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763 **Background**

764 Mine closure governance is increasing globally. This is in response to greater societal awareness of
765 the economic, environmental, cumulative impact, and social consequences of abandoned and
766 ineffectively closed mines and the sustainable development agenda in mining (APEC 2018).
767 However, “[t]he global development of these regulations has been uneven, with some jurisdictions
768 still having little or no regulation in the matter, while others possess a robust governance
769 framework” (APEC 2018).

770 This section highlights three governance issues that concern the economic, environmental, and
771 social risks of sustainable mine closure: namely, 1) the legal frameworks for financial assurance for
772 rehabilitation, 2) ongoing planning and progressive rehabilitation and restoration, and 3) support for
773 social transitions. It presents examples of governance developments and considers regulatory lag
774 between soft law and legal governance, drawing upon a range of mining jurisdictions. It briefly
775 presents challenges for industry and governments to address regulatory lag in these areas. Finally, it
776 suggests future directions for mine closure legal frameworks and governance.

777 **Literature Review**

778 *Terminology*

779 Globally, there is inconsistency in governance terminology for ecosystem recovery and its
780 relationship with mine closure. While recognizing ecological restoration is the more comprehensive
781 recovery concept (compared to remediation or rehabilitation) (Gann et al. 2019) we acknowledge

782 the terminological imprecisions and refer to restorative activities in this section as “rehabilitation”,
783 being a common term included in such governance frameworks. Below, we briefly consider some of
784 these ambiguities.

785 The need for terms to be clarified and used with greater specificity is recognized in the literature
786 (see e.g. Richardson & Lefroy (2016); Kaźmierczak et al. (2017); Cross et al. (2018)). Ecological
787 restoration in the strict sense is rarely defined in mine closure governance (Richardson & Lefroy
788 2016). It is not uncommon to find “rehabilitation” “restoration” and “remediation” used
789 interchangeably in legislation of mine closure and management of contaminated or abandoned mine
790 sites (Lima et al. 2016).

791 An example of imprecise language can be observed in the Australian state of Queensland’s
792 *Environmental Protection Act 1994* (Qld) (Queensland Government (2021), EP Act; Schedule 4), in
793 which “remediate” (contaminated land) means “to rehabilitate or restore or to take other action
794 that minimizes environmental harm”. For mine closure, the *EP Act 1994* (Qld) requires
795 “rehabilitation” of the land (see, e.g. Division 4, section 126D which addresses progressive
796 rehabilitation and closure plans (PRCPs)). Delegated regulation under the *EP Act 1994* requires land
797 to be returned to a “stable” condition in which “rehabilitation and restoration” occur (see definition
798 of “stable” at *Environmental Protection Regulation 2019* (Qld) Schedule 8, Part 1). In determining the
799 estimated rehabilitation cost of a mining activity (which is related to the amount of financial
800 assurance to be posted), the regulator must decide the amount of the estimated cost for
801 “rehabilitating the land” and for “preventing or minimizing environmental harm, or rehabilitating or
802 restoring the environment, in relation to the resource activity” (*EP Act 1994*, Part 14, Division 1,
803 section 300(1)(a)-(b)). Greater specificity of conditions for relinquishment to be achieved are then
804 agreed in tenement-specific instruments, such as the PRCP and environmental authority.

805 Similar interchangeability is observed in legislation in Canada, the European Union, and the United
806 States. Delegated legislation in the Canadian province of Ontario, concerning post-mine land use of
807 open pits, requires “restor[ing] the site to an appropriate land use” and specifies objectives for
808 “planning the rehabilitation of open pits” (Ontario Regulation 240/00 Mine Development and
809 Closure Under Part VII of the *Mining Act 1990* (Ontario) Part 2 section 18 and 19). In the European
810 Union’s Directive 2006/21/EC on the Management of Waste from Extractive Industries (European
811 Commission 2006), the term “rehabilitation” includes restoration, which appears to address
812 systemic concerns of post-mining land use. Here, “[r]ehabilitation” is defined as “the treatment of
813 land affected by a waste facility in such a way as to restore the land to a satisfactory state, with
814 particular regard to soil quality, wild life, natural habitats, freshwater systems, landscape and
815 appropriate beneficial uses” (European Commission 2006).

816 Finally, in the *Surface Mining Reclamation and Enforcement Act of 1977 (SMCRA)* (U.S.) [30 U.S.C. 25
817 section 1201 et seq. (1977)] (United States federal legislation that concerns restoration of surface
818 coal mines) progressive land “reclamation” is listed among the Act’s purposes (see section 1202 (e),
819 “assure that adequate procedures are undertaken to reclaim surface areas as contemporaneously as
820 possible with the surface coal mining operations”). However, SMCRA (which, as can be observed, has
821 “reclamation” in its title) also uses the term “restoration”. For example, SMCRA (1977) section 1231
822 establishes the Abandoned Mine Reclamation Fund, which may be used for “reclamation and
823 restoration of land and water resources adversely affected by past coal mining” (SMCRA 1977,
824 section 1231 (c)(1)). In addition, elements of ecological restoration may be observed under SMCRA’s
825 requirement to reinstate native vegetation post-operations (SMCRA 1977, section 1265(b)(19)).

