Marine Policy 114 (2020) 103257

Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol

Challenges of operationalising good industry practice and best environmental practice in deep seabed mining regulation

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ARTICLE INFO

Keywords:
Good industry practice
Best environmental practice
Deep seabed mining
Adaptive management
Self-regulation
International seabed authority

ABSTRACT

Advances and innovation in deep-water technologies have fuelled a rapid and increased interest in the commercial exploitation of deep seabed minerals. Notwithstanding the apparent momentum in this sector, numerous regulatory, technical and environmental challenges remain. The latter, in particular, solicits on-going concern amongst various stakeholders due to the potential impact of mineral exploitation on the deep-sea environment. The organisation tasked with the management and control of mineral-related activities in international waters, the 'International Seabed Authority' (ISA), is mandated to develop 'the mining code', a body of international rules, regulations and procedures that will regulate prospecting, exploration and exploitation in areas beyond national jurisdiction. Accordingly, the aim of this article is to provide a critical assessment of two commonly invoked, yet often ambiguous, concepts in this regulatory discourse – that being 'Best Environmental Practice' and 'Good Industry Practice'. The paper draws on a comparative evaluation of these concepts in established international guidance standards, in order to highlight certain considerations for the practical implementation thereof for the deep seabed mining industry. In doing so, the research provides policy and theoretical contributions to the field of natural resources regulation. It further enhances the understanding of a critical component to the sustainable operationalisation of the industry, whilst acknowledging the unique environmental protection requirements associated with the deep seabed environment.

1. Introduction

Recent years have seen an increased interest in the commercial extraction of seabed mineral resources, such as polymetallic nodules, polymetallic sulphides and cobalt-rich ferromanganese crusts, in areas beyond national jurisdiction ('the Area') [1]. Advances in technology, coupled with lessons learnt from the deep-ocean oil and gas sector, have led to a number of contractors positioning themselves to commence deep sea mining ('DSM') activities of such resources in the near future [2]. Despite the momentum in the sector, several technological and environmental challenges remain. The latter, in particular, persists amongst scientists and environmentalists, who fear that the sector could destroy fragile marine ecosystems before the means to regulate and monitor activities are put in place, or indeed developed [3–7].

The organisation tasked with the management and control of mineral-related activities in international waters, the International Seabed Authority ('ISA'), is mandated by the United Nations Convention on the Law of the Sea ('LOSC') [8] to develop the 'Mining Code'; a body of international rules, regulations and procedures that will regulate prospecting, exploration and exploitation in areas beyond national jurisdiction [9]. In addition to established regulations related to the exploration for certain mineral resources [10–14], the ISA has produced a number of revised draft regulations related to the commercial exploitation of such resources, as well as working papers related to protection of the environment during these activities [15].

In light of the above, the aim of this paper is to provide a critical assessment of two commonly invoked, yet often ambiguous, concepts in this regulatory discourse – being 'Good Industry Practice' ('GIP') and 'Best Environmental Practice' ('BEP'). The paper examines the scope and context of these concepts against the backdrop of DSM, and identifies some of the challenges associated with formulating regulatory definitions aimed at meeting operational practice. The objective thereof is to determine the pitfalls that may be avoided in future iterations of the exploitation regulations, in order for the ISA to realistically meet its responsibilities as articulated in the LOSC. This discourse is essential on two levels: firstly, on a policy level, the role, function, and limitations of

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https://doi.org/10.1016/j.marpol.2018.09.002
Received 14 June 2018; Received in revised form 4 September 2018; Accepted 11 September 2018
Available online 18 September 2018
0308-597X/

these concepts need to be clarified in order to provide regulatory parameters for mining activities in the Area. Secondly, on a practical level, it is crucial to ascertain what operational expectations may be applicable to DSM contractors, as both potential investors and contractors require regulatory certainty and transparency, in order to determine the economic feasibility of projects.

The objectives of the paper are met by firstly providing a contextualisation of these concepts in terms of established operational application in the terrestrial mining sector, and by drawing attention to the unique circumstances that apply to DSM. The paper then demonstrates certain challenges and limitations, in order to highlight the potential difficulties associated with the practical implementation of GIP and BEP on seabed mining operations. The potential role and limitations of self-regulation by contractors as an alternative or complementary form of compliance is briefly discussed, before a selection of recommendations are advanced. In closing, this paper advocates the consideration of a bespoke approach, in terms of which dedicated and prescriptive guidelines, developed by the ISA for the DSM sector, can facilitate the consistent implementation of GIP and BEP.

