

Reimagining Sustainable Space Mining with Due Diligence

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I. Introduction

Space mining promises tremendous gains.¹ *In situ* utilisation of space resources, especially of water, can make space exploration and travel more affordable, which can enable space industrialisation and settlement.² *Ex situ* utilisation of space resources can provide a critical supply of essential metals and minerals needed to manufacture goods and render services, particularly for the net-zero economy transition.³ Furthermore, the use of space resources might ultimately help reduce adverse environmental, social and governance impacts caused by, contributed to or related to terrestrial mining activities.⁴

These potential gains can be easily offset, however. The space industry itself emits greenhouse gases, for instance, during vehicle launches, which contribute to climate change.⁵ Furthermore, the likelihoods of depleting the resources in our Solar System, polluting space environment, and minerals trading in poorly regulated or unregulated contexts all remain plausible scenarios.⁶ Different actors aspire to enter the space sector, such as the traditionally non-space-faring nations (as epitomised by India’s Chandrayaan moon mission), private companies with plans for space tourism and satellite deployment, start-ups focusing on space technology, and universities investing in space research and development.⁷ The rapid increase in financial investments allocated to space start-up enterprises generates additional incentives for the actors to join the field.⁸ This situation can result in insufficient prioritisation of sustainability concerns, as such actors might primarily focus on quickly bringing their systems to market and securing funding.⁹

In this paper, we argue that an early regulatory intervention that identifies, monitors, and enforces an international standard of conduct has the potential to promote the sustainability of space mining activities.¹⁰ Since 2015, four countries – the United States (US), Luxembourg,

¹ We use the term “space mining” to refer to the exploration, exploitation, and utilization of space resources, both *in-situ* and *ex-situ*. The authors would like to thank Dr. Eytan Tepper, the organizer of the conference titled “Corporate Sovereigns: The Governance of Space Exploration Corporations” at Western University, as well as the conference participants for their valuable comments on the initial draft of this working paper.

² Raphael Deberdt and Philippe Le Billion, *Outer Space Mining: Exploring Techno-Utopianism in a Time of Climate Crisis*, Annals of the American Association of Geographers (2023); David Kornuta et al., *Commercial Lunar Propellant Architecture: A Collaborative Study of Lunar Propellant Production*, 13 REACH 100026 (2019).

³ Linda Dawson, *The Politics and Perils of Space Exploration* (Springer 2021) 36-99, 259-268.

⁴ Morgan Sterlin Saletta & Kevin Orrman-Rossiter, *Can Space Mining Benefit All of Humanity?: The Resource Fund and Citizens’ Dividend Model of Alaska, the “Last Frontier”*, 43 Space Policy 1 (2018); Jessica A Dallas et al., *Mining Beyond Earth for Sustainable Development: Will Humanity Benefit from Resource Extraction in Outer Space?*, 167 Acta Astronautica 181 (2020).

⁵ Tereza Pultarova, *How environmentally friendly is SpaceX’s Starship?* (Space.com 2024), <https://www.space.com/spacex-starship-rocket-launches-environmental-impact>.

⁶ Martin Elvis & Tony Milligan, *How Much of the Solar System Should We Leave as Wilderness?*, 162 Acta Astronautica 574 (2019); James SJ Schwartz & Tony Milligan, ‘Some Ethical Constraints on Near-Earth Resource Exploitation’ in Cenani Al-Ekabi et al. (eds), *Yearbook on Space Policy 2015: Access to Space and the Evolution of Space Activities* (Springer 2017) 227-239.

⁷ Ritu S. Lauer, *Public-private linkages and the case of asteroid mining*, Technology Analysis & Strategic Management (2023).

⁸ *ibid.*

⁹ Peter Martinez, *Implementing the Long-Term Sustainability Guidelines: What’s Next?*, Air & Space Law 48, Special Issue (2023) 52.

¹⁰ We use the phrase “the sustainability of space mining activities” to refer to the objective of sustainability in outer space, in accordance with the UN Guidelines for the Long-term Sustainability of Outer Space Activities. The guidelines emphasize “the ability to maintain the conduct of space activities indefinitely into the future in a manner that realises the objectives of equitable access to the benefits of the exploration and use of outer space for

the United Arab Emirates (UAE) and Japan – enacted legislation that allows companies to explore, extract, use, and own space resources, laying the ground for a space mining industry to flourish.¹¹ Moreover, forty countries committed to cooperating for “a new era for space exploration and utilisation”, including space mining, through the Artemis Accords that started to be signed in 2020.¹² These developments indicate the emergence of a fragmented regulatory approach to space mining activities, lacking guarantees of an international minimum standard of conduct. We argue that such fragmentation risks jeopardising the long-term sustainability objectives for outer space, as actors with expertise might exploit the pluralist context to benefit from legal entitlements and shape specialised regulatory regimes.

The paper is divided into three sections: the argument, the law, and the proposal. The argument section describes the necessity of establishing an international minimum standard with a view to promoting the sustainability of space mining activities. The law section shows that there is a fragmented regulatory approach to space mining regulations, even if a UN working group has been established to study the legal aspects of space resource activities at the international level.¹³ Finally, the proposal section introduces due diligence as an international minimum standard of conduct that can govern space mining activities.

II. The Argument

In this section, we discuss the importance of establishing an international minimum standard to promote the sustainability of space mining activities. It is important to note that this section does not address the legality of space mining, because this issue is already covered in existing academic research.¹⁴ Additionally, we observe three recent trends, which indicate that the

peaceful purposes, in order to meet the needs of the present generations while preserving the outer space environment for future generations”. See, UN General Assembly document A/74/20, *Annex II: Guidelines for the Long-Term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space*, https://www.unoosa.org/res/oosadoc/data/documents/2019/a/a7420_0_html/V1906077.pdf. [Hereinafter LTS Guidelines].

¹¹ The US Commercial Space Launch Competitiveness Act of 2015, H.R. 2262- 114th Cong. (1st Sess. 2015), Public Law No 114-90 (11/25/2015), 51 USC 51301. [Hereinafter US Space Act]. Luxembourg Law on the Exploration and Use of Space Resources of 2017, Loi du 15 décembre 2020 portant sur les activités spatiales et modifiant : 1° la loi modifiée du 9 juillet 1937 sur l’impôt sur les assurances dite «Versicherungssteuergesetz», 2° la loi modifiée du 4 décembre 1967 concernant l’impôt sur le revenu, Mémorial:1086 Journal Officiel du Grand-Duché de Luxembourg (2020). [Hereinafter Luxembourg Law]. The UAE Regulation of the Space Sector, Federal Law No. (12) of 2019. [Hereinafter UAE Law]. The Japanese Act on the Promotion of Business Activities Related to the Exploration and Development of Space Resources (Act No. 83 of 2021). [Hereinafter Japanese Act].

