impacts and legacies associated with mine closure. This will also help to ensure that opportunities for asset regeneration, re-purposing and transfer are not missed

We have identified six topical areas that require greater research attention, and that will provide the most productive step towards addressing some of the primary knowledge gaps and contribute towards improved practice. In order of priority:

1. **Mine closure liabilities at different scales:** little is known on a global scale about the current quantum of mine closures and the trajectory of planned closures in different jurisdictions – i.e. what kind of closure liabilities exist where, at what scale (regional, national, local), the range of cumulative impacts that will effect closure outcomes, and the time frames for closure.

2. **Policy and regulation:** there are limited state-based policies and regulations that address the social aspects of mine closure. There is a need for global examination of the states and jurisdictions that have the most effective legislative and policy levers for embedding social considerations into the closure process. Related research might also consider the key policy levers that would assist industry, civil society, and the participation of affected peoples generally, to most effectively engage with municipal and regional council planning.

3. **Agreement making:** local level agreements have the potential to encompass the entire operational context and project life-cycle, including social-environmental inter-dependencies that influence closure outcomes. It remains unknown the extent to which agreements that are developed systematically account for the closure process and potential post-mining futures. Future research might also consider what types of benefit sharing strategies established during the project life-cycle can best assist in easing the socio-economic impacts of mine closure.

4. **Transition and post-mining case studies and comparative analyses:** there is a dearth of detailed case studies that cover the closure process and the long-term post-closure outcomes. There is a need to invest in research and monitoring work that will provide the case studies and raw data. Without case study material and the development of aggregate data sets, it will not be possible to consolidate learnings on sustainable innovative practices, or develop more detailed and realistic practical guidance for closure practitioners.

5. **Lessons from other industries:** though there are important differences between the mining industry and other extractive industries, and other forms of large-scale industrial development, there is a need for more comparative research that would draw out potential lessons from other industries as they might apply to the mining industry.

6. **Stakeholder engagement:** there is a growing recognition across the industry that local communities and other stakeholders must be engaged in planning for closure. However, there is very little systematic guidance at a policy or regulatory level on how this is best achieved. There is a need to develop transferable methods for engaging communities in closure conversations. Future research might consider how transparent, inclusive communication concerning mine closure is best conducted. It will also need to consider the most appropriate methods for gender and community-wide inclusive approaches that also respect local decision-making processes.

Introduction

> *The excitement and fanfare that surrounds the opening of a new mine is never present when it finally closes.*[1]

This pragmatic perspective frames the challenge for the mining industry to shift from the dominant 'front-end' approach to mining to better account for the social, political, and economic impacts that occur when a mine closes. The pressing question for industry, governments and local project stakeholders is 'how might the closure of a mine become another cause for local celebration?'

A recent study on the social aspects of mine closure in the Philippines highlighted that 'mine closure is more than a managerial-technical-engineering aspect within the life-cycle of a mine. It is a social episode in the lives of individuals, households, families, communities and local governments'.[2] In this way, mine closure is best understood as a process *and* a discrete event in the life-cycle of a project. While the end of production typically represents a significant moment in the life of a project, mine closure encompasses more than the decommissioning of the processing plant, or the physical rehabilitation of the mine site.

From a social perspective, the process of mine closure is an episode or a moment in the ebb and flow of life in the surrounding communities. This process often surfaces a range of interrelated and conflicting interests, values, and agendas among the various stakeholders, or 'resource actors', who are connected to a project, each of whom will have their own visions of a post-mining future. How and why mining projects close will vary from project to project. This also means that the challenges and opportunities of the mine closure process will vary between projects. Broadly, these challenges and opportunities will encompass and overlap with a diverse range of socio-economic issues and processes, and legal requirements.

The social dimensions of resource extraction have always presented a major challenge for the extractive industries. This is no less the case for the oil and gas sector or large-scale mining. These dimensions include social and economic impacts, human rights, gender considerations, cultural heritage and human development, among others. The negative impacts and legacies of mining are increasingly under scrutiny by a growing civil society and an active local citizenry who are, to return to Laurence's opening quote, not always 'excited' when a mine opens and who query whether mining is the most appropriate form of land use. This is compounded by two critical issues. The real costs of mine closure are often poorly understood – this is true for companies and other stakeholders including host governments. And, as various commentators have noted, a large section of the industry deliberately seeks to avoid mine closure, or to seeks to externalise the costs of closure.[3] Pursuit of these strategies can cause, or greatly add to, the social costs of mine closure.

The mining industry has not yet developed or embedded the sorts of 'social performance competencies' that are required to consistently identify key social issues and trends, undertake analysis and manage operations in complex socio-political environments and minimise harm. [4] These challenges and risks are particularly acute towards the end of the project life-cycle when multiple

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[1] Laurence, D. 2006. Optimisation of the mine closure process. *Journal of Cleaner Production* 14: 285-298.
[2] Chaloping-March, M. 2008. Business Expediency, Contingency and Socio-political realities – a case of unplanned mine closure. In (eds) A.B. Fourie, M. Tibbett, I.M Weiersbye and P.J. Dye, *Mine Closure 2008 Proceedings of the Third International Conference on Mine Closure*. Australian Centre for Geomechanics, Perth. Pp 863-872.
[3] Marlow, D. 2016, Rehabilitation of land disturbed by mining and extractive industries in Queensland: Some needed legislative and management reforms. *Proceedings of the Royal Society of Queensland*, vol. 121: 39-52.
[4] Owen, J. and D. Kemp. 2017. *Extractive Relations: Countervailing Power and the Global Mining Industry*. London: Routledge.

pressures align. These include financial constraints as production rates decline, unfulfilled socio-economic development expectations, and increased complexity surrounding legacy issues, to name but a few. Mine closures can, therefore, have significant adverse effects on local economies, contribute to impoverishment, trigger the loss of key services, and lead to out-migration. Poorly managed closure processes exacerbate these impacts and can damage corporate reputations, where operators are held responsible for the impacts that they have left behind. It is increasingly the case that stakeholders expect mining operators to proactively manage the multi-dimensional impacts of closure – just as they would manage impacts at other stages of mine life. There is a significant need to better understand the social aspects of mine closure because, to borrow the title of a World Bank mining report, 'it's not over when it's over'. [5]

On the other hand, mine closure can create new opportunities, and when the process is adequately resourced and managed in an integrated way from an early stage, it has the potential to create the foundations for long-term development. From a social perspective, optimised mine closure processes should enhance (rather than detract) from local capital – produced, natural, human, financial, social and cultural – to create the foundations for a sustainable post-mining future. Repurposing infrastructure and mining landscapes, reskilling and redeploying labour, establishing alternative economic opportunities, strengthening local livelihoods and food security, and addressing social and environmental legacy issues that may have emerged during operations are among the many possibilities of the mine closure process.

The purpose of this paper is to map the publicly available literature on the social aspects of mine closure – including industry publications, industry guidance, and scholarly peer reviewed work – and to identify the major themes and gaps that inform the current knowledge base on this topic.[6] In a broad sense, the social aspects of mine closure encompass the socio-economic, political, cultural and institutional impacts that arise at the end of the project life-cycle; the planning and management processes that are required to mitigate these impacts; and an overarching emphasis on long-term sustainability beyond the life of active operations. The social impacts of closure are often connected to the level of local dependency upon the mining operation – for the economic base, infrastructure and service provision, and governance. Or in other words, the extent to which local or regional access to different types of capital is contingent upon the operation of the mining project.

This paper will cover the following:

i. We begin with a discussion on the terminology that is used by the mining industry to describe mine closure and how this influences approaches to closure and the current knowledge base.
ii. We then review the primary peer reviewed and scholarly works on the social aspects of closure and the guidance that is available to the industry on these issues, along with the legislative frameworks for managing closure, with a specific focus on the Australian context.
iii. This is followed by a review of various topical issues related to the closure process that have emerged from the peer reviewed and scholarly literature.
iv. By way of conclusion, we map out an agenda for priority research areas that will help to fill the knowledge gaps we identify in this review, and support the critical task of building

[5] World Bank and International Finance Corporation. 2002. *It's Not over when it's over: Mine Closure Around the World*. Available at: http://siteresources.worldbank.org/INTOGMC/Resources/notoverwhenover.pdf

[6] This paper also serves as a background reader for a companion industry discussion paper by the Centre for Social Responsibility in Mining on mine closure and social performance. See, Owen, J. and D. Kemp. 2018. *Mine closure and social performance: an industry discussion paper*. Brisbane: Centre for Social Responsibility in Mining (CSRM), Sustainable Minerals Institute (SMI), The University of Queensland. Available at: https://smi.uq.edu.au/new-consortium-social-aspects-mine-closure

capability across the industry (and within governments) to better understand the socio-economic possibilities and limitations of mine closure.

The terminology of mine closure

The terminology used to describe mine closure, especially its social aspects, differs across the literature and in practice. In this section, we provide a short overview of this terminology, and the implications for understanding the social dimensions of mine closure.

The term 'social closure', or cognate variants like 'social mine closure', is gaining currency across the global mining industry as a shorthand reference for the social aspects of mine closure. The term has now been in circulation for at least 10 years. The International Council for Mining and Metals (ICMM) started using the term some time ago. One of the earliest published examples appears in a paper by the ICMM presented at the inaugural Annual International Mine Closure Conference in 2006, where it was used in the context of 'integrated mine closure planning'.[7] Most recently, at the 2016 Annual International Mine Closure Conference Anglo American staff presented a paper entitled 'Social Closure Planning: scoping, developing and implementing – a case study'.[8] This paper, a case study on planning for the closure of a coal mine in South Africa, claims to present the current best practice approach in this area. What is notable is the specificity with which they engage the term and develop it as a practical concept with its own rigour, as a distinct form of closure planning that is not co-dependent with, or a lesser element, of environmental planning. Other recent publications that specifically refer to 'social closure' include Stacey et al.'s review of mine closure practice in the South African context, and Costa's brief case study of New Gold's approach to managing the social impacts of closure at the Cerro San Pedro mine in Mexico.[9]

These attempts to bring 'the social' in to focus are a corrective to the predominance in the mine closure literature and planning paradigms on the technical-environmental and physical impacts of closure. There are, however, some inherent limitations with this shorthand term. For instance, the term may be interpreted to imply that the social aspects of mining can be 'closed off' in a similar linear time-bound fashion as the physical aspects of a mining operation, suggesting that the social domain can be project managed in the same way as the decommissioning of the plant site, and that social responsibilities can be straightforwardly 'relinquished'. This may drive a focus on achieving a 'closure of the social', which in turn may promote a narrower or more short-term view of the social domain. The term potentially obscures the dynamic, complex and changing nature of the social aspects of mining.

For these reasons, the term 'social aspects of mine closure' allows for a broader understanding of the ways in which the different phases of the project-lifecycle have different social considerations or aspects that need to be understood and managed. It is a more encompassing description of the phenomena of mine closure. A focus on 'social aspects' is therefore wider than 'social impacts' or

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[7] Fleury, A. and Parsons, A.S. 2006. Integrated Mine Closure Planning. In (eds) Fourie, A. and M. Tibbet, *Proceedings of the First International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 221-226.

[8] Heymann, EF. and Botha, PR. 2016. Social closure planning: scoping, developing and implementing – a case study. In (eds) A.B. Fourie and M. Tibbett., *Mine Closure 2016 Proceedings of the 11th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 213-228.

[9] Stacey, J. et al. 2010. The socio economic aspects of mine closure and sustainable development: Literature overview and lessons for the socio-economic aspects of closure. Report 1 of 2. Johannesburg, South Africa: Centre for Sustainability in Mining and Industry.
Costa, S. 2015. Social impacts of mine closure: engaging employees and host communities in planning for closure. In (eds) A. Fourie, M., Tibbett, L., Sawatsky and D. van Zyl, *Mine Closure 2015 Proceedings of the 10th International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 797-804.

'social projects'. Similarly, from a practice perspective, the term 'closure aspects of social performance' better encompasses the closure considerations that should form part of everyday social performance work.[10]

There is an emerging awareness across the industry of the need to begin closure planning from the outset of the project life-cycle and to embed a closure perspective into routine operational planning and management (even if this does not always happen in practice). From this perspective, at least one major mining company has stressed the need to emphasise or 'insert' a closure perspective into routine social performance management work throughout the project life-cycle.[11] This is opposed to more common approaches that attempt to insert a social perspective into mine closure planning processes, which can have the effect of 'bolting on' social considerations at the eleventh hour to an existing technical-environmental planning process.

In other instances, the closure process is described with terms like 'economic rehabilitation' or 'economic transition', or simply 'transition'.[12] The term 'economic rehabilitation' has been most commonly used in relation to the rehabilitation and recovery of conflict zones (by the World Bank for instance); and given the level of conflict that often accompanies resource extraction, this might be an apt description for some mining projects.[13] It has only been adopted relatively recently by the mining industry to describe an intentional processes to mitigate the economic impacts that can accompany the end of mining activities. It can involve re-mining a mine that is closed or in care and maintenance, and that may have been regarded as uneconomic. With more effective recovery methods and processing technology, re-mining tailings and mine waste becomes viable via a smaller scale economy.

While a focus on 'economic transition' sharpens attention toward some of the core considerations for long-term sustainability, the economic aspects of mine closure are only one of the many social aspects that need to be considered. Similarly, even if the term 'transition' denotes a certain movement from one 'phase' or 'stage' in the project life-cycle to another, it is ambiguous and captures the potential for both closure or sale of an asset, or worse – unplanned closure. Such closure may include forced closure due to social and political unrest, or the sudden decision to cease production due to market conditions. Moreover, the social aspects of closure rarely 'move' or 'transition' in a linear fashion. Historical events and decisions can profoundly influence the range of social risks and opportunities that emerge during closure, which in turn may shape post-closure outcomes in unanticipated ways.