2. Contextualising 'good industry practice' and 'best environmental practice' in seabed mining discourse

Reference to the terms 'Good Industry Practice' and 'Best Environmental Practice' are frequent in the various draft regulations related to the exploitation of mineral resources in the Area. As developments are on-going, how these concepts are eventually formulated will determine future expectations and required standards for mitigation of potential environmental impacts by contractors; it will direct the consideration and approval of applications for exploitation by the ISA, and it will arguably serve as the initial baseline in the case of non-compliance and associated disputes.

Diverse international, regional and national initiatives provide for contextual interpretations related to GIP and BEP, particularly with regards to sustainable development, good corporate governance and environmental protection [16]. It can therefore reasonably be presumed that the drafters of the future exploitation regulations will rely on established standards to offer guidance in determining the nature and scope of these concepts for application in the DSM sector. However, certain peculiarities associated with the sector need to be acknowledged, as it may extensively influence the degree of reliance that can realistically be placed on established standards, as well as the manner of their potential incorporation into future exploitation regulations.

2.1. 'Good industry practice' in the extractive industries

At its most basic understanding, the concept of good industry practice simply comprises conducting particular activities in a manner that can reasonably and ordinarily be expected from a skilled person, engaged in such activities, for a given site [17]. For the purposes of terrestrial mining, a number of international industry standards offer guidance to entities engaged in mining activities and, more specifically, with regards to environmental impacts. Some reference mining activities directly [18], whereas others may find indirect application through ancillary activities, such as transport and finance [19]. Though these guidelines differ in form and scope, it normally engenders the notion that a robust assessment of all the potential inputs [20], processes, and outputs [21], will be conducted in order to identify and subsequently select the best point of departure for practice in that particular environment, and on that particular site. For example, the Environmental Protection Authority (EPA) in Western Australia prescribes for condition environmental outcomes, whereby performance indicators are respectively expressed as trigger- and threshold criteria. Each of these values is associated with a prescribed implementation action and monitoring strategy, in order to demonstrate compliance with both the process and the output [22].

The development of these trigger and threshold criteria are required to be selected on the basis that they robustly reflect the health and condition of the environmental factor which may be impacted in the particular location of the project, relate to the environmental baseline as well as the causal relationship between the project impact and the environmental factor, and promote consistency and compatibility with monitoring programs elsewhere in Australia [23]. In this manner, the EPA is providing a measurable and scientifically credible link between the bespoke trigger and threshold criteria which may apply to a particular site, and the standardised implementation of an Environmental Management Plan (EMP) that allows direct comparison with other projects or locations in Australia [23]. The EPA furthermore provides guidance encouraging proponents to use national or international standards as a benchmarking exercise by which to ensure that internal standards are meeting best practice within the industry and keeping up to date with improvements, as well as achieving the environmental outcomes required by the EPA for that project [24].

Having explored the approach to good industry practice, it is also necessary to acknowledge that good industry practice is not static. Rather it represents a dynamic level of flexibility in systems, technologies, and people, in order to identify and implement solutions in a manner that continues to reflect the conditions (including risks and opportunities) on the operations site. Alternatively put, as new challenges to inputs emerge, for example, changes in the mining substrate, site conditions, environmental values, or new technologies become available, good industry practice ought to involve the capturing, assessment and actioning of data to *adapt* to these changing conditions [23]. The same would apply in the case of perceived changes to outputs, such as disparities to the expected environmental impacts, or variations in production or economic outputs. Guidelines such as the Leading Practice series developed by the Australian Department of Industry, Innovation and Science provide examples of events that should trigger a review of both management and monitoring strategies, including changes to the mine plan, the type of mining, extreme events or incidents, or changes in the data trends [25]. Short and long-term monitoring strategies are therefore essential in order to fully understand both existing and emerging trends, and how these will manifest on an operational level. The timing of the communication of data to internal and external stakeholders is therefore critical, as is the timing on decisions made to vary inputs and processes (and subsequent variations in outputs), as a consequence of the data. For example, the Western Australian guideline on groundwater monitoring for extraction bores prescribes both an annual and triennial approach, whereby annual results are interpreted on the basis of long-term trends at least every three years, and the proponent's operating strategy adjusted accordingly [26].

