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WHITE BLACK LEGAL is an open access, peer-reviewed and refereed journal providededicated to express views on topical legal issues, thereby generating a cross current of ideas on emerging matters. This platform shall also ignite the initiative and desire of young law students to contribute in the field of law. The erudite response of legal luminaries shall be solicited to enable readers to explore challenges that lie before law makers, lawyers and the society at large, in the event of the ever changing social, economic and technological scenario.

With this thought, we hereby present to you

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DEEP SEABED MINING AND IT ECONOMIC AND SOCIAL EFFECT: A CRITICAL ANALYSIS WITH SPECIAL REFERENCE TO G20

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1. Introduction

With recent developments that can be seen in world affairs from the increase in the population to scarcity of resources due to its over-exploitation have led the countries of the world to explore other sources for the extraction of resources such as underground mining, surface mining, placer mining, etc. Thus, one more method has been arrived at by world leaders to extract the required minerals and other resources and it is Deep Seabed Mining. As the name suggests like surface mining, deep seabed mining is when the depth of oceans, rivers, and seas is dug out for the extraction of minerals. Since the river bodies are something that has existed for ages and have gone through much of the compression and regression of time which makes it an enriched source of various important minerals and other substances. The deep bottom generally begins 200 meters under sea level, but the continental shelf of the coastal countries is not its limit. Such a shelf is buried in an area of shallow water known as the shelf sea, which defines this continental shelf.¹

2. Reasons of growth of Deep seabed Mining

The ocean is one of the world's important, shared resources that need global cooperation for sustainable use and protection. The G20 should take the initiative in setting up a global ocean governance process, helping to spur discussions of and plans for an ocean economy as well as regional

¹ Lisa A. Levin, Diva J. Amon and others, "Challenges to the sustainability of deep-seabed mining", available at: https://ideas.repec.org/a/nat/natsus/v3y2020i10d10.1038_s41893-020-0558-x.html (last visited on December 25, 2023)

co-operation. Protecting the marine environment from mining impacts-particularly when biodiversity in deep mid water ecosystems, which are especially important for carbon export and nutrient regeneration, as well as larval dispersal.

Manganese nodules, discovered in the early 1960s and containing high concentrations of nickel, copper and cobalt-important elements used for making exotic but highly effective alloys were examined in detail. Nor were these metals scarce on land, but the main reserves there lay in developing countries and especially in the Soviet Union. The sea became a possible alternative source of these essential metals, catching the eye of the mining industry. Companies came together to form consortiums exploring deep-sea mining possibilities, and a number as early as the mid 1970's are already in operation. These pool resources and expertise with sharing of risks associated with this new field. The consortium also included major global mining companies and millions of dollars were spent on developing prototype mining systems, and they successfully tested them at sea in the late 1970s. But deep-sea mining's commercial feasibility was thwarted by legal uncertainties concerning who owned the ocean floor. By the beginning of this century with stable metal prices, delimited legal boundaries and advanced engineering technology a renaissance in deep-sea mining began. Now the industry is at an inflection point, with small-scale recoveries underway in national waters on a limited scale since 2017; international prospects are also poised to take off. A total of 29 exploration contracts have already been issued. With mineral demand driven by global population growth and especially with strategic metals that will only become more valuable in future, the costs & benefits of deep-sea mining must carefully weigh against environmental concerns for true long term benefit.

3. UN Convention on the Law of the Sea, 1982

(herein after referred as UNCLOS)

Deep-sea areas within their territorial waters and in Exclusive Economic Zones (EEZ) are controlled by island nations. The International Seabed Authority established under the UNCLOS sets boundaries at more than 200m below sea level. Its institutions include the

- Commission on the Limits of the Continental Shelf and
- International Tribunal for Ocean Law.

The Convention sets forth rights and obligations in ocean use. The Convention governs the area which is beyond national jurisdiction, so signed by almost 200 countries. Since its coming into force in 1994 it has been implemented under the auspices of a new institution: the International Seabed Authority (ISA). The authority's primary aim is to regulate deep seabed activity in order provide environmental protection and economic benefits. It has been drafting a mining code² that was expected to come into effect by 2020 but it has yet not enacted.