¹² *The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, COMETS and Asteroids for Peaceful Purposes* (NASA 2020), <https://www.nasa.gov/specials/artemis-accords/img/Artemis-Accords-signed-13Oct2020.pdf>. [Hereinafter The Artemis Accords].

¹³ UNCOPUOS Working Group on Legal Aspects of Space Resource Activities, <https://www.unoosa.org/oosa/en/ourwork/copuos/lsc/space-resources/index.html>. [Hereinafter WG].

¹⁴ For instance, see, Fabio Tronchetti, *Legal Aspects of Space Resource Utilization*, in Frans von der Dunk and Fabio Tronchetti (eds) *Handbook of Space Law* (Edward Elgar Publishing 2015) 769 – 776; Fabio Tronchetti, *The Exploitation of Natural Resources of the Moon and Other Celestial Bodies A Proposal for a Legal Regime* (Martinus Nijhoff Publishers 2009); Philip de Man, *Exclusive Use in an Inclusive Environment The Meaning of the Non-Appropriation Principle for Space Resource Exploitation* (Springer 2016); Ricky J. Lee, *Law and Regulation of Commercial Mining of Minerals in Outer Space* (Springer 2012); Martin Svec, *Outer Space, an Area Recognized as Res Communis Omnium: Limits of National Space Mining Law*, *Space Policy* 60 (2022); Shadi A. Alshdaifat, *Who Owns What in Outer Space? Dilemmas Regarding the Common Heritage of Mankind*, *Pécs Journal of International and European Law* (2018-II). For collaborative scholarly works, see The Hague Draft Building Blocks for the Development of an International Framework on Space Resources Activities, the

current legal discourse on space resources and mining focuses on the regulation of these activities rather than their legality. These three recent trends – the adoption of national space laws regulating space mining,¹⁵ the participation of forty States in the Artemis Accords, which includes commitments on space mining,¹⁶ and the formation of a UN working group on the utilisation of space resources¹⁷ – are explored in more detail in the next section.

This section proceeds as follows. First, we discuss the identification of the use and exploration of space, the Moon and other celestial bodies as the “province of all humankind”. Second, we emphasise the need to manage sustainability concerns in space, according to the non-binding UN Guidelines for the Long-Term Sustainability (LTS) of Outer Space Activities (LTS Guidelines).¹⁸ Third, we explain the necessity of providing legal certainty to guide commercial activities in space mining. Fourth, we discuss the concern that, without an international minimum standard of conduct for space mining activities that takes into account sustainability concerns, actors with expertise might exploit the pluralist context to benefit from legal entitlements and shape specialised regulatory regimes. These reasons are explained in more detail below.

With the adoption of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (OST) in 1967, States declared the use and exploration of space, the Moon and other celestial bodies as the “province of all humankind”.¹⁹ This concept has inspired the crystallisation of some of the foundational principles of international space law – such as the prohibition on national appropriation and the sharing of benefits derived from space use – as well as the formalisation of international cooperation on space, with the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) as its focal point.

Today, the acceptance of the use and exploration of space as the province of all humankind continues to inspire international cooperation on new matters, such as the long-term sustainability of space activities. Formally added to the UNCOPUOS agenda in 2010, sustainability concerns in space led to the establishment of the LTS Guidelines in 2018.²⁰ These guidelines stem from the realisation that the Earth’s orbital space environment constitutes a finite resource, and that no single State can effectively address the sustainability risks emerging from the increasing use of space.²¹ The LTS Guidelines recommend the implementation of twenty-one internationally recognised measures to ensure that current and future generations continue to benefit from space activities.²²

Vancouver Recommendations on Space Mining, and the ILA Guidelines on the Role of International Law in Sustainable Natural Resources Management for Development.

¹⁵ See note 11.

¹⁶ See note 12.

¹⁷ See note 13.

¹⁸ LTS Guidelines, *supra* note 10.

¹⁹ The Outer Space Treaty (signed 27 January 1967, entry into force 10 October 1967), 18 U.S.T. 2410 610 U.N.T.S. 205, 61 I.L.M. 386 (1967), Article I, https://www.unoosa.org/pdf/gares/ARES_21_2222E.pdf. [Hereinafter OST].

²⁰ Gérard Brachet, *The Origins of the “Long-term Sustainability of Outer Space Activities” Initiative at UN COPUOS*, 28 Space Policy 161 (2012).

²¹ LTS Guidelines, *supra* note 10.

²² Also see, The “Space2030” Agenda, Space as a Driver of Sustainable Development, UNOOSA 2024, https://www.unoosa.org/res/oosadoc/data/documents/2024/stspace/stspace88_0_html/st_space-088E.pdf.

The LTS Guidelines recommend States to adopt, revise, and amend their national regulatory frameworks by taking into account the long-term sustainability of space activities and in compliance with their international obligations.²³ This recommendation must be understood in line with the duty of States to authorise and continuously supervise non-governmental space activities, as specified in Article VI of the OST.²⁴ Adherence to the duty to authorise and supervise is important, not least because if a commercial space actor were to violate an international legal obligation, it would be as if the State itself has committed the violation.²⁵

Furthermore, regulatory frameworks are expected to provide clarity for commercial space activities, including for novel activities such as space mining.²⁶ Legal certainty is essential for companies to effectively guide their space activities and ensure long-term success.²⁷ Without a stable and well-defined legal environment, businesses face uncertainties that can hinder investor confidence, growth, and innovation.²⁸ Additionally, unregulated or ineffectively regulated activities risk neglecting corporate sustainability standards and adherence to the LTS Guidelines.²⁹

While regulatory frameworks on space mining are necessary, a fragmented regulatory approach is likely to be ineffective. Lessons from global resource governance demonstrate how actors with expertise (read expertise as “power” here) can exploit the pluralist context to benefit from legal entitlements and shape specialised regulatory regimes.³⁰ A fragmented legal environment with diverging standards of conduct and accountability can seriously undermine sustainability concerns, leading to environmental degradation and the abuse of human and community rights.³¹

Notably, the recent submissions of several States to the UNCOPUOS Working Group on Legal Aspects of Space Resource Activities (WG) include references to sustainability concerns and the need for an international framework that governs space mining activities, in support of our argument above.³² As of February 2024, most delegations expressed the view that developing

²³ LTS Guidelines, *supra* note 10.

²⁴ OST, *supra* note 19, Article VI.

²⁵ *ibid.*

²⁶ For instance, see, The White House, United States Space Priorities Framework (2021), <https://www.whitehouse.gov/wp-content/uploads/2021/12/united-states-space-priorities-framework--december-1-2021.pdf>.

²⁷ We especially note the views expressed during the fifty-sixth session of the UNCOPUOS Legal Subcommittee in 2017, paras 221 – 250, <https://documents.un.org/doc/undoc/gen/v17/023/54/pdf/v1702354.pdf?token=WJoyaeY8Z1WLipNgiQ&fe=true>.

