

ORIGINAL ARTICLE

INTERNATIONAL LAW AND PRACTICE

Legal status of abiotic resources in outer space: Appropriability, ownership, and access

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Abstract

Humankind's exploration and use of outer space are first and foremost limited by the obligation of non-appropriation. This prohibition, with an aim to prevent conflicts arising from competing territorial claims, does not extend to the exploitation of abiotic resources in space. Recent state practice has shown a clear trend of regarding such exploitation as a freedom of exploration and use of outer space. The future international legal regime should prohibit property claims over natural resources *in place* on celestial bodies, avoid the controversial issue of ownership, co-ordinate the resource activities of different entities by a stage-specific and priority-right-based mechanism, and harden the obligations of capacity-building and co-operation. The ideas of parallel system and monetary benefit sharing should not be discarded although resistance from major space-faring countries is foreseeable.

Keywords: abiotic resources in space; benefit sharing; common heritage of mankind; deconfliction; non-appropriation

1. Introduction

Humankind's consumption of natural resources on the Earth has accelerated to an unprecedented level, owing to the spread and deepening of industrialization around the globe and the dramatic growth of world population. Noting the depletion of earthly resources, scientists set their sights on outer space, to support humankind's continuous development on the Earth and possible settlement on other celestial bodies. Of particular interest to them are 'abiotic resources' such as water and minerals. Recent years have witnessed the leap of science and technologies and the surge of capital investment in this field.

While the utilization of extraterrestrial abiotic resources is said to be decades away, international law on this issue is primitive at best. The 1967 Outer Space Treaty (OST),¹ widely regarded as the *Magna Carta of Corpus Juris Spatialis*, does not deal with the use of abiotic resources in space *expressis verbis*, although the principles it enshrines apply to it just as to other uses. The 1979 Moon Agreement, which applies to the Moon as well as other celestial bodies within the solar system,² addresses natural resources on them expressly, but has only 18 states parties and four signatories as of 1 January 2021.³ With the issue inadequately addressed under *lex lata* of

¹1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty), 610 UNTS 205.

²1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement), UN Doc. Res 34/68 (1979), Art. 1, para.1.

³States parties of the Moon Agreement are Armenia, Australia, Austria, Belgium, Chile, Kazakhstan, Kuwait, Lebanon, Mexico, Morocco, Netherlands, Pakistan, Peru, Philippines, Saudi Arabia, Turkey, Uruguay, and Venezuela (Bolivarian

international law, a bottom-up pattern has emerged with the US, Luxembourg, UAE, and Japan enacting laws in 2015, 2017, 2019, and 2021 successively.⁴ These legislations provide legal certainties for pioneer investors and developers in this field, not only because their activities are most directly regulated by domestic law, but also that domestic legislation, as state practice, plays an important role in the interpretation of obscure treaty provisions and the development of customary international law.

The above development in law and beyond has aroused debates among states. After some preliminary discussion at the 2016 session of the Legal Subcommittee (LSC) of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS),⁵ ‘General exchange of views on potential legal models for activities in exploration, exploitation and utilization of space resources’ remains an agenda item in its annual sessions since 2017. At its 60th session in 2021, the LSC decided to establish, under a five-year workplan, a working group under this agenda item. A consensus was reached upon the mandate, terms of reference and methods of work of the working group at the 64th session of COPUOS in 2021. The issue is also under debate at the non-governmental level. For instance, the Hague International Space Resources Governance Working Group (Hague Working Group) adopted the Building Blocks for the Development of an International Framework on Space Resource Activities (Building Blocks) in 2019.⁶ These efforts would pave the way for the establishment of an international legal regime governing activities in exploration, exploitation and utilization of abiotic resources (resource activities) in outer space.

One of the fundamental questions underpinning the international legal regime governing resource activities in space, as in other areas beyond national jurisdiction (ABNJs), is the legal status of such resources. Whereas states have sovereign right to exploit their own resources,⁷ resources in ABNJs are not afforded a uniform status. For those without a generally accepted legal status, such as abiotic resources in space and marine genetic resources (MGRs) of ABNJs, reference is made to the concepts of *res nullius*, *res communis*, and Common Heritage of Mankind (CHM). *Res nullius* and *res communis* are essentially private law concepts of the Roman Empire and could not prevent Rome from restricting ocean traffic and restricting uses of ocean spaces to its own citizens and itself.⁸ Whenever referred to in international law by analogy, an elevated version of the concepts is intended to apply to the international community of states, just as the Roman law to its citizens. Of course, one must be vigilant that their meaning is not at all clear, and they seem to conflate the ideas of spatial area and resources therein.

Republic of). Signatories include France, Guatemala, India, and Romania. See ‘Status of International Agreements relating to activities in outer space as at 1 January 2021’, available at www.unoosa.org/res/oosadoc/data/documents/2021/aac_105c_22021crp/aac_105c_22021crp_10_0_html/AC105_C2_2021_CRP10E.pdf.

⁴US Commercial Space Launch Competitiveness Act, Public Law 114-90, 25 November 2015; *Loi du 20 juillet 2017 sur l’exploration et l’utilisation des ressources de l’espace* (Luxembourg), available at www.legilux.public.lu/eli/etat/leg/loi/2017/07/20/a674/jo; Federal Law No.12 on the Regulation of the Space Sector, Official Gazette, issue No.669 (UAE), for unofficial English translation see ‘Law of July 20th 2017 on the exploration and use of space resources’, available at www.legilux.public.lu/eli/etat/leg/loi/2017/07/20/a674/jo/en; Act on Promotion of Business Activities Related to the Exploration and Development of Space Resources, Official Gazette, on 23 June 2021, available at kanpou.npb.go.jp/old/20210623/20210623g00141/20210623g001410004f.html (Japan), for an English introduction see www.loc.gov/item/global-legal-monitor/2021-09-15/japan-space-resources-act-enacted/.

⁵2016 Report of the Legal Subcommittee on its fifty-fifth session, UN Doc. A/AC.105/1113 (2016), paras.74–8.

⁶The Hague International Space Resources Governance Working Group, ‘Building Blocks for the Development of an International Framework on Space Resource Activities’, November 2019, available at www.universiteitleiden.nl/binaries/content/assets/rechtsgeleerdheid/instituut-voor-publiekrecht/lucht-en-ruimterecht/space-resources/bb-thissrwg-cover.pdf (Hague Working Group Building Blocks). For commentaries to the building blocks see O. de O. Bittencourt Neto et al., *Building Blocks for the Development of an International Framework for the Governance of Space Resource Activities: A Commentary* (2020), available at boeken.rechtsgebieden.boomportaal.nl/publicaties/9789462361218#152.

⁷Declaration of the United Nations Conference on the Human Environment, 1972, UN Doc. A/CONF.48/14/Rev.1 (1972), Principle 21; Rio Declaration on Environment and Development, 1992, UN Doc. A/CONF.151/26 (Vol I) (1992), Principle 2.

⁸D. J. Bederman, ‘The Sea’, in B. Fassbender and A. Peters (eds.), *The Oxford Handbook of the History of International Law* (2012), at 359, at 362.

This article, in addressing the legal status of abiotic resources in outer space, does not seek to characterize them as *res nullius*, *res communis*, CHM or any other, due to the overlap of their elements. For instance, while a resource subject to common ownership can be *res communis* or CHM, both *res communis* and *res nullius* are open to free access.⁹ Instead, it attempts to define the legal status of abiotic resources in outer space in three dimensions, i.e., appropriability, ownership, and access, as the 1982 United Nations Convention on the Law of the Sea (UNCLOS) does with respect to the Area and its resources.¹⁰ In the discussion of these elements, a distinction will be made between abiotic resources *in place* and those *out of place*. In other ABNJs, while the claim of property over the former is usually prohibited,¹¹ legal regimes governing the latter differ significantly, ranging from the freedom of fishing in the high seas to the prohibition of unilateral exploitation of minerals in the ‘seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction’ (the Area).¹² In fact, ownership of abiotic resources *out of place*, while falling within the broad concept of appropriation, is premised on lawful access, thus addressed synchronously under the umbrella of access.

Section 2 of this article demonstrates that the prohibition of territorial sovereignty lies at the heart of the principle of non-appropriation of outer space and calls for broader acceptance of the international consensus developed in the negotiation of the Moon Agreement on the prohibition of property claims over natural resources *in place* on celestial bodies. Section 3 argues that the ownership of abiotic resources in outer space remains an open question and, as a pragmatic approach, should be avoided in the future negotiation of an international legal regime. Section 4 argues that while there is a clear trend that the exploitation of abiotic resources will form part of the freedom of exploration and use of outer space, an international regime is needed to address the pressing need of deconfliction among different entities conducting mineral activities in space and to deal with the issue of benefit sharing.

2. Appropriability

2.1 The prohibition of territorial sovereignty as the heart of non-appropriation of outer space

Sovereignty over a spatial area, in essence, denotes ‘the right to exercise therein, to the exclusion of any other State, the function of a State’.¹³ The prohibition of territorial sovereignty is an element inherent in the concept of ABNJs. Outer space is no exception. Article II of OST prohibits ‘national appropriation’ of outer space ‘by claim of sovereignty, by means of use or occupation, or by any other means’.¹⁴ This provision was designed to avoid potential conflicts over sovereign rights that might arise once nations establish settlements in space.¹⁵ It was acceptable to the US and the USSR as it would eliminate the threat of the other nation achieving dominance in space, and supported widely by developing countries as it would avoid the risk of being left out completely from the resources in outer space.¹⁶

⁹See generally P. Turrini, ‘The Sky’s Not the Limit: Legal Bonds and Boundaries in Claiming Sovereignty over Celestial Bodies’, in T. Natoli and A. Riccardi (eds.), *Borders, Legal Spaces and Territories in Contemporary International Law: Within and Beyond* (2019), at 173–209.

¹⁰1982 United Nations Convention on the Law of the Sea (UNCLOS), Art. 137.

¹¹UNCLOS, Art. 137, para.1. The UNCLOS does not explicitly prohibit the claim of property over fisheries *in place* in the high seas. This is, however, implicit in the rule that fishing is one of the freedoms of the high seas for coastal and land-locked states. To allow the claim of property over fisheries *in place* in the high seas would render the freedom meaningless.

¹²UNCLOS, Art. 87, para.1.

¹³*Island of Palmas (US v. Netherlands)*, (1928) II RIAA 829, 838.

¹⁴Outer Space Treaty, *supra* note 1, Art. II.

¹⁵E. W. Paxson III, ‘Sharing the Benefits of Outer Space Exploration: Space Law and Economic Development’, (1993) 14(3) *Michigan Journal of International Law* 487, at 494.

¹⁶B. C. Gruner, ‘A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century’, (2004) 35 *Seton Hall Law Review* 299, at 324.

The mere ‘claim of sovereignty’ over a territory is inadequate to give it good title. It must be based on means of acquisition such as occupation of *terra nullius*, cession, and accretion.¹⁷ ‘Use’ is not a valid basis for title to territorial sovereignty in itself. The closest concept that may create such a title is ‘continuous and peaceful display of State authority’.¹⁸ The criteria that international jurisprudence sets for the creation of sovereignty in remote areas are not high. In *Legal Status of Eastern Greenland*, the Permanent Court of International Justice (PCIJ) observed that

... in many cases the Tribunal has been satisfied with very little in the way of the actual exercise of sovereignty rights, provided that the other state could not make out a superior claim. This is particularly true in the case of claims to sovereignty over areas in thinly populated or unsettled countries.¹⁹

When it comes to celestial bodies, a lower threshold can be argued for the creation of sovereignty, given their uninhabited and inhospitable conditions to human settlement. But this possibility is prohibited pre-emptively. ‘Occupation’ is widely recognized as a means of acquiring original title to *terra nullius*.²⁰ This status has been denied for outer space, as Article I of OST provides that ‘[o]uter space . . . shall be free for exploration and use by all States . . . and there shall be free access to all areas of celestial bodies’.²¹ With international law prohibiting the appropriation of outer space by ‘use’ and ‘occupation’, other titles deriving therefrom, such as cession, do not come into play. In any event, the appropriation of outer space ‘by any other means’ is prohibited generally.

The treaty obligation of non-appropriation may be discharged by a withdrawal from the OST.²² However, the basic rules defining the status of outer space are not only conventional but also part of general international law.²³ In particular, Article II of OST is regarded as codifying a pre-existing rule of customary international law.²⁴ This finds support in the inclusion of the same rule in the 1963 Legal Principles Declaration, which was adopted unanimously in the United Nations General Assembly (UNGA).²⁵ Of course, a customary rule may be abolished by way of desuetude, for which ‘patterns of State practice really must change or there must be very clear evidence that the usage is no longer “accepted as law”’.²⁶ This bar is high, not to mention that, as some argue, the prohibition of national appropriation forms not only a part of customary international law but also *jus cogens*.²⁷ Having said that, as the boundary between airspace and outer space remains unresolved, states have the discretion to extend the vertical limit of their national airspace, as coastal states did horizontally to establish territorial sea.²⁸ However, the room of

¹⁷M. N. Shaw, *International Law* (2018), at 1027.