Article 136 of the Convention outlines the primary goal of the deep seabed mining (DSM) code: for the exploitation of mineral resources, which are deemed to be "The common heritage of mankind." This code includes a complete set of regulations with respect to such things as prospecting, exploration and development issued jointly by all ISA members in 1982. So far, the ISA has allocated 30 multi-year exploration permits, for an area totaling some 1.3 million km² or 0.7 % of the "area," all under contractual stipulation dealing with respective rights and obligations of individual companies involved in each case.³ A company must be supported by the member state country in which it is located, who serves as a "sponsoring state." It's up to the sponsor not only that its sponsored companies fulfil their contractual obligations and ISA requirements, but also Convention duties including environmental protection and human rights. If these measures are not properly enforced, sponsoring states can be held responsible for any resulting damages.⁴

With exhaustion of terrestrial mineral resources and geopolitical vulnerabilities there has been a return to interest about the deep-sea floor, hitherto commercially unviable like Antarctica. As a result of the electrification of transportation and renewable energy, market demand for minerals has been further exacerbated towards deep-seabed mining. The governance structure for international mineral resources is now based on the United Nations Convention on the Law of the Sea (UNCLOS). The deep ocean contains economically significant concentrations of metals like copper, cobalt, nickel zinc silver gold lithium and rare-earth elements. Polymetallic nodules, cobalt-rich ferromanganese crusts and polymetallic sulfides are some of the different ore types that appear in various settings. Cobalt,

² A comprehensive set of rules, regulations and procedures to regulate the exploration and exploitation of marine minerals. The mining code is essential, because commercial deep-sea mining cannot proceed without it.

³ Luc Cuyvers, Whitney Berry, Kristina Gjerde, Torsten Thiele and Caroline Wilhem, "*Deep seabed mining: A rising environmental challenge*", available at: <https://portals.iucn.org/library/node/47761> (last visited on December 25, 2023)

⁴ *Ibid.*

nickel, manganese, copper, lithium and silver are all concentrated in the Clarion-Clipperton Zone alone. Some prospective reports indicate that taking half of the nodules here out could provide basic substances to electrify one billion cars with lower greenhouse gas emissions than mining on land. But despite expectations of future deep-seabed mining, it still hasn't happened. The various methods of mining are expected to be modified dredging and cutting, with little processing onboard ships and further treatment offshore. Because deep-seabed mining has advantages like less overburden and no permanent infrastructure, problems would be wastewater and sediment disposal as well as solid wastes. Thus UNCLOS grants rights and imposes duties on nation-states or international organisations in different jurisdictional areas. The International Seabed Authority (ISA) oversees mineral activities on the seafloor and environmental protection beyond national jurisdiction. Under the International Seabed Authority, seabed mineral activities are seen as "the common heritage of mankind," in view of developing countries' interests. By 2001, there were already 30 approved exploration contracts.

4. Deep Seabed Mining and The Related Challenges

Deep-sea habitats (vents, nodule-rich abyssal plains, and potentially encrusted seamounts) where the resources can be extracted would naturally experience high local extinction rates as many of their fauna require these materials to use for substrate. It is noted that in the eastern Clarion-Clipperton Zone, or CCZ as it is known scientifically, half of all species larger than 2cm rely on nodules to provide them with an attachment surface. If mining proceeds with our current knowledge, species and functions may be lost before they are even fully understood. According to small-scale experiments and the experience of industries such as seabed trawling, affected biological communities can be expected to recover slowly. Two decades after simulated mining disturbance, reduced faunal biodiversity and altered species composition persist in nodule areas. If we extrapolate to the CCZ, polymetallic-nodule mining could heavily affect ecosystem functions. The soft sediment community in between is perhaps just a transitional stage with no clear sign of what kinds and how many species may emerge from below or above. Among them are cold-water corals and seamount sponges, which are easily disturbed by physical impact from mining. Recovery for organisms such as those attached to the polymetallic-bearing crusts on a relatively young node like South Mariana may take thousands or even millions of years. This is because global patterns of fauna varied greatly, as did natural disturbance regimes. Predicting recovery rates at hydrothermal vents was therefore a

