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Integrating mine closure planning with environmental impact assessment: Challenges and opportunities drawn from African and Australian practice

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ABSTRACT

Best practice mine closure planning and environmental impact assessment (EIA) principles share many common features. This research examined how mine closure planning relates to, and can be integrated with EIA by comparing practice in eight African and Australian jurisdictions. Emphasis was placed on key challenges and opportunities associated with: institutional arrangements for mine closure planning; financial mechanisms for mine-site closure and rehabilitation including abandoned/legacy mine-sites; transparency of mine closure planning and financing provisions; and regulation of artisanal and small-scale mining activity. Data was gathered through document analysis, interviews and interactions with practitioners from Western Australia, Ghana, Kenya, Nigeria, Mozambique, South Africa, Tanzania, and Zambia. Issues associated with mine closure planning and rehabilitation under existing arrangements, and opportunities for improvement through existing EIA processes already in place in each jurisdiction are explored. All eight jurisdictions have appropriate regulatory provisions in place already, but implementation capacity remains a challenge. Opportunities for effective practice lie in using mine closure planning and EIA measures in an integrated fashion, avoiding duplication and enabling synergies in management to be realized.

Keywords: mine closure planning, artisanal and small-scale mining, environmental impact assessment, mining securities, rehabilitation

1. Introduction: context and research approach

Effective mine closure planning and environmental impact assessment (EIA) alike are essential practices well established in international practice that attempt to ensure that mining activities meet sustainable development expectations. The purpose of the paper is to understand how mine closure planning relates to, and can be integrated with EIA, with specific emphasis on some key challenges and opportunities drawn from practice in African and Australian contexts. It is directed towards EIA practitioners and researchers interested in ways to enhance the efficacy of regulatory mechanisms aimed at delivering good environmental, social, and economic outcomes from mining development, especially within an African context.

The research arose from a targeted project funded by the Australian government in which

comparisons were made between comparatively advanced mining regulation practice in Australia with selected countries in Africa. Specifically, recent changes to mine closure planning provisions in Western Australia, including an innovative approach to financing contingency measures for abandoned mine sites, provided the starting point for the comparison. Seven African countries were selected for analysis on basis of having different levels of experience with and anticipated future development in mining: Ghana, Kenya, Nigeria, Mozambique, South Africa, Tanzania and Zambia. As the research was funded under the auspices of an aid program, a key ambition was to determine whether experience within mine closure in Western Australia could be extended and adapted for application within the African context. Focusing on one state jurisdiction in Australia (from a total of seven) and with the seven African countries (amounting to just 13% of nations on the continent), it was not intended that representative sampling be upheld. Nevertheless, important issues common within the African countries and to some extent also evident in the Australian context did become apparent.

Our methodology was based upon document review (i.e. relevant policies, legislation, regulations, and guidance materials primarily) and interviews with key officials from mining and environmental agencies, as well as practitioners or other experts (e.g. academics) in each of the eight jurisdictions¹. The research was founded upon the guiding questions presented in Box 1. Typically between two and ten people were interviewed from each jurisdiction; however we also directly interacted with practitioners from our target jurisdictions at a variety of events, including:

- workshops specifically reporting on the research held in Maputo, Mozambique (50 participants) and Abuja, Nigeria (120 participants) in October 2015 attended by mining regulators, consultants, companies and academics;
- attendance at the Mine Closure 2014 conference in Johannesburg and the Mining Indaba 2014 conference in Cape Town;
- participation in workshops about mining law and mine closure held at North West University, South Africa in 2013; and
- various meetings and special events with the Australian African Mining Industry Group (AAMIG), headquartered in Perth, Western Australia through which we were able to meet with Australian mining company executives operating in our target countries and other nations on the African continent.

With most members of the research team based in Western Australia, we also had much experience and exposure to regulators and practitioners alike in this jurisdiction. Finally, site visits to both operating and closed mine-sites took place in most jurisdictions. This was undertaken on an opportunistic basis, dependent upon professional and personal networks and logistical considerations (i.e. location, transport infrastructure and ability to access necessary permissions or personnel).

Box 1 Questions guiding the research (applied to each jurisdiction)

1. What policies, legislation or guidance applies for mine closure planning and rehabilitation? Which agencies are responsible?
2. What kinds of financial mechanisms are in place for mine-site closure and rehabilitation, including unexpected closure and abandoned (e.g. legacy) mine-sites?
3. What are the issues or challenges associated with mine closure planning and rehabilitation under the above arrangements in practice, and what are possible solutions?

¹ Interviews and documents for Mozambique were translated into English by one of the researchers (Portuguese in origin).

Following a brief account of international principles for mine closure planning and its relationship with EIA, including some focus on Australian and African policy context, we present summary characteristics for provisions within the eight jurisdictions examined. Thereafter the paper focuses on four particular challenges related to the principles of mine closure planning which we identified in the research as being key to mine closure success:

- provision for early and ongoing mine closure planning;
- financing closure remediation costs for abandoned and legacy mine sites;
- transparency of mine closure planning and financing provisions; and
- regulating and managing artisanal and small-scale mining activity.