That mine closure is a process, rather than a one-off event, is also evidenced by the range of terms that are applied to different kinds of activities that occur towards the end of the project life-cycle. These include care and maintenance, decommissioning, relinquishment and abandonment. Local project stakeholders may not always understand the difference between some of these activities and terms, especially when they result in similar material outcomes at the local level. For example, when the cessation of extraction and processing activities (temporarily or otherwise) impacts the provision of benefits or services. Mines entering into care and maintenance potentially 'fall between the

[10] See, Owen, J. and D. Kemp. 2018. *Mine closure and social performance: an industry discussion paper*. Brisbane: Centre for Social Responsibility in Mining (CSRM), Sustainable Minerals Institute (SMI), The University of Queensland.

[11] Personal communication with MMG management, February 2018.

[12] See for instance, State of Queensland, Department of State Development. 2016. *North Stradbroke Island Economic Transition Strategy*. Available at: https://www.statedevelopment.qld.gov.au/resources/strategy/nsi/nsi-economic-transition-strategy.pdf

[13] See UN Development Program. 2008. *Post Conflict Economic Recovery: Enabling Economic Ingenuity*. Available at: http://www.undp.org/content/dam/undp/library/crisis%20prevention/undp-cpr-post-conflict-economic-recovery-enable-local-ingenuity-report-2008.pdf

cracks' in terms of legislation, policy and good practice for managing the social aspects of closure, and can remain in this phase for many years. This effectively leads to a form of closure, yet with limited or marginal planning and a skeleton staff, if any, remaining on site to manage the social impacts that may arise. Social impacts rarely cease when production goes on hold – rather, some impacts tend to intensify as new 'closure effects' emerge.

Locating the literature

There are relatively few publications that specifically address the social aspects of mine closure and associated issues of planning and managing 'the social' domain.[14] This same point was made by Caroline Digby during her keynote address at the 2012 Annual International Mine Closure Conference, when she observed that 'even a cursory scan of the table of contents of the proceedings over the last seven years indicates how little attention there has been to the people side of mine closure'.[15] Likewise, Stacey et al. found that the 'social aspects of mine closure have been historically underplayed and under-researched'.[16] There is, however, a wealth of research and published material on the socio-economic, cultural and political impacts of mining – much of which should, of course, inform research and planning on the process of closure. While we cite some of this literature where relevant, this is not our primary focus.[17]

This review primarily draws upon literature from the late 1980s to the current time of writing, which partly reflects the period when the social dimensions of mining started gaining more industry and scholarly attention.[18] The publicly available literature can be grouped in terms of:

- **peer reviewed and scholarly literature** (applied international conference presentations and published proceedings; peer reviewed journal articles and books)
- **industry orientated literature** (e.g. policy documents, guidelines and toolkits, and industry publications).

Anecdotal evidence indicates that much of the knowledge on the social aspects of closure remains in private holdings (e.g. company and consultancy documents), or with individual expert practitioners (e.g. undocumented practice-based knowledge). This review is limited to publications in English, and

[14] A good deal of the literature on the social aspects of mine closure uses cognate terms like 'closure planning', 'integrated mine closure' or 'mining for closure'. To a certain extent these terms also reflect the gradual development of new approaches to this topic. Searches on these terms generate a greater number of results than searches on specific terms like 'social closure mines'. As this review charts the relevant literature, we recognise however, that it is difficult placing parameters around publications on the social aspects of mine closure, as more generic articles on 'closure planning' are the norm. While such articles may address some elements of the social aspects of closure, it is rarely the sole focus.

[15] Digby, C. 2012. Mine closure through the 21st Century looking glass. In (eds) A. Fourie, et al. *Mine Closure 2012 Proceedings of the 7th International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 33-38.

[16] Stacey, J. et al. 2010. The socio-economic aspects of mine closure and sustainable development: Literature overview and lessons for the socio-economic aspects of closure. Report 1 of 2. Centre for Sustainability in Mining and Industry: Johannesburg. South Africa.

[17] It is also worth noting that the bulk of the scholarly literature on effective closure planning rarely focuses on the social aspects of closure, but rather incorporates socio-economic planning as an aspect of the mine life-cycle planning. This may reflect the fact that there are so few examples of successful closure and relinquishment, so the focus remains on *planning* for closure during the mine's operation. As a result, many of the articles are practitioner approaches to mine closure which identify the need to manage the social impacts of closure without necessarily unpacking what this should entail.

[18] Some of the earliest socio-economic research on mine closure was undertaken in Canada in the early 1980s. See Hegadoren D.B. and J.C. Day. 1981. Socio-Economic Mine Termination Policies: A case study from Ontario. *Resources Policy*, December: 265-272.

the regional foci of the vast majority of the research that we have located has concentrated on Canada, the United States, South Africa, western Europe and Australia, with Latin American research also developing as an emerging field, along with South East Asia. While this review does not claim to be exhaustive, we have, nevertheless aimed to capture a range of materials that are broadly illustrative of the social aspects of mine closure as an emerging field of practice and a corresponding field of enquiry.

The most fulsome research and case study material on the social aspects of closure can be found in three main sources: the Annual International Mine Closure Conference and its published proceedings; scholarly journals orientated towards industry practitioners and policy makers; and several edited volumes and a single authored monograph on the social aspects of mine closure. For the purposes of this section, we briefly describe these sources further below, while in the section on thematic topics we draw out the primary themes from across the peer reviewed and scholarly material.

The Annual International Mine Closure Conference is convened by the Australian Centre for Geomechanics (CSIRO, Curtin University and University of Western Australia in Perth) and as a result the conference tends to focus on the technical and environmental aspects of closure (reflecting wider industry interest and depth in these fields). Industry practitioners and consultants generally attend this forum. Non-industry viewpoints are less frequently evident. The experiences (and voices) of impacted communities or local organisations (with whom industry or consultants may have worked with) scarcely have a place in this forum. The lack of involvement by community organisations directly impacted by mine closure may partly reflect the relatively high cost[19] of participation in such events, and the thematic orientation towards technical solutions to complex social phenomena. [20] Nevertheless, in the absence of other regular forums for engaging with the social aspects of closure, it has emerged as the primary global forum for presenting practice-related insights and lessons on this topic, and its published proceedings now provide one of the largest collections of work in this field.[21]

In addition to these conference proceedings, several refereed journals provide a platform for publishing research on the social aspects of mine closure.[22] These sorts of multidisciplinary disciplinary journals publish a broader range of research on the social, economic and policy aspects of resource extraction – more so than many disciplinary specific journals – and are a significant repository for knowledge on the range of cognate issues related to the social aspects of closure.

Two edited volumes explore the social aspects of mine closure, both of which include a focus on Canada. The 1992 edited volume *Coping with Closure: An International comparison of mine town experiences*, comprises 18 chapters that discuss and compare closure experiences across five

[19] Similar criticisms have been directed at many academic conferences/forums, where the high cost of participation prohibits the involvement of junior scholars, or other interested parties.
[20] Thanks to Minerva Chaloping-March for these insights.
[21] As one possible barometer of global research and industry interest in the topic, the session themes of this annual conference are telling. The papers predominantly fall into the technical categories of 'mine waste remediation' and 'evaluation of mine site restoration success' and so on. Papers that consider social issues are consistently in the minority. For instance, in the 2008 conference there were 4 papers on the socio-economic impacts of closure out of a possible 70 plus papers. The 2010 conference had a session on 'stakeholder engagement and community development' (which had 9 contributions) along with other sessions on 'recent closure case studies' and 'mining legacies and relinquishment', which indicates that this field is beginning to evolve.
[22] These include, for instance, *Resources Policy*, *The Extractive Industries and Society*, and the *Journal of Cleaner Production*.

countries: Finland, Sweden, Norway, Canada and Australia.[23] Primarily written by planners and political scientists for policy makers, it remains the most comprehensive single volume on the range of factors that influence the social impacts of mine closure. The 2015 edited volume *Mining and Communities in Northern Canada History, Politics, and Memory*, traces the history and legacies of the region's encounter with industrial mining in the twentieth century.[24] Most of the chapters emerged from a research project based at Memorial University called 'Abandoned Mines in Northern Canada', which sought to illuminate the complex historical geography of mineral development, as well as its impacts on local communities and environments. Several chapters specifically focus on mine closure legacies, or what the editors describe as the 'zombie-like after life of many mines, and the manner in which the history of these places is reflected in the contemporary reality of nearby communities'.[25] Chaloping-March's 2017 publication *Social Terrains of Mine Closure in the Philippines* is one of the only single-authored monographs on the social aspects of closure.[26] This work explores the experience of mine closure across three different case studies. Drawing upon ethnographic insights and archival material, she demonstrates how the mine closure process can become an intense locus for competition and compromise among various social actors, highlighting the complex socio-cultural, economic, political, and business realities that make up the social terrains of mine closure.

Industry literature and guidance

In the following sections, we review the emerging industry and wider civil society discussions around the social aspects of mine closure and allied topics. We provide an overview of available tools and approaches for managing the social aspects of closure. We examine what change is underway and where, what better practice looks like, what the key drivers for change have been, and how these drivers are evolving.

Literature from international finance institutions and intergovernmental organisations

The World Bank Group were early to engage with mine closure issues and have produced several publications that have prompted global discussion on the socio-economic aspects of mine closure. The first publication to do so was entitled *Mine Closure and Sustainable Development*, which contained the edited proceedings from a workshop of the same name held in early 2000.[27] Contributors included a range of industry advisors and practitioners, company managers, and applied academics. This collection did not represent guidance per se, but it was the first concerted effort to place the social aspects of closure on the industry's agenda. Consistent with the times, closure is examined through the lens of sustainable development. Contributions are grouped into three sections: 'mine closure and restructuring experience of state owned enterprises'; 'mine closure experience of international companies'; and 'the role of governments in mine closure'. As one of the earliest considerations of the global scale of mine closure challenges, the collection highlights that it was only until recently that mines were simply abandoned. At that stage few governments had mine closure legislation, and those that did focused on environmental mitigation, rather than socio-economic impacts.

[23] Neil, C.C., Tykklainen, M., and J. Bradbury (eds). 1992. *Coping with Closure: An International Comparison of Mine Town Experiences*. London: Routledge.
[24] Keeling, A., and J. Sandlos (eds). 2015. *Mining and Communities in Northern Canada: History, Politics, and Memory.* Calgary, Alberta: University of Calgary Press.
[25] Ibid, pg. 20.
[26] Chaloping-March, M. 2017. *Social Terrains of Mine Closure in the Philippines*. London: Routledge.
[27] Khanna, T. (ed). 2000. *Mine Closure and Sustainable Development*. The World Bank Group, Mining Department. London, Mining Communications.

The second, and much shorter publication by the World Bank Group's Mining Department and the International Finance Corporation (IFC) was aptly titled *It's Not over When it's over: Mine Closure Around the World*.[28] The report is structured in the form of a 'how to guide' for proactively managing mine closure with a focus on integrating environmental and social aspects. The report reinforces the need for companies to actively plan for closure early in the project life-cycle to avoid a legacy of negative environmental and social impacts, and reputational impacts that may threaten future mining investment opportunities. Companies are reminded of the need to actively engage communities on the management of mining benefits to increase the opportunities for realising sustainable outcomes for future generations. Similarly, governments are reminded that failure to provide robust legal frameworks around closure requirements, and failure to provide early planning and support for communities transitioning towards mine closure, can leave them managing complex environmental and social issues into the future.

In 2002, the International Institute for Environment and Development (IIED) published the well-known *Breaking New Ground* report, which summarised the findings from the Mining Minerals and Sustainable Development (MMSD) review process.[29] This review process and the accompanying report is widely cited as an 'important policy-springboard for the industry globally'.[30] Through the lens of 'understanding sustainable development', mining companies are encouraged to pay greater attention to the social aspects of closure by:

- Establishing management systems to review end-of life plans at existing operations, to take necessary action to strengthen them, and to continue to monitor them throughout the project life.

- Focusing on whether existing plans fully address the end of life environmental, social, and economic conditions for affected communities; care and opportunities for displaced workers; and the implications for government and other actors at all levels.[31]

The MMSD report focuses on 'integrated planning for closure', which should incorporate, or integrate, socio-economic planning and social legacies. While the report does not prescribe how this should be done, it does convey a consistent message on the importance of understanding and working with local communities at all stages of the project life-cycle.

Following the World Bank Group's Extractive Industries Review in 2004, the World Bank, the IFC and other private sector lending institutions, including the Asian Development Bank, began developing standards on both the approval of mines and mine closure that moved beyond solely economic considerations. In 2007, the IFC published the *Environmental Health and Safety Guidelines, Mining*.[32] Under a section titled 'Mine Closure and Post-Closure' these guidelines underscored the need for projects to develop a Mine Reclamation and Closure Plan that incorporates both physical rehabilitation and socio-economic considerations as an integral part of the project life-cycle.

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[28] International Finance Corporation (IFC). 2002. *It's Not Over When It's Over: Mine Closure Around the World*. Washington: IFC.

[29] IIED. 2002. *Breaking New Ground: Mining, Minerals and Sustainable Development (MMSD)*. Available at: http://pubs.iied.org/9084IIED/

[30] Solomon, F, Katz, E. and Lovell, R. 2008. The Social Dimensions of Mining: Research, Policy and Practice Challenges for the Minerals Industry in Australia. *Resources Policy* 33: 142-149.