²⁸ For instance, see the submission of the Action Team on Effective and Adaptive Governance for a Lunar Ecosystem (E.A.G.L.E. Team), Space Generation Advisory Council (May 2021) to the WG, https://www.unoosa.org/oosa/oosadoc/data/documents/2023/aac.105c.22023crp/aac.105c.22023crp.26_0.html.

²⁹ For instance, see, Vartan Badalian, *The space industry has a sustainability problem* (Green Biz 2023), <https://www.greenbiz.com/article/space-industry-has-sustainability-problem>; Deondre Smiles, *The Settler Logics of (Outer) Space* (Society and Space 2020), <https://www.societyandspace.org/articles/the-settler-logics-of-outer-space>.

³⁰ For instance, see, David Kennedy, *A World of Struggle: How Power, Law, and Expertise Shape Global Political Economy* (Princeton University Press 2018) 108-110; Sara Seck, *Revisiting Transnational Corporations and Extractive Industries: Climate Justice, Feminism and State Sovereignty*, Dalhousie University Schulich School of Law (2017), https://digitalcommons.schulichlaw.dal.ca/scholarly_works/216/.

³¹ For instance, see, Lorenzo Cotula, *(Dis)integration in Global Resource Governance: Extractives, Human Rights, and Investment Treaties*, 23 *Journal of International Economic Law* (2020) 434.

³² These States include Australia, France, Germany, Greece, Norway, UK, Belgium, Canada, China, and New Zealand. The submissions of Japan, the US and Luxembourg also included sustainability perspectives, despite the fact that they have domestic legislations on outer space mining. For a full list of submissions, see WG, *supra* note 13.

a framework for space resource activities would be advantageous, particularly for ensuring predictability, safety, sustainability, and the peaceful use of outer space.³³ However, such a framework must be developed at the international level, since national legislation outside of an international framework runs the risk of creating an adverse impact on the interests of States that are not in a position to conduct space resource activities in the foreseeable future.³⁴ This view is particularly important as we reiterate that the use and exploration of space is the province of all humankind.

III. The Law

In this section, we discuss the fragmented regulatory approach to space mining. We show that there is no widely accepted legal framework that regulates space mining activities, even though international space law provides important principles and obligations relevant to this activity. In this gap, national laws and the Artemis Accords have been developed. However, these frameworks do not adequately address the sustainability concerns of space mining activities discussed in the previous section.³⁵

This section proceeds as follows. First, we examine two relevant international space law treaties, namely the OST and the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (MA).³⁶ Then, we turn to an analysis of the national laws and the Artemis Accords with respect to their provisions on space mining. Finally, we introduce the WG and present a brief summary of the views submitted to it so far.

A. *The Treaties*

Two international space treaties are relevant to the governance of space mining activities: the OST and the MA. The OST permits the exploration and use of outer space for the benefit and interests of all countries, irrespective of their economic or scientific development, without discrimination, on the basis of equality, and in accordance with international law.³⁷ It grants States the freedom of scientific investigation while prohibiting national appropriation by claim of sovereignty, use, occupation, or any other means.³⁸

Additionally, it requires States to be guided by the principles of cooperation and mutual assistance, and to conduct their activities with due regard to the interests of all States Parties.³⁹ For instance, when conducting space activities, States shall avoid harmful contamination of outer space and celestial bodies.⁴⁰ They shall also conduct appropriate international

³³ Updated summary by the Chair and Vice-Chair of views and contributions received on the mandate and purpose of the WG, UN Doc A/AC.105/C.2/L.328 (27 February 2024), para 25, <https://documents.un.org/doc/undoc/ltd/v24/013/27/pdf/v2401327.pdf?token=AbuPfttPuIaYVcFEQl&fe=true>.

³⁴ *ibid.*, para 30.

³⁵ Although, the UAE law imposes obligations similar to a due diligence obligation. See the discussion on UAE law in this section.

³⁶ The Moon Agreement (signed 18 December 1979, entry into force 11 July 1984), 1363 U.N.T.S. 22, 18 I.L.M. 1434 (1979), <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/intromoon-agreement.html> [Hereinafter MA].

³⁷ OST, *supra* note 19, Article I.

³⁸ *ibid.*, Articles I and II.

³⁹ *ibid.*, Article IX.

⁴⁰ *ibid.*

consultations before proceeding with any activity or experiment that would potentially harmfully interfere with the activities of other States.⁴¹

The MA reiterates the freedom of exploration and use of the Moon and other celestial bodies for the benefit and interests of all countries, irrespective of their economic or scientific development.⁴² It includes the principles of due regard, cooperation, mutual assistance, and the environmental protection of the Moon.⁴³ It also obligates States to inform the UN Secretary-General, the public, and the international scientific community about their activities on the Moon.⁴⁴

Importantly, the MA declares the Moon and its natural resources as “the common heritage of humankind”, and commits States to establishing an international regime to govern the exploitation of these resources when feasible.⁴⁵ Accordingly, this international regime should include: (i) the orderly and safe development of the Moon’s natural resources, (ii) the rational management of those resources, (iii) the expansion of opportunities in the use of those resources, and (iv) an equitable sharing of the benefits derived from those resources among all States.⁴⁶

Although the MA outlines a framework for global governance of space resources, only seventeen States have ratified it.⁴⁷ Moreover, the countries with aspirational space mining projects, both governmental and non-governmental, are not parties to the MA.⁴⁸ Therefore, it is unlikely that the MA will serve as the foundation for a widely accepted global governance regime on space resources.⁴⁹

The OST, on the other hand, does not explicitly address the global governance of space resources. However, it does establish that States have an international responsibility to ensure that all space activities, whether by public or private actors, comply with the OST.⁵⁰ Therefore, the principles of due regard, mutual cooperation, and the prohibition of harmful contamination and interference shall be considered by States when regulating space mining activities. While these provisions are relevant for space mining activities, they are inadequate to ensure the sustainability of space mining activities.

⁴¹ *ibid.*

⁴² MA, *supra* note 36, Article 4.

⁴³ *ibid.*, Articles 2, 4 and 7.

⁴⁴ *ibid.*, Article 5(3).

⁴⁵ *ibid.*, Article 11.

⁴⁶ For an explanation of the concept of the common heritage of humankind, see, Aylin Yildiz Noorda, *Climate Change, Disasters and People on the Move: Providing Protection under International Law* (Brill 2022), 175-185.

⁴⁷ See, UN Depository, Status of Treaties, MA, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mt dsg_no=XXIV-2&chapter=24&clang=_en#3.

⁴⁸ Including the US, Luxembourg, the UAE, and Japan.