¹⁸M. Lachs, *The Law of Outer Space: An Experience in Contemporary Law-Making* (2010), at 41, referring to *Island of Palmas* case (*US v. Netherlands*), (1928) II RIAA 829, 839–40.

¹⁹Legal Status of Eastern Greenland, P.C.I.J. Series A/B No.53, at 46.

²⁰*Western Sahara*, Advisory Opinion, Advisory Opinion of 16 October 1975, [1975] ICJ Rep. 12, at 38–9, para. 79.

²¹Outer Space Treaty, *supra* note 1, Art. I.

²²Turrini, *supra* note 9, at 182.

²³Lachs, *supra* note 18, at 42.

²⁴R. Jakhu and S. Freeland, ‘The Relationship between the Outer Space Treaty and Customary International Law’, in Proceedings of the 67th International Astronautical Congress (IAC 2016): Making Space Accessible and Affordable to All Countries, (2016) *International Astronautical Federation* 11648, at 11661; S. Freeland, ‘Common heritage, not common law: How international law will regulate proposals to exploit space resources’, (2017) 35 *QIL* 19, at 22–3.

²⁵1962 Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, UN Doc. A/RES/1962(XVIII) (1962), para. 3.

²⁶D. J. Bederman, ‘Acquiescence, Objection and the Death of Customary International Law’, (2010) 21 *Duke Journal of Comparative & International Law* 31, at 38.

²⁷R. Jakhu, ‘Legal Issues Relating to the Global Public Interest in Outer Space’, (2006) 32(1) *Journal of Space Law* 31, at 48

²⁸S. Wolf, ‘Territorial Sea’, in *Max Planck Encyclopedia of Public International Law* (2013), available at www.opil.ouplaw.com/view/10.1093/law:epil/9780199231690/law-9780199231690-e1229?rskey=qo2ChE&result=1&prd=MPIL.

discretion is minimal compared to the infinite outer space. It is now well-established that the orbits at which space objects operate are certainly part of outer space, not to say celestial bodies.²⁹

2.2 The need for broader acceptance of the prohibition of property claims over natural resources in place on celestial bodies

While it is the prohibition of territorial sovereignty that lies at the heart of the non-appropriation principle under Article II of OST, whether the appropriation of abiotic resources on celestial bodies is also prohibited by the principle remains a matter of dispute. The crux is whether celestial bodies and abiotic resources on them have a unitary legal status.³⁰ This section addresses the question of property over abiotic resources *in place* on celestial bodies. Those *out of place*, as indicated above, will be addressed under the umbrella of access.

Different views have been opined on the material scope of Article II of OST. While Christol held that the provision only extends to the space environment consisting of outer space *per se*, the moon, and other celestial bodies,³¹ Lachs was of the view that the concept of ‘national appropriation’ under the Article covers not only sovereign rights but also property rights.³² A review of the drafting history shows that the negotiation did not dwell on the issue of resources on celestial bodies. In 1958, a year after the launch of Sputnik-1 by the USSR, an *ad hoc* Committee was established by the UNGA to examine a number of technical and legal issues relating to the peaceful uses of outer space. The Committee, when reporting on ‘the nature of legal problems which may arise in the carrying out of programmes to explore outer space’ in 1959, noted that ‘human settlement and extensive exploitation of resources were not likely in the near future’, and concluded that ‘problems relating to the settlement and exploitation of celestial bodies did not require priority treatment’.³³ This observation likely perpetuated the negotiation of OST that ensued, as the treaty is literally silent on this issue. Not only that, little can be found in the preparatory work on the issue. Soon after the conclusion of OST, the worth of abiotic resources was identified for practical applications, giving rise to the need for an international agreement providing for the orderly exploitation of such resources.³⁴ It was in the subsequent negotiation of the Moon Agreement that there emerged a consensus among states on the prohibition of property claims over natural resources *in place* on the Moon.

The Moon Agreement, while reiterating the non-appropriation principle,³⁵ proceeds by stating, ‘[n]either the surface nor the subsurface of the Moon, nor any part thereof or natural resources *in place*, shall become property of any State, international intergovernmental or non-governmental organization, national organization or nongovernmental entity or of any natural person’.³⁶ This provision marks a step forward from the OST to clarify the status of natural resources *in place* on the Moon. During the negotiation, the USSR initially proposed that ‘[n]either States, international intergovernmental or non-governmental organizations and national organizations having the status of juridical persons or not, nor natural persons, may claim the surface or subsoil of the Moon as their property’ in its 1971 Draft Treaty Concerning the Moon.³⁷ While this proposal only pertained to the surface and subsoil of the Moon, the USSR later agreed to the coverage of natural resources *in place* in the prohibition when the US accepted its position that juridical

²⁹J. Su, ‘The Delimitation between Airspace and Outer Space and the Emergence of Aerospace Objects’, (2015) 78 *Journal of Air Law and Commerce* 355–78.

³⁰J. Su, ‘Legality of Unilateral Exploitation of Space Resources under International Law’, (2017) 66 *ICLQ* 991, at 996.

³¹C. Q. Christol, ‘The Common Heritage of Mankind Provision in the 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies’, (1980) 14 *International Lawyer* 429, at 455.

³²Lachs, *supra* note 18, at 42.

³³1959 Report of the Ad Hoc Committee on the Peaceful Uses of Outer Space, UN Doc. A/4141 (1959), at 69, para. 31.

³⁴Christol, *supra* note 31, at 455.

³⁵Moon Agreement, *supra* note 2, Art. 11, para. 2.

³⁶*Ibid.*, para. 3 (emphasis added).

³⁷1971 USSR: Draft Treaty Concerning the Moon, UN Doc. A/C.1/L.568 (1971), Art. VIII, para. 1.

and natural persons should also be prohibited from having such property rights. This compromise between the two superpowers was reflected in a working paper prepared by the US in 1973, which set the basis for the final text of Article 11 of the Agreement.³⁸ This only reflects a consensus between the US and the USSR. Like on many other issues in the Agreement, there exist other views and the consensus between the two superpowers may not dominate the interpretation in the end. This has dissuaded major space-faring countries, in particular the US, from becoming a party. And for a non-state party, a compromise reached in the 1970s may no longer be valid today.

The claim of property over abiotic resource *in place*, where sovereignty claims are prohibited, cannot be ruled out. For instance, while the freedom of the sea has been dominant since the seventeenth century,³⁹ coastal states began to claim jurisdiction over the waters and subsoil adjacent to their territorial sea in the nineteenth century, resulting in the creation of the legal regimes of the continental shelf and the Exclusive Economic Zone (EEZ) in the twentieth century. For the continental shelf, coastal states initially resorted to the doctrine of ‘natural prolongation’,⁴⁰ which was recognized by the International Court of Justice (ICJ) in *North Sea Continental Shelf*.⁴¹ The legal concept of continental shelf transformed thereafter to also comprise the element of distance.⁴² The EEZ, on the other hand, arose out of ‘the pressing need for conservation and protection of fishery resources’.⁴³ Distance forms the sole criterion of its maximum breadth.⁴⁴ Beyond the continental shelf and the EEZ are the open high seas, and the Area which is now characterized as CHM. The US, though not a party to the UNCLOS, regards the regimes of EEZ and the continental shelf as reflecting customary international law, and denies private property right over mineral resources *in place* in the deep seabed. In 1974, when the UNCLOS was still under negotiation, Deepsea Ventures, Inc. notified the US Government of its assertion of exclusive mining rights over a deposit of seabed manganese nodules beneath the high seas, and requested the Government to provide diplomatic protection and protection of the integrity of the investment.⁴⁵ The U.S. Department of State explicitly stated that ‘[it] does not grant or recognize exclusive mining rights to the mineral resources of an area of the seabed beyond the limits of national jurisdiction’.⁴⁶ The 1980 Deep Seabed Hard Mineral Resources Act denies the assertion of ‘sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any areas or resources in the deep seabed’.⁴⁷ This is equivalent to a denial of property claims over mineral resources *in place* in the deep seabed.

Notwithstanding controversies surrounding the scope of non-appropriation, the prohibition of territorial sovereignty in outer space is seldom contested. Proponents of the freedom of mineral activities in space make a distinction between such activities and the exercise of territorial sovereignty, and do not take the former as contradictory to the non-appropriation principle.⁴⁸

³⁸United States of America: working paper (17 April 1973), in ‘Report of the Legal Sub-Committee on the Work of Its Sixteenth Session’ (14 March–8 April 1977), UN Doc. A/AC.105/196 (1997), Annex I, at 16–17.

³⁹Bederman, *supra* note 8, at 363–9.

⁴⁰See, e.g., Policy of the United States with respect to the Natural Resources of the Subsoil and Sea Bed of the Continental Shelf, 28 September 1945, available at www.gc.noaa.gov/documents/gcil_proc_2667.pdf.

⁴¹*North Sea Continental Shelf (Federal Republic of Germany/Denmark; Federal Republic of Germany/Netherlands)*, Judgment of 20 February 1969, [1969] ICJ Rep. 3, at 22, para. 19.

⁴²UNCLOS, Art. 76(1).

⁴³Policy of the United States with respect to the Coastal Fisheries in Certain Areas of the High Seas, 28 September 1945, available at www.archives.gov/federal-register/codification/proclamations/02668.html.

⁴⁴UNCLOS, Art. 57.

⁴⁵Deepsea Ventures, INC.: ‘Notice of Discovery and Claim of Exclusive Mining Rights’, (1975) 14 ILM 51–8. See also G. Biggs, ‘Deepsea’s Adventures: Grotius Revisited’, (1975) 9 *International Lawyer* 271.

⁴⁶International Legal Materials, Vol. XIV-No.1, January 1975.

⁴⁷Deep Seabed Hard Mineral Resources Act, 30 U.S.C § 1402 (2002).

⁴⁸Hague Working Group Building Blocks, *supra* note 6, at 8.3, 11.3; The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes (Artemis Accords), Section 10, para. 2.

The US, while upholding the freedom, denied any intention to ‘assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body’.⁴⁹ By contrast, in the current debate little is mentioned about the prohibition of property claims over natural resources *in place* on celestial bodies, which is not binding upon non-states parties to the Moon Agreement unless it forms part of customary international law. In the discussions in COPUOS LSC since 2016, only once was it mentioned that the application of the non-appropriation principle to natural resources is limited to those *in place* on celestial bodies.⁵⁰ The above disclaimer of US legislation speaks of celestial bodies, rather than natural resources thereof. The pledge thus does not include property claims over natural resources *in place* on celestial bodies.

International law may afford a permissive ground for the claim of property over natural resources *in place* on celestial bodies. Such rights, if any at all, are likely to derive from resource activities. In *Qatar v. Bahrain*, the ICJ expressed that pearling ‘seems in any event never to have led to the recognition of an exclusive quasi-territorial right to the fishing grounds themselves or to the superjacent waters’.⁵¹ Here, the Court denied the engenderment of territorial sovereignty from fishing activities. But it remains an open question whether they may give rise to exclusive rights over resources *per se*, taking such forms as historic rights.

Given the legal and practical uncertainties demonstrated above, it is important to garner wider acceptance of the prohibition of property claims over natural resources *in place* on the Moon. Otherwise, this consensus achieved in the negotiation of the Moon Agreement may be eroded, putting natural resources *in place* on celestial bodies under the risk of the creeping jurisdiction of states someday in the future, as happened to those in the EEZ and the continental shelf.

3. Ownership

3.1 The undecided ownership of abiotic resources in outer space

The prohibition of territorial sovereignty in ABNJs denies their *terra nullius* status. This does not make clear, or is decisive for, the ownership of resources therein, which can be *res communis*, *res nullius*, or CHM. For example, whilst the high seas have long been recognized as *terra communis*, not able to be appropriated and belonging to everybody, fish therein are regarded as *res nullius* that can be reduced as private property by fishermen.⁵² Outer space is likewise incapable of appropriation, but the ownership of abiotic resources therein remains an open question.⁵³ This question is not to be resolved by the prohibition of property claims over natural resources *in place* on celestial bodies.

The OST does not make clear the ownership of abiotic resources in space. Article I codifies the freedom of exploration and use of outer space. As will be argued in Section 4.1, this freedom is interpreted broadly by an increasing number of states to include the exploitation of abiotic resources therein. But even if this interpretation prevails in the end, it remains undecided whether such resources are subject to common ownership or belong to no one. Article I of the OST also provides that ‘[t]he exploration and use of outer space . . . shall be the province of all mankind’.⁵⁴ The term of ‘province of all mankind’ is obscure, not to mention that it is the ‘exploration and use of outer space’, rather than outer space *per se*, that is given such a status. To the former Soviet Union, this term meant that ‘[celestial bodies] are available for the undivided and common use of

⁴⁹US Commercial Space Launch Competitiveness Act of 2015, Sec. 403.