2. Principles for mine closure planning

2.1 International mine closure planning principles and EIA

Internationally there is a well-established expectation by industry, financiers, and practitioners alike that mine closure planning should be an intrinsic element of the entire life cycle of mining from initial project design to assessment for mining approval purposes; continuing through implementation, decommissioning, and final rehabilitation and closure (e.g. (Sweeting and Clark 2000; Mining Minerals and Sustainable Development (MMSD), 2002; International Finance Corporation, 2007; International Council on Mining & Metals (ICMM), 2008). There is an expectation that mine closure planning should be proactive, commence early, and for ongoing planning becoming progressively more detailed as the end of the life cycle of a mining operation approaches (International Council on Mining & Metals (ICMM), 2008). This echoes principles for mitigation and adaptive environmental management in EIA (e.g. (International Association for Impact Assessment and Institute for Environmental Assessment UK, 1999; Marshall *et al*, 2005)). Otto (1997) and Sanchez *et al*. (2014) make explicit linkages between EIA and mine closure planning, highlighting the importance of identifying and assessing environmental and social impacts of mining, along with putting in place appropriate mitigation, management and monitoring measures for developing the EIA for a proposed mining project. As such, the two processes should proceed hand-in-hand.

In the broad context of sustainable development, there is a sense that approaches to mine closure planning likewise mirrors the variability of scope of EIA across international practice, whereby some jurisdictions and practitioners focus in large measure on the biophysical factors, while others increasingly consider socio-economic factors. For example, the definition of a mine closure plan put forward by the Environmental Law Alliance Worldwide (2010) offers a very physically based approach including the statement that it "must include a guide to deactivate, stabilize, and perform long-term surveillance of waste management units or facilities" (p96). While direct benefits of mine closure planning are expected to arise for mining companies, such as reduced clean-up costs and decreased potential legal liability (Sweeting and Clark 2000), they are also intended to benefit all stakeholders working in or directly affected by the extractives industry sector. For example, it is envisaged the effective mine closure planning will enable community members to realise an enhanced level of wellbeing and quality of life beyond the conventional life of a mine (Otto, 1997; Stacey *et al*, 2010; Davies *et al*, 2012). By extension government regulators should be able to confidently and appropriately assess mining operations for approval decision-making on the basis of early mine-closure planning, and benefit from risk reduction and acceptable liability associated with the long term legacy of mining through progressive updating and refinement of mine closure plans during the mining life cycle (Warhurst, 1994; MacKenzie *et*

al, 2006; MacKenzie *et al*, 2007). The implementation of mine closure planning early and continued on an ongoing basis during the life cycle of a mining operation is one of the challenges we focus on later.

Mineral prices are volatile and governments and local communities are vulnerable in the event of unexpected and unplanned mine closure. Thus, incorporating mine closure measures into business feasibility at the design stage, and demonstrating that there are adequate financial resources to meet mine closure requirements is an important principle (International Council on Mining & Metals (ICMM), 2005; Sassoon, 2009; McHenry *et al*, 2015; Morrison-Saunders *et al*, 2015). While the ability of proponents in EIA to deliver necessary mitigation measures will be an important consideration in approval decision-making, there is no explicit expectation that the financial capacity of proponent be revealed in principles of best practice such as those published by the IAIA² and the IEA³ (1999). Financial provisions to cover closure remediation costs (so that governments and communities are not exposed to unreasonable risk in the event of premature closure or abandonment) is a key challenge we also focus on later. In addition we extend this topic to include financial provisioning for historical or legacy mine sites.

Engagement with the affected community and transparency of process expected for best practice EIA (International Association for Impact Assessment and Institute for Environmental Assessment UK, 1999), are equally principles for effective mine closure planning. There is an expectation that the community will be engaged in defining post mining land-use along with other social objectives of mine-closure, and that mine closure plans be subjected to periodic review processes to ensure that they reflect current developmental, environmental, and socio-political needs (International Council on Mining & Metals (ICMM), 2008; Sassoon, 2009; Stacey *et al*, 2010). Along with the ongoing review principle, there is also an expectation for continual improvement of performance to be realised and demonstrated (Mining Minerals and Sustainable Development (MMSD), 2002; International Council on Mining & Metals (ICMM), 2005). Thus, transparency of mine closure planning is necessary, and the Environmental Law Alliance Worldwide (2010) further advocate that enough specific information is provided in a mine closure plan to enable an independent appraisal of whether the plan in the specific context of the proposed mining activity is workable with respect to delivering acceptable outcomes. The third challenge we explore in this paper concerns transparency of mine closure planning including financial provisioning.

2.2 Australian mine closure planning principles

The individual states and territories of Australia are responsible for the extractive industries within their jurisdiction, including enactment of individual legislation, regulations, and guidance. It is beyond our scope to provide an account of each jurisdiction here, although later on we feature the Western Australian mine closure provisions. However, industry and government bodies have established policies, principles, and guidance for mine closure on a national basis (e.g. (Australian and New Zealand Minerals and Energy Council & Minerals Council of Australia, 2000; Minerals Council of Australia, 2005; Department of Industry Tourism and Resources, 2006). These establish principles in keeping with the international perspectives, and there are similarly well established EIA procedures operating in each Australian jurisdiction, as well as at a national level (e.g. (Elliott, 2015)).

2.3 Mine closure planning principles on the African continent

² International Association for Impact Assessment.

³ Institute for Environmental Assessment UK.

Policy and principles for mine closure planning are less well established for the African continent than for international and Australian contexts. The Economic Commission for Africa and Southern African Development Community (2004) acknowledge and emphasise the importance of early mine closure planning for increasing the likelihood that the consequences of mine closure will be ameliorated. They note that many problems associated with mining are best resolved when there is a "frank and realistic appraisal of the mine's long-term contribution to society is undertaken at the outset of the mine's development" (2004), p133. They also state that: "Modern mine developments should have economic, social and environmental evaluations, all of which should contemplate and anticipate mine closure and its consequences" (2004), p153. In the context of discussing environmental and social impact assessment, the Economic Commission for Africa and African Union (2011) p52, specify that:

"Mining plans should include plans for post-closure monitoring, maintenance and remediation of all mine facilities, including surface and underground mine workings, tailings and waste disposal facilities. And they should include a funding mechanism for all these elements".