The ultimate aim of this precision timing is to ensure that the best estimate of future impact is reassessed at the right intervals using the right data, systems, people and attitudes, to ensure that financially, socially and environmentally sound outcomes are continuously being achieved. Much in the same philosophy as 'triple bottom line approaches' [27], GIP requires a careful balancing of these three types of outcomes, and an unending quest to continuously improve the outcomes for each.

2.2. Interplay between 'Best environmental practice' and 'Good industry practice'

'Best Environmental Practice' is generally defined in the extractive industries to mean the application of the most appropriate combination of environmental control measures and strategies taking into account the criteria set by a particular regulator. In other words, widely accepted norms or customs of environmental and risk management [28]. When one considers that best environmental practice informs good industry practice, it is evident that the operational interplay between these concepts cannot be underemphasised. However, in order to

effectively inform good industry practice, certain fundamental environmental practices need to be observed.

A primary consideration for best environmental practices is the establishment of a robust environmental baseline [29]. This allows for parties, engaged in a particular activity, a point of reference from which to monitor impacts, and from which to measure the success of recovery or rehabilitation. More precisely, baseline studies are used to inform a set of site-specific trigger values, which (in increasing levels of severity) trigger first a set of internal management responses, and second a compliance action (i.e. a "stop work" scenario). Such baseline data needs to be presented in a manner that informs the operational design. In other words, using the information obtained about environmental values to best align the mine plan and mining practices in order to protect those values [23]. Though the location of an ore body is static, the manner in which it may be mined is variable and can be adjusted in order to maintain the balance between environmental, social and economic benefits.

Apart from the establishment of baseline data, BEP requires the collection of environmental monitoring data at the optimum time, in the correct manner and, arguably of most importance, *analysed* for the most appropriate parameters [30]. In practice, this entails the utilisation of a monitoring program that carefully considers monitoring locations, seasonal variance, changes in operating conditions, short and long-term trends, indicator parameters, as well as compliance monitoring.

This generated data, and the associated short and long-term trends, need to be presented to both internal and external stakeholders at the optimal time, and in a manner that is transparent and intelligible. With regards to the former, the data facilitates internal management decisions that are adaptive, responsive and innovative; in the latter instance, it facilitates the engagement of external stakeholders in the management of the operation, as well as providing the means for clearly communicating compliance to respective regulators. The Australian Government Leading Practice Guideline indicates that the timely public reporting of environmental, social and governance data should be seen as part of a larger process of ensuring sustainable company practices, effective stakeholder engagement, and corporate accountability, and when carried out effectively can also assist to identify gaps in data, generate support within the community and help to manage sustainability resources within the organisation [31]. This approach to the implementation of management strategies in environments or industries where uncertainty remains represents best practice in that it builds a protective framework that is not site (or technology) specific.

Ultimately, GIP reflects the process by which outcomes are achieved. Alternatively put, BEP establishes the process by which inputs (baseline environmental values, engineering technology) would be described, processes determined with reference to specific triggers to ensure environmental protection at all times, and outputs monitored. The implementation of BEP processes therefore contributes to GIP, by allowing proponents to (within the framework of the particular BEP described) adapt their management strategies to achieve the best outcome for the industry and the environment. It is acknowledged that breaching a compliance trigger value, and causing a "stop work" scenario, as discussed earlier, would be detrimental to both industry and environment. As such, the implementation by industry of management strategies to ensure monitoring continues to demonstrate environmental protection is beneficial for all parties, and the sharing of these processes and lessons will contribute to ongoing GIP.

2.3. Challenge of incorporating GIP and BEP into deep seabed mining regulation

Conceptualising these operational practices for the purpose of regulating a frontier industry, which is yet to commence, is a fundamentally challenging undertaking. This challenge is compounded by the operational peculiarities of the DSM sector. In other words, the *where* – taking place in international waters beyond areas of national jurisdiction [32]; the *how and when* – the application of new technologies coupled with scientific uncertainty regarding future environmental impacts of the mining methods to be used [5]; the *what* – mineral resources that belong to the whole of mankind [33], and the *who* – an untried industrial sector, arguably set it apart from other extractive industries [34]. This confluence of operational and legislative factors presents a unique challenge to regulatory drafting.

