

# DEVELOPING A GLOBAL ORDER FOR SPACE RESOURCES: A REGIME EVOLUTION APPROACH

GERSHON HASIN\*

## ABSTRACT

*Technological developments usher new opportunities for humanity to tap into the vast resources of outer space. But the current international regulations of outer space activities were adopted in the 1960s, with a narrower assessment of space use and capabilities, and must be re-evaluated. Current scholarship, however, is fixated on a static regulatory approach, proposing the installment of comprehensive regimes. Such models fail to account for the different incentives, goals, and capabilities of the participants in outer space. Building on the New Haven School of International Law, this Article offers a novel theory of regime evolution for outer space regulation, adapting the regulation at each stage of development to the optimization of normative international values, based upon the anticipated interactions of the participants involved, their goals, and their incentives. The Article begins with a review of positive law. It then applies the New Haven School methodology and identifies the participants and normative international values. The Article proceeds to pinpoint the difficulties associated with each type of static regime proposed by other scholars and, finally, develops a novel regime evolution approach to space resource regulation.*

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I. INTRODUCTION

Space resource exploitation is kicking into high-gear and private entities participate aggressively in the global race to great riches.<sup>1</sup> Technological developments increase the feasibility of space mining and provide the international community with the opportunity to access the vast mineral resources found on the moon and on asteroids in near-Earth orbit.<sup>2</sup> In 2015, in order to encourage innovation and provide assurances to its space investors, the United States passed the “U.S. Commercial Space Launch Competitiveness Act” (the “Space Resources Act”), in which it recognized the property rights of its citizens and corporations to any extracted space resources from asteroids and other celestial bodies.<sup>3</sup> But the international rules in place provide no definitive answer on whether commercial, public, or private exploitation of space resources is lawful, nor which, if any, obligations it entails.<sup>4</sup>

Since the 1960s, and more so recently as the prospect of utilizing space resources approaches realization, scholars have been tackling these predicaments, analyzing the lawfulness of commercial exploiting

1. See RAM S. JAKHU, JOSEPH N. PELTON & YAW OTU MANKATA NYAMPONG, *SPACE MINING AND ITS REGULATION* 1–3 (2017); Frans G. von der Dunk, *Asteroid Mining: International and National Legal Aspects*, 26 MICH. ST. INT’L L. REV. 83, 83–84 (2017) [hereinafter von der Dunk, *Asteroid Mining*]; Samuel Roth, *Developing a Law of Asteroids: Constants, Variables, and Alternatives*, 54 COLUM. J. TRANSNAT’L L. 827, 830–34 (2016); Priyank D. Doshi, *Regulating the Final Frontier: Asteroid Mining and the Need for a New Regulatory Regime*, 1 NOTRE DAME J. INT’L & COMPAR. L. 189, 193–95 (2016).

2. See Roth, *supra* note 1, at 830–34; Andrew Lintner, *Extraterrestrial Extraction: The International Implication of the Space Resources Exploration and Utilization Act of 2015*, 40 FLETCHER F. WORLD AFF. 139, 141 (2016).

3. U.S. Commercial Space Launch Competitiveness Act § 402, 51 U.S.C. §§ 51301–51303 [hereinafter *US Space Resources Act*]; FRANCIS LYALL & PAUL LARSEN, *SPACE LAW: A TREATISE* 184–85 (2d ed. 2018); Ram S. Jakhu & Steven Freeland, *The Relationship Between the Outer Space Treaty and Customary International Law*, 59 PROC. INT’L INST. SPACE L. 183, 198 (2016) [hereinafter Jakhu & Freeland, *Relationship*]; Tanja Masson-Zwaan & Neta Palkovitz, *Regulation of Space Resource Rights: Meeting the Needs of States and Private Entities*, 35 QUESTIONS INT’L L. 5, 9, 12–13 (2017) (Luxembourg adopting a similar law recognizing property rights); Sagi Kfir & Ian Perry, *Title IV of the U.S. Commercial Space Launch Competitiveness Act of 2015 – A Critical Step Forward in Facilitating the Development of a Viable Space Infrastructure*, 59 PROC. INT’L INST. SPACE L. 169 (2016).

4. See generally LYALL & LARSEN, *supra* note 3, at 163–88; von der Dunk, *Asteroid Mining*, *supra* note 1; RICKY J. LEE, *LAW AND REGULATION OF COMMERCIAL MINING OF MINERALS IN OUTER SPACE* 153–202 (2012). See also Edwin W. Paxson III, Note, *Sharing the Benefits of Outer Space Exploration: Space Law and Economic Development*, 14 MICH. J. INT’L L. 487, 508 (1993); Melissa K. Force, *The Paradox of United States’ Position the Regulation of Space Resource Extraction*, in 59TH IISL COLLOQUIUM ON THE LAW OF OUTER SPACE, PROCEEDINGS OF THE INTERNATIONAL INSTITUTE OF SPACE LAW 259, 267 (P.J. Blount & R. Moro-Aguilar ed., 2016); David Johnson, *Limits on the Giant Leap for Mankind: Legal Ambiguities of Extraterrestrial Resource Extraction*, 26 AM. U. INT’L L. REV. 1477 (2011).

by states and corporations, and proposing various international regimes to cope with the challenges posed by such endeavors.<sup>5</sup> In the literature on space resource extractions, lawfulness is evaluated in relation to three sources of law: (1) the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (the “Outer Space Treaty”);<sup>6</sup> (2) The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (the “Moon Treaty”);<sup>7</sup> and (3) customary international law.<sup>8</sup> While the first is widely accepted by states, the second was rejected by most space-capable states and is subscribed to by less than twenty states.<sup>9</sup> References to the latter, i.e., customary international law, are mainly concerned with a purported elevation of certain elements found in the Outer Space Treaty and the Moon Treaty to customary international law; in the absence of state practice concerning space resources, such claims seem to reflect the desired policy choices of scholars more than a firm legal reality.<sup>10</sup> But there is no consistency in legal scholarship and scholars differ on whether commercial

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5. See generally Myres S. McDougal, Harold D. Lasswell, Ivan A. Vlasic & Joseph C. Smith, *The Enjoyment and Acquisition of Resources in Outer Space*, 111 U. PA. L. REV. 521 (1963) [hereinafter McDougal et al., *Enjoyment*]; MYRES S. MCDUGAL, HAROLD D. LASSWELL & IVAN A. VLASIC, LAW AND PUBLIC ORDER IN SPACE 749–811 (1963) [hereinafter MCDUGAL, *PUBLIC ORDER IN SPACE*]; FABIO TRONCHETTI, THE EXPLOITATION OF NATURAL RESOURCES OF THE MOON AND OTHER CELESTIAL BODIES: A PROPOSAL FOR A LEGAL REGIME (2009); LEE, *supra* note 4; see also, e.g., Doshi, *supra* note 1; von der Dunk, *Asteroid Mining*, *supra* note 1; Roth, *supra* note 1; Paxson, *supra* note 4; Paul B. Larsen, *Asteroid Legal Regime: Time for a Change*, 39 J. SPACE L. 275 (2014) [hereinafter Larsen, *Asteroids*]; Lauren E. Shaw, *Asteroids, the New Western Frontier: Applying Principles of the General Mining Law of 1872 to Incentive Asteroid Mining*, 78 J. AIR L. & COM. 121 (2013); Frans G. von der Dunk, *Private Property Rights and the Public Interests in Exploration of Outer Space*, 13 BIOLOGICAL THEORY 142 (2018) [hereinafter von der Dunk, *Private*]; Alexander William Salter, *Ordering the Cosmos: Private Law and Celestial Property Rights*, 82 J. AIR L. & COM. 311 (2017); Thomas R. Irwin, Note, *Space Rocks: A Proposal to Govern the Development of Outer Space and Its Resources*, 76 OHIO ST. L. J. 217 (2015); Ezra J. Reinstein, *Owning Outer Space*, 20 NW. J. INT’L L. & BUS. 59 (1999); Leslie I. Tennen, *Towards a New Regime for Exploitation of Outer Space Mineral Resources*, 88 NEB. L. REV. 794 (2010).

6. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *opened for signature* Jan. 27, 1967, 610 U.N. T.S. 205 [hereinafter *OST*].

7. Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *opened for signature* Dec. 18, 1979, 1363 U.N.T.S. 21 [hereinafter *Moon Treaty*].

8. Statute of the International Court of Justice art. 38(1), June 26, 1945, 33 U.N.T.S. 933.

9. See von der Dunk, *Asteroid Mining*, *supra* note 1, at 85, 89–90.

10. See *infra* Section II.D.

exploitation of space resources is lawful under the current international rules.<sup>11</sup>

The existing lawfulness analysis provides the framework for the proposal of certain national or international regimes to regulate commercial exploitation of space resources. The regimes are intended to regulate access to resources, community interests, environmental protection, safety measures, dispute resolution, and other elements. They employ various mechanisms to facilitate the fulfilment of the values they strive to promote, including, *inter-alia*, state recognition of property rights,<sup>12</sup> international licensing,<sup>13</sup> municipal approaches,<sup>14</sup> auctioning of access,<sup>15</sup> cap and trade of allocations,<sup>16</sup> caps on exclusive exploitation periods,<sup>17</sup> initial fees,<sup>18</sup> revenue-sharing,<sup>19</sup> resource-sharing,<sup>20</sup> and more. While each proposed regime is somehow different, there are several common denominators.

The proposed regimes include a certain recognition of property rights of private space investors, and international regulation is based on either a first-come-first-served approach or initial allocation with some, either mandatory or voluntary, participation privileges for the space-incapable states or the entire international community. The participation of the international community takes form in either pre-exploitation fees, direct participation in exploitation, or post-exploitation revenue-sharing. Participation is based, in large part, on the principle that the exploitation of space must be for the “benefit and in the interests of all countries”<sup>21</sup> and that space is the “common heritage of

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11. For scholars claiming that commercial extractions of space resources are lawful, see, e.g., LYALL & LARSEN, *supra* note 3, at 184–85; Lintner, *supra* note 2; Kfir & Perry, *supra* note 3. *But see, e.g.*, GBENGA ODUNTAN, SOVEREIGNTY AND JURISDICTION IN THE AIRSPACE AND OUTER SPACE: LEGAL CRITERIA FOR SPATIAL DELIMITATION 191–206 (2012); Rishari Baruah & Nandini Paliwal, *Sustainable Space Exploration and Use: Space Mining in Present and Future Perspectives*, 58 PROC. INT’L INST. SPACE L. 23, 25 (2015); Tennen, *supra* note 5, at 805.

12. *See, e.g.*, Kfir & Perry, *supra* note 3; Salter, *supra* note 5.

13. *See, e.g.*, von der Dunk, *Private*, *supra* note 5; TRONCHETTI, *supra* note 5, at 233–85.

14. *See, e.g.*, D.J. O’Donnell, *Benefit Sharing: The Municipal Model*, in PROCEEDINGS OF THE THIRTY-NINTH COLLOQUIUM ON THE LAW OF OUTER SPACE, INTERNATIONAL INSTITUTE OF SPACE LAW OF THE INTERNATIONAL ASTRONAUTICAL FEDERATION 151 (1996); Tennen, *supra* note 5, at 825–26.

15. *See, e.g.*, Reinstein, *supra* note 5, at 18–20; Roth, *supra* note 1, at 862.

16. *See, e.g.*, Paxson, *supra* note 4, at 513–14.

17. *See, e.g.*, Roth, *supra* note 1, at 861–62; Reinstein, *supra* note 5.

18. *See, e.g.*, TRONCHETTI, *supra* note 5, at 233–85.

19. *See, e.g.*, Masson-Zwaan & Palkovitz, *supra* note 3; Baruah & Paliwal, *supra* note 11.

20. *See, e.g.*, O’Donnell, *supra* note 14; Tennen, *supra* note 5, at 825–26.

21. *OST*, *supra* note 6, art. I; *see also* von der Dunk, *Asteroid Mining*, *supra* note 1, at 86.

mankind.”<sup>22</sup> In broad terms, the proposed international regulatory regimes are based on property rights to the extracted resources, and any international regulation by an international authority follows either the first-come-first-served approach taken in the allocation of satellite spots (International Telecommunication Organization (“ITU”)),<sup>23</sup> or, predominantly, the regulation of the commons, known as the Area, by the International Seabed Authority under the Law of the Sea.<sup>24</sup>

But the proposed regimes fail to account for the specific incentives and goals of the participants, nor do they recognize that the interactions between the participants are likely to have different results than those underlining the development of the Law of the Sea. As this Article will explain, a misguided fixation on the Law of the Sea as a framework leads scholars to propose comprehensive regimes, failing to recognize that, as with the Law of the Sea, the regime governing space resources will develop in stages. In contrast to the static regulatory approaches proposed by scholarship, this Article builds on the policy-oriented methodology of the New Haven School and proposes a novel regime evolution approach to the regulation of outer space resources, integrating political science and policy-oriented jurisprudence. This approach can then apply to all other outer space regulations.

Applying the proposed regime evolution approach requires first outlining the critical elements of a successful global order for regulating outer space resources, specifically feasibility, effectiveness, and manageability. These elements will then be assessed in light of certain values which the various participants, including corporations, international organizations, space-capable states, and space-incapable states, utilize and strive to achieve: spurring innovation, access to wealth and resources, distribution of resources (equity), human dignity, security, safety of personnel, and environmental protection. As this Article will show in Part IV, the previously proposed static regimes are inappropriate, and the current regulation of the oceans cannot adequately constitute a

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22. See ODUNTAN, *supra* note 11, at 191; Paxson, *supra* note 4, at 498–99.

23. See *von der Dunk, Private*, *supra* note 5, at 144; *Larsen, Asteroids*, *supra* note 5, at 306–07, 320.

24. United Nations Convention on the Law of the Sea arts. 133–91, *opened for signature* Dec. 10, 1982, 1833 U.N.T.S. 397 (entered into force Nov. 16, 1994) [hereinafter *UNCLOS*]; Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, *adopted* Jul. 28, 1994, 1836 U.N.T.S. 3 [hereinafter 1994 Implementation Agreement]. For regimes, see, e.g., TRONCHETTI, *supra* note 5, at 233–85; LYALL & LARSEN, *supra* note 3, at 188; Yangzi Tao & Guoyu Wang, *The International Regime Governing Exploitation of Natural Resources in Outer Space: Potential Process of Formulation*, in 58TH IISL COLLOQUIUM ON THE LAW OF OUTER SPACE, PROCEEDINGS OF THE INTERNATIONAL INSTITUTE OF SPACE LAW 43, 51 (Rafael Moro-Aguilar et al. ed., 2015).

blueprint for outer space due to the difference in participants, incentives, and interactions. Part V of this Article will outline the proposed regime evolution approach, and the various anticipated stages of development based upon the interactions between the participants and the incentives stimulating compromises and regulations.

Constituting the first modern claim of a major participant in the interactions which will develop the regime governing space resources, the U.S. Space Resources Act employs interpretation rather than modification of the vague international rules currently in place in its approach to outer space regulation. Recognizing property rights while preserving the Outer Space Treaty and its prohibition on sovereignty claims, the U.S. claim may in fact serve as the first example of actual state practice for the purposes of customary international law, should the extractions of space resources materialize and the law apply. As this Article will show, international law governing space resources is likely to develop dynamically, in four distinct stages, with the first stage founded on the interactions initiated by the U.S. claim. Contrary to proposals for the adoption of a static regime, a comprehensive regulatory regime is unlikely to be installed until participants have the necessary incentives and its proponents are able to exercise the necessary counter levers to sway the policy choices of space-capable states—an improbable proposition at this time. As the application of the regime evolution approach will show, the stages of development will exhibit both exclusive and inclusive jurisdictions, with each stage based upon its predecessor, and will be feasible, effective, and manageable in relation to the interactions underlining the evolution. This realization indicates that to adequately affect policy choices one must focus on shifting the regime complex to confront the challenges posed in each stage, rather than attempting to instigate a comprehensive regime incompatible with the interactions between the participants.

This Article will be divided into four sections. Part II will review the positive international legal framework for commercial extraction of space resources. Part III will outline the elements of a successful global order, the participants in the establishment of the global order for space resources, and the values the optimum global order ought to promote. Part IV will review the static regimes proposed thus far and illuminate their inadequacies. Part V will outline the proposed dynamic regime evolution approach to the global order governing commercial extraction of space resources.

II. THE LEGAL FRAMEWORK FOR COMMERCIAL EXTRACTION OF SPACE  
RESOURCES

For commercial extractions of space resources to be deemed legitimate under international law, both the exclusive extraction of a space resource must be recognized as lawful *ex ante*, even if only under certain conditions, and the property rights in the extracted resources, even if subject to certain obligations, must be recognized and protected *ex post*.

The corpus of legal instruments in relation to such issues includes both international and national sources. International sources include the Outer Space Treaty, the Moon Treaty, the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (“Rescue Agreement”),<sup>25</sup> the Convention on International Liability for Damage Caused by Space Objects (“Liability Convention”),<sup>26</sup> and customary international law. The international legal framework is supplemented by national legal frameworks. Currently, there are two countries, the United States and Luxembourg, which recognize the property rights of investors to extracted space resources.<sup>27</sup> There is, however, disagreement within the international legal community on whether exclusive use and property rights are lawful under international law, and whether commercial extractions of space resources are subject to any international obligations, even if not yet specified. The positive legal framework and these legal dilemmas will be reviewed in this section.

Before considering the terms of the various treaties, it is worth recalling the rules governing treaty interpretation. While treaty interpretation entails judgment and subjectivity, it is still governed by the principles of the Vienna Convention on the Law of Treaties (“VCLT”). The relevant provisions in this regard are Articles 31 and 32 of the treaty which provide that:

Article 31. General Rule of Interpretation

1. A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.

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25. Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, *opened for signature* Apr. 22, 1968, 672 U.N.T.S. 119 [hereinafter *Rescue Agreement*].

26. Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 961 U.N.T.S. 187 [hereinafter *Liability Convention*].

27. LYALL & LARSEN, *supra* note 3, at 183.



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2. The context for the purpose of the interpretation of a treaty shall comprise, in addition to the text, including its preamble and annexes:

(a) Any agreement relating to the treaty which was made between all the parties in connexion with the conclusion of the treaty;

(b) Any instrument which was made by one or more parties in connexion with the conclusion of the treaty and accepted by the other parties as an instrument related to the treaty.

3. There shall be taken into account, together with the context:

(a) Any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions;

(b) Any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation;

(c) Any relevant rules of international law applicable in the relations between the parties.

4. A special meaning shall be given to a term if it is established that the parties so intended.

### Article 32. SUPPLEMENTARY MEANS OF INTERPRETATION

Recourse may be had to supplementary means of interpretation, including the preparatory work of the treaty and the circumstances of its conclusion, in order to confirm the meaning resulting from the application of article 31, or to determine the meaning when the interpretation according to article 31:

(a) Leaves the meaning ambiguous or obscure; or

(b) Leads to a result which is manifestly absurd or unreasonable.<sup>28</sup>

In approaching the task of interpreting a treaty, or evaluating a proposed interpretation of a treaty, as an underlining rule governing a state-party's policy in relation to the exploitation of space resources, one must be guided by the rules of treaty interpretation. That is not to say that a treaty has only one interpretation. On the contrary, generic terms in a treaty, and especially a long-term treaty such as the Outer

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28. Vienna Convention on the Law of Treaties, May 23, 1969, arts. 31–32, 1155 U.N.T.S. 331 [hereinafter *VCLT*].