With respect to financial aspects, the Economic Commission for Africa and Southern African Development Community (2004), p36, indicated that "Countries within the region are changing their regulatory frameworks to ensure that sufficient funds will be available at mine closure to rehabilitate the environment and monitor the post-mining environment". One of their recommendations for 'harmonization of approaches to environmental management' was for all Member States to introduce a "Minerals Development Fund... to provide for environmental disasters and social decline after mining" (Economic Commission for Africa and Southern African Development Community (2004), p37. In their summary of environmental legislation for the Southern African Development Community on a country by country basis, Walmsley and Patel (2011) include mention of general provisions for mine closure planning and management, development control, and mine closure related legislative provisions for individual member countries of the Southern African Development Community (SADC).

Presently the key focus for mining on the African continent appears to be orientated towards improving governance mechanisms related to attracting investment and associated opportunities for harnessing resource development (African Union, 2009; United Nations Economic Commission for Africa and African Union, 2011; African Union Commission *et al*, 2012a; African Union Commission *et al*, 2012b; African Mineral Skills Initiative, 2013; African Union, 2013), with relatively less impetus on mine closure planning. For many countries, mining represents an opportunity for much needed socio-economic development, but awareness of the importance of managing environmental resources to promote sustainable mining is acknowledged. For example, the action plan for implementing African Mining Vision (African Union Commission *et al*, 2012a) presents discussion in relation to the following goals:

- "To create a mining sector that is knowledge driven and is the engine of an internationally competitive African industrial economy" (p18);
- "To create a sustainable and well governed mining sector that is inclusive and appreciated by all stakeholders and surrounding communities" (p24); and
- "To increase the level of investment flows into mining and infrastructure projects to support broad socio-economic development" (p37).

It would be hoped that these sustainability oriented goals for mining in Africa will be translated appropriately into policies or guidance for mine closure planning. However, to date we are not aware of this happening to any meaningful extent.

An important characteristic of the extractives sector in Africa is the prevalence of artisanal and small-scale mining (ASM). The African Union (2009) reported that some 3.7 million people were

engaged in the ASM sector, with around 30 million dependent upon it. These figures were expected to triple by 2012 because increasing numbers of Africans are "impelled by growing economic crises, (which increases unemployment), and decreasing rural livelihood choices, exacerbated by natural (mainly droughts and floods) and man-made disasters (e.g. conflicts)" (p26). The 2009 report noted that ASM is labour-intensive and provides more employment than large-scale mining, it is often a precursor to large mines, and it allows exploitation of deposits not amenable to large-scale mining. Despite the importance of ASM to the livelihoods of many Africans, the African Union (2009) noted that the "ASM sub-sector is beset with problems of sustainability" (p27), that it has been "neglected both locally and in the international development agenda" (p27), and that the situation is "aggravated by legal and regulatory failures, including failure of governments to recognize and formalize the sub-sector". Consequently one goal of the Africa Mining Vision as outlined by African Union Commission et al. (2012a), p21) is: "To create a mining sector that harnesses the potential of artisanal and small scale mining to advance integrated and sustainable rural socio-economic development". Thus the fourth challenge we explore in this paper concerns the regulation and management of ASM in the context of mine closure planning and rehabilitation.

3. Comparison of mine closure challenges between Western Australia and African jurisdictions

A brief summary of key institutional arrangements for mine closure planning for each of the eight jurisdictions examined in this research in relation to the four key challenges is presented in Table 1. Results for the first two challenges pertain directly to the corresponding guiding questions for the research (from Box 1). The second two emerged in the answers we obtained from the third guiding question. It can be seen from Table 1 that all jurisdictions have in place formal regulations for mine closure planning and EIA along with financial sureties most commonly in the form of bonds. All jurisdictions conform with international expectations for public engagement during decision-making or access to mining related information. Even when expressed in summary format, it is clear that the details vary considerably between jurisdictions, and this is especially the case with regards the level of detail that applies to small scale and artisanal mining. While the institutional arrangements generally conform with international expectations around mine closure planning and EIA best practice, participants we interviewed in the research provided examples of significant challenges with actual implementation in practice. We discuss the four challenges in turn in the sections that follow.

Table 1 Key institutional provisions for mine closure challenges in the eight jurisdictions