Firstly, the difficulties normally associated with state acceptance relating to treaty terms and definitions are amplified in the case of the ISA's regulatory activities. Mineral resource development and exploitation, being usually associated with domestic jurisdictions, invariably includes a myriad of interpretations as to the nature and scope of certain terms. Consequently, establishing commonly accepted terms, definitions and thresholds for GIP and BEP, by international stakeholders, may prove arduous.

Secondly, the frontier nature of the field inherently lends itself to a state of flux, resulting in the 'shifting of regulatory goal posts.' In other words, as DSM activities and its associated impacts on the deep sea environment become progressively optimised and mitigated through advances in scientific knowledge and practicable technological developments that are economically feasible, the thresholds with regards to what constitutes GIP and BEP will likewise evolve. This in turn will necessitate a parallel evolution of the regulatory environment, as these new expectations become recognised, and subsequently incorporated, into future revisions of exploitation regulations. As certain environmental challenges, and reactionary improvements in deep seabed mining technology will likely only materialise after the commencement of test mining, legal expectations formulised *prior* to such commencement will necessarily lack operational and technical detail that will influence what is understood in terms of GIP and BEP [35].

Thirdly, the development of mineral resources in an area earmarked as forming part of the concept of common heritage of mankind, places unique restrictions and obligations on mineral commodity value chains that are traditionally profit-orientated, and will subsequently require a novel approach to regulation [36].

Finally, despite an unprecedented operational locale, the primary activity itself - in this particular case the exploitation of mineral resources – is encumbered with a negative legacy from its terrestrial counterpart, in that it is commonly perceived as having a track-record of poor industry practice and negative environmental impacts [37].

3. When theory and practice meet

As has been mentioned, various international guidelines exist that provide general or contextual interpretations of the concepts of 'best environmental practice' and 'good industry practice' [38]. Though such guidelines can prove helpful in establishing an initial definition for DSM activities, an overreliance on incorporating established, non-specific guidelines may prove problematic. The 'as is' utilisation of definitions in existing standards, particularly for the purposes of regulatory drafting, can paradoxically prove to be too wide and too limiting in the same instance.

3.1. Limitations when referring to existing standards and non-specific regulatory definitions

'Good Industry Practice', as set out in previous iterations of the ISA draft exploitation regulations, corresponded closely with defined terms in a number of generally accepted international industry instruments, most notably, the International Bar Association Model Mining Development Agreement Project [39]. In addition, provision was made for a brief listing of selected international standards but importantly, not *limited* thereto. These guidelines were purportedly aimed at guiding contractors and the ISA as to expected conduct in terms of 'Good Industry Practice', and included the International Finance Corporation

('IFC') Performance Standards [40], the family of International Organisation for Standardisation ('ISO') standards [41], and the International Marine Minerals Society [42]. The listed instruments represent a *prima facie* appropriate selection when considered as guidelines though, as it was left open-ended, any number of internationally recognised and established corporate guidelines and reporting initiatives could theoretically be applied by a contractor to demonstrate compliance with GIP.

A further concern when utilising existing standards as an 'as is' guideline to determine the above approach, is that some standards that are referenced may not be directly applicable to the activity that it is intended to guide. Instruments such as the ISO family and IFC Principles embody a selection of standards and principles - all of which may not be generally applicable to seabed mining, or only applicable under very particular circumstances. An in-depth understanding of the full scope and working of existing guidelines, which may subsequently serve as a foundation for the formalisation of DSM-specific guidelines, is therefore critical in order to avoid ambiguities.

In the case of both GIP and BEP, it is essential for regulatory purposes to ensure that clear reference is made to the party that is responsible for *adopting* and implementing the proposed practices, even though they may merely be intended to act as guidelines. Though it might appear trite, a lack of such reference might lead to an interpretation where the responsible party is merely implied, thus leading to regulatory uncertainty. It is furthermore important to ensure that the objectives of what is to be achieved through the implementation of these practices are clear and measurable.