Space Treaty, must be interpreted in an evolutionary manner,<sup>29</sup> as the ICJ explained in the *San Juan River* case.<sup>30</sup> For a treaty interpretation to be plausible, it must be “in *good faith* in accordance with the *ordinary meaning* to be given to the terms of the treaty in *their context* and in the light of its *object and purpose*.”<sup>31</sup> This Article is not the place to engage in a thorough analysis of the rules governing treaty interpretation, as this has been done elsewhere.<sup>32</sup> It is, however, important to emphasize that in contrast to some legal systems, when it comes to generic terms, international law does not give primacy to the original meaning for the state-parties who concluded the treaty. On the contrary, international law gives primacy to the “ordinary meaning of the terms of the treaty” whose meaning can evolve through time,<sup>33</sup> while reserving the original meaning intended by the parties, evident from the *travaux préparatoires*, to a secondary means of interpretation, resorted to only when the ordinary meaning is ambiguous, obscure or “leads to a result which is *manifestly* absurd or unreasonable.”<sup>34</sup>

When a treaty’s object and purpose is to establish “principles” governing over the long-term behavior of the parties, the understandings and intentions of the parties, as manifested in their respective applications of the treaty, are indispensable to the interpretation of the treaty and especially its generic terms. International interpretation always seeks to maintain the effectiveness of a treaty: *ut res magis valeat quam pereat*. The interpretation of the treaty must therefore be attuned to the process of interaction between the participants in the changing context. Adopting narrow and literal interpretations of generic terms, which ignore the realities of ongoing interactions, may fail to reflect and give effect to the policy choices of the parties and defeat the treaty’s object and purpose.

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29. For a discussion of evolutionary interpretation of the Outer Space Treaty, see *infra* text accompanying notes 62–66.

30. Dispute regarding Navigational and Related Rights (*Costa Rica v. Nicar.*), Judgment, 2009 I.C.J. 213, ¶ 66 (July 13).

31. *VCLT*, *supra* note 28, art. 31.

32. See generally RICHARD K. GARDINER, *TREATY INTERPRETATION* (2d ed. 2015); VIENNA CONVENTION ON THE LAW OF TREATIES: A COMMENTARY (Oliver Dorr & Kirsten Schmalenbach eds., 2d ed. 2018).

33. Dispute regarding Navigational and Related Rights (*Costa Rica v. Nicar.*), Judgment, 2009 I.C.J. 213, ¶ 66 (July 13).

34. *VCLT*, *supra* note 28, art. 32.

A. *The Outer Space Treaty*

The Outer Space Treaty is a cold-war era regulatory instrument signed in 1966 and entered into force in 1967 after being ratified by several countries including the United States, the United Kingdom, and the Soviet Union.<sup>35</sup> Besides weapons control, preventing claims of sovereignty on celestial bodies was a primary incentive for concluding the treaty.<sup>36</sup> Specifically, with the space race between the Soviet Union and the United States in high gear, it was feared that once a country makes a first landing on a celestial body, such as the Moon, it would lay a claim, which may then precipitate conflict on Earth.<sup>37</sup>

The Outer Space Treaty has been subscribed to by over 100 states,<sup>38</sup> and some have even suggested that several of its provisions reflect customary international law.<sup>39</sup> The Outer Space Treaty was, however, concluded at a time of state-led space travel,<sup>40</sup> and was driven by the power balance of the period. It regulated the potential interactions between the participants of the day: safeguarding the free explorations and use of space (Art. I); preventing sovereignty claims (Art. II); preserving the global order and peace (Art. III); averting the militarization of space and deployment of nuclear weapons in space (Art. IV); securing assistance to astronauts (Art. V); determining international responsibility, liability, and jurisdiction over space activities (Art. VI–VIII); avoiding adverse effects on the Earth environment (Art. IX); and promoting cooperation in space exploration (Art. X–XII).<sup>41</sup> While the Outer Space Treaty refers to state supervisory responsibility over the activities of non-governmental entities,<sup>42</sup> it is questionable whether the balance in this treaty, even if deemed relevant to commercial extraction of space resources, is relevant to the power structure in the international community today, the technological

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35. *Outer Space Treaty*, ENCYCLOPEDIA BRITANNICA, <https://www.britannica.com/event/Outer-Space-Treaty> (last visited Feb. 5, 2020).

36. See *Larsen, Asteroids*, *supra* note 5, at 282; P.J. Blount & Christian J. Robison, *One Small Step: The Impact of the U.S. Commercial Space Launch Competitiveness Act of 2015 on the Exploitation of Resources in Outer Space*, 18 N.C. J. L. & TECH. 160, 169 (2016).

37. See *Larsen, Asteroids*, *supra* note 5, at 282; see also Olavo Neto, *The Dawn of an International Regime for Space Resources—Multilateral Perspectives*, 59 PROC. INT'L INST. SPACE L. 213, 214 (2016).

38. Comm. on the Peaceful Uses of Outer Space, Legal Subcomm., *Status of International Agreements Relating to Activities in Outer Space as at 1 January 2018*, U.N. Doc. A/AC.105/C.2/2018/CRP.3, at 1, 10 (Apr. 9, 2018) [hereinafter *Treaty Status 2018*].

39. See, e.g., LEE, *supra* note 4, at 154–55; *Larsen, Asteroids*, *supra* note 5, at 289.

40. LYALL & LARSEN, *supra* note 3, at 167.

41. *OST*, *supra* note 6.

42. *OST*, *supra* note 6, art. VI.

developments which enable utilization of space resources, and the anticipated interactions between the participants.

In contrast to the world of the 1960s with two main participants and human activity mainly limited to the earth orbit and the Moon, international regulation today faces a multi-participant outer space, with human activity extending to Mars and beyond. The United States is introducing a “Space Force,”<sup>43</sup> the National Aeronautics and Space Administration (“NASA”) is planning a manned mission to Mars and plans to establish a permanent presence on the moon,<sup>44</sup> China is also planning to establish a base on the Moon,<sup>45</sup> and private actors are planning to tap into the resources of the moon and asteroids.<sup>46</sup> Although the Outer Space Treaty is the main pillar of positive international law, and a critical weapons control instrument, reality has surpassed anything anticipated when it was signed, putting in question its adequacy as a modern regulatory mechanism.

Several provisions of the Outer Space Treaty may be considered applicable to the legal questions raised by commercial extraction of space resources: Articles I, II, VI, VII and IX.

### 1. Article I of the Outer Space Treaty

Article I of the Outer Space Treaty provides that:

The exploration and use of outer space, including the moon and other celestial bodies, 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.

Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.<sup>47</sup>

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43. *About the United States Space Force*, U.S. SPACE FORCE, <https://www.spaceforce.mil/About-Us/About-Space-Force> (last visited June 21, 2020).

44. *Moon to Mars Overview*, NAT'L AERONAUTICS & SPACE ADMIN., <https://www.nasa.gov/topics/moon-to-mars/overview> (last updated Sept. 16, 2020); *United States International Legal Framework for Lunar Exploration and Resource Extraction*, DEBEVOISE & PLIMPTON (June 16, 2020), <https://www.debevoise.com/insights/publications/2020/06/united-states-international-legal-framework-for>.

45. Rafi Letzter, *China Plans to Build a Moon Base Near the Lunar South Pole*, SPACE (Apr. 27, 2019), <https://www.space.com/china-moon-base-10-years.html>.

46. See JAKHU, PELTON & NYAMPONG, *supra* note 1; von der Dunk, *Asteroid Mining*, *supra* note 1; Roth, *supra* note 1; Doshi, *supra* note 1.

47. *OST*, *supra* note 6, art. I.

This provision, as Professor Paul B. Larsen explains, was advocated by the developing countries as a precondition to their acceptance of the treaty.<sup>48</sup> It encompasses, as Ricky J. Lee notes, three principles, which he deems “fundamental”: “freedoms of exploration, access and use by all States on a non-discriminatory basis and that space activities are to be carried out for the benefit and in the interest of all States.”<sup>49</sup> Others have considered this provision to be vague<sup>50</sup> and providing for only a moral obligation.<sup>51</sup> While freedom of exploration is indeed critical for locating any pertinent space resources, lawfulness of space extractions depends on two of the principles: (1) access without discrimination and (2) activities for the benefit and interests of all countries.<sup>52</sup>

The first principle has been argued to preclude exclusive use of a celestial body which is essential to commercial extractions,<sup>53</sup> and the second has led some to infer that the provision mandates certain benefit-sharing from any resource extractions.<sup>54</sup> On that note, Belgium has recently raised this provision in opposition to the unilateral recognition of property rights by the United States.<sup>55</sup> Professor Frans G. von der Dunk, however, pointed out that most scholars consider commercial exploitation to be included in the freedom of use,<sup>56</sup> and Lee explained that benefit is subjective and may depend upon the specific state and time.<sup>57</sup> Lee also argued that commercial interests of the state must be taken into account, and hence any revenue-sharing obligation must account for such interests,<sup>58</sup> this echoes one commentator’s warning that revenue-sharing may be devastating to the commercial feasibility of developing space resources through private capital.<sup>59</sup>

Several interpretations have been put forth for the relation between Article I and commercial extraction of space resources. The interpretations of the term “benefit” concern whether benefit for all excludes

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48. Larsen, *Asteroids*, *supra* note 5, at 281–82.

49. LEE, *supra* note 4, at 154.

50. Paxson, *supra* note 4, at 492–93.

51. See LEE, *supra* note 4, at 157.

52. *Id.* at 155.

53. LEE, *supra* note 4, at 13; Irmgard Marboe, *The End of the Concept of ‘Common Heritage of Mankind’? The Views of State Parties to the Moon Agreement*, in 59TH IISL COLLOQUIUM ON THE LAW OF OUTER SPACE, PROCEEDINGS OF THE INTERNATIONAL INSTITUTE OF SPACE LAW 225, 231 (2016).

54. See, e.g., LEE, *supra* note 4, at 158; Reinstein, *supra* note 5, at 68.

55. Marboe, *supra* note 53, at 231.

56. von der Dunk, *Asteroid Mining*, *supra* note 1, at 85.

57. LEE, *supra* note 4, at 156.

58. *Id.*

59. Reinstein, *supra* note 5, at 68.

commercial use or whether such endeavors may provide a certain degree of benefit. As Lee explained, there are four broad interpretational claims: (1) commercial extractions of space resources are unlawful as they are not for the benefit of all; (2) commercial extractions of space resources are lawful subject to providing some sort of “community service,” e.g., revenue-sharing or using the resources to promote better living standards; (3) commercial extractions of space resources are lawful provided that the extracted resources may be freely purchased on the market absent discrimination; and (4) commercial extractions of space resources are lawful as long as they do not preclude space activities by others.<sup>60</sup>

While all interpretations are plausible, and none contradict the interpretation principles of the VCLT,<sup>61</sup> the ambiguous drafting of the provision and use of generic terms enable the space-capable states to credibly adopt an interpretation which legitimizes commercial extraction of space resources. As the International Court of Justice explained in the *San Juan River* case:

[W]here the parties have used generic terms in a treaty, the parties necessarily having been aware that the meaning of the terms was likely to evolve over time, and where the treaty has been entered into for a very long period or is “of continuing duration”, the parties must be presumed, as a general rule, to have intended those terms to have an evolving meaning.<sup>62</sup>

This statement is instructive. The Outer Space Treaty was signed during the cold-war, intentionally using ambiguous generic terms to be acceptable under both Western and Communist perspectives.<sup>63</sup> This was, and is after 50 years, a treaty “of continuing duration” intended to establish a long-term regulatory framework for space activities, nicknamed by one commentator as the “magna carta of space.”<sup>64</sup> Regardless of whether the Outer Space Treaty is still a valid balance of interests between the relevant participants, its terms, including “benefit,” “interests,” “use” and “national appropriation” under Article II, must be interpreted in an evolving manner, taking account of the

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60. LEE, *supra* note 4, at 158, 161; *see also* von der Dunk, *Asteroid Mining*, *supra* note 1, at 86–87.

61. VCLT, *supra* note 28, arts. 31–32.

62. Dispute regarding Navigational and Related Rights (*Costa Rica v. Nicar.*), Judgment, 2009 I.C.J. 213, ¶ 66 (July 13).

63. Blount & Robison, *supra* note 36, at 167–68; Roth, *supra* note 1, at 841–42.

64. Paxson, *supra* note 4, at 489.

developing scientific, social, and geopolitical circumstances. It would be unreasonable to consider that these terms should be interpreted in accordance with their 1967 meaning. Rather, the interpretation of these terms must evolve to accommodate the now feasible, but then barely imaginable, commercial extraction of space resources. An evolving interpretation is necessary for the treaty's preservation as an interpretation precluding or hampering commercial space extractions may render the treaty obsolete and lead to its abandonment by space-capable states. In fact, the United States' Space Resources Act presented itself as an evolving interpretation of the treaty.<sup>65</sup>

Only the third and the fourth interpretations—that commercial space activities require resources to be available for free acquisition on the market and abstention from precluding other similar activities—are reasonable interpretations of Article I in 2021, with any practical prospect for wide acceptance and adherence. Commercial activities were legitimized by the United States, and revenue-sharing, as provided by the Moon Treaty, was almost unanimously rejected by space-capable states.<sup>66</sup> It is thus unlikely that an interpretation of the generic terms in Article I as precluding commercial space activities or subjecting them to revenue-sharing would be acceptable to space-capable states. Free acquisition on the market, or in other words preventing discrimination, is indeed a poor “benefit” for those who could not afford the resources. Although forcing corporations to sell the resources freely on the market would lower their price and ensure that all states may potentially access the resources, it will have a limited effect on equitable wealth distribution and the promotion of human dignity. Such a claim may, however, be acceptable to space-capable states due to its limited adverse effects on the development of space resource exploitation. In fact, space-capable states may support such a policy choice since each state's corporations may exploit different resources and a non-discriminatory market will benefit them as well.

It is, however, questionable whether space-incapable states have an incentive to limit their participation claims for such a limited, and perhaps “imaginary,” benefit, especially because the benefit of free acquisition on the market has already been embedded in the current international trade law regime. The current international system of trade is governed under the Marrakesh Agreement, establishing the World Trade Organization (the “WTO”), and the other WTO agreements such as the General Agreement on Tariffs and Trade (“GATT”),

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65. See *infra* Section II.E.

66. See LEE, *supra* note 4, at 268–69; von der Dunk, *Asteroid Mining*, *supra* note 1, at 89–90.

the General Agreement on Trade in Services (“GATS”) and the Agreement on Trade-Related Aspects of Intellectual Property Rights (“TRIPS”). But a close look at these treaties reveals that the principle of most-favored-nation treatment underlines their treatment of trade.<sup>67</sup> Non-discrimination in trade, subject to certain exclusions, is already accepted as part of the international system of trade. The general rule prohibiting the exclusion or prohibition on exports is found in Article XI of the GATT, subject to the underlying exclusions therein and the national security exclusion in Article XXI.<sup>68</sup> Thus, unless space-capable states abandon the WTO system (which is unlikely), conclude a specific free trade agreement between themselves (may include some but not all given the current relations between Russia, China and the U.S.), or lay a claim for an export exclusion (which they may try), space-incapable states will have no incentive to confine their claim for a benefit already existing under international trade law. It is also worth noting that any trade measure adopted in respect of space resources would, unless the WTO agreements are abandoned or modified, be subject to compulsory dispute settlement.

Given its compatibility with the international system of trade, the interpretation of Article I as precluding discrimination in trade is likely to be promoted by space-capable states. When the time comes, it would be interesting to consider whether Article I of the Outer Space Treaty may be raised to confine trade exclusions under the GATT. But this would be a question of treaty interpretation, subject to the rules of the VCLT, and until such time as either treaty is universally adopted by the same parties<sup>69</sup> or elevated to customary international law,<sup>70</sup> neither can be lawfully taken into account in the interpretation of the other.

Thus, only precluding discrimination or avoiding the undermining of the activities of others may be considered as reasonable obligations imposed by Article I considering modern social, technological, trade, and geopolitical circumstances.

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67. The MFN treatment is found in GATT Article 1, GATT Article 2, and TRIPS Article 4, *see Principles of the Trading System*, WTO, [https://www.wto.org/english/thewto\\_e/whatis\\_e/tif\\_e/fact2\\_e.htm](https://www.wto.org/english/thewto_e/whatis_e/tif_e/fact2_e.htm) (last visited June 22, 2020).

68. The General Agreement on Tariffs and Trade (GATT 1994) art. XI, XXI, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, 1867 U.N.T.S. 187, 33 I.L.M. 1153 (1994).

69. *VCLT*, *supra* note 28, art. 31(2)(a).

70. *Id.* art. 31(3)(c); see *infra* Section II.D for a discussion on customary international law and the Outer Space Treaty.



2. Article II of the Outer Space Treaty

Article II is the most disputed provision with respect to commercial extraction of space resources. It provides that: “[o]uter 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.”<sup>71</sup> The provision, as von der Dunk put it, has been widely “perceived to establish outer space as a ‘global commons,’ an area not subject to any individual state’s legal authority and jurisdiction yet free for all states to access, as long as they are in compliance with any other applicable rules of international law.”<sup>72</sup> The provision entails the prohibition of sovereignty and exclusive jurisdiction over a piece of land,<sup>73</sup> and is consistent with the U.S. position during the Treaty’s negotiation that “[n]o moon, no planet shall fly a single nation’s flag.”<sup>74</sup> It embodies, in legal terms, the attempt to quell the fear that the first power to land on the Moon would declare it *terra nullius* and proclaim sovereignty.<sup>75</sup>

Scholars and policymakers debate whether this provision precludes any recognition of exclusive use of an asteroid or part of a celestial body by a state or corporation, and whether a state may recognize property rights in any extracted space resources.<sup>76</sup> According to the United States and some commentators, property rights do not conflict with the “non-appropriation” provision.<sup>77</sup> Several arguments have been advanced to support this. First, it has been argued that the term “national appropriation” applies only to states and not private entities, i.e., while precluding sovereignty, the principle does not extend to private acquisition.<sup>78</sup> In this sense, it was suggested that the prospect of private appropriation was intentionally left ambiguous.<sup>79</sup> However, as several commentators

71. *OST*, *supra* note 6, art. II.

72. von der Dunk, *Asteroid Mining*, *supra* note 1, at 86.

73. *Id.*

74. ODUNTAN, *supra* note 11, at 200 (quoting the United States during negotiations of the Outer Space Treaty).

75. Tennen, *supra* note 5, at 804–05.

76. *See, e.g.*, von der Dunk, *Asteroid Mining*, *supra* note 1, at 86; LEE, *supra* note 4, at 166–92; LYALL & LARSEN, *supra* note 3, at 163–88; TRONCHETTI, *supra* note 5, at 26–29; Larsen, *Asteroids*, *supra* note 5, at 277–90; Paxson, *supra* note 4, at 491–96; Tennen, *supra* note 5, at 804–11; Blount & Robison, *supra* note 36, at 169.

77. *See* Roth, *supra* note 1, at 850–51; Lintner, *supra* note 2, at 151–53; von der Dunk, *Asteroid Mining*, *supra* note 1, at 94. *But see* TRONCHETTI, *supra* note 5, at 194; Salter, *supra* note 5, at 312–13; ODUNTAN, *supra* note 11, at 208.

78. *See* Roth, *supra* note 1, at 841; *see also* LEE, *supra* note 4, at 166–67.