[31] IIED. 2002. *Breaking New Ground: Mining, Minerals and Sustainable Development (MMSD)*. Available at: http://pubs.iied.org/9084IIED/

[32] http://www.ifc.org/wps/wcm/connect/1f4dc28048855af4879cd76a6515bb18/Final++Mining.pdf?MOD=AJPERES

The 2005 report *Mining for Closure: Policies and Guidelines for Sustainable Mining Practice and Closure of Mines* prepared for the UN Development Program (UNDP) and the UN Environment Program (UNEP), introduced a new term – 'mining for closure' – that sought to highlight the ultimate long-term objective for the mining industry.[33] The term is not intended to signal the end of the mining industry. Rather, it emphasises the inter-relationship between social, economic and environmental sustainability, and encompasses existing guidance on the need to plan and manage for closure from the beginning of the project life-cycle. The authors describe this report as 'a recipe for stimulating debate and public accountability of mining legacies and operations. Through applying the basic principles and guidelines, not only will mining become environmentally and socially more sustainable, it may also result in more democracy, increased wellbeing and security of those directly and indirectly affected'.[34] While this represents an ambitious goal, it clearly signals the need to address some of well documented social and political impacts of mining.

Selected toolkits and guidance

In 2003, the International Council on Mining and Metals (ICMM) developed a set of 10 Sustainable Development Principles to guide companies towards improved social and environmental practice.[35] Read as a set, the principles are useful for understanding the different dimensions of mine closure. Principle 9 – 'Pursue continual improvement in social performance and contribute to the social, economic and institutional development of host countries and communities' – contains the most relevant requirements for closure, including 'contribute to community development from project development to closure in collaboration with host communities and their representatives'. The ICMM's *Planning for Integrated Mine Closure Toolkit* is essentially a practical guide for implementing Principal 9.[36] The toolkit is comprised of 13 different tools, including stakeholder engagement and community development through to biodiversity management (readers are directed to existing resources and tools on these specific topics). The report highlights the lack of industry expertise for managing the social aspects of closure and the pivotal role that communities and governments play in closure outcomes:

> It is the community that has the most local history and knowledge to inform the development of social closure outcomes. Local, provincial and national governments provide perspectives on institutional capacity, local and national economies, cultural and inter-community issues and the sustainability of social closure outcomes.[37]

It is understood that the ICMM is in the process of developing further guidance for its members on the social aspects of the mine closure planning process.

In response to the ICMM Principles, in 2006 The Minerals Council of Australia (MCA) developed a set of voluntary guidelines for its member companies called *Enduring Value*.[38] The Enduring Value framework essentially provides operational level guidance for the ICMM Principles. Closure

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[33] Peck, P. et al. 2005. *Mining for Closure: Policies and guidelines for sustainable mining practice and closure of mines.* Prepared for the UN Development Program (UNDP), UN Environment Program (UNEP).
[34] Ibid: Preface
[35] International Council for Mining and Minerals (ICMM). 2003. *Sustainable Development Framework. ICMM Principles.* Available at: https://www.iucn.org/sites/dev/files/import/downloads/minicmmstat.pdf
[36] ICMM. 2008. *Planning for Integrated Mine Closure: Toolkit*. Available at: https://www.icmm.com/website/publications/pdfs/mine-closure/310.pdf
[37] Ibid: 20
[38] Minerals Council of Australia (MCA). 2015. *The Enduring Value Framework:* voluntary Guidelines (2006, revised 2015). Available at: http://www.minerals.org.au/leading_practice/enduring_value and http://www.minerals.org.au/file_upload/files/resources/enduring_value/EV_GuidanceForImplementation_July2005.pdf

considerations are addressed across several Enduring Value principles, including the need for companies to rehabilitate disturbed land in accordance with appropriate post-mining land uses, and to design and plan all operations so that adequate resources are available to meet the closure requirements of all operations. Other important guidance on the social impacts of closure can be found in the guidance note for the framework.[39] This includes an emphasis on contributing to community development from the project development stage through to closure in collaboration with host communities and their representatives, which is elaborated as follows:

- apply a development model which identifies communities' current strengths and long-term needs for economic, social and institutional security
- strengthen and diversify the local and regional economy by supporting local businesses and products when this is feasible and consistent with sound business practices
- identify and work to realise training and other opportunities for capacity building and community development; work in partnership with relevant institutions and organisations
- ensure that exit strategies are in place for all programs, particularly if they will terminate before mine closure
- engage the community in defining the intended post mining land-use in mine closure plans
- contribute to the professional development of young people in local communities through capacity building and mentoring programs
- meet community development commitments prior to divestment, or seek to ensure that these commitments are transferred to the asset purchaser.[40]

The Mining Association of Canada (MAC) has developed a similar sustainability framework which draws upon the 1987 Brundtland Commission definition of Sustainable Development: 'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. MAC's *Towards Sustainable Mining* (TSM) framework incorporates a framework on mine closure that includes eight elements, which are intended to go beyond legal compliance. MAC members are expected to work with communities to develop closure plans and strategies to mitigate the socio-economic aspects of mine closure and help communities to develop plans for long-term economic development. Accordingly, through consultation, MAC members will:

- identify values that are important to the community of interest and develop reclamation objectives that incorporate those values
- evaluate a variety of potential end land uses that address the needs of users
- establish, finance and implement comprehensive closure plans that, wherever practicable, return mine sites to viable and diverse ecosystems that will serve the needs of post-mining use, recognising that mining can permanently alter landscapes.[41]

Anglo American developed a *Mine closure toolbox* in 2008, which was subsequently revised in 2013 and made publicly available.[42] This toolbox was initially designed to expand the planning focus from

[39] Minerals Council of Australia (MCA). 2005. *Enduring Value: The Australian Minerals Industry Framework for Sustainable development. Guidance for Implementation*. Available at: http://www.minerals.org.au/file_upload/files/resources/enduring_value/EV_GuidanceForImplementation_July2005.pdf

[40] Ibid: 23

[41] See Mining Association of Canada, Mine Closure Framework. Available at: http://www.mining.ca/towards-sustainable-mining/protocols-frameworks/mine-closure-framework

[42] Hoe-Richardson, S. 2013. What Will be Left When Your Gone. Anglo American presentation to 2013 Mine Closure Conference. Available at: http://www.angloamerican.com/~/media/Files/A/Anglo-American-PLC-V2/presentations/2013pres/Sam-Hoe-Richardson.pdf

simply making financial provisions for rehabilitation and physical closure, to planning for sustainability beyond mine closure. The toolbox contains nine basic elements for strategic planning and management of closure, emphasising a dynamic iterative approach that takes into account the unique features of each site – biological, physical, social, economic and institutional. The intended closure goal is to integrate the mine site into the surrounding bio-social environment.

In 2009, the University of Queensland's Centre for Social Responsibility in Mining (CSRM), which forms part of the Sustainable Minerals Institute, developed a strategic planning tool for the 'normalisation' of mining towns (or the transition from a 'closed' company-run town, to an 'open' government-run town). CSRM's *Towns Tool* helps to guide companies and their stakeholders through a structured workshop process to understand the knowledge base requirements for developing a decision-making framework for the future of a mining town as part of the mine closure planning process.[43] While information is available about the tool, to date there is no information about the cases it has been applied to.

Most recently, in 2018 the Asia-Pacific Economic Cooperation (APEC) Mining Task Force published a checklist for governments for managing mine closure.[44] The guideline proceeds from the basis that there is no single jurisdiction in the world that provides an ideal model for mine closure policy. The checklist was developed to provide a series of sequential steps for policy makers to identify gaps in their existing mine closure framework, and to help identify ways to address those gaps. It contains a short section on the 'socio-economic aspects of mine closure', with high-level guidance on stakeholder engagement and transitioning economies.

It remains unknown the extent to which different companies and governments, or mine affected communities, have drawn upon the available resources that we have identified here, or how useful they have been for individual operations advancing through the closure process. As we discuss in the final section of this review, future research should consider the effectiveness of specific forms of guidance, and the barriers to uptake and implementation.

Selected government guidance on the social aspects of closure

In this section we provide a more detailed review of government guidance on the social aspects of mine closure in Australia. We have purposely provided greater detail on this jurisdictional context due to our geographical positioning within Australia, and partly due to the current lack of research on the social aspects of closure in Australia.

The regulatory frameworks to manage mine closure within Australia generally say very little or nothing about managing for the social aspects of closure – the focus is on the environmental aspects of closure. This observation was reiterated in a recent 2015 study on mine closure planning and practice in Australia and Canada which found, perhaps unsurprisingly, that 'consideration of social issues [in both mine closure legislation and plans] have been found inadequate in…both Canada and Australia'.[45] However, Western Australia is an exception. Since this study was published in 2015, the

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See also Anglo American, 2013 (version 2). *Mine Closure Toolbox*. Available at: http://www.angloamerican.com/~/media/Files/A/Anglo-American-PLC-V2/documents/approach-and-policies/environment/toolbox-main-brochure-lr.PDF

[43] See Pattendon, C. and Thomas, L. 2009. Decision Making for Town Investment: Developing a Framework. Paper presented at *SD09*, Adelaide Convention Centre, 26-30 October 2009. Available at: http://www.csrm.uq.edu.au/docs/Thomas-Pattenden_SD09_MCA%20paper_CSRM%20FINAL28Oct.pdf

[44] APEC. 2018. *Mine Closure: Checklist for Governments*. APEC Mining Task Force. Singapore. Available at: https://www.apec.org/Publications/2018/03/Mine-Closure---Checklist-for-Governments

[45] Kabir SMZ, Rabbi, F. Chowdhury, M.B. and Akbar, D. 2015. A Review of Mine Closure Planning and Practice in Canada and Australia. *World Review of Business Research* 5 (3): 140-159.

Western Australian (WA 2015) government has developed a set of Guidelines for Preparing Mine Closure Plans (MCP) and require that all plans be made publicly available. This is an important government initiative that helps to improve transparency, industry accountability and broader regional governance processes. The guidelines require companies to identify all stakeholders that are involved in closure, develop a 'summary or register of historic stakeholders…with details of who has been consulted and the outcomes', and provide details on 'agreed post-mining land use' and 'closure objectives'. MCP's should also include 'an appropriate set of specific completion criteria and closure performance indictors' which should be 'specific enough to reflect a unique set of environmental, social and economic circumstances'. These are to be supported by baseline data on aspects of the physical and biological environments, as well as the social and economic aspects that are critical for meeting closure outcomes. The guidelines consider it to be good practice for companies to assess the social and economic risks associated with mine closure, although little guidance is provided on how social risks should be defined or understood.[46]

The Australian federal government has also developed various handbooks to guide companies towards improved practice and more sustainable outcomes, including guidance on managing mine closure.[47] In addition to information on environmental rehabilitation, the *Mine Closure Handbook* contains a chapter on 'community and closure' which introduces some of the common approaches for addressing the social aspects of closure, including: adequately resourcing stakeholder engagement activities as part of the mine closure planning process to increase local relevance; and measuring and monitoring community engagement and development before, during and after closure to better align with communities on post-mining land-use and completion criteria.[48]

The *Working with Indigenous Communities Handbook* (2007, revised 2016) does not contain a specific section on mine closure, but it does draw connections between mine closure and sustainable development outcomes for Indigenous communities. Accordingly, 'the aim of leading practice is to leave a positive business legacy so that communities are resilient and remain sustainable after mine closure'.[49] While there is a considerable, and not unexpected, focus in this handbook on agreement making, the principles of good agreement making do not appear to be applied to mine closure, as companies are only encouraged to seek 'in-principle agreement' through 'participation in mine closure and rehabilitation planning and works'.[50] Nevertheless, there are several case study examples in this handbook that provide some insights into what may constitute good examples of managing the social aspects of mine closure, one of which focuses on the Century Mine Agreement in north Queensland.[51] Another example demonstrates how traditional ecological knowledge (TEK) can be applied to generate mine closure criteria based on environmental co-management – a point we revisit further below.[52]

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[46] For example, are risks defined in terms of risks to host communities, or risks to companies as a result of local social issues, or both. See Kemp, D., S. Worden and J. Owen. 2016. Differentiated social risk: Rebound dynamics and sustainability performance in mining. *Resources Policy* 50: 19-26.

[47] These include: *The Mine Closure Handbook* (2006, revised 2016), *The Community Engagement and Development Handbook* (2016) and *The Working with Indigenous Communities Handbook* (2007, revised 2016). Available at: https://industry.gov.au/resource/Programs/LPSD/Pages/LPSDhandbooks.aspx

[48] 2016: 28. *The Mine Closure Handbook* 2016. Available at: https://industry.gov.au/resource/Documents/LPSDP/LPSDP-MineClosureCompletionHandbook.pdf

[49] 2016: 29. *The Working with Indigenous Communities Handbook.* Available at: https://industry.gov.au/resource/Documents/LPSDP/WorkingIndigenousCommunities.pdf

[50] Ibid: 49.

[51] Ibid: 34 and 53. See also Everingham, J., et al. 2013. *Social Aspects of the Closure of Century Mine. Combined Report*. Brisbane: CSRM, The University of Queensland.

[52] TEK is both the ecological and cultural knowledge (including land management practices and resource use patterns) held by an Indigenous group, also often referred to as Indigenous ecological knowledge (IEK).

Though not strictly a form of government led industry guidance, the recent Senate Inquiry into the 'Rehabilitation of Mining and Resources Projects as it relates to Commonwealth Responsibilities'[53] has surfaced a useful range of materials via the Submissions process. These materials provide a historical review and a snap-shot of current issues associated with the social aspects of mine closure.[54] Of particular note is a submission from the Closure Planning Practitioners Association (CCPA, formed in 2016) which seeks to 'bring attention to the gaps in social and economic considerations in the existing legislation' due to the regulatory bias towards environmental rehabilitation.[55] They point out the range of issues that have developed due to this bias:

- the more complex social and economic issues associated with mine closure, such as decommissioning/demolition or re-purposing of mine assets and establishing economically productive post-closure land uses, have had less regulatory support at state, territory and commonwealth levels
- mining regulators do not provide incentive for industry to facilitate a productive post-closure land use that provides socio-economic value to the community post closure
- there is no post-closure land use planning framework that mining companies can reference when planning for rehabilitation and closure – which subsequently discourages mining companies from investing in rehabilitation activities that provide socio-economic benefit post-closure
- the Multiple land use Framework (established under COAG – Council of Australian Governments) has started to address this gap.