Finally, it is crucial that a prescriptive reading to the application of a particular definition should be implemented. In other words, a contractor should be required to comply with a particular standard and to implement a monitoring program that enables objective, transparent and effective demonstration of compliance with the standard, as opposed to merely optional compliance to the standard in question. A non-prescriptive reading of compliance could again result in a disjointed or non-uniform adoption of best environmental practices by individual contractors.

3.2. Limitations associated with voluntary guidelines

It is also important to note that many guidelines and reporting standards are largely voluntary in nature and, as such, may prove problematic in ensuring compliance from an operational perspective. This issue is compounded when the possible number of *non-listed* but potentially applicable guidance instruments and standards, as provided for in earlier iterations of the ISA draft exploitation regulations, are considered. In the first instance, given the voluntary nature of these instruments, few have established oversight bodies with a remit that includes compliance monitoring and enforcement. In such instances, self-regulation by stakeholders themselves represents the primary means of monitoring. This subsequently raises a question as to how an intergovernmental entity, such as the ISA, may succeed in ensuring compliance where it would largely fall within the responsibility of contractors. Moreover, given the number of possible standards that may be relied on by contractors in an open-ended and non-restrictive conceptualisation of GIP and BEP, an undue and unrealistic operational burden may be placed on the regulatory entity in having to verify compliance with multiple standards which does not fall within its primary statutory remit.

A second consideration should be given to the legal nature and enforceability of voluntary codes. If stakeholders are legally required in terms of exploitation regulations to apply GIP and BEP in an operational capacity, whilst having to primarily rely on voluntary instruments for guidance, it could result in an antinomy where voluntary standards are to be applied in a mandatory manner in the Area. It is thus important to consider whether such voluntary guidelines and standards are indeed capable of being applied in such a mandatory manner.

3.3. The role of self-regulation

Operational factors, including cost, logistics, isolation of sites, and the technological monopoly of contractors, will invariably require the emerging DSM industry to perform some degree of self-regulation. In other words, in terms of which a contractor is itself responsible for primary data collection, and subsequent presentation thereof, to the regulator in order to demonstrate compliance. Given the initial capacity limitations faced by the ISA in particular, it is unlikely that this position will change in the near future – even if a contractor committed to the 'live streaming' of data, it would be almost impossible, and certainly cost prohibitive, for a regulator or external stakeholder to analyse such a large amount of data in a meaningful way.

For the reasons discussed above, the regulating authority, or any other external stakeholder, will not feasibly be able to conduct verification monitoring, and will therefore be obligated to rely, at least at initial stages of the sector's development, on data presented by contractors to demonstrate compliance. As the commencement of operations is likely to be the most uncertain time in relation to nascent industries, GIP will require a bespoke approach to self-regulatory monitoring. Accordingly, there is a need to adopt a staged approach to monitoring under these circumstances, whereby the commencement of operations includes a 'validation monitoring' period. This should involve intensive, real time, and extremely comprehensive monitoring - the nature of which may not be feasible in the long term, but which could provide confidence to the proponent and regulator that all impacts are being identified in a timely manner, and management (or cessation) actions are occurring accordingly [23]. Following the validation period, it is expected that uncertainty will be reduced, and the operation may enter a 'steady state' operational monitoring period. Such an approach is neither site-, nor technology, specific and could provide the robust approach to monitoring and regulating nascent industries required to achieve BEP.

In order to deal with the difficulty of self-regulation, some DSM contractors have proposed an independent review of environmental monitoring data to be conducted on a quarterly basis, by an appropriately qualified expert. This approach represents one form of operationalisation of GIP, in that it epitomises the presentation of data in a clear, meaningful and transparent manner. However, the real demonstration of GIP will be evident in how the contractor responds to any feedback provided by such an independent reviewer.

4. Recommendations

In light of the challenges discussed above, the adoption of an alternative regulatory approach is submitted, whereby any required guideline standards for GIP and BEP are explicitly restricted to only those formally adopted, endorsed or issued by the ISA from time to time. Such a regulatory approach provides for a level of flexibility with regards to the adoption of novel and bespoke standards, particularly those that are more specifically aimed at DSM activities as they become available.