difficult task. There are also barriers to prediction because of limited base line information and no data for recovery times at inactive vent sites. Given the intensity and location of mining, as well as its potentially cumulative nature in terms of impact on biodiversity, it is imperative to understand regional connectivity so that we don't lose this mountain chain. The REMPs now being developed by the International Seabed Authority (ISA) are crucial instruments for strategic environmental management at the regional level. The intention behind establishing the REMPs is to offer region-specific information, measures and procedures to facilitate effective protection of the marine environment in compliance with UNCLOS. They should have clear environmental objectives and establish measures, including designating protected areas (termed 'Areas of Particular Environmental Interest' or 'APEIs'), independent of contract placement. REMPs should undergo periodic reassessment, considering cumulative effects, synergistic impacts, and potential conflicts within the same region. Design criteria like climate representativity and refugia for enhancing climate resilience have been proposed for APEIs, ensuring monitoring programs differentiate climate impacts from mining effects and inform cumulative impact assessment.⁵

Mitigating the potential impacts of deep-seabed mining is challenging, as the complete mitigation hierarchy (avoid, minimise, remediate, and offset), standard in terrestrial and shallow-water extraction, is currently unattainable in the deep ocean. There are no investigations reflecting the scale of mining activity impacts, making it difficult to predict and address challenges associated with restoration. These challenges include slow recruitment and growth of deep-sea species, disruption of population connectivity, and limited understanding of proper ecosystem functions. Assisted regeneration techniques, like artificial substrates or transplantation, face high costs and technical feasibility issues. Proposed restoration strategies remain untested, and financial commitments may be extensive. Due to gaps in ecological knowledge and restoration capabilities, offsetting appears currently unable to replicate biodiversity and ecosystem services lost through deep-seabed mining.

⁵ Nicky Jenner, Sophie Benbow and others, “Update to ‘An assessment of the risks and impacts of seabed mining on marine ecosystems’” available at: https://www.fauna-flora.org/wp-content/uploads/2023/05/FFI_2020_The-risks-impacts-deep-seabed-mining_Report.pdf (last visited on December 25, 2023)

If deep-seabed mining proceeds, a precautionary and adaptive approach is recommended, integrating new knowledge to avoid and minimise harm. Clear objectives, indicators, and thresholds should inform various approaches, supported by agreed-upon monitoring standards. Areas of Particular Environmental Interest (APEIs), preservation zones, and impact reference zones should be designed and monitored scientifically, and environmental impact assessments (EIAs) should meet statistical validity requirements. While avoiding harm altogether is unlikely, reducing the mining footprint, leaving some minerals undisturbed, and implementing engineering specifications can help minimize impacts. The industry's infancy allows for the possibility of technological breakthroughs, and the effectiveness of mitigation measures requires testing within a robust regulatory framework.

Adaptive management is identified as a useful regulatory approach for deep-seabed mining operations once other challenges are addressed.

5. Effect of Seabed Mining

There are often negative social and environmental consequences for communities and ecosystems due to mining. Still there are arguments in favour of maintaining and even expanding the mining industry, despite disasters caused to society or the environment by past mining.