⁵⁰2017 Report of the Legal Subcommittee on its fifty-sixth session, UN Doc. A/AC.105/1122 (2017), at 32, para. 248.

⁵¹*Maritime Delimitation and Territorial Questions between Qatar and Bahrain (Qatar v. Bahrain)*, Merits, Judgment of 16 March 2001, [2001] ICJ Rep. 40, at 112, para. 236.

⁵²A. Kiss, ‘The Common Heritage of Mankind: Utopia or Reality?’, (1985) 40 *International Journal* 423, at 423–4; J. West, ‘Outer Space: Global commons or a wild frontier – open for competitive exploitation, profit and resettlement?’, (2016) 37 *Ploughshares Monitor* 20, at 22–3.

⁵³For instance, asteroids, when taken as a kind of resource, are regarded by some as *res communis*. See West, *ibid.*, at 22–3.

⁵⁴Outer Space Treaty, *supra* note 1, Art. I.

all States on earth, but are not jointly owned by them'.⁵⁵ This is an explicit rejection of common ownership.

The Moon Agreement provides that the Moon and its natural resources are the CHM,⁵⁶ making clear their common ownership. The establishment of an international regime to govern the exploitation of natural resources of the Moon, for which a managing body is usually indispensable, was envisaged but deferred till 'such exploitation is about to become feasible'.⁵⁷ However, the significance of this provision shall not be overstated, due to the scant support among states. At the COPUOS, whereas some states held that the principle of CHM in the Moon Agreement should be analysed to determine the rights of 'all States' in outer space law with respect to the utilization of space resources,⁵⁸ indicating a customary status of the principle, there are others who expressed that the concepts in the Agreement could not be taken to form part of customary international law due to the very small number of states parties.⁵⁹ The author subscribes to the latter view given that it is the inclusion of CHM, which has pragmatic implications on benefit-sharing and technology transfer, that hinders the accession of major space-faring countries to the Agreement.⁶⁰ In fact, the attitude of major space-faring countries towards the Agreement is indifference at best and hostility at worst. The US, under the Trump administration, explicitly stated that it 'does not consider the Moon Agreement to be an effective or necessary instrument to guide nation states regarding the promotion of commercial participation in the long-term exploration, scientific discovery, and use of the Moon, Mars, or other celestial bodies', and vowed to 'object to any attempt by any other state or international organization to treat the Moon Agreement as reflecting or otherwise expressing customary international law'.⁶¹

3.2 The pragmatic avoidance of ownership of abiotic resources in outer space

Ownership appears to be fundamental to the legal status of abiotic resources in ABNJs. But in the abstract, ownership has no controlling on access and benefit sharing. For instance, *res communis* and *res nullius*, while belonging to all and no one respectively, are equally open to free access with no obligation of benefit sharing; *res communis* and CHM, both commonly owned, are subject to different regimes of access and benefit sharing. In practice however, the divergence of views on the pragmatic issues of access and benefit sharing has caused a backlash to ownership.

The UNCLOS, which also comprises CHM, has 168 states parties.⁶² This has prompted some to characterize resources in ABNJs as CHM categorically, even where it is not so provided in *lex lata*, and to draw analogy from the UNCLOS with respect to the practical implications. Thus, at the COPUOS, it was expressed that 'there should not be any regulations promoting the commercialization of outer space, which was the common heritage of all humankind and belonged to all States on equal terms'.⁶³ Such assertions seem to neglect that even in treaties where the term of CHM is

⁵⁵USSR: working paper (28 March 1973), in 1977 Report of the Legal Sub-Committee on the Work of Its Sixteenth Session, UN Doc. A/AC.105/196 (1977), Ann. I, at 12.

⁵⁶Moon Agreement, *supra* note 2, Art. 11, para. 1.

⁵⁷*Ibid.*, para. 5.

⁵⁸2017 Report of the Legal Subcommittee on its fifty-sixth session, *supra* note 50, para. 226.

⁵⁹*Ibid.*, para. 227.

⁶⁰H. Hertzfeld and F. von der Dunk, 'Bringing Space Law into the Commercial World: Property Rights without Sovereignty', (2005) 6 *Chicago Journal of International Law* 81. See also 2017 Report of the Legal Subcommittee on its fifty-sixth session, *supra* note 50, para. 227; 2019 Report of the Legal Subcommittee on its fifty-eighth session, UN Doc. A/AC.105/1203 (2019), para. 80.

⁶¹Executive Order on Encouraging International Support for the Recovery and Use of Space Resources, 6 April 2020, Section 2.

⁶²Status of United Nations Convention on the Law of the Sea, as at 21 February 2022, available at treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXI-6&chapter=21&Temp=mtdsg3&clang=_en#1.

⁶³2021 Report of the Legal Subcommittee on its sixtieth session, UN Doc. A/AC. 105/1243 (2021), para. 184.

employed, the substantive rights and obligations may vary significantly. As Freeland pointed out, the meaning of CHM in the context of outer space should be determined by its use in the Moon Agreement itself.⁶⁴ An investigation into the drafting history of the Agreement shows that the substance of CHM in the Moon Agreement is indeed quite different from that in UNCLOS.

Forming a stark contrast to its categorical rejection of the Moon Agreement today, the US was an active advocate of CHM during the negotiation of the Agreement. It was the first to formally propose the application of CHM to the Moon,⁶⁵ although earlier than that Argentina did make a suggestion in the same line.⁶⁶ It actively defended this concept in the face of the Soviet Union's rejection that heritage as a civil law concept was inapplicable in outer space, and even co-sponsored UNGA Resolution 34/68 which commended the Agreement, requested the Secretary-General to open it for signature and ratification at the earliest possible date, and expressed the hope for the widest possible adherence to the Agreement.⁶⁷

US reversal of support also happened in the law of the sea, as the concept of CHM transformed in the negotiation of UNCLOS. Although the Moon Agreement was adopted earlier than UNCLOS, CHM had been proposed in the 1960s for the Area and the resources thereof by Dr. Arvid Pardo, then Ambassador of Malta to the United Nations.⁶⁸ This proposal gained international momentum by inclusion in UNGA Resolution 2749 of 1970,⁶⁹ of which the US voted in favour. But common ownership in itself is an abstract idea. The practical issue is access, on which states had quite different views. In this connection, the US, together with many other marine powers, voted against UNGA Resolution 2574D of 1969, which placed a moratorium on the exploitation of the resources in the Area pending the establishment of an international regime.⁷⁰ A decade later, the UNCLOS was concluded, vesting all rights in the resources of the Area in humankind as a whole,⁷¹ and establishing the Authority to act on behalf of them.⁷² The function of the Authority is primarily to 'organize and control activities in the Area, particularly with a view to administering the resources of the Area'.⁷³ Under this regime, resources of the Area shall be developed through the international administration. This is one of the fundamental characters whereby CHM is distinct from *res communis*, which are open for free access. As Pardo contemplated at the early stage of the Third United Nations Conference on the Law of the Sea (UNCLOS III), '[i]nternational administration of the commons and management of its resources for the common good distinguished the principle of common heritage from the existing traditional principle of the high seas as *res communis*'.⁷⁴ The regime in Part XI of the Convention was unacceptable to many industrial countries, who refrained from ratifying the UNCLOS. This did not change until the adoption of the 1994 Agreement Relating to the Implementation of Part XI of the UNCLOS (Implementation Agreement),

⁶⁴Freeland, *supra* note 24, at 26.

⁶⁵United States of America: working paper (A/AC.105/C.2(XI)/Working paper 12: 13 April 1972), in: 1977 Report of the Legal Sub-Committee on the Work of Its Sixteenth Session, UN Doc. A/AC.105/196 (1977), Ann. I, at 23.

⁶⁶Argentina: draft agreement on the principles governing activities in the use of the natural resources of the moon and other celestial bodies (A/AC.105/C.2/L.71 and Corr.1), initially presented to the Legal Sub-Committee in 1970, in: 1977 Report of the Legal Sub-Committee on the Work of Its Sixteenth Session, UN Doc. A/AC.105/196 (1977), Ann. I, at 21.

⁶⁷Moon Agreement, *supra* note 2.

⁶⁸UN General Assembly, 22nd Session: 1st Committee, 1515th meeting, UN Doc. A/C.1/PV.1515 (1967), para. 104.

⁶⁹Declaration of Principles Governing the Sea-Bed and the Ocean Floor, and the Subsoil Thereof, beyond the Limits of National Jurisdiction, UN Doc. A/RES/2749(XXV) (1970), para. 1.

⁷⁰Question of the reservation exclusively for peaceful purposes of the sea-bed and the ocean floor, and the subsoil thereof, underlying the high seas beyond the limits of present national jurisdiction, and the use of their resources in the interests of mankind, UN Doc. A/RES/2574(XXIV)A-D (1969).

⁷¹UNCLOS, Art. 136.

⁷²*Ibid.*, Art. 137, para. 2.

⁷³*Ibid.*, Art. 157, para. 1.

⁷⁴A. Pardo, 'Law of the Sea Conference – What Went Wrong', in R. L. Friedheim (ed.), *Managing Ocean Resources: A Primer* (1979), 137, at 139, cited in L. F. E. Goldie, 'A Note on Some Diverse Meanings of "The Common Heritage of Mankind"', (1983) 10 *Syracuse Journal of International Law and Commerce* 69, at 86–7.

which watered down the CHM significantly. States parties of the Implementation Agreement, while reaffirming the principle of CHM,⁷⁵ undertake to implement Part XI in accordance with the Agreement,⁷⁶ and recognize the prevalence of the Agreement over Part XI in the event of any inconsistency.⁷⁷ Even so, the US remains outside the UNCLOS.

The unsatisfactory experience of CHM in UNCLOS caused a heavy blow to the acceptance of the Moon Agreement, although, as to be demonstrated in Section 4.1, the CHM provisions in the two treaties have rather different implications on the access of resources. Soon after the conclusion of Moon Agreement, the question whether the US should sign and ratify the treaty elicited fierce debate in its Congress. By that time, the CHM in the negotiation of UNCLOS had developed, beyond what the US contemplated. On 30 October 1979, Senator Frank Church and Senator Jacob K. Javits addressed a joint letter to Secretary of State Cyrus R. Vance, expressing the concern that several aspects of the Moon Agreement could prove damaging to the national economic and security interests of the US.⁷⁸ Secretary Vance, in his replies dated 28 November, referred to Ambassador Richard W. Petree's statement in the UN on 1 November, which stated that the meaning of CHM for purposes of the Moon Treaty is 'to be found within the Moon Treaty itself, and 'without prejudice to its use or meaning in any other treaty'.⁷⁹ In a letter of 13 November 1979, Senator Richard Stone urged Secretary Vance to reevaluate the US position on the Moon Agreement.⁸⁰ Assistant Secretary of State J. Brain Atwood, when replying on behalf of Secretary Vance on 2 January 1980, expressed the view that '[t]he Law of the Sea experience with the common heritage concept, while relevant, would in no way be controlling regarding the negotiations of any such future agreement'.⁸¹ Leigh Retiner, Counsel of L-5, an active lobbying group against US signature of the Moon Agreement, proposed at the Congress hearings on 31 July 1980 that the signature should not happen unless the COPUOS concluded a protocol that defined CHM in a manner protective of US interests.⁸² This, of course, never happened.

The above statements reveal that within the US government there was strong scepticism against CHM. The CHM that the US supported in the negotiation of UNCLOS as well as that of the Moon Agreement was close to *res communis* featuring free access, never the UNCLOS version of today which restricts free access and incurs benefit sharing. The backlash on the ownership of natural resources in ABNJs in general is far-reaching. For instance, the Trump administration even expressly denied the 'global commons' status of outer space.⁸³ In the COPUOS, it has been expressed that references to CHM in the Moon Agreement were likely to be 'more distracting than helpful'.⁸⁴

The future negotiation with respect to resource activities in outer space should follow a pragmatic approach by avoiding the ownership issue while addressing the concrete issues, such as access, benefit sharing, and environmental protection. This pragmatic approach was actually adopted in the drafting of the Convention on the Regulation of Antarctic Mineral Resource Activities (CRAMRA). Despite of many proposals as such,⁸⁵ states chose not to be explicit on

⁷⁵1994 Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (Agreement Relating to the Implementation of Part XI of the UNCLOS), UN Doc. A/RES/48/263 (1994), 2nd preambular paragraph.

⁷⁶*Ibid.*, Art. 1(1).

⁷⁷*Ibid.*, Art. 2(1).

⁷⁸M. L. Nash, 'Contemporary Practice of the United States Relating to International Law', (1980) 74 AJIL 418, at 422.