Jurisdiction	Mine Closure Provisions	Financial Mechanisms	Transparency	Artisanal and Small Scale
Western Australia	Both <i>Mining Act 1978</i> and EIA under the <i>Environmental Protection Act 1986</i> allow for mine closure planning to be addressed during initial assessment and approval of new mines, and thereafter periodically reviewed and updated. Joint guidelines issued by the Department of Minerals and Petroleum (DMP) and Environmental Protection Authority (EPA) specify details, and the cooperative approach avoids overlap in agency activity.	Miners are responsible for all costs associated with mitigation and rehabilitation, and make a non-refundable annual payment into the Mining Rehabilitation Fund (MRF) equivalent to 1% of the estimated rehabilitation costs for disturbed/un-rehabilitated land. The MRF is used to rehabilitate (newly) abandoned mines, with interest used to rehabilitate legacy sites.	All assessment and monitoring reports, including mine closure plans and details of the MRF are published on the DMP and EPA websites as appropriate. The Auditor General periodically audits and publicly reports on agency performance (including management of the MRF).	Individual prospectors must hold a Miner's Right which allows holders to prospect on Crown land with hand-held tools (such as a metal detector) and to take and keep samples or specimens up to 20 kilograms. Beyond general DMP guidance ⁴ there are no specific provisions for regulating individual operations.
Ghana	Mining activity is regulated by the Minister of Lands and Natural Resources and the Ghana Minerals Commission (GMC) under the <i>Minerals and Mining Act 2006</i> . At the time of research the GMC was preparing to publish mine closure guidelines and code of practice under this Act. The Environmental Protection Agency Act 1994 empowers the Minister to regulate for environmental protection and rehabilitation and approvals must be obtained from the EPA before mining can commence.	EIA Regulation 23 requires a reclamation bond (comprising 10-15% cash and the rest in insurance) based estimated rehabilitation costs. Bonds specify environmental conditions to meet. The financial assurance can be progressively reduced as rehabilitation is delivered with the cash bonds being the last component to be relinquished. No formal mechanism exists to fund abandoned mine-sites.	EIAs are subject to public hearings and a formal EIA technical review committee comprising the EPA, GMC, Inspectorate of Mines (Mines Department), Water Resources Commission, Geological Survey and any co-opted member (e.g. academics) makes recommendations regarding the EIA. This ensures a whole-of-government decision on mine closure and rehabilitation.	A special licensing and approval process exists for small artisanal mining operations (>5000 small scale miners approved in Ghana). A Licence (land tenure) from GMC is issued for activities up to 10 hectares in size; and a streamlined EPA Approval (applicant completes a simplified three page application) which covers how the site will be reclaimed and abandoned. Larger sized mines must go through a full EIA process.
Kenya	The Mining Bill 2014 establishes the Ministry of Mining-Director of Mines, assisted by Director of Geology with conditions for granting mineral rights, site mitigation and rehabilitation and closure plans. The National Environmental and Co-ordination Act, 1999 also applies with the Environmental (Impact Assessment & Audit) Regulations, 2003 empowering the Minister responsible for Mining to make regulations to protect and rehabilitate.	The Mining Bill provides for environmental protection bonds (EPB) to cover associated costs of environmental rehabilitation, approved on a project basis. Partial release of the EPB may occur on satisfactory completion. The Environmental Management & Co-ordination (deposit bonds) regulations, 2014 provide for annual adjustments and periodic audits of bonds.	The Mining Bill makes the Cabinet Secretary, Director of Mines and the Director of Geological Survey responsible for facilitating access to information by the general public. All mineral agreements entered into shall be public and be made accessible to the public.	The Mining Bill makes provisional requirements (s114c) for mining permit holders of small operations to take measures necessary to protect and restore the environment within the mining area.

⁴ See for example: http://www.dmp.wa.gov.au/documents/Seven_Golden_Rules_for_Prospecting_Leaflet.pdf [accessed 15 Nov 2015]

Nigeria	The <i>Minerals and Mining Act 2007</i> establishes Ministry of Mines & Steel Development (MMSD) and Mines Environmental Compliance Department (MECD), and prohibits mining before approval of EIA studies and mitigation plans (e.g. required in <i>National Environmental Standards and Regulations Enforcement Agency (Establishment) Act 2007</i>). It requires an MECD approved community development agreement reviewed every 5 years, including “methods and procedures of environment and socio-economic management and local governance enhancement” (s116e)., plus an Environmental Protection and Rehabilitation Programme which includes actions; cost estimates; and time table of rehabilitation to achieve “future economic development or recreational use” (s120).	Mining companies have their own provisioning for funding rehabilitation with bonds for financial assurance. The <i>Minerals and Mining Act 2007</i> also empowers the Minister to establish an Environmental Protection and Rehabilitation Fund (EPRF) “for the purpose of guaranteeing the environmental obligations of Holders of Mineral titles as provided under this Act” (s121). The EPRF is administered by a trustee appointed by the Minister and is to be annually audited by an independent firm of chartered accountants (s121(7)).	The <i>Minerals and Mining Act 2007</i> establishes various authorities in relation to mine site planning and approvals. One of these is a Coordinating Committee (s19) established across government to coordinate the approval and compliance and closure matters for mine sites to ensure a whole of government approach is taken.	New Minerals and Mining Regulations have provisions that allow very small miners to form small cooperatives and apply for a single licence with the aim of reducing the costs and administrative workload otherwise faced by individual small miners.
Mozambique	The <i>Mining Act 2002</i> defines a suite of environmental management tools including a mine closure programme (s36e). The <i>Environmental Regulation for Mining Activities Act 23/2004</i> , includes a programme of rehabilitation and mine closure as part of an environmental management plan (EMP) jointly submitted with the application for a mining title (s11). The environmental licence is valid for the period of the mining title , subject to review every 5 years (s13). An environmental management report is submitted to the Ministry each calendar years end (s14(1)).	The <i>Environmental Regulations</i> (s24) require the proponent to provide a financial bond based on 100% of estimated costs for rehabilitation that is paid annually in form of insurance, bank guarantee or cash deposit in a bank account opened for that purpose and reviewed by the Ministry responsible for mineral resources every two years.	The <i>Environmental Regulations</i> (s27(3)) specify that 'the public should have access to project summaries, environmental reports and any other documentation relating to environmental and social management of the project'. The government has committed to the Extractives industry transparency initiative (http://eiti.org/) with public disclosure of mining contracts.	The Environmental Regulations define small-scale mining operations as those carried out by individuals or cooperatives which do not involve mechanized methods. These are not subject to the environmental and financial provisions outlined previously.
South Africa	The mining regulatory regime is particularly complex with dozens of applicable Acts, regulations or guidelines, including National Environmental Management Act 1998 (NEMA) provisions for EIA, and Minerals and Petroleum Resources Development Act 2002 (MPRDA). Detailed provisions exist for	A Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine (DME/DMR, 2005) specifies the establishment of rehabilitation trust funds with adequate	EIA and mine permitting procedures include engagement with Interested and Affected Parties with all documents available in the public domain. Social and Labour Plans are prepared by	Two best practice guidelines for small scale mining practices were published in 2006 and s39 and Regulation 52 of the MPRDA provide for EMPs for mining permits where less than 2000 m ³ will be excavated using manual