⁴⁹ Although we note the submission of Australia to the WG, where it advocated for a common heritage regime to govern outer space resources. See, Australia’s response to the invitation to provide information on the mandate and purpose of the Working Group on Legal Aspects of Space Resource Activities under the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space (2023 COPUOS), https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/StatesResponses/Australias_Submission_to_Space_Resource_Working_Group.pdf.

⁵⁰ By virtue of Article VI of the OST, see note 24.

B. *Artemis Accords*

The Artemis Accords is a series of non-binding multilateral agreements signed between the US government and forty-two countries, reinforcing that space resource extraction and utilisation will be conducted under the auspices of the OST.⁵¹ The accords outline the framework for peaceful and transparent space exploration and use, encouraging collaboration among nations and setting standards for responsible behavior in space. Section 10, paragraph 2 of the Accords states that the extraction of outer space resources does not inherently constitute national appropriation.⁵² Additionally, Section 11 introduces the concept of “safety zones” to prevent interference between nations’ space mining activities.⁵³

The safety zones concept is inspired by the law of the sea, where coastal states can establish safety zones within their Exclusive Economic Zone (EEZ) to protect artificial islands, installations, and structures.⁵⁴ In space, the creation of safety zones is not intended to imply territorial appropriation but to grant exclusive rights for exploration, jurisdiction, and use of facilities. However, there are concerns that the lack of a clear mechanism for designating safety zones could lead to conflicts where nations vie for additional land and resources.⁵⁵

In contrast, the concept of safety zones does not exist in deep seabed mining. This is not due to negligence but because the International Seabed Authority (ISA) regulates deep seabed mining operations outside national EEZs. The ISA’s mandates include preserving and protecting the marine environment and ensuring the equitable distribution of benefits.⁵⁶

Signatories of the Artemis Accords have expressed their intention to support multilateral efforts to develop international practices and rules for space mining, particularly through the ongoing efforts at the UNCOPOUS. The Working Group on Legal Aspects of Space Resource Activities (WG) within the Legal Subcommittee (LSC) is the primary international body for this purpose.

According to its five-year plan (2022-2027), the WG is continuing to gather views from member states and permanent observers regarding its mandate and objectives.⁵⁷ Most delegations emphasised the need for an international framework for space resource activities, considering issues related to sustainability, conservation of the space environment, and rehabilitation of areas affected by space resource activities. Our proposal below outlines a standard of conduct that can guide the legal development in this area.

⁵¹ The Artemis Accords, *supra* note 12, Section 1.

⁵² *ibid*, Section 10 (2).

⁵³ *ibid*, Section 11.

⁵⁴ Ben McKeown, Andrew Dempster and Serkan Saydam, *Artemis Accords: Are Safety Zones Practical for Long Term Commercial Lunar Resources Utilisation?*, 62 *Space Policy* (2022).

⁵⁵ Matthew Gross, *The Artemis Accords: International Cooperation in the Era of Space Exploration*, *Harvard International Law Review* (2023), <https://hir.harvard.edu/the-artemis-accords/>.

⁵⁶ The ISA’s mandate must now be considered in light of the newly adopted global oceans treaty. See, Samantha Robb, Aline Jaeckel and Catherine Blanchard, *How could the BBNJ Agreement affect the International Seabed Authority’s Mining Code* (EJIL:Talk! 2023), [https://www.ejiltalk.org/how-could-the-bbnj-agreement-affect-the-international-seabed-authoritys-mining-code/#:~:text=The%20BBNJ%20Agreement%20sets%20a,23\(4\)\)](https://www.ejiltalk.org/how-could-the-bbnj-agreement-affect-the-international-seabed-authoritys-mining-code/#:~:text=The%20BBNJ%20Agreement%20sets%20a,23(4))).

⁵⁷ UN General Assembly, *Summary by the Chair and Vice-Chair of views and contributions received on the mandate and purpose of the Working Group on Legal Aspects of Space Resource Activities* (2023) Doc A/AC.105/C2/120.

C. National laws

The first legislation authorising space mining and private ownership of mined resources was enacted in the US in 2015, following persistent lobbying by the industry for laws that would protect their commercial interests through the granting and recognition of property rights.⁵⁸ *The US Commercial Space Launch Competitiveness Act* addresses the commercial exploration and utilisation of space resources in three sections and a disclaimer.⁵⁹ The sections incorporate definitions, the obligations of the President and relevant federal agencies to facilitate and promote the commercial exploration and recovery of space resources by the US citizens, and the granting of asteroid resources and space resource rights to US citizens.⁶⁰ A disclaimer clarifies that the US does not assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body.⁶¹ Although the sections reference international obligations, they lack detailed provisions on these aspects or on the sustainable use of space resources.

Luxembourg followed suit in 2017, allowing any company registered in its jurisdiction to appropriate space resources under *the Law on the Exploration and Use of Space Resources*.⁶² Luxembourg has since signed bilateral cooperation agreements with many countries regarding space activities, including space mining.⁶³ The Luxembourg law contains more detailed provisions than the US law. It grants property rights over space resources and refers to the authorisation and continuous supervision of space resource activities.⁶⁴ However, it does not provide details on the elements of continuous supervision. The provisions on authorisation are detailed, with requirements focusing on the administrative, technical, and financial capabilities of the operator. The operator must be a Luxembourgish or European company with a registered office in Luxembourg.⁶⁵ Similar to the US law, the Luxembourg law does not include provisions for the sustainable use of space resources.

The UAE joined its counterparts in 2019, regulating the exploration, extraction, and use of space resources for scientific, commercial, or other purposes.⁶⁶ Each specified activity requires a permit from the UAE Space Agency (the Agency).⁶⁷ Cabinet Resolution No. 19 of 2023 further details the conditions for obtaining permits, including mandatory notifications and property rights over explored, exploited, or used resources.⁶⁸ The resolution establishes a space

⁵⁸ For instance, see, Isabel Feichtner, *Mining for Humanity in the Deep Sea and Outer Space: The Role of Small States and International Law in the Extraterritorial Expansion of Extraction*, 32 *Leiden Journal of International Law* 263 (2019).

⁵⁹ US Space Act, supra note 11, <https://uscode.house.gov/view.xhtml?path=/prelim/@title51/subtitle5/chapter513&edition=prelim>.

⁶⁰ *ibid*, Sections 51301 - 51303.

⁶¹ *ibid*, “Sec. 403. Disclaimer of Extraterritorial Sovereignty”.

⁶² Luxembourg Law, supra note 11.

⁶³ See, The Moon Association, *Moon Village Association Input for the UN COPUOS LSC Working Group on Legal Aspects of Space Resource Activities* (2023) 13, https://www.unoosa.org/oosa/oosadoc/data/documents/2023/aac.105c.22023crp/aac.105c.22023crp.23_0.html.

⁶⁴ Luxembourg Law, supra note 11, Article 1.

⁶⁵ *ibid*.

⁶⁶ UAE Law, supra note 11.