5.1 Economic Effect

Besides counting on mined resources in present-day civilization, one argument for terrestrial mining is its past record of profitability. As a new industry, the economic benefits of deep-sea mining have yet to be determined. In the case of onshore mining, economic benefits generally fall to the government in terms of local and national taxes and royalties. In particular cases, such as, Lihir Island in Papua New Guinea, compensation to local communities is a great economic benefit. In developing countries in particular, they can be of tremendous assistance to local and national infrastructure, amenities, and services. The benefits from mining can be used for community development, improved education and better health care. They may even help increase access to health services. Compensation payments, properly invested in livelihoods and local businesses create wealth for the whole community. They cite employment benefits, local procurement opportunities and possibilities for downstream processes as providing valuable economic spinoffs. Infrastructure investment may prove crucial in its own right. Today many mining companies spend a great deal of money on social

responsibility programs, with several leading multinational miners spending hundreds of millions dollars each year. Many of these come in the form of voluntary initiatives aimed at specific mining or their principal products. Proactive social responsibility on the part of companies is moulded by a variety of voluntary initiatives related conceptually or practically to mining and/or its primary products. Existing examples include the annual GRI 2 Sustainability Reporting Guidelines, for which there was in fact a special Mining and Metals sector supplement informally published this year.⁶

But mining's economic benefits are not altogether good. Growing evidence indicates a negative correlation between mining and economic development indicators. Sometimes the negative social effects are borne by local communities, and all wealth from mining goes elsewhere. In countries with corruption and weak financial controls, mining-related wealth can be a curse for local people. Funds slated for social work or betterment of infrastructure, health programs may wind up in the coffers of individual leaders and even some mining companies are involved whether they know it or not. In order to counteract financial corruption and ensure mine profits reach their intended beneficiaries, there has been legislation such as the Dodd-Frank Act in the United States. There have also been mechanisms like the Extractive Industries Transparency Initiative (EITI). Nevertheless, in the presence of strong regulations there is still plenty of work to be done ensuring that local communities can enjoy extracted resources from many developing countries. Economics of mining, comprehensive assessment and plan, guaranteeing that the proceeds from mining benefit host countries, regions and communities as well as identifying miner's social costs must be joined inseparably with political systems.⁷

5.2 Social Effect

It is a complex task to predict the impact of mining on society as no two projects are identical. There may be differences in scale and variability between different life cycle stages; geographically similar mines have quite-different neighbours (associated industries) who will benefit from their economic benefits or contributions but receive them at prices that leave them depleted. Exacerbating these

⁶ Kathryn A. Miller, Kirsten F. Thompson and others, "An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps", available at: <https://www.frontiersin.org/articles/10.3389/fmars.2017.00418/full>

⁷ *Supra* note 6

difficulties is the polarizing nature of mining and resource developments. Not only do they have a great impact on both affected parties, but also those who observe and assess them. Community-based assessment is gaining momentum, with both pointing away from the traditional checklist style of assessments toward community-tailored approaches that involve long-term investment in time. This leaves room for positive developments to occur before they are snuffed out again by government whim as they were back then at county's oldest school.⁸

These are the social consequences most frequently connected to terrestrial projects such as mining. They can be structured into 11 categories, including both positive effects like economic and social development on one hand, or negative impacts like loss of land or conflict with local producers which occur in abundance. Looking currently at the state of affairs in terms of proposals for seabed mining, there does not seem to be any major onshore component yet. This may mean that the direct human impacts will differ from those seen with mines back in a land far away. But as exploratory deep-sea mining and its development gradually advance, all parties concerned--worshippers of the god power must do their best to create a hospitable climate for scrutiny and reporting. Since it is still impossible at present to 100 percent predict benefits and negative impacts, this will enable continued prediction of the relationship between costs and benefits as well as continuous assessment. When related plans--including impact assessment and mitigation; community relations planning; closure or rehabilitation ideas--emerge in response to a particular mining project, they should be able encompass these different aspects.⁹

6. The International Authority of Seabed Mining

Under 200 metres lies the largest home on Earth, but even for our expert mini divers access is the most difficult. Like the land, in geographic terms various ocean environments are nothing more than a quilt being patched together. The sea floor includes mountain ranges and plateaus, as well as volcanic islands rising from the surface of its seas and chasms where canyons yawn open to be swallowed up by abyssal plains stretching out into our swamps where we live today. Unlike land,

⁸ A review on the impact of mining operation: Monitoring, assessment and management Available at: <https://www.sciencedirect.com/science/article/pii/S259012302030089X> (Last Visited: December 30, 2023).