79. Roth, *supra* note 1, at 841–42.

pointed out, since the state must authorize and supervise space activities under Article VI of the Outer Space Treaty, Article II must extend to private acts of national appropriation,<sup>80</sup> but “national appropriation” does not necessarily translate to private appropriation in the sense of property rights.<sup>81</sup>

Second, it has been argued that the legal term “celestial body” refers only to planets and moons, but not asteroids, and thus the provision does not extend to the latter.<sup>82</sup> A review of the legislative history conducted by Larsen, however, has suggested that the concept of “celestial bodies” had a broad reference which did not exclude asteroids.<sup>83</sup> This possible distinction led some scholars to suggest that a legal regime should distinguish between asteroids of different sizes, locations or composition.<sup>84</sup>

Lastly, and more importantly, it was claimed that the extraction and removal of space resources does not entail a claim of sovereignty over the celestial body itself,<sup>85</sup> meaning, for example, that the “prohibition on ‘national appropriation’ forbids the appropriation of territory, but not of natural resources.”<sup>86</sup> Such an interpretation subjects space resources to an equivalent of the common law principle of the rule of capture. Support for this interpretation is claimed to originate from the high seas regime: while a state may not lay claim to sovereignty over the high-seas, it may lawfully fish there.<sup>87</sup> This is the position taken by Luxembourg in the commentary to its law recognizing private property rights.<sup>88</sup> This analogy is appealing; however, a closer look reveals its limitation. First, fish are potentially a replenishing resource (if managed properly), in comparison to space resources which are more analogous to the resources of the seabed and subsoil.<sup>89</sup> Second, high sea fishing is

80. LEE, *supra* note 4, at 166–67; Tennen, *supra* note 5, at 806.

81. LEE, *supra* note 4, at 166–67 (explaining that the Chinese text refers only to state and not private appropriation). If, however, “national appropriation” is interpreted as a claim to sovereignty or its equivalent through practice, then it is unclear whether such acts may in fact be performed by non-state entities unless those are acting as agents of the state exercising *de facto* sovereignty.

82. Roth, *supra* note 1, at 842.

83. Larsen, *Asteroids*, *supra* note 5, at 279–80, 299.

84. See, e.g., LEE, *supra* note 4, at 187–92; Larsen, *Asteroids*, *supra* note 5, at 297–300.

85. See Roth, *supra* note 1, at 841, 851; Marboe, *supra* note 53, at 232.

86. Roth, *supra* note 1, at 841.

87. See Roth, *supra* note 1, at 851; Masson-Zwaan & Palkovitz, *supra* note 3, at 12–13; von der Dunk, *Asteroid Mining*, *supra* note 1, at 93; Baruah & Paliwal, *supra* note 11, at 27.

88. See Masson-Zwaan & Palkovitz, *supra* note 3, at 12–13.

89. McDougal et. al. categorized asteroids as a replenishing resource. See McDougal et al., *Enjoyment*, *supra* note 5, at 593; While there can be many asteroids in the solar system, see G.S.

theoretically, though unsuccessfully, regulated on a regional basis under the Law of the Sea.<sup>90</sup> Third, while the 1982 United Nations Convention on the Law of the Sea (“UNCLOS”) can be a source of authority as a widely prescribed treaty, it is not an official source for interpreting Outer Space Treaty in accordance to the VCLT.<sup>91</sup> Finally, as will be further elaborated below, the Law of the Sea is a complex mechanism with many balanced interests and thus a general application of a single element is problematic.<sup>92</sup>

The contrary interpretation, promoted by the Russian Federation<sup>93</sup> and favored by many commentators,<sup>94</sup> is that exclusive use of a space resource is prohibited as national appropriation, and any recognition of property rights entails a claim of sovereignty.<sup>95</sup> Several arguments have been put forth in this regard. Leslie Tennen argued that in light of the obligation that any private activity must be authorized by the state, the state may not grant corporations more rights than the state possesses to begin with.<sup>96</sup> Professor Armel Kerrest argued that according to the principle of non-appropriation, only the international community may recognize property rights to space resources.<sup>97</sup> The most convincing legal argument in this regard is that for a state to recognize a right to individual property over an element, be it movable or immovable, it must either have the jurisdiction to recognize such right,<sup>98</sup> or the right was internationally recognized.<sup>99</sup> As Professor Hanoch Dagan and Professor Avihay Dorfman emphasized, “the right to private control of property is quite clearly—as Jeremy Bentham famously announced—a product of the law or, more precisely, a creature of what John Austin would later

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SACHDEVA, OUTER SPACE: LAW, POLICY AND GOVERNANCE 158 (2014), these can hardly be considered a replenishing resource as once one is mined, no new asteroid is born to replace it.

90. See *UNCLOS*, *supra* note 24, arts. 61–73, 116–120, 297(3); DONALD ROTHWELL & TIM STEPHENS, *THE INTERNATIONAL LAW OF THE SEA* 315–44 (2d ed. 2016).

91. *VCLT*, *supra* note 28, arts. 31–32.

92. See *infra* Section IV.C.

93. See Masson-Zwaan & Palkovitz, *supra* note 3, at 14–15.

94. See, e.g., Force, *supra* note 4, at 267; Marboe, *supra* note 53, at 230; ODUNTAN, *supra* note 11, at 208, 218; Baruah & Paliwal, *supra* note 11, at 25.

95. See, e.g., Force, *supra* note 4, at 267; Marboe, *supra* note 53, at 230; ODUNTAN, *supra* note 11, at 208, 218–19; Baruah & Paliwal, *supra* note 11, at 25; see also Paxson, *supra* note 4, at 494; Tennen, *supra* note 5, at 811; Lintner, *supra* note 2, at 146–47.

96. Tennen, *supra* note 5, at 806.

97. Cited in Tennen, *supra* note 5, at 811.

98. See Larsen, *Asteroids*, *supra* note 5, at 282–84.

99. See ODUNTAN, *supra* note 11, at 218–19.

call a command issued by the sovereign.”<sup>100</sup> Thus, since no state may possess sovereignty over celestial bodies, they fall under no state’s jurisdiction and no property rights may be legitimately recognized by the state.

The “non-appropriation” principle is truly the Achilles’ heel of commercial space resource extractions. It is, however, important to recall that the term is not “appropriation,” but “national appropriation,” and it is unlawful by “claim of sovereignty, by means of use or occupation, or by any other means.” It is reasonable to interpret the provision as indicating that national appropriation may be exercised by a *de jure* claim of sovereignty or by its *de facto* exercise through use, occupation, or any other mean. If the *de jure* element refers to sovereignty, it is unreasonable to consider its *de facto* exercise to include mere property rights—international law, and many legal systems, distinguish between sovereign acts and commercial acts.

While it is important to apply an evolving interpretation technique to the generic term “national appropriation,” in light of current economic, social, and geopolitical perceptions, it is also important to recall that the VCLT prescribes that “[a] treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose[.]”<sup>101</sup> and any ambiguity is to be resolved, *inter alia*, by tracking the intentions of the parties through the *travaux préparatoires*.<sup>102</sup>

Opposition to the United States’ recognition of property rights stems from equating it with national appropriation.<sup>103</sup> The United States, however, distinguished this recognition by specifically disclaiming sovereignty.<sup>104</sup> As noted above, the purpose of the Outer Space Treaty, and specifically Article II, as also evident from the *travaux*, was to preclude claims of sovereignty rather than resource rights. A modern interpretation should also consider the current globalized market. While it is true that under Article VI a state must authorize and supervise space activities by nationals, in the case of multi-national corporations it is hardly definitive which “nation” has appropriated the resources, should “national appropriation” extend to property rights in resources. Is it the state of the corporation’s registration? The states of shareholders’

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100. Hanoch Dagan & Avishai Dorfman, *The Human Right to Private Property*, 18 THEORETICAL INQUIRIES L. 391, 392 (2017) (Isr.).

101. VCLT, *supra* note 28, art. 31(1).

102. *Id.* art. 32.

103. See Jakhu & Freeland, *Relationship*, *supra* note 3, at 198.

104. See *US Space Resources Act*, *supra* note 3, § 51303.

nationality? The authorizing state? In the modern globalized world, it is highly plausible that both the authorizing state and the launching state, or their nationals, will possess limited or no property rights in extracted resources. Were the term “national appropriation” deemed to cover property rights, it would be difficult to determine which state has violated international law when its nationals acquire space resources through multi-national corporations.

While both interpretations of the generic term “national appropriation,” i.e., extending or excluding property rights, are reasonable, in light of developing capabilities in the modern world to transform space resource extractions into reality, coupled with the globalized market, the interpretation adopted by the United States seems more likely to be widely embraced. A contemporary interpretation promoting the development of space resources would not exclude property rights, as these would be essential to secure the profitability of private investments.<sup>105</sup> With the object and purpose of promoting human space exploration, property rights seem to be a prime catalyst for space exploration and exploitation. Furthermore, as will be developed below, the interpretation by the United States and Luxembourg is a first sign of state practice and is likely to be accepted by other states and transformed into law in the future.

### 3. Articles VI and VII of the Outer Space Treaty

Two additional provisions of the treaty have been raised with respect to commercial extraction of space resources. The first is Article VI which provides that:

States Parties to the Treaty *shall bear international responsibility for national activities in outer space*, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The *activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty . . .*<sup>106</sup>

Second is Article VII which states that:

Each *State Party to the Treaty that launches or procures the launching of an object into outer space, including the moon and other*

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105. LEE, *supra* note 4, at 320–21; TRONCHETTI, *supra* note 5, at 194.

106. OST, *supra* note 6, art. VI (emphasis added).

celestial bodies, and each State Party from whose territory or facility an object is launched, *is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air or in outer space, including the moon and other celestial bodies.*<sup>107</sup>

These Articles provide two important concepts in space jurisdiction and liability: the authorizing state and the launching state. According to Article VI, the state bears international responsibility for national activities in space by governmental or non-governmental entities and must authorize and supervise any non-governmental space activity by its nationals (assuming it is the appropriate state). Article VII provides that the state which the space activity is launched from bears liability for any damage caused by the launched object.

Larsen explains that Article VI holds governments accountable for actions by private entities, and governments must therefore be careful when authorizing space mining operations.<sup>108</sup> Were the term “national appropriation” deemed to extend to cover property rights, since private space activities must be authorized and supervised by the state, “national appropriation” may be interpreted to extend to private property rights.<sup>109</sup> In any case, as will be elaborated below, in contrast to the Cold War era, both the authorizing state and launching state are fluid concepts in the modern, globalized world and may precipitate a “flag of convenience” problem.<sup>110</sup>

#### 4. Article IX of the Outer Space Treaty

Article IX contains a common due regard obligation:

In the exploration and use of outer space, including the moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and *shall conduct all their activities in outer space, including the moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty.* . . .<sup>111</sup>

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107. *Id.* art. VII (emphasis added).

108. Larsen, *Asteroids*, *supra* note 5, at 287, 293–94.

109. See LEE, *supra* note 4, at 166–167.

110. On the problem of flag of convenience in space, see generally Adrian Taghdiri, *Flags of Convenience and the Commercial Space Flight Industry*, 19 B.U. J. SCI. & TECH. L. 405 (2013).

111. *OST*, *supra* note 6, art. IX (emphasis added).

It provides that in conducting space activities, states must act in due regard to the corresponding interests of other states. Lee suggested that the due regard obligation may be considered to extend only to similar interests, and provides for a negative duty not to undermine the interests of other states.<sup>112</sup> Similarly, von der Dunk explains that the provision mandates that states must “ensure that space activities undertaken by them or their nationals shall not cause harmful interference with other legitimate space activities unless prior consultation with possibly affected states has taken place.”<sup>113</sup> As both scholars pointed out, this provision strengthens the interpretation of Article I as one confined to the obligation not to undermine the rights of others to conduct commercial extractions of space resources.

### 5. Final Remarks on the Outer Space Treaty

The Outer Space Treaty is the prime, and perhaps sole, concrete source of rights and obligations with respect to commercial extraction of space resources under international law. The treaty is, however, a relic of the Cold War, founded upon the contemporary balance of interests and fear of extraterrestrial sovereignty claims. It is thus doubtful whether the treaty is an appropriate regulatory instrument considering modern technological, social, and geopolitical perceptions of participants in a globalized world. With respect to access and utilization of space resources, Cold War-era science fiction is becoming science fact, and the international rules must adapt to the changing realities or be abandoned as obsolete.

As will be explained below, the United States has presented an international claim predicated upon a modern interpretation of the principles of the Outer Space Treaty to preserve the absence of sovereignty claims, while legitimizing resource extractions. The generic terms “benefit,” “interest,” “use,” and “national appropriation” should be interpreted in a manner which allows humanity to tap into the vast resources of space and the benefits they entail. The United States and U.S. corporations are determined to access these resources in a commercially viable way; the Outer Space Treaty will either evolve through interpretation or be rendered obsolete in the process.

#### B. *The Moon Treaty*

The second international treaty cited in reference to the lawfulness of commercial extractions of space resources is the Moon Treaty. The

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112. LEE, *supra* note 4, at 159–60.

113. Von der Dunk, *Asteroid Mining*, *supra* note 1, at 88.

Moon Treaty, however, has been subscribed to by less than twenty states, none of which are the leading space-capable nations.<sup>114</sup> Out of the state-parties, Australia is the only space-capable state, but is allegedly contemplating withdrawal from the treaty.<sup>115</sup> The “common heritage of mankind” principle in the Moon Treaty has been recognized to constitute the main reason that space-capable states refrained from acceding to it.<sup>116</sup> This principle was, however, used by some scholars and commentators to shed light upon the existing or desirable regime for space resources.<sup>117</sup> This is unconvincing and founded upon a shaky legal foundation.

Article 1 of the Moon Treaty provides that the provisions of the treaty relating to the moon extend to all celestial bodies. This is important when considering Article 11, which stipulates that the moon, and thus other celestial bodies, are the “common heritage of mankind,” and imposes a limitation upon resource extractions and property rights until an international regime is installed:

*Article 11*

1. The moon and its natural resources are the common heritage of mankind, which finds its expression in the provisions of this Agreement, in particular in paragraph 5 of this article.
2. The moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means.
3. Neither 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 non-governmental entity or of any natural person. . . .
5. States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible. This provision shall be implemented in accordance with article 18 of this Agreement. . . .

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114. *Treaty Status 2018*, *supra* note 38, at 2, 5–10; Roth, *supra* note 1, at 843.

115. LYALL & LARSEN, *supra* note 3, at 166.

116. See von der Dunk, *Asteroid Mining*, *supra* note 1, at 89–90.

117. See, e.g., LEE, *supra* note 4, at 168; Tennen, *supra* note 5, at 812–14; Reinstein, *supra* note 5, at 67; Paxson, *supra* note 4, at 498.



7. The main purposes of the international regime to be established shall include:

- (a) The orderly and safe development of the natural resources of the moon;
- (b) The rational management of those resources;
- (c) The expansion of opportunities in the use of those resources;
- (d) An 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.<sup>118</sup>

This provision has been influenced by the contemporary development of the concept of the “common heritage of mankind,” stemming from the New International Economic Order advocated by developing countries in the 1970s, and the regulation of the resources of the international Area under UNCLOS.<sup>119</sup>

There is disagreement between commentators on whether this provision provides for a moratorium on space resource extractions.<sup>120</sup> Nevertheless, it has been recognized to entail the absence of property rights, subject space resources to the principle of the “common heritage of mankind,” and hold potential for a regulatory mechanism similar to that of the Area under UNCLOS, which may include revenue-sharing, technology sharing, cumbersome regulation, and competition by an international entity.<sup>121</sup>

While this provision discouraged space-capable states from acceding to the Moon Treaty,<sup>122</sup> some commentators relied upon the Moon Treaty in their interpretation of the rights and obligations imposed with respect to space resources. Lee considered that the provisions of the Moon Treaty may assist in interpreting the non-appropriation principle in the Outer Space Treaty.<sup>123</sup> He then argued that, in accordance with Article 11(2) of the Moon Treaty, in relation to Article 11(3) which concerns the resources, and pursuant to the use of appropriation

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118. *Moon Treaty*, *supra* note 7, art. 11.

119. *See* von der Dunk, *Asteroid Mining*, *supra* note 1, at 89–90.

120. *See* Paxson, *supra* note 4, at 499–501.

121. *See* von der Dunk, *Asteroid Mining*, *supra* note 1, at 89–90.

122. *Id.*

123. LEE, *supra* note 4, at 168.

under Article 137(1) of UNCLOS, “national appropriation” must refer to “exercise of sovereignty.”<sup>124</sup> Similarly, another commentator argued that because the Moon Treaty was negotiated by the United States and the Soviet Union, while they did not become members, it can be used to interpret the provision of the Outer Space Treaty as it is sought to clarify that treaty.<sup>125</sup> Scholar Gbenga Oduntan relied upon the Moon Treaty to support the proposition that the non-appropriation principle in the Outer Space Treaty precludes property rights.<sup>126</sup> Other commentators have also referenced the Moon Treaty to support their interpretation with respect to the principle of non-appropriation and property rights.<sup>127</sup>

This interpretation method is, however, in blunt contrast to the rules of treaty interpretation in Article 31 of the VCLT.<sup>128</sup> While the Moon Treaty may be an agreement relating to the Outer Space Treaty, even if it were negotiated by the same architects (i.e., the United States and the Soviet Union), it is far from being concluded among all the parties or applicable by the parties to their relationship. It cannot be relied upon to interpret the Outer Space Treaty under international law.

Besides using the Moon Treaty for interpretational purposes, commentators have suggested that the principle of the “common heritage of mankind” serves, or should serve, at the core of any international regulatory regime for space resources.<sup>129</sup> One commentator even suggested that while the precise method is unclear, the international community recognizes that an obligation to share the resources of space exists.<sup>130</sup> Others, however, have pointed out that formulating an international regime for space resources based on the principle of the “common heritage of mankind” is highly unlikely, precisely because the Moon Treaty was rejected by space-capable states due to the inclusion of this principle.<sup>131</sup> As will be further explained below, there is little prospect for a space regime based on the “common heritage of mankind” and revenue-sharing; the balance of interests, leading to a

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124. *Id.* at 168–69.

125. Force, *supra* note 4, at 264.

126. ODUNTAN, *supra* note 11, at 208.

127. *See, e.g.*, Tennen, *supra* note 5, at 812–14; Reinstein, *supra* note 5, at 67.

128. VCLT, *supra* note 28, art. 31.

129. *See, e.g.*, ODUNTAN, *supra* note 11, at 207–19; Tao & Wang, *supra* note 24, at 44–45, 50; Baruah & Paliwal, *supra* note 11, at 30–32; Tennen, *supra* note 5, at 823; Paxson, *supra* note 4, at 508.

130. Paxson, *supra* note 4, at 508.

131. *See* Force, *supra* note 4, at 269; TRONCHETTI, *supra* note 5, at 119.

compromise and enabling the adoption of this concept under UNCLOS, simply does not exist with respect to space resources.

The Moon Treaty, and specifically the principle of common heritage of mankind and revenue-sharing regarding space resources, were rejected by the majority of the international community and particularly by the states which will participate at the early stages of extracting space resources. While it has been suggested that in light of U.S. legislation countries may be encouraged to ratify the treaty, this has not yet happened.<sup>132</sup> It is therefore extremely questionable whether this agreement can indicate the current international law, or serve as a likely blueprint for any regime to be developed in the future. On this note, the United States recently unequivocally rejected the proposition that space can be deemed the “common heritage of mankind.” In December 2017, Dr. Scott Pace, the Executive Secretary of the National Space Council, stated in a speech that:

Finally, many of you have heard me say this before, but it bears repeating: outer space is not a “global commons,” not the “common heritage of mankind,” not “res communis,” nor is it a public good. These concepts are not part of the Outer Space Treaty, and the United States has consistently taken the position that these ideas do not describe the legal status of outer space. To quote again from a U.S. statement at the 2017 COPUOS Legal Subcommittee, reference to these concepts is more distracting than it is helpful. To unlock the promise of space, to expand the economic sphere of human activity beyond the Earth, requires that we not constrain ourselves with legal constructs that do not apply to space.<sup>133</sup>

Similarly, the President of the United States recently proclaimed that:

The United States is not a party to the Moon Agreement. Further, the United States does not consider the Moon

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132. See Hamid Kazemi & Ali Akbar Golroo, *Legal Challenges in Front of Private Sectors on Exploration of Space Resources and Off-Earth Mining*, in 59 PROCEEDINGS OF THE INTERNATIONAL INSTITUTE OF SPACE LAW 279, 285 (P.J. Blount et al. eds., 2016); Roth, *supra* note 1, at 843.

