Chapter 1
The Wealth Beneath the Ocean Floor:
Potentials and Challenges

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ABSTRACT

The mining sector is integral to energy security and industrial growth. With growing issues of environmental degradation and scarcity of mineral deposits, many mining companies have started exploring more remote areas that can be technically challenging and less cost effective. While the deep seabed mining is increasingly seen as a potential solution to some of the limitations in traditional land-based mining. The growing interest in this sector is largely driven by the increasing global demand for these minerals, essential for technologies such as electric vehicles, renewable energy systems, and electronic devices . This chapter explores the potential of deep seabed mining from the perspective of the Blue Economy. This chapter also discusses the issues and challenges of this activity regarding the Blue Growth and Blue Justice Concepts.

INTRODUCTION

The mining industry plays a crucial role in economic development and industrialization, serving as a backbone for various sectors by providing essential raw materials. This industry is pivotal for energy production and significantly contributes to job creation, infrastructure development, and technological advancements. Critical minerals are required to support to the low-carbon economy, particularly in the energy sector. Limited supplies of these minerals hinder the efforts for the transition towards the Green Economy especially in the technologies manufacturing for solar, wind energy as well as electric vehicles. Some countries currently import most of their mineral commodities, which subsequently leads to economic vulnerability. As mining is integral to energy security and industrial growth, mining activities have experiencing transformations through innovative technologies thereby increasing profitability and compliance with environmental standards. This innovation aligns with global efforts to reduce emissions

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while ensuring that energy needs are met and supporting the critical sector for sustaining economic activities.

The mining sector has faced limitations due to several factors. Apart from the growing concerns about environmental degradation, many mineral deposits have been depleted. This scenario forced mining companies to explore more remote areas which can be technically challenging and less cost effective. Therefore, deep seabed mining (hereinafter referred to as "DSM") is increasingly seen as a potential solution to some of the limitations in traditional land-based mining. DSM refers to the extraction of mineral resources from the ocean floor, particularly in deep-sea environments, which typically lie at depths greater than 200 meters. This activity targets various mineral deposits, including polymetallic nodules, seafloor massive sulfides, and ferromanganese crusts, which are rich in valuable metals such as nickel, cobalt, copper, and rare earth elements (Thompson et al., 2023; Solheim et al., 2022). The growing interest in DSM is largely driven by the increasing global demand for these minerals, essential for technologies such as electric vehicles, renewable energy systems, and electronic devices (Solheim et al., 2022; Orcutt et al., 2020). Hence, this chapter explores the potentials of deep seabed mining from the perspective of the Blue Economy. This chapter also discusses the issues and challenges of this activity in respect of the Blue Growth and Blue Justice Concepts.

THE GOVERNANCE OF DEEP SEABED MINING

The precautionary principle is a critical framework in the governance of ocean activities, particularly in the context of seabed mining, where the potential for significant environmental impacts is high. This principle advocates for preventive action in the face of uncertainty, emphasizing that the absence of complete scientific certainty should not be used as a reason to postpone measures that could prevent environmental degradation (Wang et al., 2023). The precautionary principle serves as a guiding tenet that encourages decision-makers to be cautious when assessing the risks associated with new and potentially harmful activities, such as deep-sea mining (Moreira & Teixeira, 2020). This principle is particularly relevant due to the inherent uncertainties surrounding the ecological impacts of such activities.

In the context of DSM, many areas targeted for mining are recognized as vulnerable marine ecosystems, which are sensitive to disturbances and may take a long time to recover from any impacts (Thompson et al., 2018; Miller et al., 2018). Implementing precautionary measures, such as establishing marine protected areas (MPAs) prior to exploration and exploitation, is essential to safeguard these ecosystems and maintain biodiversity (Thompson et al., 2018). Moreover, the precautionary principle supports the need for comprehensive environmental impact assessments (EIAs) before any mining activities are approved. These assessments should not only evaluate the direct impacts of mining but also consider cumulative effects and long-term consequences on marine environments (Bisson et al., 2023). By adopting a precautionary approach, regulatory bodies can ensure that potential risks are thoroughly evaluated and that mitigation strategies are in place to address any identified threats. This is particularly important given the rapid advancement of seabed mining technologies, which may outpace the scientific understanding necessary to evaluate their impacts effectively (Miller et al., 2021).

As the precautionary principle emphasizes the importance of stakeholder engagement and public participation in decision-making processes, involvement of stakeholders can provide diverse perspectives and enhance the transparency and accountability of governance frameworks (Conde et al., 2022). By prioritizing precaution, stakeholders can better protect marine ecosystems and ensure that seabed mining