⁷⁹*Ibid.*, at 423–4.

⁸⁰*Ibid.*, at 424–5.

⁸¹*Ibid.*, at 425.

⁸²L5 News: Moon Treaty Hearings', NSS, available at www.space.nss.org/l5-news-moon-treaty-hearings/.

⁸³Executive Order, *supra* note 61, Section 1. See also J. S. Goehring, 'Why Isn't Outer Space a Global Commons?', (2021) 11 *Journal of National Security Law & Policy*, at 573, which makes a distinction between an enabling concept used in military or geopolitical contexts and a constraining concept used in economic contexts.

⁸⁴2017 Report of the Legal Subcommittee on its fifty-sixth session, *supra* note 50, para. 227.

⁸⁵UN Doc. A/37/PV.10 (1982), 37th Sess., 10th Mtg., at 17; UN Doc. A/C.1/38/PV.42(1983), 38th Sess., 1st Comm., Summary Record of the 42nd Mtg., at 20.

who owns the resources, but to go into the issues of managing body, priority rights, benefit distribution, and environmental protection directly. For instance, the CRAMRA contemplates the establishment of the Antarctic Mineral Resources Commission,⁸⁶ whose functions include the management of Antarctic mineral resource activities, environmental protection, budgetary and financial regulations, etc.⁸⁷ There is no reason why this pragmatic approach cannot be followed in space.

4. Access

4.1 Freedom of exploitation of abiotic resources in outer space

The OST provides that outer space ‘shall be free for exploration and use by all States without discrimination of any kind and on a basis of equality and in accordance with international law . . .’.⁸⁸ In the exchange of views at COPUOS, disagreement arose between states as to whether the term ‘exploration and use of outer space’ comprises the exploitation of abiotic resources therein.⁸⁹ This question cannot be resolved by a plain reading of the term in its context.⁹⁰

In the negotiation of OST, the French delegate raised the question whether the term ‘use’ implied ‘use for exploration purposes, such as the launching of satellites’, or meant ‘use in the sense of exploitation, which would involve for more complex issues’.⁹¹ Unfortunately, the question elicited little response from other states. The representative of the Soviet Union said:

a treaty could deal only with the problems arising at the current stage of human evolution, and future developments would give rise to new problems requiring subsequent solution. But it would be unwise to look too far ahead and to attempt to prescribe rules for situations on which it was impossible to form adequate judgment at the present stage.⁹²

It is, thus, clear that the freedom of exploration and use of outer space was not meant to explicitly authorize the exploitation of abiotic resources in space. Nevertheless, the freedom has been evolving in scope over time. This is contingent upon state practice, which may form ‘subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation’.⁹³ As the ILC pointed out, ‘[t]he importance of such subsequent practice in the application of the treaty, as an element of interpretation, is obvious; for it constitutes objective evidence of the understanding of the parties as to the meaning of the treaty’.⁹⁴ Besides, state practice, if fulfilling the material and mental elements, may lead to the creation of a customary rule.⁹⁵

⁸⁶CRAMRA, Art. 18(1).

⁸⁷*Ibid.*, Art. 21(1).

⁸⁸Outer Space Treaty, *supra* note 1, Art. I.

⁸⁹2018 Report of the Legal Subcommittee on its fifty-seventh session, UN Doc. A/AC.105/1177 (2018), paras. 237–8; 2019 Report of the Legal Subcommittee on its fifty-eighth session, *supra* note 60, para. 252.

⁹⁰1969 Vienna Convention on the Law of Treaties (VCLT), Art. 31, paras. 1, 2.

⁹¹COPUOS, Legal Sub-Committee, Fifth Session, Summary Record of the Sixty-Third Meeting, 20 July 1966, UN Doc. A/AC.105/C.2/SR.63 (1966). See also Official Record of the General Assembly, Twenty-First Session, First Committee, 1492nd Meetings, 17 December 1966, UN Doc. A/C.1/SR/ 1492 (1966), at 430, para. 22.

⁹²COPUOS, *ibid.*, paras. 10, 11.

⁹³VCLT, Art. 31, para. 3(b).

⁹⁴ILC, *Yearbook of the International Law Commission* (1966), Vol. II, at 241, para. 15.

⁹⁵Statute of the International Court of Justice, Art. 38(1)(b). See also *North Sea Continental Shelf*, *supra* note 41, at 44, para. 77; *Continental Shelf (Libyan Arab Jamahiriya/Malta)*, Judgment of 3 June 1985, [1985] ICJ Rep. 13, at 29–30, para. 27; *Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States of America)*, Merits, Judgment of 21 June 1986, [1986] ICJ Rep. 14, at 97–8, para. 184; *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion of 8 July 1996, [1996] ICJ Rep. 226, at 253, para. 64.

4.1.1 Freedom of exploitation of abiotic resources in outer space as a clear trend

The exploitation of abiotic resources in space as a freedom of exploration and use of outer space is championed by some countries. Some of them have enacted domestic legislations to this effect. In 2015, the US congress passed the Commercial Space Launch Competitiveness Act, which stipulates that:

[a] United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligation of the United States.⁹⁶

This legislation appears to be in line with US practice regarding mineral exploitation in other ABNJs. The US Department of State, while rejecting the assertion of exclusive mining rights over a deposit of minerals in the deep seabed by Deepsea Ventures, Inc. in 1974, continued to state that ‘the mining of the seabed beyond the limits of national jurisdiction may proceed as a freedom of the high seas under existing international law’.⁹⁷ The Convention on the High Seas in force at that time did not explicitly provide for mineral exploitation as a freedom of the high seas. The US likely took it as falling within ‘others which are recognized by the general principles of international law’.⁹⁸ This is reiterated in the 1980 Deep Seabed Hard Mineral Resources Act,⁹⁹ which comprises a licensing regime for exploration and commercial recovery activities of mineral resources in the deep seabed by those the US has jurisdiction.¹⁰⁰

Some other states have followed suit. In 2017, Luxembourg enacted its Law on the Exploration and Use of Space Resources, which provides that ‘[l]es ressources de l’espace sont susceptibles d’appropriation’ (‘Space resources are capable of being owned’).¹⁰¹ In 2019, the UAE became the third country to legislate on space mining. Although its legislation is not so explicit as those of the US and Luxembourg on the appropriability of space resources, this is a presumption in the provision that:

... the terms and conditions relating to Authorization for the extraction, exploitation and utilization of Space Resources, including their ownership, purchase, sale, trade, transportation, storage and any Space Activities aimed at providing logistical services in this regard shall be determined by a Decision issued by the Council of Ministers or whomever it delegates.¹⁰²

Japan’s Space Resources Act of 2021 also provides that the person who obtains a permit to pursue space resources extraction activities owns the resources exploited in accordance with the business activity plan attached to and approved together with the application for a permit.¹⁰³

The number of states advocating the freedom of exploitation of abiotic resources in space is small. Those with domestic legislations to the effect are even less. It is against this backdrop that the *Executive Order on Encouraging International Support for the Recovery and Use of Space Resources (Executive Order)* was issued by the former administration of the US on 6 April 2020. The *Executive Order*, while reiterating that ‘Americans should have the right to engage

⁹⁶US Commercial Space Launch Competitiveness Act, § 51303.

⁹⁷International Legal Materials, Vol. XIV-No.1, January 1975.

⁹⁸1958 Convention on the High Seas, Art. 2.

⁹⁹Deep Seabed Hard Mineral Resources Act, *supra* note 47, § 1402.

¹⁰⁰*Ibid.*

¹⁰¹*Loi du 20 juillet 2017 sur l’exploration et l’utilisation des ressources de l’espace*, Art. 1.

¹⁰²Federal Law No. 12 on the Regulation of the Space Sector, at 111.

¹⁰³Act on Promotion of Business Activities Related to the Exploration and Development of Space Resources, Art. 5.

in commercial exploration, recovery, and use of resources in outer space, consistent with applicable law', stated that 'it shall be the policy of the United States to encourage international support for the public and private recovery and use of resources in outer space, consistent with applicable law'.¹⁰⁴ It also directed the Secretary of State to 'take all appropriate actions to encourage international support for the public and private recovery and use of resources in outer space', and to 'seek to negotiate joint statements and bilateral and multilateral arrangements with foreign states regarding safe and sustainable operations for the public and private recovery and use of space resources'.¹⁰⁵ These measures were aimed to garner wider state practice in support of the freedom of mineral exploitation in space.

The Artemis program, by which the US National Aeronautics and Space Administration (NASA) aims to build sustainable elements on and around the Moon, provides an opportunity for the US to promote 'international support for the public and private recovery and use of resources in outer space' as guided by the *Executive Order*. The Artemis Accords, which embrace a set of principles to guide co-operation among nations participating in the program, have now been signed by 20 states, i.e., Australia, Bahrain, Brazil, Canada, Colombia, France, Israel, Italy, Japan, the Republic of Korea, Luxembourg, Mexico, New Zealand, Poland, Romania, Singapore, Ukraine, UAE, the UK, and the US. With respect to the status of abiotic resources in space, the Artemis Accords affirms that 'the extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty'.¹⁰⁶ The same position was held by the Hague Working Group, which in its Building Blocks proposed that '[t]he international framework should ensure that resource rights over raw mineral and volatile materials extracted from space resources, as well as products derived therefrom, can lawfully be acquired through domestic legislation, bilateral agreements and/or multilateral agreements'.¹⁰⁷ It also proposed that '[t]he international framework should enable the mutual recognition between States of such resource rights'.¹⁰⁸ With the Artemis program open to America's like-minded partners,¹⁰⁹ China and Russia have jointly initiated the International Lunar Research Station (ILRS).¹¹⁰ They have been working on a Declaration setting out principles for the establishment of and international co-operation on the ILRS. With the Declaration yet to be released, it remains to be seen how far it would go on the status of abiotic resources in space.

The above state practice with respect to the freedom of exploiting abiotic resources in space constitutes 'subsequent practice in the application of' Article I of OST. While deriving from a liberal interpretation of the provision, they reinforce the liberal interpretation conversely. Due to the sparsity of practice, it is too early to claim an agreement has been established among the parties of OST on the liberal interpretation. But this is clearly the trend. This trend is in line with the object and purpose of OST to pursue 'the great prospects opening up before mankind as a result of man's entry into outer space'.¹¹¹ It would not only secure the sustainable development on the Earth, but also provide support to humankind's settlement on other planets. Of course, precautions should always be taken to prevent the spoiling and depletion of resources on the Earth despite the ongoing exploitation of resources on other planets. In this process which is bound to benefit the development of humankind, it is important to secure the legal certainty that

¹⁰⁴Executive Order, *supra* note 61.

¹⁰⁵*Ibid.*

¹⁰⁶Artemis Accords, *supra* note 48, Section 10, para. 2.

¹⁰⁷Hague Working Group Building Blocks, *supra* note 6, at 8.1.

¹⁰⁸*Ibid.*, at 8.2.

¹⁰⁹C. Pace, 'Space Exploration and the Artemis Accords', 20 November 2020, available at 2017-2021.state.gov/dipnote-u-s-department-of-state-official-blog/space-exploration-and-the-artemis-accords/index.html.

¹¹⁰CNSA & ROSCOSMOS, International Lunar Research Station (ILRS) Guide for Partnership (V 1.0), 16 June 2021, available at www.cnsa.gov.cn/english/n6465652/n6465653/c6812150/content.html.

¹¹¹Outer Space Treaty, *supra* note 1, Preamble, para. 1.

rewards to investment will be protected. As held by Pound, a jural postulate of civilized society is that:

... men must be able to assume that they may control, for purposes beneficial to themselves, what they have discovered and appropriated to their own use, what they have created by their own labor and what they have acquired under the existing social and economic order.¹¹²

However, ‘rewards’ to investment should be limited, in particular when it becomes enormous as the technology improves. This should be limited at the stage when the priority rights are granted and can be offset by benefit sharing, matters to be discussed in Section 4.2.