The *Multiple Land Use Framework* (MLUF)[56] was principally developed to address the regulatory and policy limitations at state and territory levels on post-mining land use. It is the only framework or reference tool of its kind in Australia. However, in a somewhat self-limiting fashion, 'it is at the complete discretion of jurisdictions to determine the scope of their individual Framework and the nature in which they implement it'.[57] A Submission to the 2017 Senate Inquiry, by the Closure Planning Practitioners Association also stated that:

> [The MLUF] aims to deliver a consistent approach to resolve land use tensions and conflicts. Such conflicts are certain to arise with respect to environmental legislation and associated approval conditions when post closure land uses other than the return to pre-mining conditions are considered. Thus, further work is required to support social and economic decision-making processes.[58]

While the MLUF does not specifically address mine closure, it is an important tool for supporting more effective management of the social aspects of closure. This is achieved in part through an emphasis on inclusive and tailored engagement with diverse stakeholder groups (including

[53] Australian Government. 2017 Senate Inquiry into 'Rehabilitation of Mining and Resources Projects as it relates to Commonwealth Responsibilities'. See Submission 3. Available at: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/MiningandResources/Submissions

[54] Ibid.

[55] Submission 3 of 74. Available at: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/MiningandResources/Submissions

[56] COAG, Standing Council for Energy and Resources. 2013. The *Multiple Land Use Framework* (MLUF). Available at: http://www.coagenergycouncil.gov.au/publications/multiple-land-use-framework-december-2013

[57] Ibid: intro

[58] Submission 3 of 74. Available at: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/MiningandResources/Submissions

landholders), and the recommendation that resources are best utilised when planning processes consider the social, economic, environmental and heritage values of land use for current and future generations.[59]

Thematic topics across the literature

In this section, we examine the range of themes that have emerged from the scholarly and peer reviewed literature, including the Annual International Mine Closure Conference proceedings. This has also provided the basis for identifying where knowledge gaps exist, and where there is minimal or no targeted research. This informs our conclusions and the future research agenda in the final section. The themes we have identified can be split across two groups: **procedural and process themes**, and **topical themes**. However, as we discuss below, there is a degree of convergence or inter-relationship between many of these themes. The first four themes (integration and sustainability, stakeholder engagement, baselines and risk assessments, and governance processes and the state) are associated with the process and regulatory procedures of mine closure planning and management. The remaining six are topical issues broadly related to closure (housing and town normalisation, service and infrastructure provision, economic linkages and transitions, Indigenous engagement in post-mining land use, local level agreements with affected land-holders and communities, and finally, mining infrastructure as cultural heritage).

Procedural and process themes

(1) Integration and sustainability

Sustainability, or sustainable development – as a corporate objective, and social expectation – permeates the majority of the literature on the social impacts of closure.[60] Likewise, integrating social impacts into closure planning, as a key plank in developing a sustainable approach to the planning process, is possibly one of the most common themes to emerge across the literature. At a minimum, this approach entails integrating a closure perspective into feasibility studies and environmental impact assessments (EIAs), which should help to highlight social impacts related to closure that need to be accounted for throughout the project life-cycle.[61] For instance, in 'Thinking about the end before you start', Finucane argues that closure planning can influence project decisions and trigger improvements in project design, which in turn creates opportunities to improve outcomes and reduce project costs.[62] In a similar vein, Stacey et al. assert that planning for the social

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[59] COAG, Standing Council for Energy and Resources. 2013. The *Multiple Land Use Framework* (MLUF).

[60] Petelina, E, Sanscartier, D. MacWilliam, S. and Ridsdale, R. 2015. Sustainability Appraisal for Mine Closure. In (eds) A.B. Fourie, et al., *Mine Closure 2015 Proceedings of the 10th International Conference on Mine Closure*. Perth: Australian centre for Geomechanics. Pp 1103-1116.
Harvey, B. 2016. The eye of the beholder — utility and beauty in mine closure. In (eds) A. Fourie, et al., *Mine Closure 2016 Proceedings of the 11th International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 17-24.
Thomson, I. 2013. Key issues for socially responsible mine closure: A comparative examination of corporate polices and practice. In (eds) A. Fourie, M. Tibbett, C Digby. *Mine Closure 2013 Proceedings of the 8th International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 463-472.

[61] Smith, B. 2007. *Mine Closure: for Sustainable Mine Practices, Rehabilitation and Integrated Mine Closure Planning.* Unpublished MA thesis, UNSW. Australia.

[62] Finucane S.J. 2008. Thinking About the End Before You Start — Integrating Mine Closure Planning into Feasibility Studies and Environmental and Social Impact Assessment. In (eds) A. Fourie, M. Tibbett, I Weiersbye and P. Dye, *Mine Closure 2008 Proceedings of the 3rd International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 171-182.
See also Robertson S. and Blackwell B. 2014. Mine lifecycle planning and enduring value for remote communities. *International Journal of Rural Law and Policy*. Special edition 1, pp. 11. Available at: http://epress.lib.uts.edu.au/journals/index.php/ijrlp/article/download/3846/4210

impacts of closure should be built into the project life-cycle to enhance the possibility of achieving some form of sustainable development.[63]

However, successful integration is often undermined by the failure to start early.[64] As numerous commentators observe, 'despite the importance of the closure process, in practice it is left to the eleventh hour, commencing only immediately prior to an operation's decommissioning phase'.[65] The concept of 'mining for closure' was a deliberate attempt to confront these dis-integrated practices.[66] Building on this approach, Siwik and Clemens argue that local affected communities must be part of the mine closure design process before the mine is even operational, as the agreement to close supposedly provides social acceptance to operate.[67]

Integration as a theme, and as an operational practice, is extended to the internal development of resources and capabilities to manage the various aspects of closure.[68] As Anglo American staff Heymann and Botha make clear, developing and using in-house resources ensures deeper ownership of the mine closure plan and thus a better chance that the plan will be executed as intended.[69] This contrasts with the common practice of using external consultants to develop mine closure plans. The ability to convene multidisciplinary teams and to manage across a diverse range of internal and external relationships is critical for developing more integrated processes. This provides the basis for stronger synergies between the social, physical, biophysical and financial aspects of closure planning, and to ensure the full range of sustainability issues are adequately addressed.[70]

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[63] Stacey, J. et al. 2010. *The socio economic aspects of mine closure and sustainable development: Literature overview and lessons for the socio-economic aspects of closure*. Report 1 of 2. Johannesburg, South Africa: Centre for Sustainability in Mining and Industry.
Shandro, A. 2010. Strategic planning for mine closure: community sustainability experiences in northern British Colombia, Canada. In (eds) A. Fourie, M. Tibbett and J. Wiertz, *Mine Closure 2010 Proceedings of the 5th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 227-237.

[64] A number of articles focus on the challenges of integrating mine closure plans mid-way through the life of mine. See for instance, Dagva M.B., Warhurst, A, Macfarlane, M and Wood, G. 2008. Planning for Mine Closure: Socio-Economic Impacts. *Minerals and Energy – Raw Materials Report* 14 (3): 21-26.
Dagva, M.B. et al. 2015. Challenges of Integrating Mine Closure Plans Midway through the Life of mine in Mongolia. In (eds) A.B. Fourie, M., et al., *Mine Closure 2015 Proceedings of the 10th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 805-816.

[65] Lamb, K., Coakes, S. Australia. 2012. Effective social planning for mine closure. In (eds) A. Fourie and M. Tibbett, *Proceedings of the 7th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 627-640.

[66] Peck, P. et al. 2005. *Mining for Closure: Policies and guidelines for sustainable mining practice and closure of mines. P*repared for the UN Development Program (UNDP), UN Environment Program (UNEP).

[67] Siwik, R.S and Clemens, M.D. 2015. Mine Closure – past, present and perpetuity. In (eds) A.B. Fourie, M. Tibbett, L. Sawatsky and D. van Zyl, *Mine Closure 2015 Proceedings of the 10th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 59-70.
Finucane S.J. 2008. Thinking About the End Before You Start — Integrating Mine Closure Planning into Feasibility Studies and Environmental and Social Impact Assessment. In (eds) A. Fourie, M. Tibbett, I Weiersbye and P. Dye, *Mine Closure 2008 Proceedings of the 3rd International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 171-182.

[68] Harvey, B. 2016. The eye of the beholder — utility and beauty in mine closure. In (eds) A. Fourie, M. Tibbett, C Digby, *Mine Closure 2016 Proceedings of the 11th International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 17-24.

[69] Heymann, EF. and Botha, PR. 2016. Social closure planning: scoping, developing and implementing – a case study. In (eds) A. Flourie and M. Tibbett, *Mine Closure 2016 Proceedings of the 11th International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 213-228.

[70] Kunanayagam, R. 2006. Sustainable Mine Closure — Issues and Lessons Learnt. In (eds) A. Flourie and M. Tibbett, *Mine Closure 2006 Proceedings of the First International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 13-20.

(2) Stakeholder engagement

The importance of stakeholder engagement is a recurring theme across almost the entire body of literature on the social aspects of mine closure.[71] As Laurence notes, the importance of community engagement during operation and the inevitable mine closure phases cannot be overstated.[72] The key lessons on this theme include:

Engage communities early and often: Case material and guidance literature consistently emphasise the need to commence stakeholder engagement, consultation and empowerment in the earliest stages of the mine closure planning process, if not the earliest project planning phases.[73] As Stacey et al argue, 'social goals need to be set in full consultation with those affected by the operation and aimed at preventing ills rather than mitigating impacts after the fact'.[74] While this received wisdom is generally accepted across the industry, it is often ignored because of various practical concerns around managing expectations. As Lamb and Coakes observe, planning for closure from a social perspective 'appears to be one of the last considerations in the project cycle: with many companies

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Lamb, K., Coakes, S. Australia. 2012. Effective social planning for mine closure. In (eds) A. Fourie and M. Tibbett, *Mine Closure 2012 Proceedings of the 7th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 627-640.

Heymann, EF. and Botha, PR. 2016. Social closure planning: scoping, developing and implementing – a case study. In (eds) A. Flourie and M. Tibbett Mine, *Mine Closure 2016 Proceedings of the 11th International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 213-228.

[71] There are numerous guidebooks on stakeholder engagement, and related activities such as grievance management. See for instance, IFC. 2007. *Stakeholder engagement: A good practice handbook for companies doing business in emerging markets*. Washington, International Finance Corporation. For our purposes here, we are primarily interested in materials that address stakeholder engagement as part of the closure process.

[72] Laurence, D.C. 2002. Optimising Mine Closure Outcomes for the Community – Lessons Learnt. *Minerals & Energy – Raw Materials Report*. Vol 17 (1): 27-38.

[73] Dowd P. and Slight, M. 2006. The Business Case for Effective Mine Closure. In (eds) Fourie, A. and M. Tibbet, *Mine Closure 2006 Proceedings of the First International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 3-12.

Lord, M.T. Adams, M.H and Shearman, T.J. 2015. Century Mine Closure. In (eds) A. Fourie, M. Tibbett, Sawatsky, L and Van Zyl, *Mine Closure 2015 Proceedings of the 10th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 327-338.

Molefe, N. Molapo, M.P., and B.P. Chunderdoojh. 2006. Socio-Economically Sustainable Communities Post Mine Closure — A Case Study of the South African Coal Mining Industry. In (eds) A. Flourie and M. Tibbett, *Mine Closure 2006 Proceedings of the First International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 819-828.

Godlewski, D.W and Brown, M.J. 2010. Community Planning and Interaction – Pend Oreille Mine case study. In (eds) A. Fourie, M. Tibbett and J. Wiertz*, Mine Closure 2010 Proceedings of the 4th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 181-185.

Stacey, J. et al. 2010. *The socio economic aspects of mine closure and sustainable development: Literature overview and lessons for the socio-economic aspect of closure*. Report 1 of 2. Centre for Sustainability in Mining and Industry: Johannesburg. South Africa.

Kamuzora, M.F. 2010. Proactive Stakeholder Involvement – Tulawak's key towards successful closure. In (eds) A. Fourie, M. Tibbett and J. Wiertz, *Mine Closure 2010 Proceedings of the 4th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 187-182.

Lord, M.T. Adams, M.H and Shearman, T.J. 2015. Century Mine Closure. In (eds) A. Fourie, M. Tibbett, Sawatsky, L and Van Zyl, *Mine Closure 2015 Proceedings of the 10th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 327-338.

[74] Stacey, J. et al. 2010. *The socio economic aspects of mine closure and sustainable development: Literature overview and lessons for the socio-economic aspects of closure*. Report 1 of 2. Centre for Sustainability in Mining and Industry. Centre for Sustainability in Mining and Industry: Johannesburg. South Africa.

afraid that engagement with stakeholders in relation to closure planning will raise stakeholder expectations about final land use options that may not be feasible'.[75]

Transparent and effective communication: It has been frequently noted that a failure to engage stakeholders in a transparent process constitutes a primary failure of mine closure processes.[76] Case study materials consistently reinforce the need for effective communication throughout this process.[77] To counter these shortcomings, Lord and Shearman highlight the need for open and honest discussions with industry regulators and the commitment of resources for closure projects to build trust and confidence with stakeholders.[78] Costa extends this logic to include the involvement of reputable NGOs who are specialised in creating spaces of dialogue and consensus building between the company and its various project stakeholders.[79] Similarly, given that mine closure plans can provide a view of the potential social and economic future of a community, Finucane argues that this view must be shared and developed in consultation with those most affected.[80]

The subsidiarity principle: It is well acknowledged that local communities are a major stakeholder in the mine closure process.[81] Yet, according to McAllister et al., too often major decisions are made on their behalf, or with insufficient local input.[82] Decisions about the closure vision do not belong to mining companies alone; they also belong to the people who will remain in the area after the mine closes. Various authors highlight the need for closure processes to adopt the subsidiarity principle, whereby authority, responsibility and/or decision making is handed down to the smallest unit of government that can deal with the task most effectively.