A second notable advantage of such a restricted approach relates to clarity and a lessening of regulatory burden for both contractors and sponsoring States. Relying on a single source, that is to say a restricted list endorsed by the ISA, should moderate the need for both contractors and regulators to continuously evaluate the appropriateness and applicability of newly established or evolved third-party developed standards to the marine mining sector. The due diligence and transparency requirements for ISA endorsement procedures, coupled with a required consensus from member states to the ISA (including that of sponsoring States), further allow for an inherent degree of contractor input into the operationalisation of GIP and BEP and should thus mitigate concerns regarding regulatory uncertainty and the threat of future regulatory overburden.

A final advantage to a regulatory conceptualisation that is restricted

to an approach where the ISA is required to unambiguously adopt, endorse or issue standards and guidelines, is that it safeguards appropriate regulatory control by the ISA. Placing an *unrestricted* onus on contractors to select appropriate standards will undoubtedly result in a divergent selection and application of standards and guidelines – in turn possibly leading to non-compliance with the ISA's expectations of GIP and BEP, and disputes as to the nature and scope of these concepts. However, if the onus to identify, adopt, endorse or issue relevant standards and expectations is restricted to the ISA as the regulatory authority, greater regulatory control and oversight can subsequently be achieved.

Accordingly, it is suggested that the ISA considers the identification of existing standards, with the aim of their adoption where appropriate, or adaption where required, that meet the particular operational requirements of contractors. Where oversight is required for activities that fall outside of the immediate remit of the ISA [43], or where additional control measures are required, an approach where voluntary standards can be incorporated indirectly, whilst still remaining relevant, may prove to be more viable. One such approach may, for example, be through the requirement of loan-financed projects to access finance through institutions that subscribe to the Equator- or IFC Principles. In the alternative, contractors could be required to disclose project loan details during the application process, with an explicit assessment criterion relating to the consideration by the ISA of whether finance can only be accessed through compliance with the aforementioned principles.

Finally, in instances where reliance is placed on self-regulation, it is submitted that the incorporation of a staged approach to monitoring (that is to say, with a high-intensity monitoring in place for the validation period, and a progression to 'steady state monitoring' once environmental protection has been demonstrated to occur), should assist both industry and regulator in demonstrating that a balanced, comprehensive, and effective monitoring strategy is being delivered, regardless of the mining technology being used, or the environment in which the operation is occurring. That being said, it is important to take into consideration that, though guideline documents can serve to provide parameters for expectations, only practitioners have access to the monitoring data that will inform the dynamic management of inputs, processes and outputs that lead to GIP.

5. Conclusion

The regulation of any emergent industry, especially in instances where it is expected that associated activities will be invasive to the operational environment, is necessarily a challenging undertaking. In order to ensure the effective regulation of such activities, such as seabed mineral exploitation, it is pivotal that fundamental concepts are formalised in regulation prior to the commencement of the activities.

Though a number of established standards may offer guidance in the formulation of concepts such as 'good industry practice' and 'best environmental practice', an overreliance and arguably incorrect incorporation of 'generic' standards may not only be impracticable in operational application, but could serve to frustrate the intended outcomes of the very concepts themselves. Where practical considerations associated with a particular industry are not explicitly provided for, a lack of certainty may essentially frustrate attempts by a regulator to meet its statutory mandate, and may furthermore lead to severe misperceptions by all stakeholders with regards to industry compliance and associated responsibilities.

In order to avoid the limitations discussed in this paper, it is submitted that an overarching formalisation of the concepts of GIP and BEP, such as utilised in certain existing international standards, constitutes a less appropriate means to facilitate the operationalisation, and oversight, of DSM activities. Rather, prescriptive and dedicated procedural documents, such as the approach taken by the EPA in Western Australia (which are based on existing standards but that can be tailored to the particular requirements of seabed mining operations) [44], will ensure enhanced clarity in terms of stakeholder expectations and will contribute to a level playing field for all contractors.

Such an approach can effectively accommodate the operational requirements of seabed mining contractors on the one hand, whilst providing for the unique environmental protection requirements associated with operations in these extreme environments on the other. It is submitted that the subsequent workload necessitated with ensuring that such a dedicated guideline remains contextually current in light of the dynamic nature of technological advances in emergent industries, is warranted when weighed against the benefits to process and outcomes.