133. Dr. Scott Pace, Exec. Sec’y, Nat’l Space Council, Keynote Address at the IISL Galloway Space Law Symposium (Dec. 13, 2017) (transcript available at [https://spacepolicyonline.com/wp-content/uploads/2017/12/Scott-Pace-to-Galloway-FINAL.pdf?utm\\_content=buffer66778&utm\\_medium=social&utm\\_source=twitter.com&utm\\_campaign=buffer](https://spacepolicyonline.com/wp-content/uploads/2017/12/Scott-Pace-to-Galloway-FINAL.pdf?utm_content=buffer66778&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer) (last visited Nov. 1, 2018)).

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. Accordingly, the Secretary of State shall object to any attempt by any other state or international organization to treat the Moon Agreement as reflecting or otherwise expressing customary international law.<sup>134</sup>

Given this unequivocal statement, and the recently concluded Artemis Accords between the United States and other developed states, including Canada, Japan and the U.K.,<sup>135</sup> it is highly unlikely that either the Moon Treaty or the principle of the common heritage of mankind will guide the development of international law governing space resources.

### C. *Other International Space Treaties*

Alongside the Outer Space Treaty and the Moon Treaty, three other international instruments may be deemed relevant by some to commercial extractions of space resources: the Rescue Agreement, the Liability Convention, and the Convention on Registration of Objects Launched into Outer Space (the “Registration Convention”). While these agreements have provisions which may apply to commercial activities, they have no bearing on the legal issues that concern the lawfulness of commercial extractions of space resources with which this Article is concerned.

### D. *Customary International Law*

States may withdraw from the Outer Space Treaty within a year’s notice, corporations may conduct activities from non-member states, and the Moon Treaty has been widely rejected. Thus, any reliance upon the non-appropriation principle, the principle that space activities must be in the benefit and interest of all countries, and especially the principle of the common heritage of mankind, for regulating

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134. Exec. Order No. 13,914, 85 Fed. Reg. 20,381 (Apr. 10, 2020) [hereinafter *U.S. Executive Order Apr. 6, 2020*].

135. Artemis Accords, Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes, § 10, Oct. 13, 2020 [hereinafter Artemis Accords], available at <https://www.nasa.gov/specials/artemis-accords/img/Artemis-Accords-signed-13Oct2020.pdf>.

commercial extractions of space resources is questionable unless these principles are deemed to reflect customary international law.<sup>136</sup> This has led several scholars to claim that certain provisions of the Outer Space Treaty, specifically the principles of “benefit and interests of all,” “freedom,” “non-appropriation,” “State responsibility,” and even the “common heritage of mankind” with respect to space resources have become customary international law.<sup>137</sup> Before proceeding to evaluate the arguments of these scholars, it is important to recall the international rules governing the recognition of customary international law.

Article 38(1) of the Statute of the International Court of Justice lists, as a source of international law, “international custom, as evidence of a general practice accepted as law.”<sup>138</sup> Recognition of custom thus turns upon two cumulative conditions: (1) the existence of actual, general state practice, which is (2) recognized as law by states (*opinio juris*). This has been recognized by the International Court of Justice and a recent report of the International Law Commission (“ILC”).<sup>139</sup>

Certain provisions of multilateral treaties have been recognized to reflect customary international law, e.g., UNCLOS Article 56 on the exclusive economic zone (“EEZ”), Article 121 on islands, and Articles 74 and 83 on delimitation.<sup>140</sup> A treaty rule “may reflect” customary international law, according to the ILC, if it is established that it:

- (a) codified a rule of customary international law existing at the time when the treaty was concluded;
- (b) has led to the crystallization of a rule of customary international law that had started to emerge prior to the conclusion of the treaty; or
- (c) has given rise to a general practice that is accepted as law (*opinio juris*), thus generating a new rule of customary international law. . . <sup>141</sup>

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136. See LYALL & LARSEN, *supra* note 3, at 64–65.

137. See, e.g., LEE, *supra* note 4, at 154–55; Larsen, *Asteroids*, *supra* note 5, at 289; Jakhu & Freeland, *Relationship*, *supra* note 3, at 183, 191–94.

138. Statute of the International Court of Justice, *supra* note 8, art. 38(1).

139. Jurisdictional Immunities of State (Germany v. Italy: Greece intervening), Judgment, 2012 I.C.J. Rep. 99, ¶ 55 (Feb. 3); Michael Wood (Special Rapporteur), *Fifth Rep. on Identification of Customary International Law*, [2013] INT’L L. COMM’N, U.N. Doc. A/CN.4/717, annex, conclusion 2 (Mar. 14, 2018) [hereinafter *ILC, Customary International Law*] (“Two constituent elements.”).

140. Territorial and Maritime Dispute (Nicar. v. Colom.), Judgment, 2012 I.C.J. Rep. 624, ¶¶ 114, 118, 139 (Nov. 19).

141. *ILC, Customary International Law*, *supra* note 139, annex, conclusion 11 (“Treaties.”).

A determination of customary law must thus be established on legal grounds, especially actual state practice and *opinio juris* rather than the preferred policy. It is also important to emphasize that evidence of state practice should preferably be found in the practice of non-parties to a treaty, as practice by state-parties may simply indicate compliance with a treaty obligation.<sup>142</sup>

In 2012, Lee suggested that since there were states which objected to property rights in space, and in the absence of contrary opinion, there is a potential for a customary norm rejecting property rights in space.<sup>143</sup> First, in the absence of actual practice as regards space resources, it is unclear how statements, in conjunction with the technological inability to exercise contrary practice, may generate a principle of customary international law. In other words, the technological inability to exercise a claim does not indicate that the opposite claim represents customary international law; that would be absurd. Regardless, since the United States has recognized property rights in 2015, with Luxembourg and other countries following in its footsteps, Lee's assessment may be considered obsolete.

Recently, Larsen and Professor Francis Lyall suggested that the Outer Space Treaty, and specifically the provisions concerning freedom of exploration and use for the benefit and interests of all mankind (Art. I), the non-appropriation principle (Art. II), and state liability (Art. VI), have become customary international law.<sup>144</sup> Their argument rests upon several pillars: the broad acceptance of the treaty, including by all space-capable states; the significant lapse of time since 1967 absent any formal objections; adoption of these elements by the General Assembly resolution and in cooperation agreements; and state practice in the sense of freedom of access, absence of sovereignty claims, no objection to satellite overflight, and no military use.<sup>145</sup> They even suggested that there is "considerable strength in the argument of Carl Q. Christol that the fundamental principles of the OST [i.e. the Outer Space Treaty] now come into the category of *ius cogens*."<sup>146</sup> Similarly to Lee, they seem to rely upon the absence of contrary practice as purported evidence of actual state practice; this is unconvincing.

142. North Sea Continental Shelf, Judgment, 1969 I.C.J. Rep. 3, ¶ 76 (Feb. 20); see Xuexia Liao, *The LOSC as a Package Deal and its Implications for Determination of Customary International Law*, 35 INT'L J. MARINE & COASTAL L. 1, 7-8, 19-20 (2020).

143. LEE, *supra* note 4, at 171.

144. LYALL & LARSEN, *supra* note 3, at 70.

145. *Id.* at 64, 70-73; see also Larsen, *Asteroids*, *supra* note 5, at 289.

146. LYALL & LARSEN, *supra* note 3, at 73; see Carl Q. Christol, *Judge Manfred Lachs and the Principle of Jus Cogens*, 22 J. SPACE L. 33 (1994).

The authors presented limited evidence of state practice, and no reference to the proposition that states have accepted these principles as binding law.<sup>147</sup> The absence of any meaningful actual practice as regards space resources<sup>148</sup> and the limited space activities beyond near Earth orbit are hardly conclusive of affirmative state practice which may translate into customary international law not to mention *jus cogens*.

Similarly, Professor Ram S. Jakhu and Professor Steven Freeland suggested that the principles of “common interest,” “freedom,” and “non-appropriation” in Articles I and II of the Outer Space Treaty were considered to reflect principles of customary international law.<sup>149</sup> They submit that these principles reflect state practice from the beginning, except for the rejected Bogotá Declaration,<sup>150</sup> and were of customary nature before their codification in the treaty and may have, since then, been elevated to *jus cogens*.<sup>151</sup> Besides the fact that no reference to their acceptance as customary in the *travaux* has been provided, the non-appropriation principle has been adopted out of fear of sovereignty claims as part of the space race,<sup>152</sup> which undermines their argument. As a side note, this author finds it puzzling how a purported regulation of a commons can plausibly be equated with recognized *jus cogens* rules such as the prohibitions on genocide or slavery.

Oduntan argued that the concept of space as the common heritage of mankind is becoming part of customary international law,<sup>153</sup> which then precludes property rights in space absent international regulation.<sup>154</sup> Oduntan, however, has based his argument upon the adoption of the concept in the Moon Treaty,<sup>155</sup> the proposition that more and more states accede to the Moon Treaty and that the principle of equal access to outer space constitutes part of customary international law.<sup>156</sup> These arguments fail to prove the existence of actual state practice or

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147. *Larsen, Asteroids, supra* note 5, at 289; LYALL & LARSEN, *supra* note 3, at 63–73, 163–88.

148. *See Larsen, Asteroids, supra* note 5, at 300; Tennen, *supra* note 5, at 811; Johnson, *supra* note 4, at 1498, 1509; LEE, *supra* note 4, at 154–55.

149. Jakhu & Freeland, *Relationship, supra* note 3, at 191–92.

150. In 1976 equatorial states purported to declare sovereignty over segments of the geostationary orbit. *Id.* at 192 n.41. This claim failed to gain support, see Irwin, *supra* note 5, at 234–36.

151. Jakhu & Freeland, *Relationship, supra* note 3, at 191.

152. Tennen, *supra* note 5, at 804–05; *Larsen, Asteroids, supra* note 5, at 282.

153. ODUNTAN, *supra* note 11, at 193.

154. *See id.* at 204–05.

155. *Id.* at 193–94.

156. *Id.* at 205.

*opinio juris* and thus fail to establish a principle of customary international law.

The claims of custom discussed above seem to be mostly outcome driven rather than legally sound. Recognition of a treaty provision to reflect or generate rules of customary international law must rely upon solid legal and practical foundation, rather than *ipse dixit* statements or the preferred policy choice. In order for the principles of non-appropriation, common interests or the common heritage of mankind with respect to space resources to be recognized as representing customary international law, they must have either codified an existing or emerging customary international law or “given rise to a general practice that is accepted as law (*opinio juris*).”<sup>157</sup> As the International Court of Justice stated in *Libya v. Malta*, “the material of customary international law is to be looked for primarily in the actual practice and *opinio juris* of States.”<sup>158</sup> As concerns the commercial extraction of space resources, however, there is no state (or other) practice, and the principle of common heritage of mankind has been bluntly rejected by the vast majority of states, including all but one space-capable states.<sup>159</sup>

In the absence of *any* actual practice, it is unreasonable to use the absence of contrary practice to justify elevating a preferred policy choice to the status of customary international law. It is artificial to suggest that these provisions of the Outer Space Treaty or the Moon Treaty have codified, crystalized or generated principles of customary international law. Thus, while Articles I and II of the Outer Space Treaty currently constitute part of international law between the space-capable states, the principle of the common heritage of mankind and any moratorium on space resources in the Moon Treaty, are not. Since the interpretation of the non-appropriation principle and its relation to commercial extraction of space resources is in dispute between states and scholars, it is imprudent to consider one interpretation, convincing as it may be, as effective international law. The dispute itself is an indication of the absence of custom.

This conclusion is reinforced by the fact that, should the United States’ interpretation be rejected, the United States may simply withdraw from the Outer Space Treaty to promote its interests.<sup>160</sup> The lack

157. ILC, *Customary International Law*, *supra* note 139, at annex, conclusion 11.

158. *Continental Shelf (Libya v. Malta)*, Judgment, 1985 I.C.J. 13, ¶ 27 (June 3).

159. See LEE, *supra* note 4, at 154–55; Matthew Feinman, *Mining the Final Frontier: Keeping Earth’s Asteroid Mining Ventures from Becoming the Next Gold Rush*, 14 PITT. J. TECH. L. & POL’Y 202, 219 (2014).

160. The Outer Space Treaty may be renounced by a state-party with one year’s notice, see *OST*, *supra* note 6, art. XVI.



of enforceability of the Outer Space Treaty makes national legislation, and especially the United States' national legislation, a major factor in determining the current and future legal framework with respect to extracting space resources.

E. *National Legislation*

Many states have national legislation on space activities.<sup>161</sup> This is understandable, as the international legal framework regarding responsibility and liability is based upon the state model: launching state, registration state, and authorizing state. This international legal framework encourages states to regulate space activities by their citizens and within their territory. Such regulation includes insurance obligations, safety measures, launch specification and more.<sup>162</sup> As of today, two states, the United States and Luxembourg, have passed domestic legislation which unilaterally recognized the property rights of their nationals and corporations to extracted space resources. A third state, the United Arab Emirates ("UAE"), has expressed interest in space resources.<sup>163</sup> The United States' Space Resources Act provides 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 obligations of the United States.<sup>164</sup>

While the Act refers to "asteroid resource[s]," the broad reference to "space resource[s]" extends the Act's application to the resources of all celestial bodies, including the moon. The Act has been legislated pursuant to pressure coming from U.S. corporations pioneering in the field of space resources in order to protect their investment as they progress towards realizing the extraction of space resources.<sup>165</sup> The Act puts forth an interpretation of the Outer Space Treaty, in an attempt to bypass the non-appropriation principle, according to which property

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161. See generally DORINA ANDONI, THE ULTIMATE SPACE LAW COLLECTION VOL. 2.1 NATIONAL SPACE LEGISLATION (2013).

162. See generally LYALL & LARSEN, *supra* note 3, at 75–78.

163. *Von der Dunk, Private*, *supra* note 5, at 143.

164. *US Space Resources Act*, *supra* note 3, § 51303.

165. See *von der Dunk, Asteroid Mining*, *supra* note 1, at 94.

rights to the extracted resources may be recognized absent initial sovereignty over the resources themselves.<sup>166</sup> The “disclaimer of extraterrestrial sovereignty” part of the Act attempts to distinguish the property rights from the non-appropriation principle: “[i]t is the sense of Congress that by the enactment of this Act, the United States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body.”<sup>167</sup>

Since the non-appropriation principle is ambiguous to begin with, the U.S. Space Resources Act is an attempt to preserve the framework of the Outer Space Treaty while recognizing property rights to the resources in order to encourage private innovation and investment by preemptively protecting prospective property rights, and thus revenue.<sup>168</sup> In effect, the Act promotes the use of space resources, while refraining from legitimizing and dealing with claims to sovereignty in space.<sup>169</sup> The Act was intended to provide the necessary security for space resource mining efforts by providing domestic protection to property while postponing the international debate by disclaiming sovereignty, a debate that could have otherwise “discourage[d] the development of a domestic space industry.”<sup>170</sup> A modern interpretation of the non-appropriation principle can be deemed essential, as the interests and perspectives of the various participants have changed and developed from the Cold War era of the 1960s.<sup>171</sup> In essence, as von der Dunk pointed out, the Act ensures that: “potential claims—in particular from outside the United States—that such extracted space resources would constitute the spoils of illegal activities or would have to be somehow shared internationally under a possible interpretation of the common heritage of mankind principle would not be recognized by any U.S. court.”<sup>172</sup>

Besides the recognition of property rights, the U.S. Space Resources Act calls for future regulation and instructs the President to facilitate commercial exploitation, reduce barriers, and “promote the right of United States citizens to engage in commercial exploration for and commercial recovery of space resources free from harmful interference.”<sup>173</sup> This has been suggested to imply an instruction to promote an “international regime sympathetic to the interests of the United

166. *See supra* n.85, 87 and accompanying text.

167. *US Space Resources Act, supra* note 3, § 51303.

168. *See* Lintner, *supra* note 2, at 150–51.

169. *Id.*

170. Roth, *supra* note 1, at 849.

171. *See* Neto, *supra* note 37, at 216–17.

172. von der Dunk, *Asteroid Mining, supra* note 1, at 94–95.

173. *US Space Resources Act, supra* note 3, § 51302(a)(3).

States and its companies,<sup>174</sup> or signal that the United States “would not support any international treaties attempting to curtail ownership rights of space or asteroid resources.”<sup>175</sup> On the other hand, it has been suggested, although less convincingly, that the U.S. Space Resources Act did not in fact create property rights, but only indicated that the United States would recognize property rights subject to international law.<sup>176</sup> The more convincing interpretation is that the United States, as with the continental shelf and the deep-seabed,<sup>177</sup> has presented a claim which unilaterally recognizes property rights in space resources, in essence proposing a new legal framework for any future regime of space resources.

The U.S. Space Resources Act was objected to by Russia, Brazil, and Belgium.<sup>178</sup> Russia objected to the law as inconsistent with international law, presenting a new interpretation of the non-appropriation principle, showing disregard to the calls for international regime under the Moon Agreement, and constituting a policy of U.S. domination over space.<sup>179</sup> Brazil objected due to inconsistency with principles of international law and the preference for international rather than national regulation for space resources. Belgium stressed the non-appropriation principle with respect to space resources.<sup>180</sup> While some of these objections have substance, once these states or their nationals achieve the capabilities necessary to conduct extractions of space resources, it is questionable whether such objections would persist. Furthermore, should other states legislate similar laws and recognize property rights to space resources, the U.S. interpretation of the provision may indeed become an accepted legal interpretation.<sup>181</sup> On this issue, a Position Paper by the International Institute of Space Law stated that:

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174. von der Dunk, *Asteroid Mining*, *supra* note 1, at 95.

175. Lintner, *supra* note 2, at 151.

176. See Roth, *supra* note 1, at 850.

177. Proclamation No. 2667, 10 Fed. Reg. 12,305 (Sept. 28, 1945); See also LYALL & LARSEN, *supra* note 3, at 186.

178. See von der Dunk, *Asteroid Mining*, *supra* note 1, at 97–99; Masson-Zwaan & Palkovitz, *supra* note 3, at 14–15 (Russia and Belgium); Kfir & Perry, *supra* note 3, at 180; Marboe, *supra* note 53, at 231.

179. See von der Dunk, *Asteroid Mining*, *supra* note 1, at 97.

180. *Id.*

181. See von der Dunk, *Asteroid Mining*, *supra* note 1, at 100; *Position Paper on Space Resource Mining*, INT’L INST. SPACE L. § 3 (Dec. 20, 2015) [hereinafter *IISL Paper 2015*], <https://iislweb.org/docs/SpaceResourceMining.pdf>.

[I]n view of the absence of a clear prohibition of the taking of resources in the Outer Space Treaty one can conclude that the use of space resources is permitted. Viewed from this perspective, the new United States Act is a possible interpretation of the Outer Space Treaty. Whether and to what extent this interpretation is shared by other States remains to be seen.<sup>182</sup>

In fact, the recently concluded Artemis Accords between the United States and several of its allies, stipulate that:

The Signatories affirm that the extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty, and that contracts and other legal instruments relating to space resources should be consistent with that Treaty.<sup>183</sup>

Commentators are predominantly concerned with whether the Act is consistent with or violates the international norms set under the Outer Space Treaty.<sup>184</sup> Few, however, considered the potential normative effect of this legislation on the decision-making process of fellow states.<sup>185</sup> Focusing on the compatibility of the Act with the Outer Space Treaty to evaluate the Act's effects would be a mistake; a preferred path would consider the past and prospective reactions of the other participants. As early as 1984, Professor W. Michael Reisman recognized the importance of international incidents as norm-generators:

Rather than seeing incidents as norm-indicators or norm-generators, as does the political adviser, the international lawyer generally reacts to them in judgmental fashion, assuming that the norm in question is a priori and enduring and examining the incidents in terms of whether they indicate that a particular norm has been violated.<sup>186</sup>

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182. *IISL Paper 2015*, *supra* note 181, § 2, ¶ 2.