Accessibility and inclusion: Building upon the need to engage early and often, case study material and practical guidance emphasise the importance of partnerships with a diverse range of

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[75] Lamb, K., Coakes, S. Australia. 2012. Effective social planning for mine closure. In (eds) A. Fourie and M. Tibbett, *Proceedings of the 7th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 627-640.

[76] McCullough, C.D. 2016. Key mine closure lessons still to be learned. In (eds) A. Fourie and M. Tibbett, *Mine Closure 2016 Proceedings from the 11th International Mine Closure Conference*. Perth: Australian Centre for Geomechanics, Perth. Pp 325.

Swanson, S., Abbott, R., Funk, W., Kirk. L. and McKenna. G. 2011. Building Stakeholder Engagement in Sustainable Solutions: The Strategic Advisory Panel on Selenium Management. In (eds) A. Fourie, M. Tibbett and Beersing, *Mine Closure 2011 Proceedings of the 5th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 189-196.

[77] Godlewski, D.W and Brown, M.J. 2010. Community Planning and Interaction – Pend Oreille Mine case study. In (eds) A. Fourie, M. Tibbett and J. Wiertz*, Mine Closure 2010 Proceedings of the 4th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 181-185.

[78] Lord, M.T. Adams, M.H and Shearman, T.J. 2015. Century Mine Closure. In (eds) A. Fourie, M. Tibbett, Sawatsky, L and Van Zyl, *Mine Closure 2015 Proceedings of the 10th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 327-338.

[79] Costa, S. 2015. Social impacts of mine closure: engaging employees and host communities in planning for closure. In (eds) A.B. Fourie, M. Tibbett, L. Sawatsky and D. van Zyl, *Mine Closure 2015 Proceedings of the Tenth International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 797-804.

[80] Finucane S.J. 2008. Thinking About the End Before You Start — Integrating Mine Closure Planning into Feasibility Studies and Environmental and Social Impact Assessment. In (eds) A. Fourie, M. Tibbett, I Weiersbye and P. Dye, *Mine Closure 2008 Proceedings of the 3rd International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 171-182.

[81] Godlewski, D.W and Brown, M.J. 2010. Community Planning and Interaction – Pend Oreille Mine case study. In (eds) A. Fourie, M. Tibbett and J. Wiertz*, Mine Closure 2010 Proceedings of the 4th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 181-185.

[82] McAllister, LM. Fitzpatrick, P and Fonseca, A. 2014. Challenges for space and place for corporate 'citizens' and healthy mining communities: the case of Logan Lake BC and Highland Valley Copper. *The Extractive Industries and Society* (1): 312-320.

stakeholders, with each party contributing to ensure more equitable outcomes.[83] Accordingly, sharing intergenerational perspectives on the past and the future is important because of the multi-generational impacts of large-scale mines. This includes sharing research findings for projects that will support post-mining sustainability such as a community health projects.[84] However, the complexities and cultural constraints on comprehensive engagement are well noted – often those most difficult to engage are the most marginalised, including women and the elderly, and these groups face the greatest social risks from mine closure.

(3) Baselines, risks and impact assessments

Risk assessments and risk management are central to operational planning and management paradigms. As such, a good deal of the mine closure literature emphasises the need to address social risks in the risk assessment process for mine closure planning.[85] However, much of this literature tends to focus on a narrow company-centric approach to social risks – that is, the identification and mitigation of social issues and impacts that may present a risk to successful closure of the mine and relinquishment of leases. Less attention is provided on the sorts of risks that closure may present for local communities, or how these might in turn impact upon the operation (e.g. the relationship between these risks). Baseline studies and social impact assessments should help to address these gaps and inform these risk assessment and risk management activities.

There are a range of social impact assessment (SIA) tools and frameworks for assisting with social planning for mine closure. These include community sensitivity analysis, town resource cluster analysis, participatory multi-criteria analysis, and key stakeholder mapping.[86] The knowledge produced through these activities is critical for setting objectives and completion criteria for

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[83] Godlewski, D.W and Brown, M.J. 2010. Community Planning and Interaction – Pend Oreille Mine case study. In (eds) A. Fourie, M. Tibbett and J. Wiertz*, Mine Closure 2010 Proceedings of the 4th International Conference on Mine Closure*, Perth: Australian Centre for Geomechanics. Pp 181-185.

[84] Shandro, A. 2010. Strategic planning for mine closure: community sustainability experiences in northern British Colombia, Canada. In (eds) A. Fourie, M. Tibbett and J. Wiertz, *Mine Closure 2010 Proceedings of the 5th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 227-237.

[85] Hattingh, R and Bothma, J. 2013. Taking the risk out of a risky business: a land use approach to closure planning. In (eds) M. Tibbett, A. Fourie and C. Digby, *Mine Closure 2013 Proceedings of the Eighth International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 15-24

Lamb, K., Coakes, S. Australia. 2012. Effective social planning for mine closure. In (eds) A. Fourie and M. Tibbett, *Proceedings of the 7th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 627-640.

Lord, M.T. Adams, M.H and Shearman, T.J. 2015. Century Mine Closure. In (eds) A. Fourie, M. Tibbett, Sawatsky, L and Van Zyl, *Mine Closure 2015 Proceedings of the 10th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 327-338.

McGuire, A. 2003. Managing Mine Closure Risks in Developing Communities: A case study of the Kelian Equatorial Mine. *Mining Risk Management Conference Sydney*, NSW, 9 - 12 September 2003.

Godlewski, D.W and Brown, M.J. 2010. Community Planning and Interaction – Pend Oreille Mine case study. In (eds) A. Fourie, M. Tibbett and J. Wiertz*, Mine Closure 2010 Proceedings of the 4th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 181-185.

[86] Evans, R. 2011. Closure planning. In (eds) Vanclay, F. & A.M. Esteves, *New direction in social impact assessment*. Edward Elgar: Cheltenham, UK. Pp 221-232.

Vanclay, F., A. M. Esteves, I. Auccamp and D. Franks. 2015. *Social Impact Assessment: Guidance for assessing and managing the social impacts of projects*. Fargo ND: International Association for Impact Assessment.

Lamb, K., Coakes, S. Australia. 2012. Effective social planning for mine closure. In (eds) A. Fourie and M. Tibbett, *Proceedings of the 7th International Conference on Mine Closure*. Peth: Australian Centre for Geomechanics. Pp 627-640.

Adey, E.A., and P.H. Whitbread-Abrutat. 2013. Social mine closure planning: how is it changing and why? In (eds) M. Tibbett, A. Fourie and C. Digby, *Mine Closure 2013 Proceedings of the Eighth International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp431-440.

successful closure and post-closure outcomes.[87] For example, in a case study on mine closure planning in northern British Colombia in Canada, Shandro et al. found that baseline research – pre and post mine closure – were important tools for assessing changes in social and health-care standards, and supported mine closure planning work.[88] Some recommend the use of a high-level community vulnerability and assessment tool in the early stages of a mines life to assist organisations in focusing their community programs in such a way to mitigate the socio-economic impacts of closure. Similarly, Nelsen et al. make a case for characterising local forms of social capital that exist around a mining project, and the use of community-indicators to forecast specific social and economic outcomes for new mining projects as a way of thinking about post-closure scenarios before operations commence.[89]

(4) Governance processes and the state

It has been claimed that leading large-scale mining corporations have higher closure standards than many governments require, especially in developing country jurisdictions.[90] Some companies are motivated to develop these standards partly in order to meet broader international industry norms and expectations, and partly to manage corporate risks.[91] However, good practice guidelines consistently note the importance of involving all spheres of government in the closure process, ideally commencing during the feasibility stages of the project life-cycle.[92] Some states, such as the Philippines, have enshrined the opportunity in the constitution for civil society and interest groups to promote their interests and engage with industry.[93]

Government disengagement is a common frustration in many operational contexts.[94] This can be especially apparent as mining projects approach closure and contribute less revenue to the

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[87] Coppin, N.J. 2013. A framework for success criteria for mine closure, reclamation and post-mining regeneration. In (eds) M. Tibbett, A. Fourie and C. Digby, *Mine Closure 2013 Proceedings of the Eighth International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 485-494.

[88] Shandro, A. 2010. Strategic planning for mine closure: community sustainability experiences in northern British Colombia, Canada. In (eds) A. Fourie, M. Tibbett and J. Wiertz, *Mine Closure 2010 Proceedings of the 5th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 227-237.

[89] Nelsen J.L, Scoble M and Ostry, A. 2010. Sustainable socio-economic development in mining communities: north-central British Columbia perspectives. *International Journal of Mining, Reclamation and Environment* 24 (2): 163-179.

[90] Finucane S.J. 2008. Thinking About the End Before You Start — Integrating Mine Closure Planning into Feasibility Studies and Environmental and Social Impact Assessment. In (eds) A. Fourie, M. Tibbett, I Weiersbye and P. Dye, *Mine Closure 2008 Proceedings of the 3rd International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 171-182.

Mauric, A.P. McCullough, C.D., Wilson-Clark, C. Witcomb, A., and J. Millgate. 2012. Closure planning in a developing country – a case study from the Phu Kham Mine, Laos, Southeast Asia. In (eds) A. Fourie, M. Tibbett, and C. Digby, *Mine Closure 2012 Proceedings of the 7th International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics, Perth Mine Closure Conference. Pp 295-304.

[91] McGuire, A. 2003. Managing Mine Closure Risks in Developing Communities: A case study of the Kelian Equatorial Mine. *Mining Risk Management Conference Sydney*, NSW, 9 - 12 September 2003.

[92] Marias, L. *et al* 2005. Public Finances, Service Delivery and mine closure in Koffiefontein: from stepping stone to stumbling block. *Town and Regional Planning* 48: 5-16.

O'Faircheallaigh, C. 1992. Mine Closures in remote regions: Policy Options and Implications". In (eds) Neil, C., Tykklainen and J. Bradbury, *Coping with Closure: An International Comparison of Mine Town experiences.* Routledge, London. Pp 347-368.

[93] Chaloping-March, M. 2017. *Social Terrains of Mine Closure in the Philippines*. Routledge Focus: New York.

[94] Robertson S and Blackwell B. 2015. Remote mining towns on the rangelands: determining dependency within the hinterland. *The Rangeland Journal*. 37 (6): 583-96. http://dx.doi.org/10.1071/RJ15046

Wolfe, J.M. 1992. Schefferville: the crisis in the iron mining region of Quebec-Labrador: Mine closure in single industry towns and the problem of residual activities. In (eds) Neil, C., Tykklainen and J. Bradbury, *Coping with Closure: An International Comparison of Mine Town experiences.* Routledge, London. Pp 192-207.

government. The flip side of disengagement is direct government corruption, which can equally impact the potential for positive post-closure legacies. As case material from countries like Zimbabwe demonstrate, where state practices are structured around corruption and patronage, this often creates complications and compromises effective mine closure planning, where little or no lasting benefits can be ensured at the local level.[95]

In an earlier 1995 comparative review of community responses to closure, Lansbury and Breakspear found that engagement with available regional planning frameworks as part of the closure planning process assisted regions to achieve greater post-closure economic diversification. They found, for instance, that while there has been no formal regional policy in Canada for economic development (unlike Sweden), ad hoc efforts have been made to direct investment to particular regions where mines have closed. Whereas in 'Australia there has only been sporadic interest in regional policies and…little coordination of assistance to declining mining communities'.[96] In the South African context, Stacey et al. found that one of the major shortcomings of mine closure legislation is that closure requirements are seldom specified in detail. While the elements of mine closure plans are typically itemised, including social aspects, there is little or no information on how these requirements are to be met, or why particular approaches should be favoured over others.[97]

Topical issues

(1) Housing and town normalisation

Where mining companies have established town sites and residential accommodation for their employees, the issue of housing and town 'normalisation' is often a pressing material consideration for the mine closure planning process.[98] The various issues surrounding this theme are well documented across many of the case studies in the *Coping with Closure* edited volume.[99] Globally, there are numerous examples of so-called 'ghost towns' where the closure of the mine has led to the

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Neil, C.C. and J. Lea. 1992. Wind down and closure across a region: Local Economic Development Problems facing the Tasmanian west coast. In (eds) Neil, C., Tykklainen and J. Bradbury, *Coping with Closure: An International Comparison of Mine Town experiences.* Routledge, London. Pp 266-290.

[95] Zvarivasza, T. 2015. Making the most out of Zimbabwe's Marange Diamonds: leaving a lasting positive legacy for distressed communities. In (eds) A. Fourie, M. Tibbett, L. Sawatsky and D. van Zyl, *Mine Closure 2015 Proceedings of the 10th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp. 775–785.

Mugonda, M. 2006. The Socio-Economic Implications of Mine Closure — A South African and Zimbabwean Scenario. In (eds) A. Flourie and M. Tibbett, *Mine Closure 2006 Proceedings of the First International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 829- 834.

Limpitlaw, D. and Hoadley, M. 2006. South Africa: Faultlines in Mine Closure Planning in a Developing Country Context. In (eds) A. Flourie and M. Tibbett, *Mine Closure 2006 Proceedings of the First International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 803-810.