⁶⁷ *ibid*, Article 14.

⁶⁸ *Space Resources Regulation, Regulatory Framework on Space Activities of the United Arab Emirates*, UAE Space Agency, 2023, Article 7, https://space.gov.ae/assets/download/51e33d89/SpaceResources-EN.pdf.aspx&ved=2ahUKEwjS5e_Su4-HAxVAXQIHHYb3DKYQFnoECCUQAQ&usq=AOvVaw3WA_rjFicKsPck4su1bYwd.

resources database to store information on authorised activities and allocate national priority rights.⁶⁹ Operators must comply with conditions such as avoiding activities that jeopardise international obligations, providing technical information and risk assessments, and taking measures to prevent risks to safety and the environment.⁷⁰

During the application process, the operator must comply with several conditions, including (i) international obligations, by ensuring that space resource activities do not jeopardise the State's international obligations, (ii) information and risk assessments, by providing all required information, including technical details and risk assessments to the Agency, showing evidence of measures taken to prevent or mitigate risks to safety, property, the Earth's environment, and celestial bodies, and addressing the creation of space debris and preventing harmful interference with ongoing space activities, and (iii) additional assessments, upon the request of the Agency.⁷¹

In turn, the Agency will evaluate (i) international compliance, including the adherence to the State's international obligations and other agreed international requirements, and potential adverse impacts on the Earth's environment and celestial bodies, considering international planetary protection instruments, (ii) rights and access, including the rights of other States to access stations, installations, equipment, and space objects on the Moon and other celestial bodies, (iii) consultation and information sharing, according to the obligation to consult with affected States if space resource activities might interfere with their activities, and sharing scientific information resulting from space resource activities with the international scientific community, and (iv) priority rights, referring to the consideration of priority rights over space resources.⁷²

As part of continuous supervision, the operator must engage in (i) progress reporting, which involves keeping the Agency informed about the progress of space resource activities, and following all Agency instructions in emergencies or when there are material risks, (ii) incident reporting, by immediately notifying the Agency of any significant changes to mission planning and characteristics, and reporting any accidents, incidents, or risks involving the operator or other entities, including subcontractors, (iii) environmental and safety reporting, by reporting any damage or potential damage to persons or property, and harmful or potentially harmful impacts on the Earth's environment and celestial bodies, and the creation of space debris or risks thereof, and (iv) yearly and final reporting, by providing yearly reports on the progress and results of space resource activities, and notifying the Agency upon mission completion and report the final results.⁷³

However, it is important to note that, to our knowledge, no operator has been licensed to undertake space mining in the UAE thus far. Consequently, the future compliance with these requirements and the implications for addressing sustainability concerns remain uncertain.

Turning to Japanese law, the *Act on the Promotion of Business Activities for the Exploration and Development of Space Resources*⁷⁴ was adopted in 2021 to establish special provisions for licensing of space resource activities, supplementing the procedures outlined in the *Space*

⁶⁹ *ibid*, Article 6.

⁷⁰ *ibid*, Article 6.

⁷¹ *ibid*, Article 4.

⁷² *ibid*, Article 5.

⁷³ *ibid*, Article 8.

⁷⁴ Japanese Act, *supra* note 11.

Activities Act.⁷⁵ This law also specifies the rules for acquiring ownership of space resources, which are in line with the *Basic Space Act of Japan*.⁷⁶

The licensing process for space resource activities is specifically controlled under the Space Activities Act and the Act on the Promotion of Business Activities for the Exploration and Development of Space Resources.⁷⁷ Applicants must provide detailed information to obtain a license, including (i) purpose, (ii) duration, (iii) location, (iv) methods of exploration and development, and (v) additional information, as specified by the Japanese cabinet office order beyond the preceding items.⁷⁸ The only publicly available business activities plan on space mining under the law belongs to ispace, inc., which is a five-page-long technical document delineating the mission with visualisations.⁷⁹

At the time of application, the following conditions must be met: (i) compliance: the business activity plan must comply with the basic principles of the Basic Space Act; (ii) safety and compliance: it must be shown that the activity will not adversely affect the implementation of conventions on the development and use of outer space, and public safety must be ensured, and (iii) capability: the applicant must demonstrate sufficient ability to execute the business activity plan.⁸⁰ Lastly, the issued license must be publicly announced.⁸¹

IV. The Proposal

In this section, we argue that the due diligence standard of conduct should be adopted to enable the sustainability of space mining activities. First, we define due diligence within the context of international law. Second, we explore the “proceduralisation” effect of due diligence and examine some best practices. Finally, we discuss the application of the due diligence standard to space mining activities, presenting policy alternatives for States to consider.

A. Due Diligence: Meaning and Potential

Due diligence is usually attached to (or “grafted onto”) an obligation of conduct, thereby “qualifying” State obligations.⁸² It is a relatively old concept, the content of which is

⁷⁵ See, Japan, Information on the mandate and purpose of the Working Group on Legal Aspects of Space Resource Activities under the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space, https://www.unoosa.org/documents/pdf/copuos/lsc/space-resources/LSC2023/StatesResponses/Japan_Information_to_Space_Resource_WG.pdf. Also see, Hiroko Yotsumoto, Daiki Ishikawa and Tetsuji Odan, *The Space Law Review: Japan*, *The Law Reviews* (2023).

⁷⁶ Japanese Act, supra note 11, Article 5.

⁷⁷ *ibid*, Article 3 and Form 1.

⁷⁸ *ibid*.

⁷⁹ The Cabinet Office of Japan, Business Activities Plan (Tentative Translation), https://www8.cao.go.jp/space/english/resource/documents/bap_e_22019.pdf.

⁸⁰ Japanese Act, supra note 11, Article 22.

⁸¹ *ibid*, Article 4.

⁸² There is scholarly debate as to the nature of due diligence in international law. Due diligence has been characterized as a “standard”, and “obligation”, “customary international law”, and a “general principle of law”, among others. Pisillo-Mazzeschi, Besson and McDonald are some of the advocates of the categorisation of due diligence as a “standard” of conduct. See Riccardo Pisillo-Mazzeschi, *The Due Diligence Rule and the Nature of the International Responsibility of States*, 35 *German Yearbook of International Law* (1992) 15-16; Neil McDonald, *The Role of Due Diligence in International Law*, 68 *International Comparative Law Quarterly* 104 (2019); Samantha Besson, *La Due Diligence en Droit International* in *The Hague Academy of International Law* (eds), *Collected Courses, Volume 409* (Brill 2020) 215-280. Lanovoy categorises due diligence as an “obligation”,

determined by reference to a primary rule of general or specific international obligation, such as neutrality, the no-harm rule, the principle of prevention, and the responsibilities to protect and preserve. Currently, due diligence operates in several legal fields, including human rights law, the law of international responsibility, the law of the sea, corporate social responsibility (CSR) and environmental, social and governance (ESG) law.⁸³

For the purposes of space mining, we propose initially attaching the due diligence obligation to the no-harm rule (i.e., the general obligation of States to ensure that the activities within their jurisdiction and control do not cause damage to the environment of other states or areas beyond national jurisdiction). Specific international space law principles and obligations, some of which were discussed in the previous section, could substantiate and potentially expound on this, with the ultimate goal of promoting the sustainability of space mining activities.