183. Artemis Accords, § 10, art. 3.

184. *See, e.g.*, Blount & Robison, *supra* note 36, at 181; Jakhu & Freeland, *Relationship*, *supra* note 3, at 198; LEE, *supra* note 4, at 154–55; Salter, *supra* note 5, at 312–13; Masson-Zwaan & Palkovitz, *supra* note 3, at 9; Kfir & Perry, *supra* note 3; Marboe, *supra* note 53, at 232.

185. *See, e.g.*, Reinstein, *supra* note 5, at 80; Roth, *supra* note 1, at 848.

186. W. Michael Reisman, *International Incidents: Introduction to a New Genre in the Study of International Law*, 10 YALE J. INT'L L. 1, 4 (1984); *see also* Blount & Robison, *supra* note 36, at 177–78.

As Reisman explained:

The student of incidents . . . is not involved in judging the lawfulness of the behavior of actors in the incident concerned, but rather evaluates the reactions of other relevant actors and, through those reactions, the subjective conceptions of right and/or tolerable behavior entertained by those other actors. Hence what is important in this exercise is not so much what happened as what effective elites think happened and how they react.<sup>187</sup>

The study of the U.S. Space Resources Act as an international incident can “serve as a type of ‘meta-law’, providing normative guidelines for decisionmakers in the international system in those vast deserts in which case law is sparse.”<sup>188</sup> Outer space activities are in fact such a desert.

The initial Russian objection to the U.S. Space Resources Act has been attributed to intergovernmental tensions,<sup>189</sup> the adoption of similar legislation by Luxembourg (an EU member), and interests expressed by UAE<sup>190</sup> may indicate that global elites consider the U.S. legislation legitimate. Further support can be found in the fact that China not only did not criticize the U.S. claim, but is developing its own space mining program.<sup>191</sup> Absent persistent objections from other space-capable states, the Act may serve to define and interpret international law with respect to space resources,<sup>192</sup> and thus generate an international norm recognizing property rights in space resources.<sup>193</sup> A first step in that direction has been achieved through the Artemis Accords<sup>194</sup>

While formulated as an “interpretation” of the Outer Space Treaty, the U.S. Space Resources Act is the first modern claim by a participant in the process of shaping the developing regime to govern commercial

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187. Reisman, *supra* note 186, at 17.

188. *Id.* at 19.

189. *See von der Dunk, Private, supra* note 5, at 149; Kfir & Perry, *supra* note 3, at 180.

190. *von der Dunk, Private, supra* note 5, at 143.

191. *See Doshi, supra* note 1, at 196; Namrata Goswami, *China in Space: Ambitions and Possible Conflict*, 12 STRATEGIC STUD. Q. 74 (2018); Andrew Jones, *China to Launch Space Mining Bot*, IEEE SPECTRUM (Sep. 16, 2020), <https://spectrum.ieee.org/tech-talk/aerospace/satellites/china-to-launch-space-mining-bot>.

192. Blount & Robison, *supra* note 36, at 182.

193. *See infra* Section V.A.

194. *See The Artemis Accords*, NAT'L AERONAUTICS AND SPACE ADMIN., <https://www.nasa.gov/specials/artemis-accords/index.html> (last visited Jan. 11, 2021).

extraction of space resources. The United States claims to alter the current regime of non-appropriation, as pointed out by Russia and Belgium, and to confine “national appropriation” to the narrow meaning of sovereignty, thus allowing for property rights in the resources, absent the rights, national or international, to recognize them. The reactions and counterclaims to be made by the other space-capable states and the rest of the international community will shape the developing regime. Three additional points bear emphasis in this regard.

First, since U.S. corporations are leading the private sector’s engagement, innovation, and implementation of commercial extractions of space resources,<sup>195</sup> the United States’ recognition of their property rights to the resources may, in fact, serve as the first “actual practice” by a state for the purpose of identifying customary international law. Any future respect for such property rights by international trading partners and particularly other states (e.g. the Artemis Accords), coupled with similar laws adopted in other jurisdictions, may serve to establish *opinio juris* in this regard. Second, unilateral recognition by the United States of exclusive use of natural resources that would have otherwise been inclusively used by all, and recognition of property rights thereof, has in the past served to establish customary international law in regards to the continental shelf.<sup>196</sup> This historical precedent may be replicated to generate an international norm for space resources.<sup>197</sup> Third, as with the mining of the deep-oceans and the 1994 Implementation Agreement,<sup>198</sup> the unilateral recognition of property rights by the United States may encourage the development of an international regime favorable to the corporate interests of space-capable states.<sup>199</sup> Unless the Russian objections persist and are voiced by other space-capable states, the Act may serve to define and interpret international law with respect to space resources.<sup>200</sup>

It would therefore not be surprising if, once commercial extraction of space resources by U.S. corporations becomes a reality, the United States’ interpretation of the non-appropriation principle will be recognized as representing customary international law or at least serve as a blueprint for any international regime to be developed. The

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195. *See von der Dunk, Private*, *supra* note 5, at 147.

196. ROTHWELL & STEPHENS, *supra* note 90, at 102–11.

197. *See von der Dunk, Asteroid Mining*, *supra* note 1, at 101.

198. *See id.* at 92.

199. It has been suggested that the U.S. Space Resource Act instructs the President of the United States to negotiate an international regime favorable to U.S. corporate interests. *See von der Dunk, Asteroid Mining*, *supra* note 1, at 95.

200. *See Blount & Robison*, *supra* note 36, at 182.

“disclaimer of extraterrestrial sovereignty” indicates that while the United States intends to promote extractions of natural resources in space, it will internationally legitimize it through an interpretation of the Outer Space Treaty rather than its replacement or denunciation. This is understandable, since as long as the exercise of effective control over territory on another planet or moon is theoretical, undermining the national non-appropriation principle may only lead to theoretical sovereignty claims, precipitating disputes over non-exercisable claims to sovereign rights. It is questionable whether the United States, or another space participant, will continue to respect this distinction once theoretical sovereignty claims become substantive.

F. *Concluding Remarks on Existing Legal Framework*

The existing legal framework regarding commercial extractions of space resources provides limited answers to whether exclusive use of parts of celestial bodies and property rights to any extracted resources are lawful under international law. The ambiguous generic terms of the Outer Space Treaty, and the widely-rejected Moon Treaty, provide few definitive answers. Further, references to customary international law lack the requisite factual and legal foundation.

Evaluating compatibility of modern commercial extractions of space resources with international law is thus confined to the ambiguous provisions of the Outer Space Treaty, a relic of the Cold War, which exhibits the interests, objectives, and perspectives of participants of a bygone era. But the engine of innovation steams forward and private space entrepreneurs are developing the technology and machinery necessary to transform science fiction into science fact. International law must not remain frozen in the 1960s but evolve to adapt to the changing technological and commercial realities.

The evolution and adaptation of international law may be performed through interpretation or modification. National legislation, and particularly the U.S. Space Resources Act, may indicate the preferred path for international law’s development, i.e., interpretation rather than modification. It is extremely questionable whether there currently exist incentives for the space-capable states, and particularly the United States, to relinquish any prospect for their nationals to extract space resources, or for common action by the international community;<sup>201</sup>

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201. See von der Dunk, *Asteroid Mining*, *supra* note 1, at 100; Eligar Sadeh, *International Space Governance: Challenges for the Global Space Community*, in RECENT DEVELOPMENTS IN SPACE LAW: OPPORTUNITIES & CHALLENGES 43, 44 (R. Venkata Rao et al. eds., 2017).

what can the space-incapable states truly offer in return? The future international regime will develop in relation to the incentives in place for its development. Before turning to the proposed regimes, the difficulties they present, and the proposed regime evolution approach, the next section will lay the theoretical foundation for any regime governing commercial extractions of space resources.

### III. THE GLOBAL ORDER OF COMMERCIAL EXTRactions OF SPACE RESOURCES

For an international regulatory regime for commercial extractions of space resources to be successful, it must be feasible, effective, and manageable. Feasibility refers to whether such an international regime may be realized, i.e., whether such a regime is likely to be adopted by the participants considering their conflicting goals, interests, and leverages. Effectiveness refers to whether the adopted regime is likely to promote the values the participants strive to utilize and develop. Manageability refers to the ability to sustain or enforce the regime with respect to outliers. In essence, the proposed regime must be acceptable to the relevant participants, it must promote the aspired interests and values and it must successfully affect the policy choices of the participants. With few authoritative sources of law and evolving opportunities and challenges, the regime governing space resources will develop through the “responses of key actors to . . . critical event[s],”<sup>202</sup> which will, as Reisman explained, shape the development of international norms, practice, and law.<sup>203</sup>

The methodology of the New Haven School of International Law for evaluating the interactions between the various participants in outer space in general, and utilization of space resources in particular, has been outlined by Myres S. McDougal, Harold D. Lasswell, Ivan A. Vlasic and Joseph C. Smith in 1963 and will not be repeated here.<sup>204</sup> In broad terms, it involves determining the participants, their objectives, the situations in which their interactions occur, the base values they employ, the strategies taken by the participants, the outcomes of their interactions and their effects.<sup>205</sup> This broad methodology will be refined below to fit the purposes of the Article.

For ascertaining whether a regime is feasible, one needs to consider the participants involved, their bases of power, the objectives they seek

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202. Reisman, *supra* note 186, at 2.

203. *See generally id.*

204. *See generally* MCDUGAL, *PUBLIC ORDER IN SPACE*, *supra* note 5, at 3–85.

205. *See generally id.* at 8–85.



to achieve, and their anticipated interactions and outcomes. Effectiveness of the regime will turn upon whether it optimizes the gain in value for all participants, and manageability will depend upon situations where the interaction will occur and the potential strategies that the participants will employ.

McDougal et al. considered certain participants, objectives, and values, based on their understanding of outer space as of the 1960s.<sup>206</sup> Additionally, their analysis centered on whether the global order should consider the resources to be exclusive or inclusive.<sup>207</sup> While their analysis is helpful, much has changed, and different participants and values have become relevant. As the commercial extractions of space resources is developing, it becomes clearer which are the relevant participants and their objectives, and which values, or basic policies, the requisite regime needs to promote. They will be reviewed below in both a descriptive and prescriptive manner.

#### A. *Participants and Objectives*

The participants in any potential regime for the commercial extractions of space resources include: (i) private space entrepreneurs; (ii) space-capable states; (iii) states that currently lack space capability (space-incapable states); and (iv) international organizations. Since private capital is taking a lead in developing the requisite technologies and conducting the necessary surveys to make commercial space extraction a reality,<sup>208</sup> it is best to begin with private space entrepreneurs. The pursuant review of participants and interests is not conclusive and may change as commercial extraction of space resources is realized.

##### 1. Private Space Entrepreneurs

Early space travel was dominated by states because the requisite investment amount was enormous, the risks high, and the expected return value extremely low.<sup>209</sup> With the development of technology and the reduction of costs associated with space travel, private corporate entities began to take their place alongside states in the space industry.<sup>210</sup> We have witnessed private satellites construction and launches,<sup>211</sup>

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206. McDougal et al., *Enjoyment*, *supra* note 5.

207. *Id.*

208. Masson-Zwaan & Palkovitz, *supra* note 3, at 6.

209. *See* Roth, *supra* note 1, at 862.

210. *See* Lintner, *supra* note 2, at 141.

211. LYALL & LARSEN, *supra* note 3, at 37.

private space tourism,<sup>212</sup> and now the prospect of private extraction and utilization of space resources.<sup>213</sup> In this regard, private entities, Deep Space Industries and Moon Express, just to name a few,<sup>214</sup> have been preparing to launch probes in preparation for extraction of space resources.<sup>215</sup> To facilitate foreseeability in the industry and protect the investments, the U.S. government, pressured by the industry, adopted legislation which recognized the property rights of U.S. corporations to extracted space resources. It is therefore evident that private corporate entities are key participants in the interactions which develop and implement any global regime for space resources.

While some scholars have questioned the economic logic and profitability of extracting space resources,<sup>216</sup> space investors' prime objective is to maximize the profits from their investment. To realize space extractions, investors are required to develop technologies, execute missions to evaluate the potential resources, send extracting missions and return the resources to the Earth.<sup>217</sup> In order for their investment to be profitable, the revenue received from extracting space resources needs to surpass procurement and delivery costs. Thus, space investors will strive to put in place mechanisms to protect their investments from expropriation by governments, particularly through an international recognition of property rights to the extracted resources.<sup>218</sup> The recognition of property rights depends on recognizing the acts of extraction and exclusive appropriation of the resources as legitimate and lawful under national and international law. Otherwise, in a globalized economy, labeling such extracted resources as "spoils of illegal activities,"<sup>219</sup> in the same sense as "blood diamonds,"<sup>220</sup> could restrict the market for such resources and reduce their value to investors. Finally, as more space investors gain capabilities, investors will require a dispute settlement mechanism to validate and protect their claims. Absent global regulation or under a first-come first-served regime, dispute settlement

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212. *Id.* at 227–35.

213. JAKHU, PELTON & NYAMPONG, *supra* note 1, at 2–3, 64–71.

214. For a comprehensive recent list, see Matthew Weinzierl, *Space, the Final Economic Frontier*, 32 J. ECON. PERSPS. 173, 178 (2018).

215. JAKHU, PELTON & NYAMPONG, *supra* note 1, at 2–3, 64–71.

216. *See Larsen, Asteroids*, *supra* note 5, at 275 n.1. *But see* LEE, *supra* note 4, at 21–26.

217. *See* Roth, *supra* note 1, at 834–39.

218. *See* Salter, *supra* note 5, at 313–14; Roth, *supra* note 1, at 839.

219. *See* von der Dunk, *Asteroid Mining*, *supra* note 1, at 94.

220. *See Blood Diamond*, ENCYCLOPEDIA BRITANNICA, <https://www.britannica.com/topic/blood-diamond> (last visited Nov. 1, 2018).

will become critical to protecting the rights of investors vis-à-vis other investors or states.

It is important to note that corporations also care about public perception which affects their profitability. By promoting values important to consumers, corporations secure the loyalty of their customers which increases the profitability of the corporation. An example of this can be found in the struggle against climate change. Many corporations voluntarily impose restrictions which reduce their greenhouse gas emissions to combat climate change, which has been attributed *inter alia* to an attempt to create a public image favorable to consumers.<sup>221</sup> With respect to commercial extractions of space resources, corporations may impose certain restrictions upon their operations should public opinion favor such actions. For example, corporations may choose to invest in protecting the environment or promoting crew safety, should such policies create an image which increases their profits. On the other hand, significant public pressure would be required for corporations to invest in developing the space capabilities of space-incapable states, an investment which would create competition.

Private space investors may also cooperate with states or intergovernmental organizations through public-private partnerships.<sup>222</sup> While such entities are likely to exhibit incentives and goals similar to those of private investors, they would also account for the interests and goals of states. Interactions involving such entities are likely to depend on the level of governmental participation in the entity's governance, and the identity of the governmental participant.

## 2. Space-Capable States

In our Westphalian system of global governance, states play a key role in any international regulatory regime. Any global regulation of space resource extractions will rely upon state consent and cooperation for its feasibility and manageability. Whether the extraction of space resources would be internationally lawful, and which, if any, obligations will be imposed is subject to the decision-making process of the international community, based upon the state system.

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221. See DANIEL ESTY & ANDREW WINSTON, GREEN TO GOLD: HOW SMART COMPANIES USE ENVIRONMENTAL STRATEGY TO INNOVATE, CREATE VALUE, AND BUILD COMPETITIVE ADVANTAGE 7–29 (2009).

222. See, e.g., Karen L. Jones, *Public-Private Partnerships: Stimulating Innovation in the Space Sector*, CTR. FOR SPACE POL'Y & STRATEGY (2018), [https://aerospace.org/sites/default/files/2018-06/Partnerships\\_Rev\\_5-4-18.pdf](https://aerospace.org/sites/default/files/2018-06/Partnerships_Rev_5-4-18.pdf).

Moreover, while private space entrepreneurs are pioneering in the realm of resource extractions, space-capable states are very active in space travel. China has a rover on the Moon and is planning to send further missions, which may include resource exploitation, and the United States is planning to capture an asteroid.<sup>223</sup> As many space technologies require the investment of vast capital with limited revenue, as in the past, state investment in space programs may be required to realize any large-scale space extractions. Whether or not states will decide to participate in the commercial extraction of space resources will depend upon many factors, including, *inter alia*, the associated costs and benefits, strength of private sector investments, ability to control the private sector, and prestige. While some space-capable states, presumably the United States and EU countries, may depend upon their private sector,<sup>224</sup> other states, such as China and Russia, may initiate their own public space extraction projects to compete with these corporations.<sup>225</sup>

The objectives of space-capable states will vary depending on the strength of their private sector and the level of their technological development and capabilities. For example, while Russia voiced opposition to the United States' recognition of private property in space resources,<sup>226</sup> its opposition may be attributed to other geopolitical concerns,<sup>227</sup> or may falter, should the Russian government or corporations develop the necessary capabilities. In general terms, space-capable states will strive to safeguard their rights and the rights of their corporations to space resources in order to protect investments and foster innovation.<sup>228</sup> The aspiration of states to protect and encourage investments by their nationals through international law can be seen in the widespread protection of foreign investments under international investment law.<sup>229</sup> On a different note, states may also aspire to protect the well-being of their citizens employed by the corporations in space. As public entities, some space-capable states may concern themselves with

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223. *Larsen, Asteroids*, *supra* note 5, at 275–76; *Doshi*, *supra* note 1, at 196.

224. This is clearly the path chosen by the United States. *See U.S. Executive Order Apr. 6, 2020*, *supra* note 134.

225. *See, e.g., Doshi*, *supra* note 1, at 196.

226. *Masson-Zwaan & Palkovitz*, *supra* note 3, at 14–15.

227. *Kfir & Perry*, *supra* note 3, at 180.

228. *E.g.*, Congress has instructed the President to act to protect the property rights of US citizens, which has been interpreted to include promoting an international legal order based on these property rights. *See supra* Section II.E.

229. *See FOREIGN INVESTMENT DISPUTES: CASES, MATERIALS AND COMMENTARY 2–9* (R. Doak Bishop, James Crawford & W. Michael Reisman eds., 2d ed. 2014).

the protection of the environment, both in space and on Earth against any adverse effects of space mining.<sup>230</sup>

Furthermore, as more space-capable states and their corporations join the quest for space resources, and because states have a supervisory obligation under international law over space activities by their nationals (assuming it is the appropriate state),<sup>231</sup> preventing conflicts would require a dispute settlement mechanism. Finally, space-capable states will also aspire to settle the question of liability, as it is questionable whether the current liability regime, based upon a launching state and the “appropriate state” (or the authorizing), is adequate in the age of private space travel and globalization.<sup>232</sup> Whether through formal international regulatory instruments or informal regulation through consortiums of states, space-capable states will likely aspire to install international regulation to safeguard their interests and optimize their gain in values.