Acknowledgements

The authors would like to express their gratitude to the Pew Charitable Trusts, for supporting earlier research upon which this paper is based, notably: *The CODE PROJECT - Developing ISA Environmental Regulations* (2017), available at 〈www.pewtrusts.org/en/research-and-analysis/white-papers/2017/07/first-report-of-the-code-project-developing-international-seabed-authority-environmental-regulations〉. The findings and views expressed in this publication remain those of the authors and do not necessarily reflect the views of the Pew Charitable Trusts. The authors would also like to express their appreciation for comments and suggestion by the two anonymous reviewers, which have contributed to the quality of the paper.

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[17] See for example the International Bar Association's suggested definition for 'Good Industry Practice' as set out in the Model Mining Development Agreement, where Section 1.1 defines it as: "…the exercise of that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected to be applied by a skilled and experienced person engaged in the international mining industry…" [emphasis added].

[18] Examples include, but are not limited to, the 10 Principles of the International Council on Mining and Metals, and the Global Reporting Initiative G4 Mining and Metals Sector Disclosures.

[19] See for examples the family of International Organisation for Standardisation ('ISO') standards, in particular the ISO 14001 standard, the Equator Principles, the United Nations Sustainable Development Goals, and the International Finance Corporation Performance Standards.

[20] Examples of inputs include baseline environmental data, mining methods, and engineering possibilities.

[21] Examples of outputs can include, but are not limited to environmental impacts and economic revenues.

[22] See for example, EPAWA Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual, 2016. Section 6.2 on defining outcome-based environmental management plan provisions, available at: 〈www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/EIA%20Procedures%20Manual-131216.pdf〉 (Accessed 6 May 2018); EPAWA EnvironmentalAssessment Guideline No. 17: preparation of management plans under Part IV of the EP Act, 2015. Available at: 〈http://edit.epa.wa.gov.au/EPADocLib/EAG%2017%20CEMPS%20August%202015.pdf〉 (Accessed 6 May 2018).

[23] R. Grogan, Regulating extractive industries: what works in practice? Practitioners' perspectives on the effective implementation of environmental legislation, Gro Sustainability Pty Ltd for The Pew Charitable Trusts, 2017.

[24] EPAWA Environmental Assessment Guideline No. 17: preparation of management plans under Part IV of the EP Act, 2015. Section 7.1.2, available at: 〈http://edit.epa.wa.gov.au/EPADocLib/EAG%2017%20CEMPS%20August%202015.pdf〉 (Accessed 6 May 2018).

[25] See Leading Practice Sustainable Development Program for the Mining Industry, evaluating performance: monitoring and auditing, section 4.20 – review of monitoring programs, available at: 〈https://industry.gov.au/resource/Programs/LPSD/Evaluating-performance-monitoring-and-auditing/Monitoring-implementation/Pages/Review-of-monitoring-programs.aspx〉 (Accessed 28 April 2018).

[26] Department of Water, Western Australia (DOWWA), 2009. Operational policy no. 5. 12 – Hydrogeological reporting associated with a groundwater well licence. November 2009, available at: 〈www.water.wa.gov.au/_data/assets/pdf_file/0003/1659/89953.pdf〉 (Accessed 28 April 2018).

[27] T. Hacking, P. Guthrie, A framework for clarifying the meaning of triple bottom-line, integrated, and sustainability assessment, Environ. Impact Assess. Rev. 28 (2–3) (2008) 73–89.

[28] M.R. Clark, H.L. Rouse, G. Lamarche, J. Ellis, C.W. Hickey, Preparation of Environmental Impact Assessments: general Guidelines for Offshore Mining and Drilling with Particular Reference to New Zealand, National Institute of Water and Atmospheric Research, 2017.

[29] A. Jaeckel, An environmental management strategy for the international seabed authority? The legal basis, Int. J. Mar. Coast. Law 30 (1) (2015) 93–119.

[30] See for example, Department of Water, Western Australia (DOWWA), 2009. Operational policy no. 5. 12 – Hydrogeological reporting associated with a groundwater well licence. November 2009, available at: 〈www.water.wa.gov.au/_data/assets/pdf_file/0003/1659/89953.pdf〉 (Accessed 28 May 2018); EPAWA Environmental Assessment Guideline No. 17: Preparation of management plans under Part IV of the EP Act, (2015), sections 6.3.4, 7.1.1 and 7.1.2, available at: 〈http://edit.epa.wa.gov.au/EPADocLib/EAG%2017%20CEMPS%20August%202015.pdf〉 (Accessed 6 May 2018).