⁹ Evidence of the impacts of metal mining and the effectiveness of mining mitigation measures on social-ecological systems in Arctic and boreal regions: a systematic map protocol Available at: <https://environmentalevidencejournal.biomedcentral.com/articles/10.1186/s13750-019-0152-8> (Last Visited: December 30, 2023).

however, the bottom of the ocean is rich in minerals but mostly less concentrated. Many of those found on shore are also here and polymetallic nodules make up half or more by volume with foundation stones like ferromanganese crusts included as deep sea resources.¹⁰

The fact that the deepest oceanic regions are rich in mineral deposits has been known since as early as 1860. In Jules Verne's 20,000 Leagues Under the Sea Captain Nemo declared that in zinc, iron, silver and gold are to be found at great depth though not necessarily as luxurious or beautiful diamonds. Nevertheless, their quantities outdo our most extravagant needs a billion-fold easily so they will do just fine with us humans. As much as he was right in thinking that resources were so rich, perhaps he underestimated the obstacles to their exploitation.¹¹

The 1960s changed direction and focused turned to deep seabed minerals. The emergence of the importance of marine resource extraction that John L. Mero, an American geologist explored, in his book, entitled— Molybdenum is a rare metal with low density and high strength occurring mostly in ancient metamorphic rocks. Under normal circumstances it's difficult to mine a ton being only 10 times as dense as air. From this point of view, Ambassador Arvid Pardo of Malta presented a proposal to the First Committee on Special Political Sections in 1967.¹² Ambassador Pardo's initiative, in tune with the spirit of its time, served as an important basis for the United Nations nine-year endeavour to create a comprehensive regime for ocean governance. In 1970, the General Assembly, through resolution 2749 (XXV), endorsed the ***“Declaration of Principles Governing the Sea-Bed and the Ocean Floor, and the Subsoil thereof, beyond the limits of national jurisdiction”***.

According to Pardo's criteria, the Assembly in 1982 declared that mineral resources of the seabed belong not to any individual state but rather fall under what was then identified as "the common heritage of mankind," co-developed by humanity through an international framework established precisely for this purpose.¹³

¹⁰ The International Seabed Authority and Deep Seabed Mining by Michael Lodge Available at: <https://www.un.org/en/chronicle/article/international-seabed-authority-and-deep-seabed-mining> (Last Visited: December 30, 2023).

¹¹ Guenter Weissberg, "International Law Meets the Short-Term National Interest: The Maltese Proposal on the Sea-Bed and Ocean Floor: Its Fate in Two Cities", available at: <https://www.jstor.org/stable/757994> (Last visited on 25th December, 2023)

¹² *Supra* note 8

¹³ The National Interest and the Law of the Sea Available at: chrome-

The machinery conceived and laid out by the General Assembly thus finally appeared in physical form 24 years later as the International Seabed Authority (ISA), Kingston, Jamaica. This is a wholly independent organization affiliated to the United Nations common system. The United Nations Convention on the Sea Law (UNCLOS) is a big rule set up by the United Nations. People often call it just UNCLOS. It came from the Third United Nations Conference on Sea Law (UNCLOS III) that took place between 1973 and 1982. Right now, 168 groups have agreed to the convention. These include 167 countries (consisting of most members in United Nations plus Palestine).¹⁴ The European Union has signed it too. Fourteen UN member countries have signed the agreement, but they haven't fully approved it yet. UNCLOS established three international institutions: the Commission on the Limits of the Continental Shelf, International Seabed Authority (ISA), and International Tribunal for The Law of The Seas. The HPSC comprises the Authority, an international body established by UNCLOS to regulate and control marine mineral exploitation in 'the Area,' which is defined as all seabed beyond 200 nautical miles from the coast. This area of jurisdiction goes well past outermost limits of a nation's continental shelf. The Area accounts for a little over 50 percent of all the seafloor on Earth.¹⁵