### 3. States Lacking Space Capabilities

For any international regime to be universally accepted, (assuming incentives for collective action develop), the consent of states which currently do not possess the capabilities to participate in commercial extraction of space resources will be important. These states are distinguished from space-capable states due to different modes of participation and interests. Since these states possess limited, if any, leverage over the space-capable states, it is doubtful whether the latter will have an incentive to enter into an international arrangement which provides for the interests of the former<sup>233</sup>—a quid-pro-quo without the quo. Furthermore, the space-capable states, e.g., the United States, Russia, China, the United Kingdom, and France, are the world’s strongest economies and military powers. It is thus doubtful whether space-incapable states may use market pressure or threat of military force to affect the policy choices of space-capable states. Nevertheless, if through public opinion, market pressure, or due to the security afforded by a universally-acceptable regime, states without space capabilities may exhort certain concessions from the space-capable states. It is thus important to consider them as participants in any prospected international regime.

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230. *OST*, *supra* note 6, art. IX. On environmental protection in space see generally LOTTA VIKARI, *THE ENVIRONMENTAL ELEMENT IN SPACE LAW* (2008).

231. *OST*, *supra* note 6, art. VI.

232. *See infra* Section IV.A.

233. *See* von der Dunk, *Asteroid Mining*, *supra* note 1, at 100.

The main interest of space-incapable states, as evident from the Moon Treaty, includes the promotion of the principle of the “common heritage of mankind” as applicable to space resources.<sup>234</sup> Their objectives will include either a moratorium on all space resource extractions, or a certain revenue-sharing obligation,<sup>235</sup> but some control over distribution of resources is vital.<sup>236</sup> Since the resources are used to develop further capabilities,<sup>237</sup> access to resources is as, or even more, important than the access to proceeds. States without space capabilities are thus likely to aspire to create a mechanism which will grant them equitable or even equal access to the resources themselves rather than a fraction of proceeds, similar to the promotion of the New International Economic Order in the 1970s and 80s.

Besides the access to resources or the proceeds, another objective of space-incapable states will be to secure active participation in missions and technology sharing.<sup>238</sup> Absent the sharing of technology and access to resources, the gap between space capable and incapable states will continue to grow. Inevitably, these objectives are temporary, since once these states achieve the necessary capabilities, their objectives will change accordingly.

Alongside the resource-related objectives, space-incapable states, like space-capable states, should (and hopefully will) aspire to protect their citizens employed by the space industry, protect Earth and space environments, and promote human dignity. In this sense, there could be a certain correspondence between the objectives of the space capable and incapable states, which may create the conditions necessary to establish international regulations protecting employees of the space industry and the environments of Earth and space. This will, however, have only a secondary effect on the lawfulness of space extractions themselves.

#### 4. International Organizations

International organizations are anticipated to partake in the development and application of a global regime for space resources. These international organizations can be divided into three broad categories: (1) the United Nations and its specialized agencies; (2) non-

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234. *Moon Treaty*, *supra* note 7, art. 11; LEE, *supra* note 4, at 17, 76–82.

235. *See, e.g., Moon Treaty*, *supra* note 7, art. 11; Roth, *supra* note 1, at 843; LEE, *supra* note 4, at 158.

236. *See* O'Donnell, *supra* note 14.

237. *See* Doshi, *supra* note 1, at 199–200.

238. Paxson, *supra* note 4, at 506.

governmental organizations (“NGOs”); and (3) international institutions established as part of the global order for space resources. The last category is relevant for evaluating the manageability of the regime, and the objectives of such organizations will depend upon the specific regime. In general terms, the ability to promote compliance with the regime is likely to be the main objective of such participants. The United Nations system and NGOs are likely to be central participants in developing the regime and its application; their interests and actions will sound in the feasibility, effectiveness, and manageability of the regime.

The United Nations is a complicated participant in this regard. On the one hand, the United Nations Security Council is dominated by space-capable states, i.e., the United States, China, Russia, France and the United Kingdom, while the General Assembly is dominated by states which currently lack space capabilities. It is thus anticipated that, at least initially, there would be a conflict of interests between the Security Council and General Assembly. While the General Assembly may endorse a regime promoting the interests of space-incapable states, as occurred with the Moon Treaty,<sup>239</sup> the ability of such a resolution to sway the policy choices of space-capable states will be limited and will depend mainly upon public pressure. The U.N. system is, however, not limited to the General Assembly and Security Council; the Secretariat and specialized agencies may also play a role.

Recently, the U.N. Deputy Secretary-General Amina Mohammed emphasized U.N. support for promoting multilateralism.<sup>240</sup> Unless this support shifts, the Secretariat is likely to promote multilateralism as a blueprint for a space regime. It should, however, be noted that the Secretary General’s appointment is subject to the consensus of the permanent members of the Security Council, which are also the major space-capable states.<sup>241</sup> Thus, it would be reasonable to assume that the Secretariat is unlikely to act in a manner contrary to the interests of the space-capable states, and in any case not for longer than five-years.<sup>242</sup>

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239. G.A. Res. 34/68, Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Dec. 5, 1979).

240. Press Release, Deputy Sec’y-Gen., Multilateralism Key to Global Prosperity, Sustainability, Deputy Secretary-General Tells Symposium, Warning Trade Restrictions Could Erode Confidence, Derail Growth, U.N. Press Release DSG/SM/1171-DEV/3327-ECO/282 (Apr. 27, 2018).

241. *Appointment Process*, UNITED NATIONS, <https://www.un.org/sg/en/appointment.shtml> (last visited Dec. 20, 2018).

242. *See id.*

As space activities are conducted beyond national jurisdiction, the specialized agencies will each strive to promote its sphere of influence in space. For example, the World Health Organization is expected to express concern over adverse effects on the health of individuals employed by private space investors in space or on the population of Earth due to environmental risks,<sup>243</sup> and the International Labour Organization is likely to participate in protecting the rights and welfare of those employed by the industry.<sup>244</sup> The World Bank Group may invest in developing space capabilities in developing countries to reduce poverty levels<sup>245</sup> and the World Intellectual Property Organization will concern itself with shaping international policy choices with respect to protecting the intellectual property of space investors.<sup>246</sup> While it is still impossible to sketch all the objectives sought by the U.N. system, it is extremely likely that these organizations will take a significant role in the interactions leading to the establishment and evolution of any international regime governing commercial extraction of space resources and its subsequent management.

NGOs are the last piece of the puzzle. NGOs may promote the feasibility, effectiveness, and manageability of any global regime. Today, NGOs protect many values on the international scale, including human rights, labor rights, the right to health, environmental protection, development of economies and more.<sup>247</sup> NGOs are thus likely to strive to promote the same values for commercial utilization of space resources, including environmental protection, protecting the rights of personnel employed in the space resource industry, shifting resources to develop space capabilities of developing countries, et cetera. Most importantly, private entities of global governance may promote compliance with the regime<sup>248</sup> or even facilitate the development of a regime using public opinion and market pressure against space investors.

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243. For the mandate of the World Health Organization, see *WHO's Role, Mandate and Activities to Counter the World Drug Problem*, WORLD HEALTH ORG., [https://www.who.int/substance\\_abuse/publications/drug\\_role\\_mandate.pdf](https://www.who.int/substance_abuse/publications/drug_role_mandate.pdf) (last visited Nov. 2, 2018).

244. For the mission of the ILO, see *Mission and Impact of the ILO*, INT'L LAB. ORG., <https://www.ilo.org/global/about-the-ilo/mission-and-objectives/lang-en/index.htm> (last visited Nov. 2, 2018).

245. On investment priorities of the World Bank Group, see *What We Do*, WORLD BANK GRP., <https://www.worldbank.org/en/what-we-do> (last visited Nov. 2, 2018).

246. On the actions of WIPO, see *Inside WIPO*, WORLD INTELL. PROP. ORG., <http://www.wipo.int/about-wipo/en/> (last visited Nov. 2, 2018).

247. On private entities of global governance, see EYAL BENVENISTI, *THE LAW OF GLOBAL GOVERNANCE* 57–68 (2014).

248. *Id.*



NGOs may also include public-private partnerships, either aimed at promoting certain aspects of outer space regulation or engaged in resource-related activities. One example for such cooperation can be seen in the “The Hague Space Resources Governance Working Group” which has released its proposed *Building Blocks* for the regulation of space resources.<sup>249</sup> The activities involving such participants may vary and depend on their composition and objectives.

### B. Values and Basic Policies

In an increasingly interconnected world, producing an inclusive and stable global order requires consideration of the interests of all relevant stakeholders rather than focusing on specific interested parties.<sup>250</sup> As Reisman explained: “[a] public order of human dignity is defined as one which approximates the optimum access by all human beings to all things they cherish.”<sup>251</sup> Contemporary values or basic policy choices that the regime ought to optimize and participants would use include: (i) skill or knowledge in the sense of spurring *innovation*; (ii) *wealth* in the sense of access to resources and revenue; (iii) *equity* in the sense of distribution of resources within the international community; (iv) *security* in the sense of preventing global conflict; (v) *health* and *safety* of personnel; (vi) *environmental protection*; and (vii) *human dignity*. While other values may be used or promoted by the participants as the utilization of space resources develops, these values are currently anticipated to be used and promoted by the participants and should be nourished and balanced by any international regulatory regime. They will be briefly reviewed below.

#### 1. Skill or Innovation

Successful commercial utilization of space resources turns upon spurring innovation. For commercial extraction of space resources to be developed it must be profitable, in the sense that the resources extracted and brought back to the Earth would be more valuable than the resources expended to procure and deliver them. It is thus

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249. *Building Blocks for the Development of an International Framework on Space Resource Activities*, THE HAGUE INT’L SPACE RES. GOVERNANCE WORKING GRP. (Nov. 12, 2019), <https://www.universiteitleiden.nl/binaries/content/assets/rechtsgeleerdheid/instituut-voor-publiekrecht/lucht-en-ruimterecht/space-resources/final-bb.pdf>.

250. Eyal Benvenisti, *Sovereigns as Trustees of Humanity: On the Accountability of States to Foreign Stakeholders*, 107 AM. J. INT’L L. 295, 295 (2013).

251. W. Michael Reisman, Siegfried Wiessner & Andrew R. Willard, *The New Haven School: A Brief Introduction*, 32 YALE J. INT’L L. 575, 576 (2007).

recognized that technological innovation is imperative to reducing the costs associated with surveying, extracting, and transporting space resources.<sup>252</sup> Incentives for innovation may vary depending on the participant. States may be encouraged to develop technologies necessary for space resource extraction due to prestige,<sup>253</sup> for the sake of knowledge,<sup>254</sup> or due to strategic reasons, such as access to valuable resources.

Space investors' incentives differ and are primarily economic. To encourage innovation by private investors, the prospective gains from the developed technology need to be higher than development costs, which requires reducing any associated costs.<sup>255</sup> Developed states and corporations based in such countries thus have a significant edge in the development of technologies necessary for commercial utilization of space resources.<sup>256</sup>

While states may be willing to invest in space innovation with a higher risk factor and reduced prospective gain,<sup>257</sup> private investors would require a certain level of protection for their investment and a higher prospective gain from success.<sup>258</sup> To facilitate the investment of private capital in space innovation to develop commercial utilization of space resources, the regime would be required to provide certain assurances that the expected gain be higher than the requisite investment. Absent such assurances, investors may be reluctant to invest capital in innovation.

## 2. Wealth

The development of technologies which enable economically viable extraction and transportation of space resources will grant access to vast resources,<sup>259</sup> providing wealth to those lucky enough to succeed. But the development of such technology requires a significant investment,<sup>260</sup> and hence wealth is critical to success. Wealth in the sense of access to resources is thus both a prerequisite and a motivation,

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252. See Roth, *supra* note 1, at 833; JAKHU, PELTON & NYAMPONG, *supra* note 1, at 5.

253. See President's Science Advisory Committee, *Introduction to Outer Space*, NASA, <https://history.nasa.gov/sputnik/16.html> (last visited Nov. 2, 2018).

254. See, e.g., *Curiosity Rover*, NASA, [https://www.nasa.gov/mission\\_pages/msl/index.html](https://www.nasa.gov/mission_pages/msl/index.html) (last visited Nov. 2, 2018).

255. See Kfir & Perry, *supra* note 3, at 177.

256. See *id.*; TRONCHETTI, *supra* note 5, at 189.

257. See Roth, *supra* note 1, at 862.

258. LEE, *supra* note 4, at 13–14.

259. JAKHU, PELTON & NYAMPONG, *supra* note 1, at 3–4.

260. See Doshi, *supra* note 1, at 201–02.

providing a significant and recurring edge to the developed and wealthy states. In other words, the wealth of developed, space-capable countries and their corporations would allow them to succeed in developing the technology to access the vast resources of space, which will then provide them with wealth to further fuel their progress.

It was suggested that by providing access to resources, commercial extraction of space resources would, in itself, provide wealth to all other countries and benefit all mankind.<sup>261</sup> Whether or not this optimistic vision is likely to materialize, wealth will undoubtedly be pursued by space-incapable states. This can be achieved, for instance, through participation in investments,<sup>262</sup> revenue-sharing,<sup>263</sup> or technology sharing.<sup>264</sup> But it could also be achieved through problematic means such as lenient regulation to attract foreign investors.

Access to wealth should, however, be balanced against other factors, such as sustainability of access and preventing exploitation which may alter the course of asteroids and cause risk.<sup>265</sup> International regulation of access to wealth is important to prevent the “tragedy of the commons” from extending into outer space resources.<sup>266</sup> For an international regime to be successful, it must provide for gains in wealth to as many interested participants as possible, not only the developed, space-capable states. This leads to equity or equitability of the regime.

### 3. Equity

Realizing the proposition that “space resources could serve . . . as a great ‘equalizer’ between different territorial communities”<sup>267</sup> requires promoting equity in not only access to but also utilization of space resources. Equity or an “equitable solution,” as it relates to the distribution of access to resources, is not a new concept under international law. The underlining objective of the rules governing the division of exclusive jurisdiction over ocean resources under international law is achieving an “equitable solution”.<sup>268</sup> Thus, to a certain degree, equity constitutes an important value for all participants. Critically, for any

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261. See Paxson, *supra* note 4, at 494; Kfir & Perry, *supra* note 3, at 177.

262. See ODUNTAN, *supra* note 11, at 213–14.

263. See Baruah & Paliwal, *supra* note 11, at 37–39.

264. *Id.*

265. LEE, *supra* note 4, at 284–85.

266. See *infra* Section IV.A.4.

267. McDougal et al., *Enjoyment*, *supra* note 5, at 540.

268. See UNCLOS, *supra* note 24, arts. 74, 83.

regulatory regime to be universally accepted, specifically by the space-incapable states, it will need to be based on the principle of equity or equitability,<sup>269</sup> providing for the broadest possible distribution of access to resources. The widely accepted Outer Space Treaty provides for elements of equity,<sup>270</sup> but not equality,<sup>271</sup> as the basis for utilization of space resources. In addition, the Moon Treaty, while prescribed to only by a few states, provides for the principle of the “common heritage of mankind” as governing the extraction and utilization of space resources.<sup>272</sup> As explained above, however, any claim that the principle of the Common Heritage of Mankind should govern the regime of commercial exploitation of space resources should be taken with a grain of salt.<sup>273</sup>

Nevertheless, it is highly likely, as evident from the Moon Treaty, that space-incapable states will condition their prescription to an international regime upon certain equitability in the distribution of access to resources.<sup>274</sup> Equitability may be limited to equal access to the resources on the free market,<sup>275</sup> include some form of revenue-sharing, or even extend to sharing the resources themselves. The “equalization” between communities through space resources<sup>276</sup> requires that the equitability of access to resources be optimized alongside, or instead of, revenue-sharing. Since some of these resources are critical for building space capabilities and propulsion, it is questionable whether mere revenue-sharing may truly “equalize” space capable and incapable states.

As the negotiations of UNCLOS have demonstrated, the prospect of technology sharing is essential for developing countries.<sup>277</sup> However, while UNCLOS prescribes technology sharing in deep-sea ventures, this provision has been strongly objected to by developed countries, and amended by the 1994 Implementation Agreement which removed this obligation.<sup>278</sup> Apart from the economic interests, the objection by

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269. See LEE, *supra* note 4, at 256; Irwin, *supra* note 5, at 232–33; Gennady M. Danilenko, *Outer Space and the Multilateral Treaty-Making Process*, 4 BERKELEY TECH. L.J. 217, 225–26 (1989).

270. LEE, *supra* note 4, at 158.

271. *Id.*; LYALL & LARSEN, *supra* note 3, at 182.

272. *Moon Treaty*, *supra* note 7, art. 11.

273. See *supra* Section II.B.

274. LEE, *supra* note 4, at 256; see Irwin, *supra* note 5, at 232–33.

275. See LEE, *supra* note 4, at 161; von der Dunk, *Asteroid Mining*, *supra* note 1, at 86–87.

276. McDougal et al., *Enjoyment*, *supra* note 5, at 540.

277. See Douglas Yarn, *The Transfer of Technology and UNCLOS III*, 14 GA. J. INT'L & COMPAR. L. 121 (1984).

278. 1994 Implementation Agreement, *supra* note 24, Annex § 5; see also ROTHWELL & STEPHENS, *supra* note 90, at 18–19.

the developed countries is understandable, as much of the technology is owned by private entities, not the government;<sup>279</sup> private entities are, understandably, uneager to transfer their proprietary technology in return for mining rights. Although space-incapable states are likely to request technology sharing as part of any international regime, the same difficulties would be associated, and such a request is unlikely to be accepted or implemented.

#### 4. Security

Competition and conflict are divided by a thin line. Absent international regulation that is widely accepted by the international community, commercial exploitation of space resources can precipitate international conflict. Conflict may emerge between space capable and incapable states or between the space-capable states themselves. It may concern overall legality or relate to rights over a specific resource.

International regulation is thus critical for internationally legitimizing exclusive use of space resources in general or specifically, either by a state or a corporation, and preventing conflict between states. As the Outer Space Treaty prescribes that states must approve and supervise the activities of non-governmental entities in space, conflict between corporations over an asteroid may escalate to an international dispute between states. Providing security through allocation of use and dispute settlement is thus an essential part of any international regime and may need to develop quickly as more participants begin extracting space resources.

#### 5. Safety and Health

International regulation must promote and protect crew safety. While companies are experimenting with automated machinery for commercial exploitations of space resources,<sup>280</sup> it is likely that human space travel will be required.

In government-sponsored space activities, the protection of the safety and well-being of the astronauts is a primary concern.<sup>281</sup> The Outer Space Treaty provides that “States Parties to the Treaty shall regard astronauts as envoys of mankind in outer space and shall render to them all possible assistance in the event of accident, distress, or

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279. See James Malone, *The United States and the Law of the Sea After UNCLOS III*, 46 L. & CONTEMPORARY PROBS. 29 (1983).

280. See JAKHU, PELTON & NYAMPONG, *supra* note 1, at 37–40.

281. See, e.g., Sarah Frazier, *Real Martians: How to Protect Astronauts from Space Radiation on Mars*, NAT'L AERONAUTICS & SPACE ADMIN. (Sept. 30, 2015), <https://www.nasa.gov/feature/goddard/real-martians-how-to-protect-astronauts-from-space-radiation-on-mars>.

emergency landing on the territory of another State Party or on the high seas” and that “[i]n carrying on activities in outer space and on celestial bodies, the astronauts of one State Party shall render all possible assistance to the astronauts of other States Parties.”<sup>282</sup> To recall, this obligation is supplemented by the Rescue Agreement.<sup>283</sup> But its applicability to employees of commercial entities is questionable.

With respect to private commercial exploitation of space resources several safety concerns are raised: first, whether these personnel are “astronauts” in the sense of the Outer Space Treaty,<sup>284</sup> a question that is heightened by the fact that these people would not be truly “envoys of mankind” but rather envoys of a corporation for the sake of profit; and more importantly second, aside from issues of liability and responsibility, it is important to ensure that corporations do not sacrifice the safety and health of their employees for profit.