Also due to the sparsity of state practice, a customary rule for the freedom of mineral exploitation in space is in the process of crystallization at best, although unanimity is not always required for the practice to meet the material element of customary international law and the practice of ‘specially affected States’ should be given special weight.¹¹³ Efforts have been made to identify a permissive customary rule for the exploitation of abiotic resources in space, by recourse to state practice regarding the collection of extraterrestrial substance. Since the 1960s, several manned or unmanned missions have been conducted, by the US, the former Soviet Union, Japan, and more recently China, to collect and return to the Earth samples from the Moon and asteroids. For instance, NASA is recorded to have returned 2,415 lunar samples weighing a total of 842 pounds (382 kilograms). These materials are considered a National Treasure, and goodwill gifts were presented to 135 states.¹¹⁴ The collection of extraterrestrial samples has never encountered protests, and the gifts of samples were accepted with gratitude. It is, thus, argued that a customary rule has come into existence permitting the free exploitation of abiotic resources in space.¹¹⁵

Proponents of the above argument neglect the novel distinction between scientific research and mineral exploitation, in terms of scale and purpose.¹¹⁶ In other ABNJs, scientific research and resource exploitation are usually regulated separately. In the high seas, fishing and marine scientific research are two separate freedoms.¹¹⁷ In the Area, both the Authority and states parties may carry out marine scientific research;¹¹⁸ all rights in the resources thereof are vested in mankind as a whole, on whose behalf the Authority shall act.¹¹⁹ The freedom of scientific investigation in Antarctica is recognized under the Antarctic Treaty,¹²⁰ while mineral exploitation is explicitly prohibited by the Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol).¹²¹ The distinction between scientific research and mineral exploitation is, as a matter of fact, implicit in OST. The former is highlighted as a special form of ‘exploration and use of outer

¹¹²R. Pound, *An Introduction to the Philosophy of Law* (1922), at 192.

¹¹³*North Sea Continental Shelf*, *supra* note 41, at 43, para. 74. See also ILC, ‘Identification of customary international law’, in Report of the International Law Commission, Sixty-eighth session (2 May–10 June, 4 July–12 August 2016), at 120, Conclusion 8, para. 1; at 136–7; at 136, fn. 715.

¹¹⁴R. Z. Pearlman, ‘NASA Busts Woman Selling \$1.7M Moon Rock’, *SPACE.com*, 26 May 2011, available at www.space.com/11804-nasa-moon-rock-sting-apollo17.html.

¹¹⁵Letter from H. R. Hertzfeld, M. Schaefer, J. C. Bennett and M. J. Sundahl commenting on Professor Joanne Gabrynowicz’s letter, dated 15 May 2015, in Congressional Recording on Spurring Private Aerospace Competitiveness and Entrepreneurship Act of 2015 (21 May 2015), H3518–9; J. E. Dunstan, ‘Toward a Unified Theory of Space Property Rights: Sometimes the Best Way to Predict the Weather Is to Look Outside’, in E. L. Hudgins (ed.), *Space: The Free Market Frontier* (2002), 223, at 229; S. Coffey, ‘Establishing a Legal Framework for Property Rights to Natural Resources in Outer Space’, (2009) 41 *CaseWResJIntlL* 119, at 126.

¹¹⁶Su, *supra* note 30, at 1004–5.

¹¹⁷UNCLOS, Art. 87, para. 1.

¹¹⁸*Ibid.*, Art. 143, paras. 2, 3.

¹¹⁹*Ibid.*, Art. 137, para. 2.

¹²⁰Antarctic Treaty, Art II.

¹²¹1991 Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol), Art. 7.

space'.¹²² The latter, as concluded above, is not expressly addressed in OST. States refrain from protesting the collection of lunar and asteroid samples, probably believing that such activities fell within the ambit of scientific investigation and were carried out on behalf of the humanity as a whole. The latter is not illusion, given that the flags of other states were flown on the Apollo manned lunar landing missions. These flags then accompanied the sample gifts given by NASA,¹²³ making the recipient state even more reluctant to lodge a protest. It is, thus, farfetched to infer the freedom of large-scale mineral exploitation from the practice of sample collection, although it may form an initial step leading to, thus serving the purpose of, mineral exploitation. Ultimately, it would be rather absurd for a state to find itself suddenly bound by a legal rule which is starkly different from what it understood and consented to.

One may also argue for the freedom of mineral exploitation, under the Moon Agreement, as an incidental right of the freedom of scientific investigation.¹²⁴ Article 6 of the Agreement provides 'States Parties may in the course of scientific investigations also use mineral and other substances of the Moon in quantities appropriate for the support of their missions.'¹²⁵ With the term 'quantities appropriate for' broadly interpreted as 'quantities needed to', it is held that '[s]ince, over time, the nature and extent of such investigations may be far-ranging, this provision will allow for very substantial uses of natural resources'.¹²⁶ The crux lies in the scope of 'use for the support of scientific investigations', whether it is limited to the investigation phase, normally in the form of sample collection, or also extends to the commercial exploitation to 'fund' scientific investigations. The latter interpretation would allow substantial exploitation as scientific investigations in outer space are quite expensive.

The same question arose in the *Whaling in the Antarctic* case, when Japan argued that the sale of whale meat to fund research is allowed by Article VIII, paragraph 2 of the International Convention on the Regulation of Whaling (ICRW),¹²⁷ which provides that '[a]ny whales taken under these special permits shall so far as practicable be processed and the proceeds shall be dealt with in accordance with directions issued by the Government by which the permit was granted'.¹²⁸ The Court said:

... the fact that a programme involves the sale of whale meat and the use of proceeds to fund research is not sufficient, taken alone, to cause a special permit to fall outside Article VIII. Other elements would have to be examined, such as the scale of a programme's use of lethal sampling, which might suggest that the whaling is for purposes other than scientific research. In particular, a State party may not, in order to fund the research for which a special permit has been granted, use lethal sampling on a greater scale than is otherwise reasonable in relation to achieving the programme's stated objectives.¹²⁹

Here, the Court implicitly made a distinction between the sale of whale meat 'incidental to' the killing of whales for the purpose of scientific research, and the killing and sale of whale meat 'in the name of' scientific research. Although the Court did not oppose the selling of whale meat from

¹²²Outer Space Treaty, *supra* note 1, Art. I. See also N. M. Matte (ed.), *Space Activities and Emerging International Law* (1984), at 261.

¹²³E.g., on the sample gifted to New Zealand, it is inscribed: 'This flag of your nation was carried to the Moon and back by Apollo 11, and this fragment of the Moon's surface was brought to Earth by the crew of that first manned lunar landing.' See Museum of New Zealand Te Papa Tongarewa at www.collections.tepapa.govt.nz/object/64368.

¹²⁴2019 Report of the Legal Subcommittee on its fifty-eighth session, *supra* note 60, para. 253.

¹²⁵Moon Agreement, *supra* note 2, Art. 6.

¹²⁶Christol, *supra* note 31, 465–6.

¹²⁷*Whaling in the Antarctic (Australia v Japan; New Zealand intervening)*, Judgment of 31 March 2014, [2014] ICJ Rep. 226, at 259, para. 92.

¹²⁸1946 International Convention on the Regulation of Whaling, Art. VIII, para. 2.

¹²⁹*Whaling in the Antarctic*, *supra* note 127, at 259–60, para. 94.

those necessary for scientific research, it clearly took it illegal to kill whales and sell the meat, beyond what was necessary for research, to fund the research. This distinction is instrumental in the determination whether there is an abuse of Article 6(2) of the Moon Agreement, which is easy to verify as scientific research usually only requires small samples, thus involving very little ‘incidental exploitation’ of mineral resources.

4.1.2 *The lack of a prohibition on the exploitation of abiotic resources in outer space*

In the modern international legal system predominated by positivism, any restriction on states shall be interpreted narrowly. As the PCIJ found in the *Lotus* case, ‘[t]he rules of law binding upon States . . . emanate from their own free will . . . Restrictions upon the independence of States cannot therefore be presumed.’¹³⁰ The loose interpretation of this dictum, i.e., to the effect that what is not prohibited is permitted, has been put in question.¹³¹ But between the presumption of prohibition and that of freedom, it is the latter that conform to the reality of state practice in the case of *non liquet*. Therefore, the baseline approach to outer space is a general freedom, which can only be limited by international consensus, and there is no explicit prohibition of commercial exploitation to start with.¹³²

The non-appropriation principle codified in Article II of OST, as discussed in Section 2.1, only prohibits territorial sovereignty in outer space. That this principle does not prohibit the exploitation of abiotic resources in space also finds support in the fact that the Moon Agreement, while containing at least the same, if not more stringent, prohibition against national appropriation as the OST, comprises rules regulating resource activities on the Moon.¹³³ In the exchange of views in COPUOS, the assertion that the exploitation of abiotic resources in space fell within the scope of non-appropriation was rarely made and has waned gradually.¹³⁴ Having said that, the exploitation is permitted not simply because it is not prohibited.¹³⁵ Rather, it is to derive from the freedom of exploration and use of outer space. In addition, it is without prejudice to the application of certain limits on the enjoyment of this freedom.

A caveat exists, however, with respect to the definition of celestial bodies. In the preceding discussion, celestial bodies and abiotic resources therein are regarded as having different status. This binary perspective may not apply to small asteroids and comets, as to exploit the abiotic resources therein would result in the consumption of the whole celestial body, tantamount to its appropriation in effect. No definition of celestial bodies is provided in any of the five UN treaties relating to outer space. Although it was acknowledged, in the scientific circle at the time when the OST was negotiated, that the size of celestial bodies varies significantly,¹³⁶ the legal definition may not comprise all natural bodies found in space irrespective of their size. It is normal for a legal term to depart from the physical counterpart, an example being continental shelf which transcended the physical criteria of ‘natural prolongation’ to also comprise the element of distance.¹³⁷ Lachs, writing in 1972, said that:

¹³⁰SS *Lotus* case (*France v. Turkey*), PCIJ Rep Series A No.10, at 18.

¹³¹A. Hertogen, ‘Letting Lotus Bloom’, (2015) 26 *European Journal of International Law* 901.

¹³²F. von der Dunk, ‘The US Space Launch Competitiveness Act of 2015’, *JURIST*, 30 November 2015, available at www.jurist.org/commentary/2015/11/frans-vonderdunk-space-launch/.

¹³³2018 Report of the Legal Subcommittee on its fifty-seventh session, *supra* note 89, para. 260. See also D. Zannoni, ‘The Dilemma Between the Freedom to Use and the Proscription against Appropriating Outer Space and Celestial Bodies’, (2020) 19 *Chinese Journal of International Law* 329, at 338–41.

¹³⁴2017 Report of the Legal Subcommittee on its fifty-sixth session, *supra* note 50, para. 241.

¹³⁵Cf. Board of Directors of the International Institute of Space Law (IISL), ‘Position Paper on Space Resource Mining’, 20 December 2015, available at www.iislweb.space/wp-content/uploads/2020/01/SpaceResourceMining.pdf, at 3.

¹³⁶Su, *supra* note 30, at 997.

¹³⁷UNCLOS, Art. 76(1).

in the present state of man's knowledge there is little that can serve as a basis for any distinction between a natural or physical definition of a celestial body, on the one hand, and a legal definition on the other.¹³⁸

Little progress has been made ever since on the legal definition of celestial bodies, due to the lack of practical need to resolve this issue. As space mining comes closer to the reality, the definition of celestial bodies has become an issue calling for resolution.

Even the Moon Agreement, leaving aside for now its limited number of states parties, does not place a moratorium on the unilateral exploitation of abiotic resources on the Moon.¹³⁹ Article 11 of the Agreement prohibits property claims over natural resources *in place* on the Moon, i.e., those in their original state before recovery. As discussed in Section 2.2, this provision prohibits property claims over natural resources *in place* on the Moon, like those enjoyed by coastal states in the EEZ and the continental shelf. The term 'in place', according to Christol, was proposed by the US to 'make sure that the prohibition against the assertion of property right would not apply to moon rocks and other natural resources when they were reduced to the possession of the exploiter'.¹⁴⁰ Mr. Hosenball, then head of the US delegation to COPUOS, explicitly denied the moratorium interpretation upon conclusion of the Moon Agreement.¹⁴¹ This position was upheld by the US Administration in response to domestic concerns with regard to the 'de facto moratorium' effect of the Agreement on resource-related activities in outer space.¹⁴² Then Secretary of State Cyrus R. Vance's reply to Senators Church and Javits was but one example:

In regard to the important matter of the exploitation of the natural resources of the moon and other celestial bodies, the Treaty contains no moratorium on exploitation and, in fact, has provisions designed to facilitate and encourage such exploitation. For example, Article XI(3) of the Moon Treaty makes clear that although the 1967 Outer Space Treaty provides that "Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means," this "non-appropriation" principle applies to the natural resources of celestial bodies only when such resources are "in place." Thus Article XI(3) would permit ownership to be exercised by States or private entities over those natural resources which have been removed from their "place" on or below the surface of the moon or other celestial bodies.¹⁴³

The Soviet Union, which rejected the idea of CHM in a categorical manner initially, accepted it when developing countries gave up imposing such a moratorium.¹⁴⁴ The no-moratorium interpretation is also in line with the object and purpose of the Agreement, which in its Preamble underlines 'the benefits which may be derived from the exploitation of the natural resources of the Moon and other celestial bodies',¹⁴⁵ as a moratorium would discourage the research and development of technologies. The exploitation is bound to benefit humankind as a whole,

¹³⁸Lachs, *supra* note 18, at 44.