	EMPs (s39 of MPRDA) including rehabilitation and closure plans specifying environmental objectives for mine closure, management of identified environmental risks, with liabilities and financial provisions.	finances to cover closure and rehabilitation cost and related mechanisms for discharging fiduciary duties.	mining proponents in consultation with affected communities but these are not public documents.	labour techniques.
Tanzania	The Mining (Safety, Occupational Health and Environmental Protection) Regulations 2010 arising from the Mining Act 2010, outline requirements for reclamation, rehabilitation bond and mine closure. Mine closure plans must be submitted to the Chief Inspector outlining reclamation and rehabilitation of mine-sites to an acceptable use, the cost of reclaiming and rehabilitating the mining area in the even of premature closure and including a program to support economic activities to provide alternative livelihood to local communities beyond the mine life (s205(1)). The Chief Inspector is to convene a national mine closure committee meeting for approval of the mine closure plan (s205(2)).	Mining licence holders are required by the Minister to provide for posting of a rehabilitation bond to the value of costs provided in the mine closure plan in the form of either an Escrow Account; a Capital Bond; Insurance Guarantee Bond; or Bank Guarantee Bond (s206(1)). An environmental performance bond may also be required to be deposited with the Director of Environment as security for good environmental practice until its refund to the depositor or otherwise if confiscated from the miner it will be used to rehabilitate a degraded environment (s227)	The Regulations (s172) provide freedom of access to environmental information relating to implementation of the Mining Act and to the state of the environment including actual and future threats. There are provisions for public participation in environmental decision making (s178) and mine closure plans must incorporate the comments of the district authorizes and surrounding local communities or district mine closure committee (s205(1)(c)).	The Mining Act 2010, s4 defines a “primary mining licence” for small scale mining (<US\$100,000 capital investment) only be issued to citizens of Tanzania (s8(2)). The Minister may declare an exclusive area for small scale miners (s15). Mining Environmental Protection for Small Scale Mining Regulations, 2010 make provisions for an environmental protection plan, including audit and review (Part II), with specific controls for pollutants and mineral processing; e.g. no cyanide leaching (Part III). Commencement of new mine workings is not permitted until previous workings are backfilled and re-vegetated (Part IV).
Zambia	The <i>Mines and Minerals Development Act 2008</i> (MMDA) requires an EMP including protection and reclamation of land and water resources to be included in applications for a large scale mining licence (s24), with provisions for environmental impact studies (s75) notwithstanding existence of a separate <i>Environmental Management Act 2011</i> , enabling the Minister to set conditions for rehabilitation of mining lands (s76). <i>The Mines and Minerals (Environmental) Regulations</i> under the MMDA require EIA entailing an environmental impact statement (EIS) to include the EMP, a plan for mine-site rehabilitation and management, estimated costs and annual updating provisions (s5).	Conditions on mining approvals may include lodgment of cash deposits for securing environmental performance (s76(2)(b) of MMDA) to be paid into an Environmental Protection Fund (s82). Three categories with differential fund payments are calculated according to annual progressive rehabilitation audits to show progress towards targets (s66 & 11 th Schedule), and progressively higher concessions given against the full cash contribution to be submitted to the Fund (3 rd Schedule).	The Environmental Regulations (s7) specify that the Director shall maintain a record of each EIS or any other document for any mine-site temporarily closed or abandoned and records of closing down a mine open to the public, while s68 provides for public access to project briefs and EIA documents, including comments made by the public during hearings. Zambia is a signatory to the EITI.	Part IV of the MMDA pertains to small-scale mining operations for prospecting areas of up to 10km ² and licenced mining areas up to 400ha with separate provisions for mining of gemstones. A plan for small-scale or gemstone mining is to be prepared based on mining area, time period and investment information, but the legislation does not mention environmental protection measures. MMDA Part VII addresses artisanal mining with a non-renewable mining right issued for only two years for land areas up to 5ha; no environmental controls are identified.

3.1 Provision for early and ongoing mine closure planning

All of the jurisdictions examined in this research have specific legislation or regulations for mining and EIA that relate to mine closure with a broad intention that it occurs early in the development planning and assessment cycle with appropriate refinements and updates occurring during mining operations especially as the closure period draws closer. In Western Australia, mine closure plans are initially submitted with the development application and are periodically reviewed and updated thereafter, with increasing level of detail expected as the mine closure phase draws nearer (e.g. Department of Mines and Petroleum and Environmental Protection Authority, 2015). The mine closure plan thus brought into being during, for example, during the pre-mining EIA stage of the process, remains a 'live' document subject to update with review by experts and affected community alike (Morrison-Saunders and Pope, 2013) throughout the life cycle of the mine site. A different approach is employed in South Africa whereby the mine closure plan required to be prepared by proponents, as the time of closure approaches, is itself subject to EIA (Alberts *et al*, submitted).