The safety, health, and well-being of personnel in zero-gravity is especially important as the space environment can have an adverse effect on human physiology.<sup>285</sup> Under such conditions, proper training and exercise are critical to the health of personnel.<sup>286</sup> When commercial exploitation by corporations becomes a reality, personnel may spend prolonged periods of time in space. This requires the establishment of international regulations to safeguard all human personnel in space, either state or private, from the adverse effects of space.

In regard to their physical health, the fact that personnel will spend prolonged periods of time in the “province of all mankind,” theoretically beyond the reach of any terrestrial government, requires international safety regulations. In the age of globalization and multinational corporations, it is important for international regulations to be put in place to prevent corporations from mistreating the personnel and provide for their well-being. In the modern world, dependence upon the home-state of the corporation, the nationality state of the personnel, the spacecraft registration state, or the launching state is inadequate and may create a race to the bottom.<sup>287</sup>

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282. *OST*, *supra* note 6, art. V.

283. Rescue Agreement, *supra* note 25.

284. See, e.g., Steven A. Mirmina, *Astronauts Redefined: The Commercial Carriage of Humans to Space and the Changing Concepts of Astronauts under International and U.S. Law*, 10 *FIU L. REV.* 669 (2015).

285. Laurie J. Abadie, Charles W. Lloyd & Mark J. Shelhamer, *The Human Body in Space*, NAT'L AERONAUTICS & SPACE ADMIN., <https://www.nasa.gov/hrp/bodyinspace> (last visited Nov. 2, 2018).

286. *Your Body in Space: Use It or Lose It*, NAT'L AERONAUTICS & SPACE ADMIN. (Aug. 5, 2004), [https://www.nasa.gov/audience/forstudents/5-8/features/F\\_Your\\_Body\\_in\\_Space.html](https://www.nasa.gov/audience/forstudents/5-8/features/F_Your_Body_in_Space.html).

287. See *infra* Section IV.A.1.

## 6. Environmental Protection

International regulation must safeguard and promote the protection of the environments of Earth and outer space. As the climate change crisis has demonstrated, the Earth environment is a prime case of the “tragedy of the commons.”<sup>288</sup> It is thus imperative that when asteroids and other celestial bodies are mined for resources, when the resources are brought to Earth, or the asteroid moved to Earth orbit, regulations be put in place to prevent environmental risk.<sup>289</sup> On a different note, a commercially viable extraction of space resources can, in itself, promote the protection of the Earth environment by diminishing, or even negating, the need to extract such resources on Earth.<sup>290</sup> While any national or international regulation in place would likely address environmental protection, it does not affect the legality of exclusive use or property rights in space resources.

## 7. Human Dignity

An essential element of any global order is its ability to promote human dignity. In order for any global order that governs human exploitation of space resources to promote human dignity, it must be inclusive and acceptable to as many participants as possible; “[a]n instrumental goal of a public order of human dignity is of course the equipping of all individuals for full participation in authoritative decision.”<sup>291</sup> In 1963, McDougal recognized that space resources may serve to balance the inequalities between states and promote overall benefit.<sup>292</sup> To achieve such a noble objective, the regime governing space resources must take human dignity into account so as to maximize the aggregated gain for all relevant stakeholders and expand the inclusiveness of the regime.

### C. Concluding Remarks on Global Order

Not all values discussed above relate to the lawfulness of commercial extractions of space resources. Nonetheless, they would affect the development of the global order for space resources. Certain objectives and

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288. See Jouni Paavola, *Climate Change: The Ultimate Tragedy of the Commons?*, in PROPERTY IN LAND AND OTHER RESOURCES 417 (Daniel H. Cole & Elinor Ostrom eds., 2012).

289. Irwin, *supra* note 5, at 244.

290. Roth, *supra* note 1, at 864–65.

291. Myres S. McDougal, Harold D. Lasswell & W. Michael Reisman, *The World Constitutive Process of Authoritative Decision*, 19 J. LEGAL EDUC. 253, 256 (1967).

292. McDougal et al., *Enjoyment*, *supra* note 5, at 540.

values would thus be more important than others to the legality of commercial extraction of space resources. The discussions of participants, strategies, and values are essential for the evaluation of the difficulties associated with proposed international regimes for commercial extraction of space resources and deducing the likely development of a regime for space resources.

#### IV. PROPOSED INTERNATIONAL REGIMES

Scholars and commentators have proposed many different regimes with varied levels of complexity. It would be impractical and inefficient to attempt to comment on every single regime and its specific fine-tuned elements. Therefore, this section will discuss three broad categories of proposed regimes, and address the difficulties associated with them: (1) national regulation modelled after the high seas regime under UNCLOS; (2) international regulation on a first-come first-served basis based on the ITU model; and (3) international regulation mimicking the regulation of the international Area and the International Seabed Authority under UNCLOS. While most proposed regimes claim to fine-tune and improve these existing regimes, they are still founded upon their fundamental structures.

Most comprehensive international regimes proposed in scholarship are composed of three elements: (a) regulating access to resources; (b) dispute settlement; and (c) environmental protection. The critical legal questions impacting the commercial viability of extractions of space resources are whether exclusive use of a celestial body is lawful, whether property rights in the extracted resources are recognized, and any conditions thereof. Thus, only elements (a) and (b), i.e., the regulation of access to resources and any disputes related to such resources, provide the framework for evaluating any proposed regulations and their development.

As will become evident, the static regimes proposed by scholars fail to account for the incentives, goals, and interactions of the participants in outer space. The proper way, as the final section will explain, is to develop the regime governing space resources, and outer space in general, in stages, through a dynamic process of regime evolution that is guided by the underlying normative objective of value optimization.

To recall, any international regime for commercial extraction of space resources must be feasible, effective and manageable, thus optimizing the core values of skill, wealth, equity, security, health and safety, environmental protection, and human dignity. The core limitation of



international regulations at this point in time is feasibility, which is the first step of any prospective international regime; absent feasibility, the prospective regime is unlikely to develop. Currently, the developed, space-capable states have limited, if any, incentive to relinquish possible rights and privileges for a multilateral regime.<sup>293</sup> Until such time that incentives exist, i.e. that space-incapable states have anything to offer in return for an international regime or force the space-capable states to cooperate, the feasibility of any multilateral international regulation is highly questionable. It should be noted, however, that under the current veil of ignorance concerning space resources, some more risk averse space-capable states may be willing to make compromises to secure other interests. In any event, understanding the difficulties associated with each regime enables sketching the anticipated evolution of the regime governing space resources.

#### A. National Regulation

The first type of potential regime is the least creative, but perhaps the most realistic, of the options. This type of regime is founded upon the U.S. Space Resources Act and the premise of high sea fishing. Under this regime, all states are entitled to recognize property rights of their citizens to space resources and regulate such actions domestically.<sup>294</sup> While there can be some fine-tuning, including environmental safeguards and dispute settlement, the basic premise is that as international regulation is unattainable or unnecessary, each state should legitimize and regulate commercial space extractions due to the importance of accessing these resources. Under this regime, space resources are *res nullius*, and are appropriable by those which succeed in acquiring them.

While such a regime is indeed feasible, as it depends upon individual states rather than international cooperation, its effectiveness will be limited in the long run. This regime will promote innovation and access to wealth, but it will fail to promote equity, human dignity, and security, and it may have dire effects on safety, health and environmental protection. The limitations of this regime are evident in four main issues: (i) regulatory race to the bottom; (ii) non-arbitrary access to resources; (iii) gold-rush mentality; and (iv) tragedy of the commons.

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293. See von der Dunk, *Asteroid Mining*, *supra* note 1, at 100.

294. See, e.g., *US Space Resources Act*, *supra* note 3, § 51303; von der Dunk, *Private*, *supra* note 5, at 147–48.

1. Regulatory Race to the Bottom

National regulation of commercial extractions of space resources is accompanied by national responsibility and liability under the Outer Space Treaty Articles VI and VII and the Liability Convention. As discussed above, the “appropriate state” would bear supervisory responsibility for the actions of non-governmental entities in space, and the launching state would bear liability for any damage from the launch.<sup>295</sup> This proposition entails the assumptions that the authorizing appropriate states and the launching states would regulate the conduct of private corporations and impose safeguards to prevent any adverse effects, protecting the health and safety of not only the crew, but also that of others. In fact, many states have laws and regulations concerning the safety of space activities and require private corporations to procure significant insurance to cover liabilities.<sup>296</sup> But how will this assumption play out in a globalized world with nationally-based regulation of property rights in space?

While it is difficult to predict how events will unfold, the absence of any international equity considerations under a nationally-based regime indicates that space-incapable states are likely to respond by making claims and taking actions which will foster their ability to participate in the distribution of access to wealth. As it will take time for most developing countries to develop space capabilities, a likely method for participation will be through attraction of space investors as either the authorizing state or the launching state, i.e., either provide launching platforms or, more importantly, encourage operations to take place through a domestic subsidiary. As space operations occur in space, risks for space investors from expropriation are limited, and with the current international framework protecting the flow of capital, developing countries may be able to attract space investors through incentives which are likely to be reduced regulations, reduced liability requirements and increased property rights in the extracted resources. Luxembourg’s mimicking of the U.S. Space Resources Act may serve as an example of a space-incapable state attempting to attract space entrepreneurs. Luxembourg’s claim has already bore fruit and several corporations have established their space-resources related operations there.<sup>297</sup>

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295. See *supra* Sections II.A & II.C.

296. See generally ANDONI, *supra* note 161.

297. See Mahulena Huffman & P.J. Blount, *Emerging Commercial Uses of Space: Regulation Reducing Risks*, 19 J. WORLD INV. & TRADE 1001, 1005–06 (2018).

The drive of space-incapable states to participate, absent international regulation, may thus adversely affect the health and safety of the crew and others, and reduce environmental safeguards, while transferring larger portions of wealth to corporations. Although there is a “bottom” or limit on how low the regulation may go, such a regime encourages state participants, both space capable and incapable, to reduce any regulatory burden on space investors in order to gain access to some of the wealth. Since the predominant incentive of corporations is the maximization of wealth, the equilibrium point between safety, health, and wealth will likely be reduced to the point in which adverse effects are just above those provoking public protest to a degree risking profitability. Since public pressure has had the effect of altering the decision-making of corporations as concerns worker rights and environmental concerns,<sup>298</sup> the bottom for space investors may eventually be just above the public’s tipping point. The incentives under this regime would be to increase skill and wealth at the expense of safety, health, and environmental protection. While counter-claims made by international organizations and public pressure may push for more safety, health and environmental protection, the basic foundation of the regime incentivizes the reduction of these values.

## 2. Non-Arbitrary Access to Resources

Access to resources under international law can either be arbitrary or not. Arbitrary access to resources refers to a regulatory regime by which a participant may gain access to a certain natural resource irrespective of its ability to exercise power. In other words, the exclusive access to the resources themselves is recognized irrespective of the capabilities of the participant. This does not mean that a participant may in fact be able, at any given moment in time, to access the resource from a technological perspective. The critical element, however, is that the exclusive jurisdiction is recognized irrespective of those capabilities. Non-arbitrary access, on the contrary, is when access to the resources depends upon the ability of a participant to exercise power or capabilities to the exclusion of others.

To understand this distinction, one may consider the development of the regime governing the access to the resources of the seabed and the subsoil under the Law of the Sea. Before the 1958 Convention on the Continental Shelf, access to such resources was subject to the

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298. See NAT’L RSCH. COUNCIL ET AL., *DECISION MAKING FOR THE ENVIRONMENT: SOCIAL AND BEHAVIORAL SCIENCE RESEARCH PRIORITIES* 52–68 (Garry D. Brewer & Paul C. Stern eds., National Academies Press 2005).

regime of *mare liberum*. Accordingly, each participant was able to access the resources if it had the technological capability to do so. Such access was non-arbitrary and dependent upon the capabilities of each participant, giving an edge to the more powerful and developed members of the international community in the utilization of ocean resources. The 1958 Convention on the Continental Shelf established a dual arbitrary and non-arbitrary regime. It provided that:

[T]he term “continental shelf” is used as referring (a) to the seabed and subsoil of the submarine areas adjacent to the coast but outside the area of the territorial sea, to a depth of 200 metres or, beyond that limit, to where the depth of the superjacent waters admits of the exploitation of the natural resources of the said areas; . . .<sup>299</sup>

Accordingly, the convention recognized the exclusive sovereign rights of the coastal state up to the depth of 200 meters, which is arbitrary, but also beyond that depth based on exploitability criteria, which is non-arbitrary and dependent upon the capability to exploit the resources.<sup>300</sup> As no exclusive rights were retained in the area where a coastal state could not exploit the resources of the seabed and the subsoil, other, more developed participants could have exploited them.

The non-arbitrary access to the resources of the seabed and subsoil was mostly replaced with arbitrary access in the 1982 UNCLOS. There, the international community recognized exclusive sovereign rights over the shelf either based on the distance criteria,<sup>301</sup> geology and geomorphology (subject to international verification),<sup>302</sup> or regulated by the International Seabed Authority.<sup>303</sup> Similarly, except for limited parts of the high seas, the Law of the Sea provides for exclusive water column rights based on distance<sup>304</sup> or subject to regional fishing regulations beyond that distance.<sup>305</sup> In essence, the access to the resources of the oceans became mostly arbitrary or internationally regulated, with states recognized with exclusive jurisdiction irrespective of their ability to exercise power or capabilities.

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299. Convention on the Continental Shelf art. 1, Apr. 29, 1958, 433 U.N.T.S. 311.

300. *See id.* arts. 1–2.

301. UNCLOS, *supra* note 24, arts. 56, 57, 76.

302. *Id.* art. 76.

303. *Id.* arts. 133–191.

304. *Id.* art. 56.

305. *See Regional Fisheries Management Organizations and Deep-Sea Fisheries*, FOOD & AGRIC. ORG. U.N., <http://www.fao.org/fishery/topic/166304/en> (last visited Jun. 24, 2020).

Similarly, access to land-based resources has become arbitrary due to the illegalization of land acquisition through war.<sup>306</sup> With conquest illegalized, states' exclusive access to land based resources is arbitrarily determined and may not, *de jure*, be altered through a participant's ability to exercise power.<sup>307</sup> With access to ocean resources arbitrarily attached to land territory or internationally regulated, the rules established in the twentieth century limit conflict over natural resources, which once was a predominant catalyst of war. This structure essentially provided security as part of the global order by negating any resource-related profits from warfare. With fossil fuels, for example, this structure of arbitrary access has provided substantial leverage to otherwise weak members of the international community for a long period of time.<sup>308</sup>

Security by preventing conflict between the participants in space activities is vital, especially because the initial active participants, *i.e.*, space-capable states, are also the most powerful players in the international community. Since Article VI of the Outer Space Treaty mandates the authorization and supervisory responsibility of states over the space activities of non-governmental entities, it presents a risk for the escalation of a private dispute to the inter-state level. The non-arbitrary nature of access to resources may serve as a point of conflict between nations. The U.S. Space Resources Act of 2015 inserted a non-arbitrary element into the otherwise arbitrary global governance of access to resources.

Absent international regulation of commercial extraction of space resources, the nation state-based regulation of access to space resources resurrects access to resources by non-arbitrary means. In other words, under this regime, the better the technological- and resource-based starting point, the better the chances of accessing vital resources. Such a regime deviates from the twentieth century principle of arbitrary access and may precipitate conflict between those able and unable to access certain resources. In the long run, such a regime may promote conflict, since power may again become a source of access to resources. Absent claims to sovereignty over space resources, prohibited under the United States' own interpretation of the Outer Space Treaty, it is unclear how the current international rules discourage conflict over

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306. See OONA A. HATHAWAY & SCOTT J. SHAPIRO, *THE INTERNATIONALISTS: HOW A RADICAL PLAN TO OUTLAW WAR REMADE THE WORLD* ch.13 (2017).

307. It is of course, ideally, as the ability to exercise power may enable one participant to *de facto* access the resources exclusively recognized to belong to another.

308. See, *e.g.*, MICHAEL GRAETZ, *THE END OF ENERGY* 21–22 (2011).

resources. Therefore, at a certain stage of the regime's development, as further explained below, a dispute settlement mechanism for space resource claims and disputes will become important.

### 3. Gold-Rush Mentality

Lauren E. Shaw proposed to model the international regulatory regime for space resources on the United States' 1872 General Mining Law for the Western Frontier.<sup>309</sup> While Shaw's regime is international, including a regulatory agency, rather than national, the comparison to the nineteenth century U.S. expansion is interesting and provides a reference to a potential adverse consequence of national-based or first-come first-served regimes.

Non-arbitrary access to resources promotes a gold rush mentality.<sup>310</sup> The absence of access allocation and national sovereignty stimulates a race to the resources. Corporations are encouraged to be the first to reach and lay claim to a certain resource and exclude others from utilizing these resources through means other than their expulsion. Just as with the race to the bottom of regulations, profit driven corporations may discard safeguards in order to win the competition, so long as they do not provoke public pressure which affects their profitability. This also creates an incentive to promote innovation and wealth at the expense of health, safety, and environmental protection. Merged with the race to the bottom of national regulations, it achieves the effect of incentivizing the taking of additional risks to promote profit.

### 4. Tragedy of the Commons

The phenomenon called the tragedy of the commons refers to the lack of incentive for each member to confine its use of the resource and preserve it for the enjoyment of others; what is optimal for a single participant is not optimal for the rest of the participants.<sup>311</sup> Almost every commentator supporting the U.S. Space Resources Act refers to the regime of the high seas as a justification for the recognition of property rights in the absence of sovereignty.<sup>312</sup> This is puzzling, however, since a

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309. See generally Shaw, *supra* note 5.

310. On potential gold-rush mentality in space mining, see generally Feinman, *supra* note 159.

311. Garrett Hardin, *The Tragedy of the Commons*, 162 SCI. 1243 (1968); Max Benson Cassidy, *The Tragedy of the Commons and High Seas Fishery Management*, INSTITUTIONAL SCHOLARSHIP (2013), <https://scholarship.tricolib.brynmawr.edu/handle/10066/11254>.

312. See Kfir & Perry, *supra* note 3, at 172; Blount & Robison, *supra* note 36, at 172; Roth, *supra* note 1, at 851; von der Dunk, *Asteroid Mining*, *supra* note 1, at 93.

widely recognized problem with the regime of the high seas is the tragedy of the commons.<sup>313</sup>

On the high seas, any state or individual has the incentive to procure as many fish as possible, regardless of the depletion of stocks for the enjoyment of others. Taken to space, individual states or corporations would have the incentive to grab as many resources as possible, in the absence of any incentive to preserve the resources or space environment. It is important to recognize that McDougal's 1963 assumption that "[w]here the flow of such resources is more than sufficient to meet the needs of all participants who have or are likely to have space capabilities, as in the case of ocean fish, the greatest production and widest distribution of values can obviously be produced through shared enjoyment"<sup>314</sup> has unfortunately been rebutted by the gruesome depletion of ocean fisheries.

### B. *First-Come First-Served International Regulation*

The second type of regulatory regime is an international regulatory regime modeled after the ITU and the allocation of spots and frequencies for satellites.<sup>315</sup> Under the ITU, satellite spots and frequencies are allocated by an international organization on a first-come first-served basis, to any state, for a certain period of time, regardless of its ability to utilize the spot.<sup>316</sup> The proposed regimes thus build upon the ITU's successful experience and global coordination, and propose that rights to extract space resources be allocated on a first-come first-served basis. In order to prevent or limit the abuse of the system and to promote the regime's effectiveness, some have proposed that the allocation be subject to plans for utilization,<sup>317</sup> be limited in time,<sup>318</sup> or be dependent on a continuous show of adequate progress.<sup>319</sup> Some have incorporated wealth-sharing obligations to promote equity, either on a mandatory or voluntary basis.<sup>320</sup> Putting the issue of wealth-sharing aside to be further discussed below, the first-come first-served regime poses several of the same difficulties associated with the national regulatory regime.