826 In contrast to the above, Brazil seems to provide a model for greater clarity of restoration
827 terminology. Gastauer et al. (2019) explain that Brazil requires restoration of “self-sustainable

828 ecosystems to historical conditions” (p. 74). The authors contrast Brazil’s approach with other
829 mining jurisdictions that apply a more limited approach to land or environmental rehabilitation.

830 *Financial Assurance*

831 Financial assurance, which reflects the “polluter pays” principle of environmental law, is intended to
832 protect the public in the event the mining company is unable to meet its environmental obligations
833 (Peck & Sinding, 2009). A common regulatory requirement in mining jurisdictions is for the operator
834 to post financial assurance for rehabilitation costs. The nature of this assurance varies, but may
835 include instruments such as sureties, collateral, or self-guarantees (e.g. company guarantees) (see
836 e.g. *Surface Mining Control and Reclamation Act of 1977* (U.S.), section 509; see also Office of
837 Surface Mining Reclamation and Enforcement (2019)). These mechanisms are not always effective.
838 For example, the posted assurance may be insufficient for government to cover abandonment costs
839 or for unplanned events such as landslides, water treatment or address the amount of local
840 engagement when rehabilitating the mine. Liability is also transferred to government when a self-
841 bonding instrument is provided as financial assurance and then the providing entity becomes
842 insolvent. Such scenarios require government (and ultimately the taxpayer) to cover rehabilitation
843 costs or, where complete or partial rehabilitation is not funded, to leave the site in its abandoned
844 state with its associated physical risks (Mackie & Besco 2020).

845 A related financial assurance issue concerns government’s oversight of rehabilitation liability
846 transfers. Scrutiny is increasing for two types of transactions that are associated with this transfer
847 risk: 1) tenement title transfers from the operator to a third party; and 2) change of control of the
848 title holder (e.g. sale of controlling shares). Depending on the legal framework, the regulator may
849 not have oversight of these transfers (with the latter generally having less transparency). Regulators
850 have begun to mitigate these financial assurance risks through pooled assurance funds and through
851 increased transparency of transfers.

852 An example of a pooled fund is found in Western Australia, which enacted the *Mining Rehabilitation*
853 *Fund Act 2012* (WA) and the associated *Mining Rehabilitation Fund Regulations 2013* (WA). Under
854 this scheme, mining tenement holders pay an annual levy on disturbed land. The government
855 reserves the right to require performance bonds for specific tenements (see DMIRS 2020 and
856 Sommer & Gardner 2012). The Australian state of Queensland has also introduced a pooled fund
857 contribution and surety scheme through the *Mineral and Energy Resources (Financial Provisioning)*
858 *Act 2018* (Qld), aspects of which differ to Western Australia's framework (see also DES 2021)) (for
859 further reading, see Martin & McKenna (2018) for a description of differences between Western
860 Australia's and Queensland's pooled funds and Hamblin, Gardner & Haigh (2022) chapter 5.3.2).

861 An example of increased government oversight of transfers of rehabilitation liability is also found in
862 Queensland (see *Mineral and Energy Resources (Financial Provisioning) Act 2018* (Qld); *Mineral and*
863 *Energy Resources and Other Legislation Amendment Act 2020* (Qld)). These changes give
864 government authority to approve mining tenement transfers to third parties and, in doing so, to
865 consider the financial capability of the transferee to cover rehabilitation costs. Government also has
866 authority to consider the financial and technical resources of the tenement holder to undertake
867 restorative activities in the case of an ownership change or indirect change of control (for further
868 information see Department of Resources (2020).

869 *Mine Closure Planning and Progressive Rehabilitation*

870 Legal frameworks commonly require mining tenement holders to develop mine closure plans.
871 Planning requirements may be located in or across a variety of regulation or legislation-based
872 instruments. These may have various names such as environmental impact assessments or
873 statements (EIAs/EISs), environmental management plans (EMPs), or mine closure plans (see Young
874 et al. 2022 Section 2).

875 Legal requirements vary. Mine closure planning requirements are more established in some
876 jurisdictions than others (Morrison-Saunders et al. 2016). They may lack detail (see e.g. Nakazwe
877 (2017) critique of Zambia’s EIA mine closure requirements); be difficult to enforce (see e.g.
878 Munyanduki (2017) observation that there is “no clear legal obligation to rehabilitate a [uranium]
879 mine” in Namibia (p. 337)); or use a static, “front-end” approach to social impacts, which fail to
880 consider how community stakeholders’ views change over time (Vivoda et al. 2019, Section 6b).
881 These can lead to ineffective mine closure.