¹³⁹Cf. G. Oduntan, 'Who Owns Space? US Asteroid-Mining Act Is Dangerous and Potentially Illegal', *The Conversation*, 25 November 2015, available at theconversation.com/who-owns-space-us-asteroid-mining-act-is-dangerous-and-potentially-illegal-51073, arguing that the Moon Agreement reflects customary international law and forbids states from engaging in commercial mining on celestial bodies until there is an international regime to govern such exploitation.

¹⁴⁰Christol, *supra* note 31, at 470–1.

¹⁴¹COPUOS, Verbatim Record of the Two Hundred and Third Meeting, Held at Headquarters, New York, UN Doc. A/AC.105/PV.203 (1979), at 22.

¹⁴²Nash, *supra* note 78, at 422–6.

¹⁴³*Ibid.*, at 422–3.

¹⁴⁴S. N. Hosenball, Statement, Subcommittee on Space Science and Applications, Committee on Science and Technology, US House of Representatives, 6 September 1979, at 6–7, cited in Christol, *supra* note 31, at 469.

¹⁴⁵Moon Agreement, *supra* note 2, Preamble, para. 5.

although the distribution of benefits in a wider range can only be realized by an international regime. In this regard, Christol wrote that the strategy behind the Agreement was to allow for exploitative activities despite an awareness of the fact that there would be extraordinary costs involved in returning substantial amounts of such resources to earth.¹⁴⁶ This liberal interpretation of Article 11(3) does not contradict the non-appropriation principle reiterated in Article 11(2), which as demonstrated above only pertains to territorial sovereignty.

As a matter of fact, the Moon Agreement was a victory for major space-faring countries amidst the New International Economic Order (NIEO) movement, which had the connotation that the Western countries 'have been blatantly immoral and should atone for their guilt by accepting the obligations of the new international economic order'.¹⁴⁷ Soon after the UNGA adopted Resolution 2754 imposing a moratorium on the exploitation of resources in the deep sea-bed in 1969,¹⁴⁸ developing countries embarked on new efforts to impose a similar moratorium on the Moon. At the time, there seemed to be two versions of CHM, one resembling the Roman concept of *res communis* featuring free access, the other prohibiting unilateral exploitation. While the former version was advocated by developed countries, it is the latter that prevailed in both UNCLOS and CRAMRA. CRAMRA, without mentioning CHM, prohibited Antarctic mineral resource activities outside the Convention.¹⁴⁹ By contrast, the CHM that found its way into the Moon Agreement was the version promoted by developed countries, one containing no moratorium on the exploitation of mineral resources on the Moon. Hence, it is fair to say that the Moon Agreement is consistent with the OST with respect to the right to recover and use natural resources on the Moon.¹⁵⁰

The above interpretation, which is largely made from the US perspective, is not without dispute.¹⁵¹ In the COPUOS, it was expressed that:

the unilaterally enacted national legislation of [the US] that protected private property rights in resources extracted from the Moon or any other celestial body represented a reversal of the negotiation position of that State at the time of the negotiation of the Moon Agreement in the Committee and its adoption by the General Assembly.¹⁵²

The US delegate, without going into its real position in the negotiation of the Moon Agreement, simply said this issue should be reviewed in accordance with its international treaty obligations.¹⁵³ The existence of different interpretations with respect to the possible moratorium effect of the Moon Agreement attest to the lack of a consensus to this effect. In the end, such a moratorium, even if it can be established, would not be very impactful due to the small number of states parties of the Moon Agreement. It is well possible that non-parties now find unilateral pledges made more than four decades ago, such as those above, contrary to their interest.

¹⁴⁶Christol, *supra* note 31, at 468.

¹⁴⁷H. G. Johnson, 'The New International Economic Order', Graduate School of Business, University of Chicago, Selected Papers, No.49, at 1, available at www.chicagobooth.edu/~media/0ABF9E91CCDB42C4BBA92737DCE91EEA.pdf.

¹⁴⁸Question of the reservation exclusively for peaceful purposes of the sea-bed, *supra* note 70, declaring that 'pending the establishment of [an] international regime: (a) States and persons, physical or juridical, are bound to refrain from all activities of exploitation of the resources of the areas of the sea-bed and ocean floor, and the subsoil thereof, beyond the limits of national jurisdiction; (b) No claim to any part of that area or its resources shall be recognized'.

¹⁴⁹CRAMRA, Art. 3.

¹⁵⁰Executive Order, *supra* note 61, Section 1.

¹⁵¹S. B. Rosenfield, 'The Moon Treaty: The United States Should Not Become a Party', (1980) 74 *ASIL Proceedings* 162, at 165–6; I. 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', (2019) 32 *Leiden Journal of International Law* 255, at 265–6; T. Cheney and C. J. Newman, 'Managing the Resource Revolution Space Law in the New Space Age', in R. J. Wilman and C. J. Newman (eds.), *Frontiers of Space Risk: Natural Cosmic Hazards & Societal Challenges* (2018), at 256–7.

¹⁵²2016 Report of the Legal Subcommittee on its fifty-fifth session, *supra* note 5, para. 75.

¹⁵³*Ibid.*, para. 76.

Another question, which is again without much impact at the practical level but should be raised only for the sake of completeness, is whether a moratorium would arise when the negotiation of an international regime is ongoing or runs into stagnancy. A negative view was expressed by Mr. Reis who represented the US in the LSC.¹⁵⁴ He also held that refusal by a state to accept such an international regime would not preclude that state or its nationals from exploiting the natural resources of the moon or other celestial bodies.¹⁵⁵ Such a position, if put to the extreme, would defeat the purpose of the lump sum deal of no-moratorium under Paragraph 3 of Article 11 of the Moon Agreement and the obligation of negotiating an international regime under Paragraph 5. As Mr. Hosenball pledged after denying the moratorium effect of Article 11:

This permits orderly attempts to establish that such exploitation is in fact feasible and practicable, by making possible experimental beginnings and, then, pilot operations, a process by which we believe we can learn if it will be practicable and feasible to exploit the mineral resources of such celestial bodies. My Government will, when and if these negotiations for such a regime are called for, under articles XI and XVIII, make every effort to see that the regime is successfully negotiated.¹⁵⁶

The same pledge was reiterated by Ambassador Richard W. Petree, then US Deputy Representative to the Security Council.¹⁵⁷ The need to negotiate an international regime further dissuaded the US from becoming a party.¹⁵⁸

4.2 The need of an international regime for mineral activities in outer space

The Moon Agreement envisages the establishment of an international regime to govern the exploitation of the natural resources of the Moon 'as such exploitation is about to become feasible'.¹⁵⁹ Such a moment cannot be said to have arrived, as the technical feasibility and economic sustainability of extraterrestrial mineral extraction await to be proved. But it is at least time to initiate discussion of the significant issues to be encountered, such as international co-ordination and benefit sharing. Note that the international regime of deep seabed mining was established decades before it became feasible. In fact, the states parties of the Moon Agreement have already started the discussions.¹⁶⁰

4.2.1 International co-ordination of mineral activities in outer space

The need of an international regime for mineral activities in outer space will primarily stem from the potential conflicts between entities conducting such activities if the *laissez-faire* approach is followed. The risk of conflict is high when the resource in question is subject to competing acquisition. In contrast to the assumption of *res communis* that they were inexhaustible and consequently their consumption was non-rivalry, today many resources in ABNJs have become increasingly limited. The surface of the Moon, with a size equivalent to the African continent, may become congested as an increasing number of lunar bases are established, especially in its polar regions where water ice concentrates.

¹⁵⁴H. Reis, Press Release USUN-37(73), P.5, 19 April 1973, cited in Christol, *supra* note 31, at 462–3.

¹⁵⁵Nash, *supra* note 78, at 426.

¹⁵⁶COPUOS, Verbatim, *supra* note 141, at 22.

¹⁵⁷Nash, *supra* note 78, at 424–5.

¹⁵⁸Rosenfield, *supra* note 151, at 164.

¹⁵⁹Moon Agreement, *supra* note 2, Art. 11, para. 5.

¹⁶⁰Report of the Legal Subcommittee on its fifty-fifth session, *supra* note 5, para. 82.

Domestic licensing regimes are insufficient to the end of avoiding potential conflicts. On the contrary, they may aggravate it. In the context of deep seabed mining, although the US maintains a domestic regime for the exploration and exploitation of mineral resources in the Area,¹⁶¹ it has clarified that a license under the Act ‘gives the holder the exclusive right to explore a specific area, but only as against other US entities’ and the US would need to accede to the UNCLOS for the license to be afforded international recognition and security of tenure.¹⁶² In practice, some US nationals have incorporated subsidiaries in states parties of the UNCLOS so that they can participate in the deep seabed mining within UNCLOS.¹⁶³ This attests to the limit of the *laissez-faire* approach whereby each state adopts its own licensing regime for the extraction of abiotic resources in ABNJs.

Existing international law contains general principles for the deconfliction of activities in outer space. Article IX of OST provides that states parties shall ‘conduct all their activities in the outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty’.¹⁶⁴ It also sets out a mechanism of prior consultation to avoid harmful interference. The Moon Agreement, on the other hand, did not go further than setting out main purposes of the international regime to be established, namely orderly and safe development, rational management, expansion of opportunities in the use, and equitable sharing of benefits.¹⁶⁵

As a means of deconfliction, the idea of ‘safety zone’ has been proposed by NASA and the Hague Working Group.¹⁶⁶ This is not a new idea. It has been employed in other open areas such as the Exclusive Economic Zone (EEZ), the high seas, and the Area. In the EEZ, the coastal state has, among others, the jurisdiction with regard to the establishment and use of artificial islands, installations and structures.¹⁶⁷ Around such artificial islands, installations and structures, the coastal state has the right to establish reasonable safety zones ‘in which it may take appropriate measures to ensure the safety both of navigation and of the artificial islands, installations and structures’.¹⁶⁸ In the Area, safety zones shall be established around installations used for carrying out activities there ‘to ensure the safety of both navigation and the installation’.¹⁶⁹ Around scientific research installations, which may be deployed and used in any area of the marine environment, safety zones may be created too.¹⁷⁰

The application of safety zones in the sea is aimed to guarantee the safe and orderly conduction of concurrent utilizations of the sea. Navigation is the primary utilization to be balanced against what the safety zone is established for. These utilizations are given equal importance and shall be respected mutually. For instance, the breadth of safety zones established in the EEZ shall not exceed a distance of 500 metres measured from each point of the outer edge although some flexibility is possible.¹⁷¹ In addition, such safety zones shall be respected by all ships,¹⁷² and ‘may not be

¹⁶¹Deep Seabed Hard Mineral Resources Act, *supra* note 47, §1401–1473.

¹⁶²J. Dingwall, ‘Commercial Mining Activities in the Deep Seabed beyond National Jurisdiction: the International Legal Framework’, in C. Banet (ed.), *The Law of the Seabed: Access, Uses, and Protection of Seabed Resources* (2020), 139, at 153–4, citing US Department of Commerce, NOAA, Deep Seabed Mining: Approval of Exploration License Extensions (7 September 2017) Vol. 82, Issue 172 FR 42327, 42328; and US Department of Commerce, NOAA, Deep Seabed Mining – A Report to Congress (December 1995) I, available at www.gc.noaa.gov/documents/gcil_dsm_1995_report.pdf.

¹⁶³*Ibid.*

¹⁶⁴Outer Space Treaty, *supra* note 1, Art. IX.

¹⁶⁵Moon Agreement, *supra* note 2, Art. 11, para. 7.

¹⁶⁶Artemis Accords, *supra* note 48, Section 11; Hague Working Group Building Blocks, *supra* note 6, at 11.3.

¹⁶⁷UNCLOS, Art. 56, para. 1(b)(i).

¹⁶⁸*Ibid.*, Art. 60, para. 4.

¹⁶⁹*Ibid.*, Art. 147, para. 2I.

¹⁷⁰*Ibid.*, Art. 260.

¹⁷¹*Ibid.*, Art. 60, para. 5.