[96] Lansbury, R.D and C. Breakspear. 1995. Closing down the mine: A tale of two mining communities and their responses to mine closure. *Economic and Industrial Democracy*. Vol 16: 275-289.

[97] Stacey, J. et al. 2010. *The socio economic aspects of mine closure and sustainable development: Literature overview and lessons for the socio-economic aspects of closure*. Report 1 of 2. Centre for Sustainability in Mining and Industry: Johannesburg. South Africa.

[98] Related research has looked at housing in the local community, as a benefit of mining operations. For instance, Mamonto et al. discuss a case study of the Indonesian PT NMR mine closure in East Ratatotok where local home ownership has increased from 2.2% to 69%, and the condition of houses has improved from only 22% of cement floors in 1994 to more than 95% cement in 2011. And likewise, the number of villages in the mining hinterland grew from 3 (in 1986 when the mine started) to 18 villages after closure (2012).

[99] Neil, C.C., Tykklainen, M, and J. Bradbury (eds). 1992. *Coping with Closure: An International Comparison of Mine Town Experiences*. Routledge, London

closure of the town, especially if it was built to house mine-workers as a single purpose town.[100] In Australia, for example, there are only a small number of residential mining communities still operating, most of which have existed since the 1960s.[101] Those that do exist in Australia (including in the Pilbara) are slowly becoming 'normalised' prior to mine closure or 'opened up' with the government gradually assuming responsibility for services.[102] This is also occurring for many previously 'closed' mining towns in the Bowen Basin region of Qld.[103] Perhaps unsurprisingly, there is more research and literature on 'housing market dynamics' in mining towns, rather than the social impact of closure on housing.[104]

Other case study materials consider whether or not the provision of housing can lead to positive development outcomes[105]; the importance of formalising relationships to ensure mutually shared expectations about ownership and/or rental of housing for ex-mine-workers and [106]; and analysis of the possible range of innovative housing management options. For instance, town normalisation often entails the development of a more diversified local economy, where company housing becomes part of the local real estate market; in such cases, the company may on-sell the housing to create a housing market and incentives to remain.[107]

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[100] Archer, K. and Bradbury, J. 1992. Schefferville: the crisis in the iron mining region of Quebec-Labrador: The Life and Death of a company town. In (eds) Neil, C.C., Tykklainen, M., and J. Bradbury, *Coping with Closure: An International Comparison of Mine Town Experiences*. Routledge, London. Pp 169-191.
Maude, A. and Hugo, G. 1992. Mining Settlements in Australia. In (eds) Neil, C.C., Tykklainen, M., and J. Bradbury, *Coping with Closure: An International Comparison of Mine Town Experiences*. Routledge, London. Pp 66-94.

[101] Browne, AL. Stehlik, D & Buckley, A. 2011. Social licences to operate: for better not for worse; for richer not for poorer? The impacts of unplanned mining closure for "fence line" residential communities. *The International Journal of Justice and Sustainability*, 16 (7): 707-725.
Talman, P and Tykkylainan, M. 1992. Finland: Restructuring Policy in the 1980s. In (eds) Neil, C.C., Tykklainen, M., and J. Bradbury, *Coping with Closure: An International Comparison of Mine Town Experiences*. Routledge, London. Pp 313-326.

[102] Moller, M and R. Flugge. 2006. Pilbara Iron's Approach to Sustainable Development During Mine Closure — The Case Study of Greater Tom Price and Pannawonica Operations. In (eds) A. Flourie and M. Tibbett, *Mine Closure 2006 Proceedings of the First International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 237-246.

[103] Petkova, V., Lockie, S., Rolfe, J., and Ivanova, G. 2009. Mining developments and social impacts on communities: Bowen Basin case studies. *Rural Society* 19: 211–228.

[104] Haslam McKenzie F and Rowley S. 2013. Housing market failure in a booming economy. *Housing Studies*, 28 (3): 373-88.
Haslam McKenzie F. 2011. Fly-in fly-out: The challenges of transient populations in rural landscapes. In (eds) Luck G, Race D and R. Black, *Demographic Change in Rural Landscapes: What Does it Mean for Society and the Environment?* Springer (Landscape Series). London. Pp. 353-74

[105] Mamonto, P.D.L., and C.E.D., Sompie. 2012. Sustainable development for post-closure – a case study of PT Newmont Minahasa Raya. In (eds) A. Fourie, M. Tibbett, and C. Digby, *Mine Closure 2012 Proceedings of the 7th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 279-294.

[106] Molefe, N. Molapo, M.P., Chunderdoojh, BP. 2006. Socio-Economically Sustainable Communities Post Mine Closure — A Case Study of the South African Coal Mining Industry. In (eds) A. Flourie and M. Tibbett, *Mine Closure 2006 Proceedings of the First International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 819-828.

[107] O'Hara, G., Bordian, J. Clausen, K. and Wernick, B.G. 2010. Environmental remediation works stimulate renewed interest in mine heritage and tourism at Britannia Beach. In (eds) A. Fourie, M. Tibbett and J. Wiertz, *Mine Closure 2010 Proceedings of the 5th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 205-215.

A sub-topic within town-normalisation is the need to manage for the influx or in-migration of workers and the subsequent tensions that emerge within the community, including competing ethnicity and identity issues. This is a major and critical aspect of mine closure in some states and regions such as the Philippines and Indonesia.[108]

(2) Service and infrastructure provision

There is relatively little research on whether the establishment of infrastructure and service provision during mining operations can lead to post-mining sustainable economic development, although notable exceptions include O'Faircheallaigh's 1986 monograph *Mine Infrastructure and Economic Development in North Australia*.[109] Case study material tends to focus on the challenges surrounding the continued provision and maintenance of these services and infrastructure. Questions surrounding governance, maintenance of infrastructure and responsibility for provision of services (activities that may have all been primarily driven by the mining company) are central to mine closure planning. Recent research at the Century Mine in Queensland Australia has documented the range of local concerns around future post-mining service and infrastructure provision and governance in this remote region.[110] As the case material demonstrates, and as we elaborate below, these aspects of mine closure are closely tied issues around land use planning, local level agreements, and 'economic transition'.

Case material on the repurposing of mining infrastructure and land include examples where mine camp buildings have been dismantled and donated to the local government for use by the community for educational and cultural purposes[111], the development of a tourism village with conference facilities, or re-purposing company lease land areas as real-estate.[112] At the Homestake mine in South Dakota, mine shafts and pit infrastructure were re-purposed for a deep underground national science lab, and the slime plant was remodelled as a casino-resort.[113] Hydro-electric plants

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Gove/Nhulunbuy example. ABC news. 2014. Nhulunbuy's Empty Houses set for NTG and Rio Tinto Economic Initiative. Available at: http://www.abc.net.au/news/2014-11-21/rio-tinto-and-nt-government-nhulunbuy-initiative-announced/5909778

[108] Chaloping-March, M. 2017. *Social Terrains of Mine Closure in the Philippines*. Routledge Focus: New York.

[109] O'Faircheallaigh, C. 1986. *Mine Infrastructure and Economic Development in North Australia*. Centre for Resource Studies, Queen's University, Kingston, Ontario.

See also, Koch, A and Gartrell, J. 1992. Keeping Jobs in the Kootenays: Coping with Closure in British Colombia. In (eds) Neil, C.C., Tykklainen, M, and J. Bradbury, *Coping with Closure: An International Comparison of Mine Town Experiences*. Routledge, London. Pp 208-224.

Browne, AL. Stehlik, D & Buckley, A. 2011. Social licences to operate: for better not for worse; for richer not for poorer? The impacts of unplanned mining closure for "fence line" residential communities. *The International Journal of Justice and Sustainability*, 16 (7): 707-725.

Chaloping-March, M. 2008. Business Expediency, Contingency and Socio-political realities – a case of unplanned mine closure. In (eds) A.B. Fourie, M. Tibbett, I.M Weiersbye and P.J. Dye, *Mine Closure 2008 Proceedings of the Third International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 863-872.

[110] Everingham, J. & Keenan, J. 2017. *Hindsight for Foresight: lessons about Agreement Governance from Implementing the Gulf Communities Agreement*, CSRM: Brisbane. Available at: file:///C:/Users/uqnbaint/Downloads/hindsight-for-foresightfinal.pdf

[111] McGuire, A. 2003. Managing Mine Closure Risks in Developing Communities: A case study of the Kelian Equatorial Mine. *Mining Risk Management Conference Sydney*, NSW, 9 - 12 September 2003.

[112] Chaloping-March, M. 2008. Business Expediency, Contingency and Socio-political realities – a case of unplanned mine closure. In (eds) A.B. Fourie, M. Tibbett, I.M Weiersbye and P.J. Dye, *Mine Closure 2008 Proceedings of the Third International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 863-872.

[113] Duex, T.A. 2010. Sustainable development activities during closure of the Homestake gold mine. In (eds) A. Fourie, M. Tibbett and J. Wiertz, *Mine Closure 2010 Proceedings of the 4th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 193-198.

built by the mine for additional power generation were on-sold at nominal fee to the nearby city, while the water sources system was also donated by the mine to the regional water utility system.[114]

This literature suggests that if a 'mining for closure' lens is applied, then decision making around infrastructure establishment during the project design phase should also consider the existing context and the range of possibilities of post-mining uptake and upkeep of the new service provision.

(3) Economic linkages and transitions

There is a broad range of case studies and examples of 'economic transition', or post-mine economic development, that include the re-purposing of mining infrastructure and landscapes, and efforts to (re)develop livelihoods to strengthen food security, and economic diversification. The growing body of case study material on economic transition illustrates the diverse possibilities of post-mining economies which, in-turn underwrite economic 'rehabilitation'.[115] As Harvey argues, 'companies, communities and regulators faced with mine closure scenarios should explicitly place future economic occupation of mine sites at the forefront of mine closure visioning and leave open future options for creative human enterprise'.[116]

Opportunities for economic diversification are often constrained by the geography of the area and the options for re-purposing of mining infrastructure and landscapes. In remote areas where there are no other comparable forms of large-scale development, eco-tourism is sometimes promoted as one of the few long-term sustainable livelihood options for engagement with the market economy which can also create opportunities for companies to maintain areas of intact ecosystems.[117] In assessing the viability of agriculture as a post-mining land use and economic activity, the site specific issues to consider include the footprint of the mine, the level of remediation needed for ensure non-contamination, the forms of pre-existing livelihoods and the extent of food security need. As Howieson et al. observe, in some cases disused mine sites are better converted into agricultural sites, rather than restored to their original condition. They emphasise the need for such innovative strategies as food security in many regions is an increasingly critical challenge.[118] There is also growing interest around the re-purposing of mining pit lakes. Examples include pit-lake re-purposing to promote leisure tourism in a post-mining communities, which, if properly remediated, may also minimise risks to health and habitat.[119] Elsewhere mine pit lakes have been repurposed as large-scale

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[114] Ibid.

[115] Chaloping-March, M. 2017. *Social Terrains of Mine Closure in the Philippines*. Routledge Focus: New York. Pearman, G.I. 2009. *101 things to do with a hole in the ground*. Eden Project: United Kingdom.

[116] Harvey, B. 2016. The eye of the beholder — utility and beauty in mine closure. In (eds) A. Fourie, M. Tibbett, C Digby, *Mine Closure 2016 Proceedings of the 11th International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 17-24.

[117] Molefe, N. Molapo, M.P., Chunderdoojh, BP. 2006. Socio-Economically Sustainable Communities Post Mine Closure — A Case Study of the South African Coal Mining Industry. In (eds) A. Fourie and M. Tibbett, *Mine Closure 2006 Proceedings of the First International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 819-828.

Koch, A and Gartrell, J. 1992. Keeping Jobs in the Kootenays: Coping with Closure in British Colombia. In (eds) Neil, C.C., Tykklainen, M, and J. Bradbury, *Coping with Closure: An International Comparison of Mine Town Experiences*. Routledge, London. Pp 208-224.

Browne, AL. Stehlik, D & Buckley, A. 2011. Social licences to operate: for better not for worse: for richer not for poorer? The impacts of unplanned mining closure for "fence line" residential communities. *The International Journal of Justice and Sustainability* 16 (7): 707-725.

[118] Howieson, J. Calmy, H., Ballard, N., Skinner, P., O'Hara, G and Skinner, L. 2017. Bread from Stones: Post-mining land use change from phosphate mining to farmland. *The Extractive Industries and Society* 4: 290-299.

[119] Mccullough, C. D., & Lund, M. A. 2006. Opportunities for sustainable mining pit lakes in Australia. *Mine Water and the Environment*, 25(4): 220-226.

See also Pearman, G.I. 2009. *101 things to do with a hole in the ground*. Eden Project: United Kingdom.

water reservoirs[120], or used for urban waste management purposes, such as the former Woodlawn poly-metallic mine in south of Sydney in Australia.

Reclamation and re-purposing can also occur on a regional scale, creating other alternative economic opportunities. For instance, the Appalachian coal country in the United States had suffered economic and environmental abandonment due to severe acid mine drainage (AMD) issues.[121] Community groups developed the AMD&ART program as a purposeful effort to link AMD remediation with the arts which included the development of the 'Ghost Town Rail Trail' and 'enhancing economic growth around [mining] heritage themes: the devastating loss of coal jobs in the 1950s and after that a region filled with orange streams, abandoned structures and declining communities'. Here a re-purposing becomes a re-imagining and reclaiming.