Grafted onto this general obligation, due diligence can prescribe an international minimum standard of what a “reasonable” government would do in the specific situation of space mining. Reasonableness relates to whether a State knew or should have known about the risk of violation. It leaves States the discretion to evaluate their measures according to what could reasonably be expected of them in a given situation.⁸⁴ Undertaking all possible measures that could be reasonably expected is an integral part of satisfying the due diligence standard. It typically involves risk management (i.e., analysing, assessing and rating risks triggered by the due diligence obligation), policy definition and execution (i.e., defining and executing a policy that sets standards and processes to implement the due diligence obligation), and the establishment of grievance systems (so that stakeholders can express reasonable concerns about the existence of potential or actual adverse effects related to the due diligence obligation).

Due diligence is a suitable standard for space mining because of its inherent flexibility. It is sufficiently flexible to accommodate the management of risks (emanating from nature as well as private actors) in complex situations involving diverse actors in the face of scientific uncertainty. In other words, the conduct considered reasonable to meet the relevant due diligence standard is not static. A State would not meet its due diligence obligations, if it disregarded the plausible indications of potential risks. Thus, the standard of conduct varies over time, with new scientific and technological knowledge, so that it can be customised to fit the case at hand.

Moreover, flexibility relates to the particular capacities and capabilities of States as per economic development. Reference to State capabilities is “of great significance to developing countries, for which the content of their commitments should be construed more narrowly than in the case of developed states”.⁸⁵ This means that States might be afforded some differentiation with respect to their capabilities when fulfilling their due diligence obligations.⁸⁶

which he argues can also be rooted in customary international law. See Vladyslav Lanovoy, *Complicity and its Limits in the Law of International Responsibility* (Bloomsbury 2016). Kulesza argues that due diligence is a general principle of law. See Joanna Kulesza, *Due Diligence in International Law* (Brill 2016). We subscribe to the characterization of due diligence as a “standard of conduct”, because, in our opinion, it reflects the legal jurisprudence in the most accurate way.

⁸³ Heike Krieger, Anne Peters and Leonhard Kreuzer (eds), *Due Diligence in the International Legal Order* (Oxford University Press 2021). For mandatory due diligence under CSR and ESG laws, see, Radu Mares, *Corporate Self-Regulation and the Climate: The Legal Trajectory of Sustainability Due Diligence in the European Union* in Ottavio Quirico and Frank Baber, *Implementing Climate Policies* (Cambridge University Press 2023).

⁸⁴ *ILA Study Group on Due Diligence in International Law*, Second Report (July 2016) 8-9.

⁸⁵ Kulesza, *supra* note 82, 237.

⁸⁶ See the discussion below in note 101.

The inherent flexibility of due diligence leads to its “leeway” function, which is suitable for space mining.⁸⁷ Whilst due diligence achieves a “paradigmatic shift” from the state of nature to a legally regulated sphere, it provides a leeway for states to pursue their legitimate interests. Controversial inquiries as to the content of substantive rules regulating wrongdoing (e.g. responsibility, accountability, damages) can be deferred to less controversial questions relating to informed decision-making and process. The antagonistic interests concerning novel and complex issues do not need to be enshrined explicitly for a due diligence standard to be adopted. In particular, the WG could elaborate on the topic with the possibility of drafting a future legal framework. A due diligence standard of conduct is well-suited for facilitating discussions on such a framework, aligning with the trend of a soft law approach to international outer space law-making.

B. *Due Diligence and Proceduralisation*

The biggest achievement of the due diligence standard of conduct would be the proceduralisation of space mining. Due diligence acts as a technique of proceduralisation and brings the actions of State and non-State actors under a defined legal standard by restricting States’ and non-State actors’ freedom to act. Due diligence achieves this by being used in a legal and non-legal sense, as a tool for states to take prudent steps to avoid “a range of bad outcomes”, including incurring economic loss, being held to have violated a rule of international law, and suffering political opposition or embarrassment. Hence the difference in daily usage of the term, “acting with due diligence” and “doing due diligence”.⁸⁸ Acting with due diligence means taking the appropriate amount of care, and may amount to a legal standard, whereas doing due diligence denotes a broader exercise of risk identification and mitigation.

Furthermore, the primary rule to which the due diligence standard is grafted onto might result in the detachment of due diligence from the result, therefore completely proceduralising the primary rule. A prominent example is the *Costa Rica v Nicaragua / Nicaragua v Costa Rica* decision by the International Court of Justice, where the Court recognised that the procedural obligations to take diligent measures not to cause transboundary environmental harm are violated, independent of whether such harm has occurred.⁸⁹ This shows the considerable potential of procedural obligations to “flesh out” the due diligence standard of the preventive aspects of the transboundary harm rule.⁹⁰ This framework opens the doors to holding States to their procedural duties and serves as a “powerful tool in protecting the environment”.⁹¹

C. *Best Practices*

We suggest that due diligence obligations in the fields of deep seabed mining, as well as CSR and ESG regulations, can serve as best practices for space mining. With respect to the first, the

⁸⁷ Krieger, Peters and Kreuzer, *supra* note 83.

⁸⁸ McDonald, *supra* note 82.

⁸⁹ *Certain Activities Carried out by Nicaragua in the Border Area (Costa Rica v Nicaragua) and Construction of a Road in Costa Rica along the San Juan River (Nicaragua v Costa Rica) (Merits) (Certain Activities/Construction of a Road Case)* [2015] ICJ Rep 665, paras 101-112.

⁹⁰ Jutta Brunnée, *ESIL Reflection: Procedure and Substance in International Environmental Law: Confused at a Higher Level?*, 5 *European Society of International Law* (2016).

⁹¹ *ibid.* Also see Jutta Brunnée, “International Environmental Law and Community Interests: Procedural Aspects” in Eyal Benvenisti and Georg Nolte (eds), *Community Interests Across International Law* (Oxford University Press 2018).