¹⁷²*Ibid.*, para. 6.

established where interference may be caused to the use of recognized sea lanes essential to international navigation'.¹⁷³ Similarly, in the Area, '[t]he configuration and location of such safety zones shall not be such as to form a belt impeding the lawful access of shipping to particular maritime zones or navigation along international sea lanes',¹⁷⁴ and safety zones around scientific research installations shall be of a reasonable breadth not exceeding a distance of 500 metres, and all states shall ensure that such safety zones are respected by their vessels.¹⁷⁵ Thus, the regime of safety zones concretizes due regard, a reciprocal obligation applicable to different utilizations of the sea generally.¹⁷⁶ Forming a contrast to this, the Artemis Accords, while correctly invoking Article IX of OST as the legal basis for safety zones,¹⁷⁷ should have placed more emphasis on the reciprocal obligation of due regard rather than the unidirectional obligation of voiding harmful interference.¹⁷⁸ The Hague Working Group Building Blocks seems to take a more balanced approach, by providing that the free access to any area of outer space shall not be impeded by such safety measure.¹⁷⁹ While allowing the restriction of access for a limited period of time,¹⁸⁰ the Building Blocks also took it necessary to conduct appropriate international consultations in the case of overlapping safety zones and conflicts involving the freedom of access.¹⁸¹

Even if the reciprocal deficiency is remedied, the regime of safety zone in itself may not be sufficient for the co-ordination of mineral activities in outer space between different entities. The most straightforward question to be encountered is what preferential rights should be accorded to pioneer developers and on what basis. In other ABNJs such as the Area and Antarctica, sophisticated rules are stipulated whereby mineral activities are typically divided into three stages, i.e., prospecting, exploration, and exploitation, in which the subjects are subject to different levels of deconfliction measures in terms of exclusivity and privileges. For mineral activities in outer space, the Hague Working Group Building Blocks proposed:

The international framework should enable the attribution of priority rights to an operator to search for and/or recover space resources for a maximum period of time and a maximum area upon registration in an international registry, and provide for the international recognition of such priority rights. The attribution, duration, and the area of the priority right should be determined on the basis of the specific circumstances of a proposed space resource activity.¹⁸²

The term 'search for' here is ambiguous and may cover both prospecting and exploration. To accord operators engaged in the prospecting of resources preferential rights is unusual in other ABNJs. In the Area, for instance, prospecting may be conducted simultaneously by multiple prospectors in the same area or areas.¹⁸³ In Antarctica, it was contemplated that prospecting of mineral resources therein shall not require authorization by institutions of the CRAMRA,¹⁸⁴ and operators engaged in prospecting in the same general areas shall conduct their activities with due regard to

¹⁷³*Ibid.*, para. 7.

¹⁷⁴*Ibid.*, Art. 147, para. I(c).

¹⁷⁵*Ibid.*, Art. 260.

¹⁷⁶*Ibid.*, Arts. 56(2), 58(3), 60(3), 79(5), 87(2), 234. See also B. H. Oxman, 'The Principle of Due Regard', in ITLOS, *The Contribution of the International Tribunal for the Law of the Sea to the Rule of Law: 1996-2016* (2018), 108, arguing that due regard is now 'one of the great organizing principles of the law of the sea'.

¹⁷⁷Artemis Accords, *supra* note 48, Section 11, para. 3.

¹⁷⁸*Ibid.*, Section 11, para. 7.

¹⁷⁹Hague Working Group Building Blocks, *supra* note 6, at 11.3.

¹⁸⁰*Ibid.*

¹⁸¹*Ibid.*, at 11.4.

¹⁸²*Ibid.*, at 7.

¹⁸³UNCLOS, Ann. III, Art. 2(1)(c).

¹⁸⁴CRAMRA, Art. 37(2).

each other's rights.¹⁸⁵ In both areas, prospecting does not confer on the prospector any rights with respect to resources.¹⁸⁶ It is exploration and exploitation/development that are usually conducted in an exclusive manner. For this reason, they are usually subject to the approval of managing bodies, the Authority for the Area and the Regulatory Committee for Antarctica.¹⁸⁷ In case of competing applications for exploration in Antarctica, the applicants shall be invited to resolve the competition among themselves, by means of their own choice within a prescribed period, and if unresolved it shall be resolved by the Regulatory Committee.¹⁸⁸ Exploration does not confer exclusive rights of exploitation, but it does give the entity a priority. In addition, the rights of authorized exploration and development prevail the right of prospecting.¹⁸⁹

The above provisions for the Area and Antarctica offer valuable experience for the design of an international co-ordinating regime for mineral activities in outer space. In doing so, the features of resource activities in outer space should be taken into account, in particular how the prospecting of abiotic resources in space is different from that on the Earth. For instance, some researchers proposed the idea of 'astronomical prospecting' for the accurate determination of the orbits of Near-Earth Asteroids (NEAs) and a preliminary determination of their composition, thus reducing the need for *in situ* prospecting.¹⁹⁰ Such prospecting can be done on a non-exclusive basis. As it can be scaled to characterize all NEAs as they are discovered, it is inappropriate to accord priority rights to entities conducting them. However, when surveying satellites and rovers are used not only to determine the existence of minerals but also to conduct qualitative assessment of minerals there, the line between prospecting and exploration becomes blurred. The future international co-ordinating regime should grant priority rights that are commensurate to the labour spent. Pound's idea of rewarding investments should not be unlimited.

The future international co-ordinating regime should also be designed in such a way to avoid *de facto* monopoly of abiotic resources in space. The exercise of the freedom of exploration and use of outer space is inherently limited by the freedom itself, which is enjoyed by 'all States without discrimination of any kind'.¹⁹¹ As the space capability of states varies greatly, the over-exploitation by states with more advanced capability may create a *de facto* monopoly, and hinder the enjoyment of this freedom by late-coming states.¹⁹² There is even a risk that the very small number of subjects capable of carrying out mineral activities in space have *de facto* property over abiotic resources *in place* on celestial bodies, which this article has argued against so strongly. This concern is valid as the priority rights can be renewed repeatedly and a cartel can be easily formed between the very few exploiting subjects to split the available resources. The freedom of exploration and use should be interpreted as preventing the occurrence of such scenarios. In the words of Lachs, the law should 'refuse to sanction situations which may close the door to equal rights and benefits for all States in the future'.¹⁹³

Of course, this question shall not be divorced from the exhaustibility of abiotic resources in space. In principle, the freedom of exploitation should be subject to heavier limitations when the resource in question becomes limited. This is what has happened to the freedom of fishing in the high seas, which has come under increasing limitation by regional fisheries management organizations as they become limited. In the context of space, what stands at the two ends of the

¹⁸⁵*Ibid.*, Art. 37(4).

¹⁸⁶UNCLOS, Ann. III, Art. 2(2); CRAMRA, Art. 37(1).

¹⁸⁷UNCLOS, Ann. III, Art. 3; CRAMRA, Arts. 44, 53(1).

¹⁸⁸CRAMRA, Art. 45(5).

¹⁸⁹*Ibid.*, Art. 37(5).

¹⁹⁰M. Elvis et al., 'Astronomical Prospecting of Asteroid Resources', (2017) *European Planetary Science Congress*, Vol. 11, EPSC2017-94-1, 2017.

¹⁹¹Outer Space Treaty, *supra* note 1, Art. I.

¹⁹²2019 Report of the Legal Subcommittee on its fifty-eighth session, *supra* note 60, para. 254; 2018 Report of the Legal Subcommittee on its fifty-seventh session, *supra* note 89, para. 241.

¹⁹³Lachs, *supra* note 18, at 43.

exhaustibility scale are the Asteroid Belt between the Mars and the Jupiter, which seem to contain infinite mineral resources in the light of current technology, and the Moon and the Mars, whose resources are more limited. Of course, accessibility should also be taken into account. Asteroids coming close to the Earth are easier to access than those residing in the Asteroid Belt. Their exploitation should be encouraged before they drift away.

Therefore, a category-specific regime is plausible for the international co-ordination of mineral activities in outer space. The exploitation of asteroids, including NEAs with a narrow time window for access, should be subject to the ‘first come, first served’ principle to promote efficient use. On the other hand, abiotic resources on close planets, which are limited, should be partly reserved for late-coming states. A parallel regime resembling that for the Area is ideal for this purpose, but resistance from major space-faring countries is foreseeable. Innovation is needed to balance equality against efficiency. In this regard, some experience can be learned from the international regulations of radio frequencies and the Geostationary-Satellite Orbit (GSO). The International Telecommunication Union (ITU) recognizes that:

radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries.¹⁹⁴

The concept of ‘efficient, rational and cost-effective utilization’ is implemented through a ‘first come, first served’ procedure, while a certain amount of frequency spectrum is set aside for future use by all countries, particularly those which are not in a position, at present, to make use of these resources.¹⁹⁵ In order to promote efficient use, a 7-year limit is applied to ‘bring into use’ successful applications.¹⁹⁶ The ITU now also requires that the majority of slots applied for must be used directly by the country requesting the slots.¹⁹⁷ In a word, equality must be afforded an opportunity, but should not undermine efficiency in an undue manner.

4.2.2 *The need to revive the obligation of benefit sharing*

The obligation of benefit sharing is another element of CHM which distinguishes it from the Roman concepts of *res communis* and *res nullius*. Accordingly, developing countries ask for a portion of the direct revenues deriving from the exploitation of resources in ABNJs.

On benefit-sharing, the OST only explicitly goes as far as the sharing of results of activities conducted in outer space, to the greatest extent feasible and practicable.¹⁹⁸ Article I lays down the general obligation that the exploration and use of outer space ‘shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind’.¹⁹⁹ Whether this provision incurs the obligation of benefit sharing is a matter of dispute. Some even doubt the possibility of complying with, or to verify compliance with this provision given the broadness of the terms used therein.²⁰⁰

¹⁹⁴Constitution of the International Telecommunication Union, Art. 44(2).

¹⁹⁵ITU Radio Regulatory Framework for Space Services, available at www.itu.int/en/ITU-R/space/snl/Documents/ITU-Space_reg.pdf.

¹⁹⁶Radio Regulations, Art. 11.

¹⁹⁷C. R. Buxton, ‘Property in Outer Space: The Common Heritage of Mankind Principle vs. The First in Time, First in Right, Rule of Property’, (2004) 69 *Journal of Air Law and Commerce* 689, at 703–4.

¹⁹⁸Outer Space Treaty, *supra* note 1, Art. XI.

¹⁹⁹*Ibid.*, Art. I.

²⁰⁰S. Freeland, ‘The Role of “Soft Law” in Public International Law and its Relevance to the International Legal Regulation of Outer Space’, in I. Marboe (ed.), *Soft Law in Outer Space: The Function of Non-binding Norms in International Space Law* (2012), 9, at 20.

At the COPUOS, some delegations expressed that developing countries were not to be excluded from the benefits of space exploration and their rights were to be considered,²⁰¹ and benefits were to be enjoyed by all states and peoples.²⁰² This is not without challenge. A contrary view can be advanced that to reap the benefits of the exploitative activity is ‘inherently unfair’.²⁰³ Some also observed that to reap such benefits neither ‘provides an incentive for technologically advanced nations to conduct expeditions’, nor provides incentive for less-developed nations to develop technology or fund exploration.²⁰⁴ As a legal obligation, benefit sharing only arises from the explicit consent of states.

Even the Moon Agreement, which addresses natural resources of the Moon explicitly, does not contain a benefit sharing mechanism. It only provides for, as one of the main purposes of the international regime to be established,

[a]n equitable sharing by all States Parties in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the Moon, shall be given special consideration.²⁰⁵

This provision speaks of ‘equitable’, rather than ‘equal’ sharing of benefits. While the latter means equivalent or identical distribution of financial and economic benefits, the former means distribution proportionate to the economic, scientific, or technological effort put forth by each state.²⁰⁶ Therefore, the Moon Agreement does not envisage a one-sided approach for the benefit of developing countries, but seeks a balance between investing and non-investing states parties.²⁰⁷ Of course, distribution solely by labour is not always equitable. It may lead to a situation that many states remain empty-handed for not being able to put in any effort in extracting mineral resources in outer space. In this regard, Article 11(7) of the Moon Agreement also requires that special consideration be given to the interests and needs of the developing countries. It is thus also fair to say that the Agreement does not envisage a one-sided approach for the benefit of space-faring countries either.

The obligation of equitable benefit sharing did not form an obstacle to the endorsement of the Moon Agreement by space powers. Mr. Hosenball, while pledging to negotiate an international regime, acknowledged that the no-moratorium was ‘part of the compromises made by many delegations’.²⁰⁸ By the time, equitable sharing of benefits was accepted as one of the main purposes of the regime to be established, which in turn formed part of the compromises. In the last few decades however, this obligation has come under growing criticism. Concerns have been expressed that the new international regime to be established would potentially be predominated by developing countries which outnumber and can outvote developed countries, thus being able to impose the obligations of technology transfer and payment of international taxes on the latter.²⁰⁹ These are regarded as ‘unwise business decisions’ made by nations that ‘do not bear any risk’.²¹⁰ Of course, there was no uniform view among the delegations, when the Moon Agreement was

²⁰¹2017 Report of the Legal Subcommittee on its fifty-sixth session, *supra* note 50, para. 229.

²⁰²*Ibid.*, para. 238.

²⁰³Buxton, *supra* note 197, at 693.

²⁰⁴*Ibid.*

²⁰⁵Moon Agreement, *supra* note 2, Art. 11, para. 7.

²⁰⁶Buxton, *supra* note 197, at 695.

²⁰⁷Freeland, *supra* note 24, at 27.

²⁰⁸COPUOS, Verbatim, *supra* note 141, at 22.