7. The Role of G20 in Deep Seabed Mining

The international oceans cover half the world's oceans, and thus roughly a third of its surface area. International waters appear to become an issue that nations in all corners must handle within this coming decade. These vast areas, where such huge lots of global maritime economic activities are to be found, have enormous potential. A complex jigsaw of different international and regional legal instruments exists for the conservation and management of the oceans. UNCLOS, the Convention on Biodiversity, known as CBD and commitments in Sustainable Development Goals are some of them. Meanwhile, ambitious proposals such as the "30 by 30" (or 30x45) initiative are garnering international attention. The concept envisions governments around the world creating 30 percent of land and ocean area protected areas by 2030.¹⁶

extension://efaidnbmnnibpcajpcglclefindmkaj/https://cdn.cfr.org/sites/default/files/pdf/2009/04/LawoftheSea_CSR46.pdf (Last Visited: December 30, 2023)

¹⁴ Ibid.

¹⁵ Ibid.

¹⁶ All About the Ocean Available at: <https://education.nationalgeographic.org/resource/all-about-the-ocean/> (Last Visited : December 30,2023).

The policy focus is to set a coherent governance system for the world, which are currently absent and because of this lag, there should be directed attention from G20 countries. This is a system that ought to allow for the monitoring and control of new marine activities which endanger shore ecology. On March 4, 2023 a historic milestone was achieved; after nearly two decades of planning and negotiations involving many personalities among the delegates from various countries, the treaty to establish governance for The High Seas (The United Nations High Seas Treaty) was finally advanced in accordance with such goals.¹⁷ To achieve sustainability and to protect the environment, G20 can do the following:

7.1 Easy comprehensive environmental planning and cooperation

Put aside all prejudice and advocating a precautionary approach to conserve biodiversity. The ISA, which governs all activities in the high seas equivalent to exploration of land resources, has drawn up regulations defining such ocean-going activities under permits. However, many are still worried that exploitation is likely to have greater and sustainable effects on natural environments than exploration alone would produce. As a result, the contemporary debate relates to possible loss of biodiversity caused by commercial activities in the Area. While the differences in depth and location have already led to wildly different variants of deep-sea resources, large ore lots from all four resource classes are set to leave long strings of death following their extraction.¹⁸ Therefore, being cautious should be accepted. Currently, the ISA is only beginning its work on a set of regulations (mining code) to control undertakings in commercial mining activities within the Area. Thus, we have an excellent chance to get some positive experience under our belt first so that countries remaining undecided or uncertain about adopting these kinds of legal arrangements will be more easily persuaded later when they see just how well things are and why is the concept of ecosystem services (ES) so urgent for Deep Sea Mining environmental planning, and how would it be practically integrated. The most acceptable general definition of ES are those which link semantics and social relevance.

It is not only meant to define a field but also what humans gain through this knowledge; it may well be characterized as provisioning, regulating, cultural services (i.e., direct contributions) and

¹⁷

¹⁸ Ibid.

supporting services (such as soil protection).¹⁹

7.1 Strengthen administrative efficiencies and prioritize the recycling of metals

Also invest in regulating the Common Heritage of Humankind (CHM) by enhancing the International Seabed Authority's capacity. In 1982 the United Nations Convention on the Law of the Sea (UNCLOS) established 'the Area,' referring to the seabed beyond national jurisdiction and its mineral resources, as part of mankind's common heritage. Article 136 of Part XI designated this principle in order to distinguish it from governing principles for water columns under freedom-of-the-seas guidelines. This legal distinction seeks two objectives: firstly, preventing states establishing sovereign rights over territorial domains; secondly, ensuring international supervision is present when exploiting economic opportunities by granting exploitation rights and specifying regimes permitting fair benefit sharing. While primary focus remains non-appropriation and equitable benefit sharing with regards CHM concept's overarching tenets - an allowance does exist enabling authorized resource utilization through exclusive allotments that often escape recognition during related discussions.²⁰