A number of companies now specialise in the 'economic rehabilitation' of previously uneconomic mine sites. For instance, the Australian company Century Bull reprocesses tailings from remnant mineralisation (zinc bearing tailings), using existing infrastructure while also progressively rehabilitating sites to generate ongoing economic contribution.[122] This company is currently re-working the resources at the Century mine, which according to the former operator of the mine 'provides new life for the substantial Century assets, while supporting dedicated rehabilitation and ongoing employment, training and business opportunities…[and] will continue to generate employment and training opportunities and other ongoing benefits to the communities and businesses'.[123]

There is great potential for economic linkages and dependencies to create positive or negative effects locally in the transition to closure and during the post-closure period. Current good practice encourages mining companies to source services locally to generate local economic inputs. But as mines move towards the end of the project life-cycle, this is typically accompanied by a decrease in local economic opportunities and revenue flows. Miradauro et al. document the need for mine closure planning processes to consider how these local service providers will manage in the post-closure period. They found that re-skilling these secondary service workers, as well as local mine workers, is an essential step towards economic diversification.[124]

These linkages often extend beyond workers and local businesses. Municipal dependency can also be a significant issue. The interrelationship between mining activities, the local municipality and public finance is a key issue of consideration in planning for the social impacts of closure. Analysis on this issue, in a range of global contexts, indicates that mine closure typically impacts municipal and public

[120] Chaloping-March, M. 2008. Business Expediency, Contingency and Socio-political realities – a case of unplanned mine closure. In (eds) A.B. Fourie, M. Tibbett, I.M Weiersbye and P.J. Dye, *Mine Closure 2008 Proceedings of the Third International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 863-872.

[121] Comp, T.A. 2013. From environmental liability to community asset: mined land reclamation. In (eds) A. Fourie, M. Tibbett, C Digby. *Mine Closure 2013 Proceedings of the 8th International Conference on Mine Closure.* Australian Centre for Geomechanics, Perth. Pp 415-422.

[122] Raging Bull Mining Pty Ltd. Available at: http://www.ragingbullmining.com/

[123] See North West Star newspaper. March 1 2017 "MMG sells Century mine for rehabilitation". Available at: http://www.northweststar.com.au/story/4499774/mmg-sells-century-for-mine-rehab/

[124] Miradauro, L. Piagentine, S.M, Costa, M. 2008. Minimisation of socio-economic impacts during mine closure. In (eds) A. Fourie, M. Tibbett, I Weiersbye and P. Dye, *Mine Closure 2008 Proceedings of the 3rd International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 853-865.

finances as revenue streams diminish or disappear.[125] On the one hand this might account for the often observed absence of governments during mine closure planning. On the other hand, as Robertson and Blackwell demonstrate, governments must be involved in the closure process in order to address issues of dependency.[126]

The literature on mining economies suggests that the legacy of individual companies may be remembered as much by the creative or functional re-purposing of the infrastructure and the changed landscape, as by their remediation and rehabilitation efforts. While such planning should occur at the design stage, it is almost never too late to engage the local community and the municipal government in discussions on alternate uses for the post-mining infrastructure and land use.

(4) Indigenous engagement in post-mining land use

The vast majority of the literature on Indigenous peoples and mining concerns negotiated local level agreements and socio-economic impacts. As a result, agreements are treated separately below. In most contexts, planning for the social impacts of mine closure often focusses on the future of infrastructure, such as roads, and services, and post-mining land use. The land use options will vary between regions and projects.[127]

For many Indigenous communities, post-mining land use and rehabilitation of mining areas assumes an additional level of significance within the mine closure process.[128] Given the importance of land for local Indigenous communities, as the basis for identity, the source of livelihoods and a sense of place, post-mine land use planning and management processes must engage with cultural criteria and understandings of landscape values. The rehabilitation of cultural landscapes by integrating traditional ecological knowledge (TEK) into the mine site rehabilitation is an emerging practice in both Australia and Canada.[129] Breadmore and Lafferty discuss the incorporation of traditional

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[125] Marias, L. *et al* 2005. Public Finances, Service Delivery and Mine Closure in Koffiefontein: from stepping stone to stumbling block. In *Town and Regional Planning* 48: 5-16.
O'Faircheallaigh, C. 1992. Mine Closures in Remote Regions: Policy Options and Implications. In (eds) Neil, C.C., Tykklainen, M., and J. Bradbury, *Coping with Closure: An International Comparison of Mine Town Experiences*. Routledge: London. Pp 347-368.

[126] Robertson S and Blackwell B. 2015. Remote mining towns on the rangelands: determining dependency within the hinterland. *The Rangeland Journal*. 37 (6): 583-96. http://dx.doi.org/10.1071/RJ15046

[127] Brereton, D and Everingham, J. 2016. *Making and implementing agreements with Indigenous communities: a case study of the Gulf Communities Agreement.* Brisbane: CSRM, The University of Queensland.

[128] Cohen, T 2017, 'Bringing country back? Indigenous aspirations and ecological values in Australian mine-site rehabilitation', In K Jalbert, A Willow, D Casagrande and S Paladino (eds), *ExtrACTION: impacts, engagements, and alternative* futures, Taylor & Francis, Abingdon, Oxon, pp. 137-50.
Smith. H.D. 2008. Using Traditional Ecological Knowledge to Develop Closure Criteria in Tropical Australia. In (eds) A. Fourie, M. Tibbett, I Weiersbye and P. Dye, *Mine Closure 2008 Proceedings of the 3rd International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 47-56.
Smith, H.D. and A. Thompson, A. 2013. Towards closure at Jabiluka: rehabilitation of the Boyweg Almudj sacred site complex. In (eds) M. Tibbett, A. Fourie and C. Digby, *Mine Closure 2013 Proceedings of the Eighth International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp. 423–429.

[129] Breadmore, R.E. and G.J. Lafferty. 2015, Mine closure and first nations – social licence strategies for effective community engagement. In (eds) A. Fourie, M. Tibbett, L. Sawatsky and D. van Zyl, *Mine Closure 2015 Proceedings of the 10th International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp. 753–762.
Jones, CE and MacLean, M.L.A. 2013. Reclaimed landscapes – incorporating cultural values. In (eds) M. Tibbett, A. Fourie and C. Digby, *Mine Closure 2013 Proceedings of the Eighth International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp. 441–446.
Sandlos, J. and Keeling, A. 2016. Aboriginal Communities, traditional knowledge, and the environmental legacies of extractive development in Canada. *The Extractive Industries and Society* 3: 278-287.

knowledge into hard science and engineering approaches to rehabilitation.[130] Likewise, according to Smith, in order for TEK to play a role in post-mining landscape planning and management, meaningful and scientifically defensible ways of integrating socio-cultural perspectives with environmental decision making must be developed.[131] He further argues that it is possible to develop closure criteria that meets the expectation of Indigenous landowners and scientific rigour. Post-mine land remediation, or rehabilitation activities can also provide a source of future economic opportunity for local land connected groups. For example, this can include potentially ongoing roles for Indigenous land managers and ranger groups to ensure that rehabilitation progresses as planned and meets locally relevant cultural criteria.

Similarly, post-mining land use and access strategies can contribute or detract from community well-being. In a case study of a Nunuvut community in the Canadian arctic, participants rated mine closure impacts on a 'Well-Being Wheel', an evaluation tool featuring five axes: family life, jobs, food independence, health and learning.[132] In this context, there were ongoing issues of land access for hunting and fishing which impacted community well-being. At the same time they point to positive examples of old cut-lines being reclaimed for hunting. However, in other contexts closer to contaminated sites, long-term restrictions on land can occur, in turn impacting local livelihoods.[133]

Rixen and Blangey discuss the impact of legacy issues on community wellbeing.[134] They found that the cumulative impacts of mining on community wellbeing remain under-emphasised, especially in the aftermath of mine closure, raising the question of whether any sustainable benefits have been derived from the operations.[135] Hockley and Coulter's case study of the Red Dog mine in Alaska illustrates how planning for closure was tailored to the needs and interests of the Inupiat, as the resident population, with the assistance of various experts. In this case, mine closure planning occurred over 4 years across many information sessions, requiring diverse communication styles.[136] However, as a general observation, Ross and Bond found that Aboriginal communities in Canada are often inadequately prepared for closure, and lack the capacity to offset the impacts.[137]

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[130] Breadmore, R.E. and G.J. Lafferty. 2015, Mine closure and first nations – social licence strategies for effective community engagement. In (eds) A. Fourie, M. Tibbett, L. Sawatsky and D. van Zyl, *Mine Closure 2015 Proceedings of the 10th International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp. 753–762.

[131] Smith. H.D. 2008. Using Traditional Ecological Knowledge to Develop Closure Criteria in Tropical Australia. In (eds) A. Fourie, M. Tibbett, I Weiersbye and P. Dye, *Mine Closure 2008 Proceedings of the 3rd International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 47-56.

[132] Rixen, A and Blangy, S. 2016. Life after Meadowbank: Exploring gold mine closure scenarios with the residents of Qam in i'tuaq (Baker Lake), Nunuvit. *The Extractive Industries and Society* 3: 297-312.

[133] Le Clerc, E. and Keeling, A. 2015. From Cut Lines to Trap Lines: Post Industrial land use at Pine Point Mine. *The Extractive Industries and Society* (2): 7-17.

[134] Rixen, A and Blangy, S. 2016. Life after Meadowbank: Exploring gold mine closure scenarios with the residents of Qam in i'tuaq (Baker Lake), Nunuvit. *The Extractive Industries and Society* 3: 297-312.

[135] For Australia, see, Scambary, B. 2013. *My Country, Mine Country: Indigenous People, Mining and Development Contestation in remote Aboriginal Australia*. ANU Press: Canberra.
Holcombe, S. 2010. Sustainable Aboriginal livelihoods and the Pilbara mining boom. In Ian Keen (ed), *Indigenous Participation in Australian Economies: Historical and Anthropological Perspectives*, ANU Press: Canberra Australia. Pp. 141-164.

[136] Hockley, D.E and Coulter, G.A. 2010. Many Voices, one plan: eliciting and integrating stakeholder feedback In (eds) A. Fourie, M. Tibbett and J. Wiertz, *Mine Closure 2010 Proceedings of the 5th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 167-180.

[137] Ross, N. and B. Bond. 2008. Viability of Aboriginal Communities Beyond Mine Closure. In (eds) A. Fourie, M. Tibbett, I Weiersbye and P. Dye, *Mine Closure 2008 Proceedings of the 3rd International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 873-878.

(5) Local level agreements with communities and affected land holders

Agreement making is a signature recognition by industry that establishing relationships with local communities and stakeholders is of mutual benefit. These agreements shift the paradigm of industry-community relationships to engage with future-looking legacies that are intrinsically social. Yet, our initial investigations suggest that very few agreements specifically address the closure process, or post-closure considerations. Mine closure objectives and requirements, especially details concerning the social aspects of mine closure, are rarely outlined within negotiated local level agreements, which is partly because these closure plans are often developed during operations – after these agreements have been signed.

A fundamental issue explored across this literature for the Australian context is whether or not these agreements have assisted in shifting the high levels of structural disadvantage and material poverty found among many Indigenous populations who live in remote areas and in the vicinity of large-scale mines.[138] Equally important, are implementation plans, resourcing and governance arrangements for the actual commitments detailed within these agreements, and likewise agreement monitoring and review processes.[139] Typically, within Australian mining Indigenous Land Use Agreements (ILUAs) there are targets and aspirations set around business development, employment and training and development possibilities. This is especially the case in remote regions with little access to mainstream markets and capital.[140] From this perspective, there is huge scope for local level agreements to address local aspirations beyond mine life. Negotiated agreements provide an opportunity for companies that have operated in an area to revisit and re-adjust its relationship with local Indigenous communities and actively alter their legacy.[141] Recent agreements in Canada, are starting to include some post-closure socio-economic provisions, such as post-closure wellness strategies.[142] However, as few agreements are in the public domain, this is essentially an invisible area that needs more attention.

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[138] Altman, J.C and Martin, DF. (eds). 2009. *Power, Culture, Economy: Indigenous Australians and Mining.* Centre for Aboriginal Economic Policy Research, ANU Press: Canberra
Scambary, B. 2013. *My Country, Mine Country: Indigenous People, Mining and Development Contestation in remote Aboriginal Australia*. ANU Press: Canberra.
Langton, M. Mazel, O. Palmer, L. Shain, K. and Tehan, M (eds). 2006. *Settling with Indigenous People: Modern Treaty and Agreement-Making*. The Federation Press: Melbourne.
Langton, M. and Longbottom, J. 2012. *Community Futures, Legal Architecture: Foundations for Indigenous Peoples in the Global Mining Boom.* Routledge: London.
See also O'Faircheallaigh, C. 2016. *Negotiations in the Indigenous World: Aboriginal Peoples and the Extractive Industry in Australia and Canada.* Routledge: New York.

[139] O'Faircheallaigh, C. 2016. *Negotiations in the Indigenous World: Aboriginal Peoples and the Extractive Industry in Australia and Canada*. Routledge: New York.

[140] Rio Tinto. 2016. *Why Agreements Matter.* Available at: https://www.riotinto.com/documents/Rio_Tinto_Why_Agreements_Matter.pdf

[141] Crook et al. 2006. Implementing and Monitoring ILUAs in the Minerals Industry: The Western Cape Communities (WCCA) Agreement. In (eds) Langton *et al. Settling with Indigenous Peoples: Modern Treaty and Agreement Making.* The Federation Press: Melbourne.
Doohan, K., Langton, M., Mazel, O., 2012. From paternalism to partnership: the good neighbour agreement and the Argyle diamond mine indigenous land use agreement in Western Australia. In (eds) Langton, M., Longbottom, J. *Community Futures, Legal Architecture: Foundations for Indigenous Peoples in the Global Mining Boom*. Routledge: London, UK.