As we established previously, best practice mine closure planning commences early and is subsequently an iterative process subject to regular review or audit and updating as necessary. What also became apparent to us during this research, especially as expressed by delegates at the Mine Closure 2014 conference was that geotechnical parameters must form the basis for determining post mining land use. This of course resonates directly with core EIA wisdom that the baseline environment must be well understood before the consequences of new development proposals can be predicted. In the mining context though, it is critical that post-mining land use options must include consultation with local community stakeholders so as to realistically manage expectations as to what can be achieved at a given site. Expectations often run high for what mining might deliver to a community, especially when a new mining development is announced, and especially so in African nations where economic development is a driving force for governments and individuals alike. Careful communication with affected communities is needed throughout the mine closure planning cycle in this regard.

The combination of mechanisms for mine closure planning immediately raises the question as to how different agencies cooperate and work together to achieve the best outcomes post-mining. As can be seen in Table 1, there is often emphasis on multi-agency or whole-of-government engagement with the evaluation and assessment of mine closure plans. The situation is especially complex in South Africa where at least 15 Acts of Parliament pertain to mine closure and rehabilitation activity (e.g. (Alberts *et al*, submitted)). The solution to managing inter-agency cooperation employed in Western Australia is to utilise the mining legislation for regulating post-mining performance wherever possible, and only trigger the separate EIA processes where significant environmental issues are at stake (Morrison-Saunders *et al*, 2014). EIA conditions of approval are only set for matters not covered by other existing legislative provisions so as to avoid duplication in effort. Furthermore, the guidelines for mine closure planning in this jurisdiction (now in their second edition) are jointly authored by the two agencies involved - i.e. Department of Mines and Petroleum and Environmental Protection Authority, 2015) - so that the vision and agenda for mine closure planning is shared and applied consistently by both agencies. In this jurisdiction there is considerable trust and cooperation between the agencies as well a sense that each has the necessary capacity to uphold and enforce their responsibilities. In contrast to the Western Australian approach, the *Mining Act* 2002 in Mozambique and the *Mines and Minerals Development Act* 2008 in Zambia specifically incorporate EIA and other environmental controls into the legislation.

While in the Australian situation where both regulation and agency capacity to uphold them are generally not under question, across the African continent issues with capacity of government agencies are evident. For example the Economic Commission for Africa and African Union (2011), p52) wrote:

"Developing discharge and emission standards, mine closure obligations to be applied to mining and mineral processing in Africa and a cadre of professionals with the needed skills to conduct impact assessments still

presents challenges. Financial and human resource constraints in most African countries limit the capacity of institutions tasked with enforcing these requirements".

Similar sentiments were expressed to us for each of the seven African nations studied and with particular reference to mine closure planning and rehabilitation activities, including for South Africa, which arguably has the most developed and sophisticated arrangements for mine closure planning and regulation in place (Alberts *et al*, submitted). In Kenya, for example, coordination between different ministries was identified as a challenge with capacity development identified by interviewees as a priority for immediate attention. Informants in Mozambique told us the mining sector regulators were not prepared for the mining boom that commenced several years ago. Beyond capacity considerations generally, limited budget allocations and lack of supervision and inspection at provincial and local level was believed to have resulted in mining companies not fully implementing their environmental protection and mine closure plans. Similarly for Zambia, we were informed that there were a limited number of inspectors and expertise to enforce the mining laws as well as suggestions of political interference whereby the interests of other agencies overruled environmental protection measures. In Nigeria a dedicated program to identify abandoned mine sites commenced in 2007, with some 1260 such sites since being mapped and a program to categorise and prioritise sites for rehabilitation by government implemented. Between 2008 and 2014 some 20 sites were reclaimed by the Nigerian Government with some being returned to beneficial uses (e.g. a water source for irrigation in one example provided to us). This dedicated mine rehabilitation program for abandoned mines suggests that Nigeria has developed capacity within the government to manage these processes, and this experience could be transferrable to other African nations. However, we were also emphatically informed by several Nigerian sources that there is a back log of operations to be inspected or audited, there is generally inadequate capacity and resources within responsible government agencies to implement the rehabilitation program, and that guidelines for environmental protection and the operation of the environmental rehabilitation fund are needed.

A final challenge related to capacity arises where illegal mining is prevalent. A particular example and explanation of this was given to us by our informants from Ghana, despite it being clear that this country has an extensive and well established regulatory framework for the extractives sector. We were advised that this illegal mining is not local Ghanaians undertaking the small scale prospecting, but instead is large-scale mechanised operations of a commercial scale. It was suggested that this may also be connected to organised crime, and that this is considered as much as a national security issue as an environmental one. This is a significant issue for the government officials and for the licensed operators as there is no approval or closure. Within Ghana this practice is referred to as "Galamsey", which is a corruption of the phrase "Gather them and Sell them [gold]". We were advised that it was estimated that ~500,000 people were involved in illegal mining in Ghana (out of a national population of approximately 26 million), which is approximately the same number of people involved in legitimate mining and that around 35% of the national production of gold was from illegal mining. Bermúdez-Lugo (2014) reported that illegal artisanal gold mining in Ghana is a challenge for the government and 'if left unaddressed, has the potential to have adverse economic and environmental implications as illegal miners continue to encroach upon operating mining concessions and to pollute bodies of water in their search for gold' (p204).

In Western Australia, we are not aware of there being any issues regarding illegal mining. However, one company reported on problems with illegal access to their mining tenement for activities such as fire wood collection or off-road trail-bike riding which negatively impacted on their rehabilitation and environmental protection activities. In this instance it is the capacity of the company to maintain perimeter fences intact or to 'police' their land-holding that is at stake, not that of government.