²⁰⁹K. V. Cook, ‘The Discovery of lunar Water: An Opportunity to Develop a Workable Moon Treaty’, (1999) 11 *Geo. Int’l Envi’t L. Rev.* 647, at 667.

²¹⁰Coffey, *supra* note 115, at 128, citing the view of 4Frontiers Corporation, an emerging space commerce company focused on the settlement of Mars.

concluded, as to what specific obligations the general requirement of equitable benefit sharing would entail. It is, thus, not clear whether the current debates indicate a decay of the obligation of benefit sharing, or form a continuation of the effort to dwell on an issue never solved in the negotiation. But the former has clearly happened in other ABNJs, where very strong benefit-sharing mechanisms negotiated during the NIEO movement for the Area and Antarctica were either watered down significantly or never put in practice.

The UNCLOS provides that activities in the Area 'shall . . . be carried out for the benefit of mankind as a whole . . . and taking into particular consideration the interests and needs of developing States . . .', and the Authority 'shall provide for the equitable sharing of financial and other economic benefits derived from activities in the Area . . .'.²¹¹ It establishes a 'parallel' system whereby entities with advanced technologies are required to share their preliminary research, by submitting two mining sites. The applicant is also required to share specialized technology with the Enterprise and qualified developing nation.²¹² In addition, the payment of application fees, annual fixed fee, and other financial contributions is mandatory for entities substantively engaged in the exploration and exploitation of the Area.²¹³ These obligations were then eroded by the 1994 Implementation Agreement. Under the Agreement, transfer of technology is no longer mandatory and unconditional, but follows a market approach;²¹⁴ more specific rules are laid down for economic assistance to developing countries affected;²¹⁵ and financial requirements are significantly reduced and more flexibilities are provided.²¹⁶

The benefit-sharing mechanism for Antarctica, on the other hand, was never put into real test as to the acceptability to states. With an aim to 'promote opportunities for fair and effective participation of all Parties' and 'take into account the interests of the international community as a whole',²¹⁷ CRAMRA comprises a regime of benefit sharing similar to that in UNCLOS. For the conduction of prospecting, the request for identification of an area for possible exploration and development, and the application of a permit for exploration and development, the payment of fees is required.²¹⁸ Operators engaged in exploration and development shall pay levies and payments in the nature of and similar to taxes, royalties or payments in kind.²¹⁹ In determining the disposition of revenues accruing to it, which are surplus to the requirement for financing the budget, the Commission shall 'promote scientific research in Antarctica, particularly that related to the Antarctic environment and Antarctic resources, and a wide spread of participation in such research by all Parties, in particular developing country Parties', and 'ensure that the interests of the members of Regulatory Committee having the most direct interest in the matter in relation to the areas in question are respected in any disposition of that surplus'.²²⁰ However, with the entry into force of the Madrid Protocol on 14 January 1998, which provides for comprehensive protection of Antarctica and prohibits all mineral resource activities of indefinite duration,²²¹ the CRAMRA was shelved. It is uncertain whether its regime of benefit sharing can survive the new international geopolitics even if the moratorium of Antarctic mining is lifted.

Today, it has become increasingly difficult to incorporate the obligation of benefit sharing into new law-making processes regarding ABNJs. Negotiations are currently underway with an aim to conclude the Regulations on Exploitation of Mineral Resources in the Area (Mining Code). It

²¹¹UNCLOS, Art. 140.

²¹²*Ibid.*, Ann. III, Art. 5.

²¹³*Ibid.*, Ann. III, Art. 13.

²¹⁴Agreement Relating to the Implementation of Part XI of the UNCLOS, *supra* note 75, Ann., Section 5.

²¹⁵*Ibid.*, Ann., Section 7.

²¹⁶*Ibid.*, Ann., Section 8.

²¹⁷CRAMARA, Art. 2(3).

²¹⁸*Ibid.*, Arts. 37(7), 39(2), 44(2), 53(2).

²¹⁹*Ibid.*, Art. 47(k)(i), (ii).

²²⁰*Ibid.*, Art. 35(7).

²²¹Madrid Protocol, *supra* note 121, Art. 7.

would concretize the benefit-sharing provisions of UNCLOS and the 1994 Implementation Agreement by comprising the obligation to pay royalty and fees.²²² While the legal obligation of monetary benefit sharing is explicitly provided in the two mother treaties, hence not subject to much dispute, states disagree on the extent of sharing and the utilization of fees collected. Greater difficulties are met in the negotiation of an agreement for the conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction (BBNJ), which is yet given CHM status.²²³ While developing countries demand inclusion of the obligation of benefit-sharing by tying it to the access of MGRs, developed countries are against such an obligation, in particular that in the monetary form.

The strong mechanisms of benefit sharing were achieved in UNCLOS and CRAMRA because it was tied to the right of access preemptively. The Moon Agreement, on the other hand, set the issue of benefit sharing aside for the future negotiation when the exploitation is feasible, in order not to frustrate the efforts seeking feasible exploitation. This gap provides an opportunity for space-faring countries, even if they join in the treaty, to decouple free access from benefit-sharing, with the former upheld and the latter watered down if not abandoned completely. The obstacle to benefit sharing will be high in the future negotiation of an international legal regime, which is likely to follow a binary pattern between space-faring countries and non-space-faring countries. Although among the former category of states there will be need for deconfliction, most of them are not parties to the Moon Agreement and share the common interest on the freedom of mineral exploitation in space. This forms a contrast to the negotiation of UNCLOS which cannot be simplified into a narrative of developing/developed countries. There, while developing countries were keen to preserve the deep seabed as the CHM, many of them were also coastal states seeking to extend their jurisdiction into the sea.²²⁴ The extension of jurisdiction also coped with the interest of many maritime powers, who at the same time advocated the preservation of high seas freedoms. By contrast, the binary pattern likely to be followed in the future negotiation on mineral activities in space would make it more difficult to achieve compromises than in UNCLOS III. This holds true for the issue of benefit sharing.

Recent state practice has betrayed the resistance of major space-faring countries to strong benefit sharing. The Artemis Accords provide for the obligation of open sharing of scientific data,²²⁵ with private sector operations exempted from this commitment.²²⁶ This practice represents a narrow interpretation and application of Article XI of OST, which may be justifiable by the discretion of 'to the greatest extent feasible and practicable' in the provision. The Hague Working Group Building Blocks addresses the benefits 'arising out of the utilization of space resources' explicitly. The sharing of such benefits is to be realized 'through the promotion of the participation in space resource activities by all countries, in particular developing countries', and the benefits to be shared may include enabling, facilitating, promoting, and fostering the development of space science and technology and of its applications, the development of relevant and appropriate capabilities in interested states, co-operation and contribution in education and training, access to and exchange of information, incentivization of joint ventures, the exchange of expertise and technology among states on a mutually acceptable basis, and the establishment of an international fund.²²⁷ The inclusion of compulsory monetary benefit-sharing in the future international framework is explicitly rejected.²²⁸

²²²Draft regulations on exploitation of mineral resources in the Area, Prepared by the Legal and Technical Commission of the Seabed Authority, 22 March 2019, ISBA/25/C/WP.1, Part VII & Part VIII.

²²³Revised draft text of an agreement under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, UN Doc. A/CONF.232/2020/3 (2019), Part II.

²²⁴J. Mossop, *The Continental Shelf Beyond 200 Nautical Miles: Rights and Responsibilities* (2015), at 61.

²²⁵Artemis Accords, *supra* note 48, Section 4, Section 8, para. 2.

²²⁶*Ibid.*, Section 8, para. 3.

²²⁷Hague Working Group Building Blocks, *supra* note 48, at 13.1.

²²⁸*Ibid.*, at 13.2.

Capacity building and co-operation are apparently a tuned-down version of benefit sharing, but their value deserves a second thought. As an old Chinese saying goes, ‘Give a man a fish and you feed him for a day; teach a man to fish and you feed him for a lifetime.’ This may be useful at the early stage of mineral exploitation in space, when strong mechanisms of monetary benefit sharing may discourage technology development. When profitability remains to be proved, co-operation and capacity building are more feasible means of benefit sharing. The problem of this approach pertains to the legal nature of co-operation and capacity building. Although the OST does take international co-operation as an objective,²²⁹ whether it is a legal obligation was subject to dispute. This question was clarified in the 1996 International Cooperation Declaration. According to it, while particular account should be taken of the needs of developing countries, states are free to determine all aspects of their participation in international co-operation in the exploration and use of outer space on an equitable and mutually acceptable basis.²³⁰ It is thus important to establish the legal obligations of capacity-building and co-operation. This seems acceptable to major space-faring countries as well as others, although the latter may expect more than this.

Having said that, monetary benefit sharing shall not be ruled out. With the advance of technology, space mining can become a highly profitable enterprise. If it is agreeable that Pound’s theory of rewarding investments should be limited, monetary benefit sharing can help to offset the rewards disproportionate to investment. Existing legal regimes, international and domestic, offer valuable experience on the forms of monetary benefit sharing, such as the collection of fees and royalties. Of course, to establish the legal obligation of monetary benefit sharing, the consent of major space-faring countries is needed. The immense difficulty of this approach is foreseeable. The acceptability of such an obligation is also related to the utilization of the gains collected. Proposals have been made to apportion the resource fund among states, e.g., by reference to the citizen’s dividend model of Alaska.²³¹ However, the simple division of gains among states would make the whole benefit sharing regime less acceptable to major space-faring countries. Perhaps to limit the use to deal with common challenges in space and even on the Earth, such as the proliferation of space debris and the spread of pandemics, would help to garner wider acceptance from key players.

5. Conclusions

This article has examined the legal status of abiotic resources in outer space from three interrelated aspects, namely appropriability, ownership, and access. The principle of non-appropriation, as applied to outer space, was aimed at prohibiting territorial sovereignty and preventing conflicts arising therefrom. This principle has been reinforced, rather than derogated, as it is affirmed repeatedly by states, including those advocating the freedom of space mining. By contrast, the prohibition of property claims over abiotic resources *in place* on celestial bodies, which is binding only on states parties of the Moon Agreement, has received rather limited attention in the current debate. Although the superpowers explicitly agreed to this obligation in the negotiation of the Moon Agreement, a consensus reached nearly half a century ago may not be valid today. It is thus important to garner wider acceptance of this obligation, in particular among major space-faring countries, so that the creeping jurisdiction over natural resources *in place* on celestial bodies, as happened to those in the EEZ and the continental shelf, can be prevented.

²²⁹Outer Space Treaty, *supra* note 1, Preamble, paras. 4, 5; Arts. I, III, X, XI.

²³⁰Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, UN Doc. A/RES/51/122 (1996), paras. 1, 2.

²³¹M. S. Saletta and K. Orrman-Rossiter, ‘Can space mining benefit all of humanity?: The resource fund and citizen’s dividend model of Alaska, the “last frontier”’, (2018) 43 *Space Policy* 1, at 3–4.

Ownership seems fundamental to the question of legal status. But it is an abstract idea which has no controlling on access. From common ownership follows two completely different regimes of access – free access and access through a unitary regime. While the latter version certainly prevails in the UNCLOS, both versions have their proponents in the Moon Agreement. This has dissuaded major space-faring countries to refraining from becoming a state party. As Rosenfield said at the American Society of International Law in 1980,

it is not a question of whether the US interpretation, as provided by its delegates, or by its unilateral statements, represents what will eventually become the correct or incorrect answer. The question is why should we enter into a treaty which is subject to such questions?²³²

It is thus pragmatic to avoid this issue which seems to be more distracting than helpful.

Today, there is a clear trend that the exploitation of abiotic resource will form part of the freedom of exploration and use of outer space. Even the Moon Agreement does not introduce a moratorium on the exploitation. An international legal regime is called for in order to address several couples of relationships, in particular that between different entities conducting mineral activities in space, and that between space-faring countries and non-space-faring countries. The relationship between different entities conducting mineral activities in space may be the most urgent to regulate in order to avoid conflicts between them. Drawing on the experience in the sea and Antarctica, a stage-specific and priority-right-based mechanism would be helpful for the purpose of deconfliction. The specifics of resource activities in space should be taken into account in tailoring a mechanism which affords exploiting entities priority rights commensurate with the efforts they put in. This mechanism should also be designed in such a way as to avoid de facto monopoly of abiotic resources in space. The interests of late-coming actors can be preserved by reserving part of the limited resources for them, but this reservation should also be limited in time and purpose in order to balance equality against efficiency. The relationship between space-faring countries and non-space-faring countries, on the other hand, shall be addressed in an equitable manner. In order not to discourage scientific and investing efforts, co-operation and capacity-building should be the primary forms of benefit-sharing at the early stage and, as technology advances, monetary benefit sharing can be used to offset the rewards disproportionate to investment. To limit the utilization of gains collected to tackle common challenges such as the proliferation of space debris and the spread of pandemics may help to ease the resistance of major space-faring countries.

²³²Rosenfield, *supra* note 151, at 165–6.