882 Ongoing mine closure planning across the LoM, updating plans as operations develop, is generally
883 viewed as best practice (see e.g. the Mining Association of Canada’s *Mine Closure Framework* (MAC
884 2008) and the ICMM’s *Integrated Mine Closure Good Practice Guide* (ICMM 2019b)). Some
885 jurisdictions contemplate progressive rehabilitation in their mine closure frameworks. For example,
886 Queensland, Australia, requires tenement holders to prepare a Progressive Rehabilitation and
887 Closure Plan (part of the reforms in the *Mineral and Energy Resources (Financial Provisioning) Act*
888 *2018* (Qld); see also Department of Environment and Science (2021)). In Ontario, Canada, the
889 tenement holder must “take all reasonable steps to progressively rehabilitate a site whether or not
890 closure has commenced or a closure plan has been filed” (*Mining Act 1990* (RSO), c M.14, section
891 139.1(1)). The intended effect of Western Australia’s pooled rehabilitation fund is to encourage
892 progressive rehabilitation, with a tenement holder’s annual levy reducing as the land is rehabilitated
893 across the LoM (see e.g. DMP & EPA (2015)).

894 *Social Transition*

895 Another aspect of ecological restoration and sustainable mining practice concerns the post-mine
896 social transition for mine-reliant communities (Mfunne et al. 2020). While the literature and industry
897 recognize the importance of the social aspects of mine closure (such as the “just transition” agenda

898 and coal mine closures), development of regulation is nascent compared to governance of its
899 physical and technical aspects (see, e.g. Vivoda et al. (2019); Kung et al. (2020)).

900 For example, a review of mine closure regulations in ten jurisdictions found that, while stakeholder
901 and community engagement were contemplated in the mining regulations generally, there were no
902 specific regulations concerning the social aspects of mine closure (Kung, et al. 2020). While legal
903 frameworks may presently lack comprehensive governance of social transition, aspects may be
904 included in requirements for EIAs, social impact assessments (SIAs) or combined environmental and
905 social impact assessments (ESIAs), as well as in mine closure plans (see above). Development of
906 these assessments early in a mining project, but without ongoing monitoring and adjustment, may
907 mean that the social impacts identified early do not reflect the impacts at mine closure (Solomon et
908 al. 2008).

909 Compliance with legal frameworks, particularly where those frameworks lag best practice, may leave
910 a risk to the industry's social license to operate. Soft law or self-governance can fill this regulatory
911 lag (see below).

912 **Challenges for Industry and Solutions**

913 Good governance supports sustainable development, an international best practice agenda for the
914 mining sector (see e.g. ICMM 2019; ICMM 2020; UN General Assembly 2012; Nakazwe 2017). To
915 support sustainable mining practices for successful rehabilitation, legal frameworks should establish
916 clear environmental and social objectives, provide transparency, and be enforceable (Munyanduki,
917 2017). Ineffective governance can result in unsustainable mining practices and poor rehabilitation
918 (Klopper & Wessels 2017).

919 Therefore, a challenge for industry is how to deliver effective mine closure and restoration in
920 jurisdictions that may have weak formal mine closure or post-mining restoration governance.

921 Societal demands for business to operate sustainably and ethically mean that mere regulatory
922 compliance for rehabilitation may not be enough to maintain social license (particularly where
923 regulations lag or conflict with recognized best practice) (Deloitte 2020; Section 6b).

924 Terminology in mine closure and rehabilitation legislation may not explicitly address ecosystem
925 recovery or may fall short of doing so. This suggests that another challenge for industry is to navigate
926 rehabilitation semantics and meet societal expectations. It is not that environmental law (more
927 broadly) or that all mining jurisdictions fail to contemplate ecosystem restoration; rather governance
928 of mine closure and rehabilitation still has a way to go.

929 How can industry act consistently with sustainable development practices and overcome regulatory
930 insufficiencies? Industry can overcome regulatory lag by self-regulation using international best
931 practice (e.g. through recommended industry standards or soft law). As an example, the Mine
932 Association of Canada's (MAC) *Mine Closure Framework* (2008) addresses several of the issues
933 above, such as financial assurance and progressive rehabilitation: "MAC members will establish
934 financial assurance for closure in accordance with applicable laws. *In the absence of such laws,*
935 financial assurance may be provided by bonds, letters of credit or other financial instruments, or by
936 self-insurance or self-guarantee" (emphasis added).

937 **Future Directions** The sustainable development agenda is a core issue for the mining sector and
938 mine closure. As the mining industry enters a phase of closures, regulators will seek to improve the
939 efficacy of mine closure governance, such as changing financial assurance risk profiles and
940 incentivizing progressive rehabilitation. Regulators, industry, and community could also work
941 together to clarify and incorporate consistent terminology both within and across jurisdictions.

942 The effective management of the social aspects of mine closure and the post-mine social transition
943 are emerging in the mine closure agenda. Regulation of them may evolve to extend beyond their

944 contemplation in ESIA's. The "just transition" agenda and its influence on coal mine closures may
945 inform practice for other mining sectors.

946 Therefore, mining companies should seek to conduct mine site environmental repair and closure in a
947 manner consistent with best practice to overcome deficiencies of legal governance. In this case, soft
948 law or self-governance frameworks that achieve best practice standards might usefully guide
949 industry practice, facilitate the social license to operate, encourage ecological restoration, and
950 inform the evolution of the legal frameworks.

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