3.2 Financing closure remediation costs for abandoned and legacy mine sites

Bonds are the most common financial mechanism provided for in the jurisdictions we examined to provide surety in the event of mine abandonment as documented in Table 1. However, for all of the African countries we investigated interviewees raised issues regarding actual practice or performance. For example, in Mozambique we were informed that there is no regulation of the bond system and that there are difficulties in monitoring of bond payments, while in Kenya it was evident that different bond requirements were being applied for different projects, and concerns were raised that bond amounts did not necessarily reflect likely rehabilitation costs. Having a general format or formula for estimating rehabilitation costs may be useful to bring uniformity in estimation in bond requirements.

Prior to promulgation of the Mining Rehabilitation Fund in Western Australia in 2012, bonds also were used. Two problems were encountered with the use of bonds in Western Australia. Firstly, the actual amount of money in individual bonds typically fell far short of the estimated rehabilitation liability (Department of Mines and Petroleum, 2014), meaning that in practice no bond has ever been called in by the Western Australian government. Secondly, bonds can only be used for the individual mine site in question with no funding mechanism to address the problem of legacy abandoned mine sites (Gorey et al, 2014). The MRF addresses both of these issues as any part of the principal can be used to rehabilitate a given mine-site and the interest earned is specifically set aside for legacy sites that predate the implementation of the MRF (Gorey et al, 2014). The MRF operates through each tenement holder under the Mining Act 1978 who have an estimated rehabilitation cost for the tenement more than \$50,000 being required to make a non-refundable payment into the MRF each year. The payment is equivalent to 1% of the estimated rehabilitation costs calculated in relation to the extent of disturbed or unrehabilitated land for each tenement. The mining proponent remains responsible for all closure and rehabilitation works to be carried out on their site. The fund is held by the Western Australian Government and administered by DMP as a security to be used exclusively for restoration of any mine site that becomes abandoned, and interest earned on the capital is to be used for restoration of legacy abandoned mine sites. Management of the MRF is publicly disclosed with expenditure bound by the provisions of the Financial Management Act 2006 (WA) and reporting by the office of the Auditor General (e.g. (Office of the Auditor General Western Australia, 2014)).

The innovation of the MRF was in large measure the trigger for this research. For example it was intended to explore opportunities for establishing similar approach in African mining jurisdictions. While the MRF is a suitable solution to mining securities in an Australian context (as confirmed by the Office of the Auditor General Western Australia, (Office of the Auditor General Western Australia, 2014)); importantly it was developed in consultation with industry stakeholders (Gorey *et al*, 2014). Consideration for the functionality of a MRF approach is that it likely is dependent upon the size and scale of mining operations in a given jurisdiction. For Western Australia the MRF could be quickly grown because of the number of established operations joining the scheme, reflecting an extensive and well established industry that has been operating for well over one hundred years. The large number of operational mines makes the central fund sufficiently large to be useful without putting an excessive financial burden on individual mining companies. While the mining sector in South Africa is similarly as well developed as that in Western Australia, other African countries may not yet have reached critical mass in this regard. In African nations where substantive mining activity is relatively embryonic, or otherwise is dominated by small scale and artisanal operations, it may be that the critical mass for a successful fund is not in place (i.e. based upon the 1% contribution annually for un-rehabilitated land, rather than raising the price miners have to pay which obviously would impact on financial viability). Our initial sense is that the use of bonds may probably suit conditions in African nations at least for the time being, particularly as bonds are a point of negotiation with mining companies over rehabilitation measures. An interesting advantage of having a bonds system brought to our attention by several practitioners in different African nations was their use as a bargaining tool for regulators. Some regulators indicated to us that they negotiate to return parts of a bond to the proponent when certain rehabilitation works have been undertaken. Such practice would not be permissible in an Australian

context.

Concerns surrounding where a fund such as the MRF would be held were raised by participants in our study, especially where there is political instability or possibility of corruption. Bonds are lodged with banks on an individual mine-site basis only, and can only be called in by government for that particular operation, whereas there would always be significant temptation to channel money in a single central fund toward other financing priorities. That said, Nigeria in particular has established an Environmental Protection and Rehabilitation Fund over and above the bond system that operates in a similar fashion to the MRF of Western Australia (albeit not exclusively tied to mining activity). Several informants from this country raised concerns about the operations of the EPRF so far being limited in scope and adequacy, but were generally of the view that the concept had value. We also note that many African participants suggested that there were more pressing sustainable development priorities in which to invest any available money, rather than holding them in a mining rehabilitation fund.

3.3 Transparency of mine closure planning and financing provisions

Common to all eight jurisdictions examined in this research is the principle of transparency for mine closure planning, financing and EIA, along with expectations for stakeholder engagement in decision-making processes. There is an argument that ‘best practice’ mine closure and financing transparency in the mining sector enables stakeholders to readily *access* and *understand* the environmental, social, and financial outcomes of a mining activity over time. However, current mine closure and financial transparency initiatives in practice only require greater information disclosure – with disclosure distinctly dissimilar from transparency. In research we recently published on ‘best practice’ in relation to transparency of mining operations, a civil society would require access to (McHenry *et al*, 2015):

- Activities at the site (i.e. tenement/mine-site level and processing, infrastructure, etc.) as distinctly disaggregated from the company or parent company activities on a national level;
- The level of environmental disturbance, and the detailed plan to correct/rehabilitate the disturbance over time;
- Actual historical performance of correcting disturbance (i.e. disturbance and success of rehabilitation); Social data in terms of how affected people who were consulted and involved in decision-making about final post-mining land use and progression towards it, and the availability of this data to interested third parties to enable investigation of fairness, particularly with land owners and traditional custodians; and Financial flows (i.e. royalties, taxes, payments from mining companies or affiliated people, subsidiaries, or parent companies) to government or communities).