Seabed Disputes Chamber (SDC) of the International Tribunal for the Law of the Sea (ITLOS) clarified that due diligence under the relevant legal instruments is a “duty to ensure” that the activities in the Area⁹² do not cause harm to the environment beyond national jurisdiction.⁹³ The duty to ensure is not an obligation to achieve, or an obligation of result, but rather “an obligation to deploy adequate means, to exercise best possible efforts, to do the utmost, to obtain this result”.⁹⁴ Adopting laws and regulations and taking administrative measures that are “reasonably appropriate for securing compliance by persons” under the jurisdiction of States parties are some examples of fulfilling this duty.⁹⁵

Furthermore, SDC identified “direct obligations” relevant to meeting the due diligence obligation to ensure, which are in most cases couched as obligations to ensure compliance with a specific rule.⁹⁶ For example, such direct obligations can include the obligation to conduct environmental impact assessments, and to apply a precautionary approach and the best environmental practices.⁹⁷ The SDC’s advisory opinion provides valuable guidance on the responsibilities and obligations of States in sponsoring deep seabed mining activities, attempting to ensure that activities operate within limits to prevent harm.

Additionally, in 2024, ITLOS has unanimously delivered an advisory opinion on the application of the UN Convention on the Law of the Sea (UNCLOS) to climate change.⁹⁸ It reiterated that the obligation of due diligence requires a State to put in place a national system, including legislation, administrative procedures and an enforcement mechanism, and to exercise adequate vigilance to make such a system function efficiently, with a view to achieving the intended objective.⁹⁹ Applied to marine pollution from anthropogenic greenhouse gas emissions, ITLOS considered the standard of due diligence that States must exercise to be stringent, one which requires a State with greater capabilities and sufficient resources to do more than a State that is not so well placed.¹⁰⁰ Nonetheless, all States are under an obligation to implement the obligation of due diligence in accordance with their capabilities and available resources.¹⁰¹

Turning to the CSR and ESG regulations, the legislative developments around mandatory due diligence for businesses have been accumulating around the world. Due diligence here is generally understood to mandate information about (i) a company’s (including financial firms’) policies on climate and other ESG issues, (ii) measures taken to embed those policies into management systems (including a traceability system throughout the global value chain for supply chain due diligence obligations), (iii) identified areas of significant risks and specific

⁹² The Area is defined as: the seabed and ocean floor, and the subsoil thereof, beyond the limits of national jurisdiction.

⁹³ *Responsibilities and obligations of States sponsoring persons and entities with respect to activities in the Area* (Advisory Opinion) (1 February 2011) Seabed Disputes Chamber of International Tribunal for the Law of the Sea 50 ILM 458. [Hereinafter SDC Advisory Opinion].

⁹⁴ *ibid.*, para 110.

⁹⁵ *ibid.*, para 119.

⁹⁶ *ibid.*, para 122.

⁹⁷ *ibid.*

⁹⁸ *Request for an Advisory Opinion Submitted by the Commission of Small Island States on Climate Change and International Law* (Advisory Opinion) (21 May 2024) International Tribunal for the Law of the Sea No. 31.

⁹⁹ *ibid.*, paras 240-242.

¹⁰⁰ *ibid.*, para 241.

¹⁰¹ Previously, the Seabed Disputes Chamber of the International Tribunal for the Law of the Sea said that this ensures that “responsibility will nevertheless lie” if the State’s conduct “falls below an international minimum standard”, which reinforces the idea that due diligence should not boil down to a “hollow hook”. See, SDC Advisory Opinion, *supra* note 93, 242.

priority risk areas, and (iv) the actions taken to prevent and mitigate those risks. It refers to a legal framework that imposes a binding obligation on businesses to systematically assess, mitigate, and prevent potential adverse impacts on human rights and the environment throughout their operations and supply chains.¹⁰²

This approach requires companies to proactively identify, analyse, and address the potential risks and harms associated with their activities, products, and services. It encompasses a range of actions, including conducting comprehensive risk assessments, implementing appropriate policies and procedures, monitoring and auditing practices, and providing effective remedies for any violations or resulting harms. By mandating such due diligence, this approach seeks to hold businesses accountable for their environmental, social, and governance responsibilities, ensuring that they operate in a manner that respects human rights, promotes sustainable development, and minimises negative impacts on the environment.

These legislative developments are rooted in the application of international non-binding instruments, most notably the UN Guiding Principles on Business and Human Rights (UNGPs), and the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas (the Guidance).¹⁰³ The UNGPs pioneered the concept of human rights due diligence for businesses, envisaging the following four-step process: (i) assessing actual and potential human rights impacts, (ii) integrating and acting upon the findings, (iii) tracking responses, and (iv) communicating how impacts are addressed. The Guidance, on the other hand, developed the following five-step due diligence framework in the area of conflict minerals: (i) establishing strong management systems, (ii) identifying, assessing and prioritising risks, (iii) managing risks, (iv) carrying out independent third-party audits to verify due diligence practices, (v) communicating and publicly reporting on due diligence. The US, the EU, and Switzerland modelled their legally binding supply chain due diligence regulations with respect to conflict minerals on the Guidance.¹⁰⁴

Notably, supply chain due diligence obligations exist across different topics in many jurisdictions. The most prominent examples are in the EU (deforestation), the United Kingdom (UK) and Australia (modern slavery), Switzerland (child labour), France and Norway (human rights), and Germany (human rights and the environment).¹⁰⁵ The EU Corporate Sustainability Due Diligence Directive also requires certain companies to demonstrate what actions they are taking to protect the environment and human rights.¹⁰⁶ Furthermore, due diligence reporting is increasingly being integrated into regulations mandating public sustainability reporting, such

¹⁰² Rachel Chambers & Jean Martin, *Reimagining Corporate Accountability: Moving Beyond Human Rights Due Diligence*, 18 New York University Journal of Law & Business 773 (2022).

¹⁰³ The UN Guiding Principles on Business and Human Rights (UN Human Rights Office of the High Commissioner, 2011), UN Doc HR/PUB/11/04, https://www.ohchr.org/sites/default/files/Documents/Publications/GuidingPrinciplesBusinessHR_EN.pdf; OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas (3rd edn, OECD 2016), <https://www.oecd.org/daf/inv/mne/OECD-Due-Diligence-Guidance-Minerals-Edition3.pdf>.

¹⁰⁴ European Parliament and Council Regulation (EU) 2017/821 of 17 May 2017 laying down supply chain due diligence obligations for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict-affected and high-risk areas; Dodd Frank Act, Conflict Minerals, 75 Fed. Reg. 229, 249 (December 23, 2010) (U.S. Securities and Exchange Commission); Articles 964j-964l of the Swiss Code of Obligations.

¹⁰⁵ For a large dataset, see, Ius Laboris, *Supply Chain Due Diligence Laws* (last updated April 2022).