[142] Ross, N. and B. Bond. 2008. Viability of Aboriginal Communities Beyond Mine Closure. In (eds) A. Fourie, M. Tibbett, I Weiersbye and P. Dye, *Mine Closure 2008 Proceedings of the 3rd International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 873-878.
O'Fairchaellaigh, C. 2016. *Negotiations in the Indigenous World: Aboriginal Peoples and the Extractive Industry in Australia and Canada.* Routledge: New York.

(6) Mining infrastructure as cultural heritage

There is a small, but growing body of literature on the ways in which long life mines can also develop cultural values, where sentimental attachments form and historical values accrue to a site over several generations. For instance, throughout many regions of Europe the history of the industrial revolution has left a deep mining legacy. As a result, many European states seem to be more advanced, than other regions globally, with memorialising both ancient and modern mining landscapes. Likewise, as the home of the industrial revolution, there is perhaps less contestation about this legacy. In the UK, Rose and Morgan discuss the work of the post-mining alliance and the Clayfutures Project to regenerate mining lands in the region of a depressed economy.[143] In such contexts, the social aspects of closure also encompasses industrial heritage and the preservation of historical artefacts from the operational history of the project for both economic and research opportunities. For instance, Duex outlines a case study of the 120 year Homestake lead mine in the USA, where a tourist economy has developed that includes interpretive pathways historical mine tours.[144] Case studies from Australia include the Mt Kembla mine rehabilitation and memorial pathway and Broken Hill as an active mining town and a heritage listed city renowned for its mining history.[145] [146]

Conclusions and future research agendas

This review sought to map the publicly available knowledge on the social aspects of mine closure, and to identify critical knowledge gaps. Several limitations have framed this study. This was a desktop exercise, and did not involve fieldwork in active closure contexts to obtain primary data, and our review did not include industry grey literature on mine closure. Nevertheless, several conclusions can be drawn from this review. In the following paragraphs we expand upon these, and then map a future research agenda.

1. The knowledge base on the physical aspects of mine closure is significantly deeper and more developed than the social aspects. Unlike environmental closure processes, the standards, guidelines, regulatory frameworks, knowledge and tools for managing the social aspects of mine closure are at an early stage of development, while implementation is inconsistent. Companies tend not to have strong policy architecture (including standards or internal guidelines) to support business units in addressing the social aspects of closure, and few governments have policies or legislation

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[143] Rose, J.E. and H.L. Morgan. 2010. Tea and Cake: talking with Communities about Life after Mining. In (eds) A. Fourie, M. Tibbett and J. Wiertz, *Mine Closure 2010 Proceedings of the 5th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics, Perth. Pp 159-166.

[144] Duex, T. 2010. Sustainable development activities during closure of the Homestake gold mine. In (eds) A Fourie, M. Tibbett and J. Wiertz, *Mine Closure 2010 Proceedings of the 5th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 193-198.

[145] Larance, A.J. 2012. Mt Kembla Mine rehabilitation and memorial pathway: a case study of effective stakeholder engagement to ensure successful final land use planning and environmentally and socially sensitive project outcomes. In (eds) A. Fourie and M. Tibbett, *Mine Closure 2012 Proceedings of the 7th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp731-746.

[146] See also: Comp, T.A. 2013. From environmental liability to community asset: mined land reclamation. In (eds) M. Tibbett, A. Fourie and C. Digby, *Mine Closure 2013 Proceedings of the Eighth International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 415-422.

Rademeyer, B. Le Roux, T. 2008. Mine Infrastructure Planning and Design for Closure — Integrating Sustainable Post-Closure Land-Use from the Outset into the Design of Mine Infrastructure. In (eds) A. Fourie, M. Tibbett, I Weiersbye and P. Dye, *Mine Closure 2008 Proceedings of the 3rd International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 255-268.

O'Hara, G., Bordian, J. Clausen, K. and Wernick, B.G. 2010. Environmental remediation works stimulate renewed interest in mine heritage and tourism at Britannia Beach. In (eds) A. Fourie, M. Tibbett and J. Wiertz, *Mine Closure 2010 Proceedings of the 5th International Conference on Mine Closure*. Perth: Australian Centre for Geomechanics. Pp 205-215.

that address these gaps. These differences are reflected in the much larger body of publicly available literature on managing the physical or environmental aspects of closure (which includes practical guidance, planning tools, detailed case studies and longitudinal research and data sets).

2. There is limited technical literature on the social aspects of mine closure, which suggests that there is limited expertise in this domain. The shortage of innovative case studies and policy guidelines indicate a dearth of expertise in this field. Mine closure experts typically focus on issues such as mined land rehabilitation, mine water management, topsoil replacement, groundcover monitoring, vegetation management, post-closure land use, and physical decommissioning. These are all areas where the industry can draw upon its deep technical expertise, which is reflected in the literature base. Equivalent expertise is needed for addressing the multiple social aspects of mine closure, such as workforce planning, housing, town normalisation, post-mining economies, issues associated with infrastructure and services for a resident population, stakeholder engagement, heritage management, and agreements with local and Indigenous communities. Across the industry there has been a siloing of experiences and lessons learnt.

3. There are multiple barriers that prevent mining companies from optimising the social aspects of mine closure. As Owen and Kemp argue, these barriers can be grouped in terms of those that are external to the company, those that exist at the interface between the company and other parties, and those that exist within the company.[147] The combination of barriers will vary across different mines and different companies, and they will be mutually reinforcing in a variety of ways.

Rarely is there a co-ordinated vision amongst government agencies, mine site operators, different disciplinary experts and other key stakeholders on post-closure futures. Many stakeholders are also concerned about the prospect of sites being handed back to the public under these circumstances, and the legacies associated with abandoned mines and those that close unexpectedly or prematurely. This is an issue confronting companies of all sizes, and developed and developing countries alike.

Some of the 'success factors' for optimising the social aspects of mine closure are documented in existing industry guidance and case study material. While it is not our intention to provide a 'check list' of success factors, this review has identified useful guidance for companies on the social aspects of mine closure. Various case studies that we have cited also provide specific examples of where some positive outcomes have been achieved in terms of transitioning local economies, stakeholder engagement, and repurposing assets and mining landscapes. However, the criteria for assessing the 'success' of these actions is rarely specified.

While the industry has access to some guidance around the social aspects of mine closure, as well as some case material presenting positive outcomes, this guidance is not consistently applied. As noted above, the reasons for this will vary across companies and mines. However, a major reason is the lack of social performance capability across organisations, which can lead to a propensity to underestimate the work associated with the social aspects of closure.

4. Active industry, and government, engagement with the social aspects of mine closure. There has been a growing recognition by some major companies, governments and notably by civil society, that business as usual is not viable. The industry now subscribes to a vast array of international standards and policy norms, which in turn demand greater accountability. The negative impacts and legacies of mining are coming under increasing scrutiny. From a long-term sustainability perspective, effective

[147] Owen, J. and D. Kemp. 2018. Mine closure and social performance: an industry discussion paper. Brisbane: Centre for Social Responsibility in Mining (CSRM), Sustainable Minerals Institute (SMI), The University of Queensland.

closure may be more important than effective operations. A major challenge is to establish mine closure processes and practices that ensure that the personal, household, societal and economic costs created by mining and closure are reduced and the benefits equitably shared. For land connected peoples, including Indigenous peoples, the social costs are often linked to environmental changes. Existing industry regulations – which often focus on 'pre-state' rehabilitation – rarely address the requirements for managing society-environmental relationships in the post-closure phase. Active industry, and government, engagement with the social aspects of closure will help to ensure that opportunities for asset regeneration, re-purposing and transfer are not missed.

Future research

At the beginning of this review we noted that the social aspects of large-scale mining have been extensively researched and documented, and that this expansive body of literature has primarily concentrated on the socio-economic and political impacts that arise during mining operations. Almost all of the topical areas or issues that are addressed in this much larger body of literature are directly relevant for understanding the social aspects of mine closure. That is, the socio-economic and political impacts that arise during operations are almost always present in a more acute form towards the end of the project life-cycle. From this perspective, future research on the social aspects of mine closure will need to consider an equally broad range of topics.

For the purposes of charting a way forward for a research agenda, in our view there are at least seven topical areas that require greater attention and that will provide the most productive step towards addressing some of the primary knowledge gaps and contribute towards improved practice. We elaborate upon these in order of priority.

(1) Mine closure liabilities at different scales

Little is known on a global scale about the current quantum of mine closures and the trajectory of planned closures in different jurisdictions – i.e. what kind of closure liabilities exist where, at what scale (regional, national, local), the range of cumulative impacts that will effect closure outcomes, and the time frames for closure.[148] For instance, are some countries or regions potentially facing a large closure liability in the near term? Broader scale research is warranted, and this data could be analysed by scale, commodity, land type, population, and company. This might also extend to a comparison of bond amounts.

(2) Policy and regulation

As we have observed above, there are limited state-based policies and regulations that address the social aspects of mine closure. There is a need for global examination of the states and jurisdictions that have the most effective legislative and policy levers for embedding social considerations into the closure process. A first step would entail a detailed comparative legislative review to fully understand

[148] For example, in 2002, the World Bank produced a table of examples of major mines, some of which employed up to 10,000 people facing closure in the next 10 years. They focused on 25 mines they had financed in Africa, South America and the Pacific (World Bank and IFC 2002). As far as we understand, this exercise has not been replicated with current closure data. Similarly, a preliminary review of Australia, indicates that numerous major operations are slated for closure in the next two to ten years. In northern Australia alone, there are at least 5 mines preparing for closure, including Argyle, Ranger, East Weipa, Telfer and several operations in the Pilbara, while Century Mine continues with economic rehabilitation. Several of these are iconic mines with established local communities and townships. Other well-known operations approaching closure currently include Yannacocha and Pierena (Peru), Phu Bia and Sepon (Lao), Hidden Valley and Ok Tedi (PNG), Waihi (NZ), and Vatakoula gold mine (Fiji), Mintails and Richards Bay (South Africa) to name but a few. All of these mines are situated in complex social and economic landscapes, and social legacies such as economic dependency, impacts upon sustainable livelihoods, and demographic change will be complex to manage. The overall closure liability for Australia and these other regions is currently unknown.

the existing policy and regulatory landscape – where the most significant gaps exist, where innovative developments are occurring and lessons that can be borrowed or adapted across different jurisdictional contexts. Related research might also consider the key policy levers that would assist industry, civil society, and the participation of affected peoples generally, to most effectively engage with municipal and regional council planning. There is also a need to better understand the how government commitments to the Sustainable Development Goals connect with regulation of resource development, especially management of mining legacies.

(3) Agreement making

Local level agreements have the potential to encompass the entire operational context and project life-cycle, including social-environmental inter-dependencies that influence closure outcomes. It remains unknown the extent to which agreements that are developed at the outset of a project (and even those that are periodically reviewed and revised) systematically account for the closure process and potential post-mining futures. The role that agreements can play in the closure process remains under-researched. Future research might also consider what types of benefit sharing strategies established during the project life-cycle can best assist in easing the socio-economic impacts of mine closure. There is also strong need to better understand the sorts of agreement governance arrangements that will support collaborative mine closure planning processes, including the capability of local/Indigenous communities to manage resources (such as funds, materials, etc.) and how such capabilities can be scaled up and harnessed as part of the agreement.

(4) Transition and post-mining case studies and comparative analyses

The majority of the case material that we have reviewed has detailed specific aspects of the mine closure planning process, or strategies to address the social aspects of closure. Moreover, where case studies are provided by companies in guidebooks, or presented by their employees in conference forums, these accounts are often sanitised, or the complexities are glossed. Few of the materials reviewed are based upon long-term comparative research of closure. As such, there is a dearth of detailed case studies that cover the closure process and the long-term post-closure outcomes. There is a need to invest in research and monitoring work that will provide the case studies and raw data that will help to answer some of the following questions: What are the threshold issues for determining particular and optimum post-closure economies? What are the most appropriate development models and methods for particular contexts? Are there transferable approaches for anticipating the impacts of closure in specific closure contexts? How does mine closure affect gender relations and gender roles? Without case study material and the development of aggregate data sets, it will not be possible to consolidate learnings on sustainable innovative practices, or develop more detailed and realistic practical guidance for closure practitioners.

(5) Lessons from other industries

There are important differences between the mining industry and other extractive industries, and other forms of large-scale industrial development, and these differences shape the outcomes of post-closure futures, or what we can otherwise term industrial transformation.[149] Despite these differences, there is a need for more comparative research that would draw out potential lessons from other industries as they might apply to the mining industry.[150] As Caroline Digby, one of the founders of the Post-Mining Alliance, noted, 'There is a huge wealth of knowledge about communities transitioning from one economy to another in the brownfield regeneration literature. It

[149] Owen, J. and D. Kemp. 2018. *Mine closure and social performance: an industry discussion paper*. Brisbane: Centre for Social Responsibility in Mining (CSRM), Sustainable Minerals Institute (SMI), The University of Queensland. Pp 3.

[150] This literature review has not covered this separate body of literature, and within the constraints of this review we found limited material that explicitly applies these lessons to the mining industry.

would be a rewarding piece of research to assess how some of these case studies might be adapted to mines facing closure.'[151]

(6) Stakeholder engagement

While there is a growing recognition across the industry that local communities and other stakeholders must be engaged in planning for closure – there is very little systematic guidance at a policy or regulatory level on how this is best achieved. There is a need to develop transferable methods for engaging communities in closure conversations. Future research might consider how transparent, inclusive communication concerning mine closure is best conducted. It will also need to consider the most appropriate methods for gender and community-wide inclusive approaches that also respect local decision-making processes.

[151] Digby, C. 2012. Mine closure through the 21st Century looking glass. In (eds) A. Fourie, M. Tibbett, and C. Digby, *Mine Closure 2012 Proceedings of the 7th International Conference on Mine Closure.* Perth: Australian Centre for Geomechanics. Pp 33-38.

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