However, at the present time public information disclosure of mining operations clearly falls short of what might be broadly considered to be transparent to civil society in all eight jurisdictions analysed, with selective reporting, and documentation spanning from overwhelmingly complex and abundant or particularly limited – all of which do not achieve transparency (McHenry *et al*, 2015). Nonetheless, a promising opportunity is the linking of voluntary international mining transparency commitments from governments, with mandatory monitoring, analysis, and enforcement of compliance with jurisdictional mining laws. Such mandatory measures must ideally be clear and publically available, and be traceable down to the precision of each tenement. Enabling both independent accounting of financial transactions to a high level of detail, and improved national capacity for minerals sector governance to improve the impetus for mining companies to maintaining high standards of environmentally sustainable and economically beneficial operations (Sequeira *et al*, (in press)).

In a second line of investigating arising from our research, we examined mining company voluntary environmental disclosures in Zambia as an indicator of the impact of the Extractive Industry Transparency Initiative (EITI). We found that the levels of disclosure for non-EITI and EITI selected

companies were similar for environmental provisions at country, subsidiary, and multinational levels (Sequeira *et al*, (in press)). While EITI compliance may improve the environmental financial disclosure by mining companies, we determined that the detail and specificity of voluntarily disclosed information did not enable third parties to effectively investigate whether governments or companies were compliant with environmental and governance laws. Evolving EITI to require a project/tenement level of disclosure would improve transparency for local communities, civil society organisations, and also local governments in terms of environmental liabilities and associated payments.

3.4 Regulating and managing artisanal and small-scale mining activity

From Table 1 it is clear that practices vary considerably across the jurisdictions examined, with Tanzania having the most detailed provisions in place to manage small-scale mining. In many countries within Africa artisanal and small-scale mining constitutes a significant proportion of the mining sector, something that is not the case in an Australian context. Notwithstanding that some countries within our sample, for example Ghana and Zambia, do have provisions in their regulations for managing ASM, it was virtually unanimous with all persons we consulted during this research that significant challenges exist with this sector. Recently we argued that during the EIA of new large-scale mining operations it could pay to include consideration of ASM activity, based on comments from research informants that there is a tendency for small scale operators to move into a site when the initial major operator ceases their operations (Morrison-Saunders *et al*, 2015). When a large-scale operation has finished, there are still smaller quantities that would be of economic value to ASM if there were conditions where this was a socio-economic option likely to be adopted by a section of the population (i.e. low labour costs, small overheads, small/local market, little economic opportunities and job prospects, poverty, and relative non-adherence to law).

We previously mentioned illegal mining with the example of large-scale operations reported to us for Ghana. Much artisanal mining in South Africa appears to be illegal and to pose considerable danger not just to the people involved directly in mining, but also in terms of violence when miners are confronted by authorities. In one confrontation reported in the media (BBC, 2014) deaths ensued when violence erupted. During a coal mine closure site visit in South Africa we were shown and informed about illegal mining of old rock dumps and of closed underground operations. Following contouring the rock dumps had been rehabilitated using top soil 'mined' from nearby agricultural land with vegetation planting following. However, local residents were aware that lumps of coal remained within the rock dumps (which they could use directly for heat or cooking purposes) and their tunneling into the dumps to extract these had completely destabilised and eroded the rehabilitation efforts. With regards the underground mining, collapses permitted illegal miners to enter the tunnels and mine within the pillars left behind to stabilise the workings. This of course is not only extremely dangerous for the miners directly but increases the incidence of subsidence and further collapses. The mining company could not easily simply fill or block collapsed areas as it becomes virtually impossible to determine whether or not illegal miners are below ground, with the company obviously wishing to avoid trapping people underground. Planning for illegal mining is inherently difficult, although it makes sense to factor it in (Morrison-Saunders *et al*, 2015), and utilising the relatively well established EIA processes available in each of our sample countries may provide a useful starting point for this.

4. Conclusion

Our key focus in this paper was to understand the relationships between mine closure planning and EIA using eight jurisdictions from Australia and Africa as our focus. We identified several points of intersection between these two processes. Firstly the core principles of mine closure planning are on the whole very similar to those of best practice EIA principles. While there is a particular emphasis in the extractives sector on financial securities to be put in place for unexpectedly abandoned mine sites and

for financial transactions within the mining sector to be fully disclosed, similar sentiment can be found in EIA practice in relation to the capacity of proponents to implement proposed mitigation measures. Secondly all jurisdictions examined had both mining and EIA related regulations in place that could be applied to mining operations. An important issue arising here relates to the capacity to implement existing regulations and an observation put to us in several jurisdictions that coordination between different agencies can lead to gaps or oversights in performance. In terms of transparency, we found consistency of all eight jurisdictions upheld transparency principles for mine closure planning, financing, EIA, and stakeholder engagement, but in practice fell short of what might be broadly considered to be transparent with selective reporting, often either very limited disclosure or overwhelmingly large and complex and obfuscating to civil society and other interested parties. We recommend the linking of voluntary international mining transparency initiatives with streamlined mandatory monitoring, analysis, and enforcement of jurisdictional mining laws to provide consistent detail publically searchable at the level of the tenement. Finally, the various forms of ASM and small-scale legal and illegal mining activities occur in the eight jurisdictions, and the span of government approaches in place varies considerably. This is clearly reflective of the diversity of these activities and the challenges for the ASM and small-scale mining sector globally. We recommend further exploration of how the EIA processes may enable advancement in this often polarised sector with much potential for improvement in terms of safety, environmental credentials, and potentially broader incorporation into the formal economy to achieve greater levels of economic benefit to jurisdictions that it is concentrated.

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