¹⁰⁶ Amendments adopted by the European Parliament on 1 June 2023 on the proposal for a directive of the European Parliament and of the Council on Corporate Sustainability Due Diligence and amending Directive (EU) 2019/1937 (COM(2022)0071 – C9-0050/2022 – 2022/0051(COD)), https://www.europarl.europa.eu/doceo/document/TA-9-2023-0209_EN.html.

as in Switzerland and the EU.¹⁰⁷ The Dutch Bill on Responsible and Sustainable International Business Conduct and the UK campaign for a UK Business, Human Rights and Environment Bill are also drawing attention as mandatory due diligence regulations in the making.¹⁰⁸

A brief overview of these regulations illustrates at least two important points for the purposes of our analysis. First, notwithstanding the proliferation of different regulatory frameworks, the absence of an internationally acknowledged due diligence requirement to govern terrestrial mining activities persists. Second, States can marshal these best practices to advance the due diligence standard of conduct for space mining in non-institutional and/or institutional ways. Non-institutional avenues involve proposing the adoption of a binding or non-binding legal instrument within the framework of UNCOPUOS, particularly within the WG.

D. *Due Diligence and Space Mining*

In UNCOPUOS, there appears to be a prevailing trend where the development of legally binding treaties is at a stall, coupled with notable resistance to introducing new items on the Legal Subcommittee (LSC) agenda. This practice has been acknowledged, as Marchisio, the Chairperson of the LSC at that time, observed in 2005, suggesting that the end of outer space treaty-making since 1979 signalled the conclusion of the LSC's role in law-making.¹⁰⁹ However, despite this perspective, we maintain that the possibility of crafting a legally binding treaty on space mining exists. Despite challenges, the evolving nature of space activities necessitates continued negotiations, and the establishment of comprehensive regulatory frameworks. In this context, a potential treaty can address the emerging complexities and promote responsible and sustainable space mining practices.

The treaty, however, is not the only option. States can incorporate due diligence requirements into their national space laws. In line with existing ESG regulations, the implementation of annual public due diligence reporting and monitoring frameworks for space mining companies can also be considered. This proactive approach may contribute to the recognition of the due diligence standard either as customary law derived from widespread State practice and/or inspire regional/multilateral legal instruments.

However, as our analyses in the previous sections show, domestic legislative frameworks adopted in the US, Luxembourg, the UAE, and Japan do not adequately address the sustainability concerns related to space mining activities.¹¹⁰ As we argued, a fragmented approach runs the risk of undermining the use and exploration of space as a province of humankind, and might lead to legal uncertainty, as well as a pluralist legal context that benefits actors with expertise. Therefore, international approaches need to be considered.

¹⁰⁷ Articles 964a-964c of the Swiss Code of Obligations; The EU Corporate Sustainability Reporting Directive (CSRD) Directive (EU) 2022/2464 and the corresponding European Sustainability Reporting Standards (ESRS).

¹⁰⁸ Unofficial translation of the Dutch Bill is available at, <https://www.mvoplatform.nl/en/wp-content/uploads/sites/6/2021/03/Bill-for-Responsible-and-Sustainable-International-Business-Conduct-unofficial-translation-MVO-Platform.pdf>.

¹⁰⁹ Sergio Marchisio, *The Evolutionary Stages of the Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS)*, 31 *Journal of Space Law* 219 (2005).

¹¹⁰ For a comparison, see, Morgan M. DePagter, 'Who Dares, Wins: How Property Rights in Space Could be Dictated by the Countries Willing to Make the First Move' (CJIL Online 1.2, Comment), <https://cjil.uchicago.edu/online-archive/who-dares-wins-how-property-rights-space-could-be-dictated-countries-willing-make>.

Establishing an international technical body, similar in structure to the Intergovernmental Panel on Climate Change (IPCC), presents a promising avenue for assessing the science behind sustainable space mining. Such a body could be composed of experts from relevant natural and social sciences disciplines. The primary function of this body would be to provide authoritative assessments and offer guidance on the technical, environmental, and socio-economic knowledge of space mining, its impacts and future risks, and options for reducing the risks.

While the Scientific and Technical Subcommittee of UNCOPUOS plays a crucial role in addressing technical aspects related to space activities, including the long-term sustainability of outer space, its mandate may not be sufficient to comprehensively assess the scientific complexities and implications specific to space mining on a regular basis.¹¹¹ The subcommittee's work contributes to the development of technical guidelines, standards and recommendations for space-related matters, providing a platform for member states to exchange scientific information, share best practices, and discuss technical aspects of space operations. In contrast, the new technical body suggested here would provide policymakers with regular scientific assessments and remain neutral, i.e., policy-relevant but not policy-prescriptive.

The assessment reports of such a new technical body could play a pivotal role in advancing the due diligence standard of conduct under international law. It could provide a scientific basis for determining the reasonable actions and flexibility that States can exercise under the due diligence standard of conduct. This could contribute to the development of a consistent accountability framework for sustainable space mining, balancing environmental protection, social considerations, and the equitable utilisation of space resources under international law.

V. Conclusion

Humanity remains dependent on accessing, exploring, and using natural resources. The recent legislative developments on space mining in the US, Luxembourg, the UAE, and Japan, along with the commitment of countries to space mining through the Artemis Accords, have set the legal basis for a space mining industry to flourish. However, these developments also indicate a fragmented regulatory approach to space mining, which risks jeopardising the long-term sustainability objectives for outer space, as actors with expertise might exploit the pluralist context to benefit from legal entitlements and shape specialised regulatory regimes.

To address this challenge, we propose the adoption of a due diligence standard of conduct at the international level as a key tool to guide the sustainability of space mining activities. The due diligence standard encompasses rigorous assessment processes, monitoring mechanisms, and accountability measures to ensure responsible practices throughout the lifecycle of space mining operations in accordance with applicable law. By embracing this standard, States can uphold their obligations to preserve the sustainability of space activities, and fulfil their obligations to supervise the activities of non-governmental entities in space. The space mining industry actors would be provided with legal certainty, compelling them to investigate,

¹¹¹ The European Space Policy Institute makes a similar call for the establishment of an IPCC-type of scientific body to create regular scientific assessments on Earth orbital environment. See, ESPI, *Space Environment Capacity: Policy, Regulatory and Diplomatic Perspectives on Threshold-based Models for Space Safety & Sustainability* (2022), 51, <https://www.espi.or.at/wp-content/uploads/2022/06/ESPI-Report-82-Space-Environment-Capacity-Full-Report.pdf>.

disclose, prevent, minimise, and address potential adverse impacts of their operations on sustainability issues.

We discuss policy options that States can consider to advance the due diligence standard. These options include the establishment of an international technical body similar to the IPCC to provide scientific expertise and guidance, as well as the exploration of an international treaty specifically focused on space mining regulations.

By adopting these options and committing to a unified regulatory approach, States can proactively address the challenges posed by the fragmented regulatory landscape. Such efforts have the potential to not only contribute to the long-term sustainability of space activities but also foster cooperation, transparency, and equitable access to space resources among nations.

This paper contributes to the discussions on due diligence, space mining and resource governance under international law. International regulatory intervention and the adoption of a due diligence standard offer a pathway to ensure sustainable and responsible space mining activities, mitigating potential risks and promoting the preservation of space as a shared resource for present and future generations.