The fair distribution of benefits arising from Deep Sea Mining (DSM) is a contentious topic, with ongoing discussions about the best approaches to ensure ethical utilization. The financial structure for DSM consists of two parts: an initial payment scheme whereby states and contractors receive some portion of profits obtained from extracting deep-sea minerals, as well as a mechanism aimed at distributing economic and monetary advantages based on equitable sharing principles. This comprises the revenue collected by ISA in accordance with said payments regime. To distribute funds fairly, one proposed system is the Seabed Sustainability Fund suggested by ISA's Finance Committee that would be funded through levies imposed on mineral value extracted within international waters. It is not practical to anticipate the ISA, which is significantly understaffed, to properly execute it. To address this concern, this proposal suggests that G20 governments should focus on improving the resources of ISA so they can implement three vital sections of UNCLOS related to DSM: Article 136 (CHM concept), Article 137:2 (resource regulation), and Article 145 (marine environment

¹⁹ *Supra* note 7

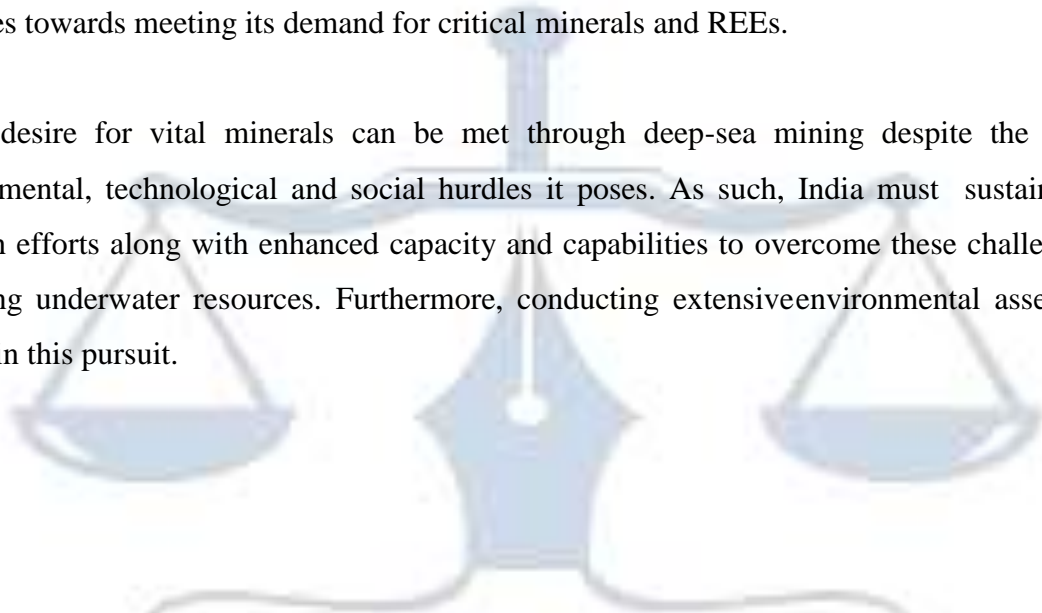
²⁰ *Ibid.*

protection).²¹

8. CONCLUSION & SUGGESTIONS

India must prioritize the deep-sea mission from a geo-economic point of view. The country's ambition to excel in manufacturing strategic defense systems, semiconductors, and clean energy systems depends on having access to Rare Earth Elements (REEs). Currently, India mostly depends on imports for its REEs requirements thus it needs to explore land-based sources and cooperate with like-minded countries towards meeting its demand for critical minerals and REEs.

India's desire for vital minerals can be met through deep-sea mining despite the substantial environmental, technological and social hurdles it poses. As such, India must sustain scientific research efforts along with enhanced capacity and capabilities to overcome these challenges while exploring underwater resources. Furthermore, conducting extensive environmental assessments is crucial in this pursuit.



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²¹ Improving Governance of Deep-Sea Mining, *available* at: file:///D:/User%20Data/Downloads/T20_PolicyBrief_TF6_Deep-SeaMining.pdf (Last visited on 25th December, 2023)