[31] Leading Practice Sustainable Development Program for the Mining Industry, evaluating performance: monitoring and auditing, section 4.16.1 public reporting and assurance, available at: 〈https://industry.gov.au/resource/Programs/LPSD/Evaluating-performance-monitoring-and-auditing/Monitoring-implementation/Pages/Public-reporting-and-assurance.aspx〉 (Accessed 28 April 2018).

[32] Art. 1.1(1) of Part XI, LOSC identifies 'the Area' as: "…the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction.".

[33] As stated in the Preamble of the LOSC, "…the area of the seabed and ocean floor and the subsoil thereof, beyond the limits of national jurisdiction, as well as its resources, are the common heritage of mankind, the exploration and exploitation of which shall be carried out for the benefit of mankind as a whole, irrespective of the geographical location of States…".

[34] L.M. Wedding, S.M. Reiter, C.R. Smith, K.M. Gjerde, J.N. Kittinger, A.M. Friedlander, S.D. Gaines, M.R. Clark, A.M. Thurnherr, S.M. Hardy, L.B. Crowder, Managing mining of the deep seabed, Science 349 (6244) (2015) 144–145.

[35] See ISA, Ongoing Development of Regulations on Exploitation of Mineral Resources in the Area, available at: 〈www.isa.org.jm/legal-instruments/ongoing-development-regulations-exploitation-mineral-resources-area〉 (Accessed 14 May 2018).

[36] LOSC, Art 153, Annex III art (4)(b). In this regard, also see P.C.F. Crowson, Mining unearthed: the definitive book on how economic and political influences shape the global mining industry, Aspermont UK, London, 2008 at 353–354.

[37] J.M. Durden, K. Murphy, A. Jaeckel, C.L. Van Dover, S. Christiansen, K. Gjerde, A. Ortega, D.O. Jones, A procedural framework for robust environmental management of deep-sea mining projects using a conceptual model, Mar. Policy 84 (2017) 193–201.

[38] See notes 16 & 19.

[39] Compare for example the International Bar Association's suggested definition for 'Good Industry Practice' as set out in the Model Mining Development Agreement, where Section 1.1 defines it as: …the exercise of that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected to be applied by a skilled and experienced person engaged in the international mining industry and includes but is not limited to the guidance provided, as applicable, by the International Council on Mining and Metals, by the IFC Performance Standards, and by ISO 14001 standards [emphasis added]. See IBA, MMDA 1.0 Model Mine Development Agreement: a Template for Negotiation and Drafting, 2011. Available at: 〈www.mmdaproject.org/〉 (Accessed 28 April 2018).

[40] The IFC Performance Standards form an integrated part of the IFC Sustainability Framework. The former comprises eight standards that parties responsible for implementing and operating a project financed by the IFC need to meet throughout the life of the particular investment. IFC Performance Standards on Environmental and Social Sustainability, 2012, available at: 〈www.ifc.org/wps/wcm/connect/c8f524004a73daeca09afdf998895a12/IFC_Performance_Standards.pdf?MOD=AJPERES〉 (Accessed 28 April 2018).

[41] Available at 〈www.iso.org/standards.html〉 (Accessed 28 April 2018).

[42] IMMS, Code for Environmental Management of Marine Mining, 2011. Available at: 〈www.immsoc.org/IMMS_downloads/ISBA-16LTC-2-EN.pdf〉 (Accessed 28 April 2018). It should be borne in mind that following of and adherence to the principles and guidelines contained in the Code are voluntary in nature. The aim of the IMMS Code is to complement applicable binding national and international regulations for the protection of the marine environment with regard to marine mining where these regulations exist, and to provide environmental principles and guidelines for marine mining companies where these are absent or could be improved upon.

[43] Examples include, but are not limited to, environmental concerns associated with transport of ore outside of the Area, and secondary processing at onshore facilities.

[44] EPAWA Environmental Assessment Guideline No. 17: preparation of management plans under Part IV of the EP Act, 2015. Sections 6.3.4, 7.1.1 and 7.1.2, available at: 〈http://edit.epa.wa.gov.au/EPADocLib/EAG%2017%20CEMPS%20August%202015.pdf〉 (Accessed 6 May 2018).