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313. See, e.g., Cassidy, *supra* note 311.

314. McDougal et al., *Enjoyment*, *supra* note 5, at 593.

315. See, e.g., von der Dunk, *Private*, *supra* note 5, at 144; Larsen, *Asteroids*, *supra* note 5, at 306–07, 320; Baruah & Paliwal, *supra* note 11, at 37–39; Reinstein, *supra* note 5, at 84–93.

316. For a more elaborate discussion on the ITU structure, see generally LYALL & LARSEN, *supra* note 3, ch. 8.

317. See Reinstein, *supra* note 5, at 84–93.

318. *Id.*; see also TRONCHETTI, *supra* note 5, at 188–89.

319. LEE, *supra* note 4, at 288–89.

320. See Baruah & Paliwal, *supra* note 11, at 37–39.

1. Limited Benefit to the International Community

The first-come, first-served regime presents significant difficulty with respect to effectiveness. Absent conditions for allocation, the regime risks allocating exclusive use to states or corporations which lack the ability to execute the missions.<sup>321</sup> Such allocation may encourage a regulatory race to the bottom as space-incapable states would strive to attract space investors, or otherwise negate the access to wealth and promotion of innovation. For example, Tonga had claimed sixteen satellite spots, without the capability to use them, and was convinced to limit its claim to six through negotiations.<sup>322</sup> On the other hand, providing for certain conditions upon the allocation and continuity presents two difficulties. First, it preserves the advantage of space-capable states at the expense of equity for the space-incapable states.<sup>323</sup> In this sense, while the first-come, first-served allocation regime would optimize the avoidance of conflict and promote security, it would also provide for limited additional equity in relation to national regulation. Second, it incentivizes space-capable states to claim vast allocations and then creates a gold-rush mentality. In other words, space-capable states would be encouraged to claim as many allocations as possible and then push towards execution in lieu of promoting safety, health, and environmental protection, in order to preserve the allocation due to any performance obligations or a fixed timeframe.

Therefore, absent any conditions upon allocation, this regime risks inefficiency, and by imposing pre- or post-investment conditions, the regime has a limited aggregated value benefit in comparison to a world of national regulation. The benefit of this regime is thus limited to establishing coordination between the space-capable states. However, coordination may be achieved through means which do not promote a gold-rush mentality and the risks associated with it. The key difficulty with this regime, rests in its current feasibility.

2. Different Incentives

As noted, the feasibility of any international regime turns upon the existence of circumstances which incentivize the participants to establish the regime. In the case of the ITU, a central incentive for the regime was physics. Since there are limited orbits and limited frequencies

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321. See TRONCHETTI, *supra* note 5, at 189–90.

322. LEE, *supra* note 4, at 288–89.

323. See TRONCHETTI, *supra* note 5, at 189.



to be used by satellites, coordination is essential because otherwise the satellite system cannot function.<sup>324</sup>

The many potential participants in satellite launches and the physical constraints have incentivized the creation of an international allocation regime. States have predominantly cooperated with this regime, with the only outlier being the unsuccessful Bogotá Declaration, in which equatorial states purported to claim sovereignty over geosynchronous orbits above their territory, which are valuable and limited in spots.<sup>325</sup> In essence, the regime of the ITU was successful because there were limited available slots, and without this allocation the participants would have prevented each other from operating satellites.

Currently, however, it is unclear whether these circumstances pertain to space resources.<sup>326</sup> While it is true that two corporations or states may attempt to extract resources from the same asteroid or from the same spot on a larger celestial body, due to the abundance of resources and the scarcity of active participants, such interactions are unlikely in the near future. Since there are no similar constraints, and therefore incentives for space-capable states to subject to an international regime of allocation are absent, a similar regime is unlikely to be adopted for commercial extraction of space resources in the foreseeable future.<sup>327</sup>

### C. *International Allocation of Access to Resources via an International Authority*

The vast majority of proposed regimes utilize the Law of the Sea, as concerns the seabed and the subsoil of the international Area, as a framework for a proposed regime for the extraction of space resources.<sup>328</sup> Some claim that the provisions of UNCLOS should be used for space, and others try to distinguish their proposed regime from UNCLOS. While they differ on the specifics, the regimes based on UNCLOS follow a similar fundamental logic: space resources belong to all mankind, therefore the exclusive use and property rights in space resources should be regulated by an international authority, similar to the International Seabed Authority, and the wealth derived from

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324. See von der Dunk, *Asteroid Mining*, *supra* note 1, at 92–93.

325. TRONCHETTI, *supra* note 5, at 175–77.

326. See von der Dunk, *Asteroid Mining*, *supra* note 1, at 93; Larsen, *Asteroids*, *supra* note 5, at 307.

327. See von der Dunk, *Private*, *supra* note 5, at 148.

328. See, e.g., ODUNTAN, *supra* note 11, at 218–19; Tao & Wang, *supra* note 24, at 51; Paxson, *supra* note 4, at 510; TRONCHETTI, *supra* note 5, at 244–85; Larsen, *Asteroids*, *supra* note 5, at 314; LYALL & LARSEN, *supra* note 3, at 186; O'Donnell, *supra* note 14, at 156; Tennen, *supra* note 5, at 827–29; Roth, *supra* note 1, at 861–62; LEE, *supra* note 4, at 273–313.

extractions should be shared with the other members of the international community who are unable to participate.

The reliance upon the provisions of UNCLOS and the 1994 Implementation Agreement regarding the deep ocean seabed and subsoil as the foundation of the regime of extracting space resources is misguided. The error is in disregarding two fundamental interconnected issues: (i) the balance between inclusive and exclusive resource allocation under UNCLOS and (ii) the package deal structure of UNCLOS.

### 1. Inclusive and Exclusive Resource Allocation under UNCLOS

Under international law, enjoyment of, and access to, resources can be either exclusive or inclusive. Inclusive allocation means that the resources are reserved for the enjoyment of all members of the international community, while exclusive allocation assigns the enjoyment of the resources to a particular participant. Subjecting access to space resources to international regulation via an international organization will establish a regime of inclusive allocation of such resources. Reliance on the regulation of the Area to support such claims is inappropriate, as the regime governing ocean resources does not support such broad application of inclusive jurisdiction. On the contrary, the Law of the Sea provides for exclusive allocation as the central element of the regime governing ocean resources, with limited inclusive jurisdiction over the least accessible resources.

Where it comes to predicting and proposing policy choices, cherry-picking can be a dangerous and misleading path. Commentators see space as an unused common area and then look towards Earth to find a precedent for regulating common areas; they then assume that the regulation of the international Area can be replicated and implemented in space. What they forget, however, is that the Area is in fact “the seabed and ocean floor and subsoil thereof, beyond *the limits of national jurisdiction*,”<sup>329</sup> which under UNCLOS extends far beyond the sovereign territory of the state, extending up to 200 nautical miles from the baselines and beyond to the edge of the continental margin.<sup>330</sup> The regime of ocean resources developed in stages during the twentieth century from a three-nautical-mile territorial sea to include both exclusive and inclusive use of the resources of the water column, seabed, and subsoil. In fact, most of the resources of the seabed and subsoil (oil and gas) accessible when UNCLOS was signed were exclusively allocated as they were

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329. UNCLOS, *supra* note 24, art. 1.

330. *Id.* art. 76.

located within the definition of the continental shelf, extending up to the edge of the continental margin.<sup>331</sup>

The regulation of the Area under UNCLOS was thus intended to apply to only *part* of the resources of the oceans, which were then difficult to access. This regulation in fact failed to gain the necessary support, being deprived of most of its “common heritage” substance by the 1994 Implementation Agreement, which the United States still refuses to ratify.<sup>332</sup> This regulatory regime was recognized as part of the UNCLOS package deal,<sup>333</sup> which included, *inter alia*, recognition of a twelve nautical mile territorial sea, a 200-nautical-mile EEZ and continental shelf rights extending up to the continental margin.<sup>334</sup> UNCLOS thus included most of the ocean’s resources which were then accessible under exclusive state jurisdiction, recognizing, in theory, the least accessible resources as part of the “common heritage of mankind” and subjecting them to international regulation of access through the International Seabed Authority and benefit-sharing from resources. The inclusive use of the seabed subject to international regulation was thus recognized in conjunction with vast exclusive jurisdictions for coastal states over ocean resources.

Scholars advocating the use of the Area’s regulation as a framework for the regulation of space resources disregard the vast exclusive jurisdictions under UNCLOS, proposing to impose the regulation of the Area extending to *part* of ocean resources to *all* of space resources. Such a proposition disregards the balance of jurisdictions under UNCLOS, picking part of the balance and imposing it absent the other parts of the package deal. If the regulation of ocean resources is to be a blueprint for outer space activities, one needs to account for exclusive jurisdictions in addition to inclusive jurisdictions. The regulation of the oceans as a whole should be evaluated. In other words, it is important to realize that the regime of the Area was only the final (thus far) development of the regime of ocean resources; exclusive state jurisdiction was, and still is, the initial and main element of the regime governing ocean resources.

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331. ROTHWELL & STEPHENS, *supra* note 90, at 87. The first contracts in the international Area were awarded only in 2001. See *Minerals: Polymetallic Nodules*, INT’L SEABED AUTH., <https://isa.org.jm/exploration-contracts/polymetallic-nodules> (last visited Oct. 2, 2020).

332. ROTHWELL & STEPHENS, *supra* note 90, at 141–42.

333. On the “package deal,” see generally UNITED NATIONS CONVENTION ON THE LAW OF THE SEA 1982: A COMMENTARY, 29–85 (1985) [hereinafter *VIRGINIA COMMENTARY*].

334. *UNCLOS*, *supra* note 24, art. 3 (territorial sea), 57 (EEZ), 76 (continental shelf).

## 2. Package Deal Incentives of UNCLOS

Commentators also forget that UNCLOS was a package deal, which balanced the interests and leverages employed by a wide variety of states: two superpowers; coastal states, either developing or developed; landlocked states; and geographically-disadvantaged states.<sup>335</sup> These participants formed various interest groups which pulled different levers of power. For example, while the major naval powers wanted to preserve the freedom of navigation and rights to traverse straits, developing countries wanted an extended territorial sea and to secure interests to the resources in a 200-nautical-mile band.<sup>336</sup> In fact, before UNCLOS was signed, many developing countries, predominantly in South America, had already declared 200-nautical-mile zones and even territorial seas.<sup>337</sup> Though they would not have been able to enforce their claims against the United States or Soviet Union, they were still present in the oceans and able to exercise some degree of jurisdiction over the resource rights they claimed. These developing countries held control over some international transport routes, were present in the oceans and could physically access the resources (at least of the water column), and even land-locked states could still own ships docked at a neighbor's port.

The balance in UNCLOS was thus predicated upon the ability of all participants to exert certain leverages. This situation, however, does not, in the foreseeable future, pertain to space. Space-incapable states cannot physically challenge the ability to exploit resources; they cannot exploit the resources themselves; they cannot prevent space travel; nor do they have anything to offer space-capable states in return for an international regime confining their decision-making and economic gain. Because space-capable states are also the world's strongest economies and military powers, the only remaining tool space-incapable states have is public pressure, but considering the alterations made in the 1994 Implementation Agreement and the United States' continued refusal to join both it and UNCLOS, it is questionable whether public pressure can effectively sway the policy choices of space-capable states in favor of equitable considerations with respect to the interests of space-incapable states.

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335. See ROTHWELL & STEPHENS, *supra* note 90, at 12–14. See generally VIRGINIA COMMENTARY, *supra* note 333.

336. See ROTHWELL & STEPHENS, *supra* note 90, at 1–14; Tommy T.B. Koh & Shanmugan Jayakumar, *The Negotiating Process of the Third United Nations Conference on the Law of the Sea*, in VIRGINIA COMMENTARY, *supra* note 333, Vol. I, at 30 (1985).

337. VIRGINIA COMMENTARY, *supra* note 333, at 494.

The space-capable states simply have no incentive to be subject to a regime similar to that of the Law of the Sea. Space, unlike the oceans, is only accessible to space-capable states, and therefore the balance of interests of any regime will be dominated by their interests, objectives, and values, rather than those of other participants. With access to theoretically unlimited resources, it is unreasonable to assume that the balance achieved in UNCLOS, as concerns only the least accessible and valuable resources, would be accepted to govern *all* the resources of space.

It is interesting to consider in this regard the gains of land-locked states in ocean resources under UNCLOS. Land-locked states were the least advantageous participants in the UNCLOS negotiations and had the least to offer to the coastal states. Nevertheless, since land-locked states could access the oceans through neighboring states and own and operate ships, they in fact had *more* leverage over coastal states than space-incapable states have over space-capable states. Nevertheless, although land-locked states, allied with geographically disadvantaged states, advocated during the negotiations for participation rights in the EEZ and continental shelf,<sup>338</sup> their gains in respect of rights to ocean resources were extremely limited.

In the continental shelf, extending from the coasts up to the continental margin, no right of participation was recognized.<sup>339</sup> With respect to the water column extending from the coasts up to 200 nautical miles, land-locked states were recognized with participation rights in only living resources, confined to the *surplus* of the resources that were exclusively accorded to the coastal state, and were further subjected to the economic and nutritious interests of the coastal states<sup>340</sup> and “bilateral, subregional or regional agreements” to be negotiated.<sup>341</sup> This, as Professor Yoshifumi Tanaka explained, made any participation dependent upon “the good will of the coastal State concerned.”<sup>342</sup> They would of course, as other states, participate in the bits and pieces of any revenue-sharing obligation from the outer continental shelf and the Area and may conduct high sea fishing.

Overall, it is evident that the land-locked states were accorded rights to ocean resources proportional to their ability to exercise leverage. As

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338. *VIRGINIA COMMENTARY*, *supra* note 333, at 695–731; ALEXANDER PROELSS, UNITED NATIONS CONVENTION ON THE LAW OF THE SEA: A COMMENTARY art. 69 (2017).

339. *VIRGINIA COMMENTARY*, *supra* note 333, at 832.

340. *UNCLOS*, *supra* note 24, art. 69(1)–(2).

341. *Id.* art. 69(2).

342. YOSHIFUMI TANAKA, *THE INTERNATIONAL LAW OF THE SEA* 412 (2d ed. 2015).

owners and operators of ships they were granted certain theoretical fishing rights within EEZs but were excluded from any continental shelf rights. It is therefore unclear why commentators think it plausible that, considering the balance of power between space-capable and space-incapable states, a regime similar to that of the Area for *all* space resources is likely to develop. It is far more likely that the absence of leverage by space-incapable states would accord them no more, and probably fewer, rights in extracted space resources than the rights accorded to land-locked states in accessible ocean resources within the EEZ.

#### V. THE REGIME EVOLUTION APPROACH TO OUTER SPACE RESOURCES

Commercial extractions of space resources are coming, and international legal scholarship must evaluate the path ahead to determine the preferable, yet plausible, way forward for international law. To achieve this, one must consider the participants involved and their objectives, values, strategies, circumstances, and the possible outcomes of their interactions.<sup>343</sup> For any proposed policy choice to realistically be adopted, it must be attuned to the process of claim and counter-claim by which international law is developed, as initiated by the United States in the 2015 Space Resources Act. This circular process of claims, interaction, and outcomes will develop the regime governing commercial extractions of space resources. The role of the international scholar is to propose the most preferable path, which promotes the most values out of the feasible and likely adoptable paths based on the anticipated interactions between the participants.

As will be shown in this Article, the process by which the Law of the Sea was developed indicates that it would be hasty for the scholar to jump ahead to a world of countless participants, with intersecting interests and counter leverages, and propose that the regime of space resources should start at a comprehensive regulatory regime. The Law of the Sea did not begin with UNCLOS, nor is the regime of space resources likely to begin with a duplication of UNCLOS's regulation of the Area or that of the 1994 Implementation Agreement. The regime of space will inevitably develop based on the circumstances and the interests present at any stage of development, as the regime governing the oceans developed from Grotius to UNCLOS.<sup>344</sup>

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343. See generally McDougal et al., *Enjoyment*, *supra* note 5.

344. See generally ROTHWELL & STEPHENS, *supra* note 90.

Professor Donald R. Rothwell and Professor Tim Stephens explain that:

The international law of the sea has developed across several quite distinctive phases, ranging from early theoretical debates between scholars over the status of the oceans, to the dominance of the freedoms of the sea doctrine, to the *gradual* codification of the law of the sea throughout the twentieth century.<sup>345</sup>

During the Middle Ages, the oceans were subject to various, though unsustainable, claims for appropriation by powers, which raised the debate over the concepts of *mare clausum* and *mare liberum*.<sup>346</sup> With the triumph of the Grotian doctrine of *mare liberum*, the freedom of the seas was protected as the foundation of the Law of the Sea up until the nineteenth century.<sup>347</sup> At that time, the development of naval capabilities to threaten coastal states had driven states to lay claim to exercise jurisdiction over adjacent waters (the territorial sea) to protect against foreign forces.<sup>348</sup> While its prime purpose was security, the territorial sea extended to engulf the resources of the waters.<sup>349</sup> With the development of state practice, and following the United States' 1945 proclamation of rights over the continental shelf, the United Nations' codification process began to take shape.

The first UNCLOS Conference of 1958 produced conventions on the territorial sea, the contiguous zone, the continental shelf, the high seas, and fishing, with an optional dispute settlement protocol.<sup>350</sup> Following claims to extend maritime zones and a growing interest in the regulation of the deep seabed due to technological developments, UNCLOS was adopted in 1982. This convention balanced many conflicting interests and claims and provided for a comprehensive regime of the Law of the Sea, which included, *inter alia*, the extension of the territorial sea, establishment of the regimes of straits and islands, recognition of exclusive state jurisdiction up to 200 nautical miles, a more precise definition of continental shelf entitlements, protection of the freedoms of the high seas, and the subjection of the deep seabed to the principle of the common heritage of mankind (modified by the 1994 Implementation Agreement).<sup>351</sup> The United States and several other

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345. ROTHWELL & STEPHENS, *supra* note 90, at 1 (emphasis added).

346. *Id.* at 2.

347. *Id.* at 3–4.

348. *Id.* at 4.

349. *Id.*

350. *See id.* at 6–9.

351. *See id.* at 10–20.

countries still refuse to ratify the convention, and the deep seabed operations of U.S. citizens are still regulated via domestic law.<sup>352</sup> The United States is, however, an outlier on this matter, as many states, including the United Kingdom, Russia, Germany and China, have cooperated with the International Seabed Authority in deep sea mining.<sup>353</sup>

Like any international resource-related regime, the development of the regime of space will depend upon the number of active participants, the quantity of available resources, and the type of resources exploited.<sup>354</sup> While it is impossible to foresee precisely which rules and balances would be agreed upon by the participants in the development of the regime, it is possible to sketch a general course of development, based on likely interactions between participants. This Article proposes to adopt a novel regime evolution approach to the regulation of space resources, according to which the regime of access to space resources will, as Law of the Sea did, develop gradually in stages which are consistent with the leverages, interests, and capabilities of the participants at each stage of development. Based on anticipated interaction, four distinct, expected stages are identified below: (1) pioneers; (2) coordination; (3) allocation; and (4) regulation.

#### A. *The Stage of Pioneers*

Regulation of commercial extraction of space resources is moving from academic debates into the global arena. The stage of pioneers will likely resemble the age of freedom of the seas under the Law of the Sea. There would be a limited number of active participants, presumably the major space-capable states and their citizens, including the United States, Russia, member states of the EU, the United Kingdom, Japan, India, and China. Regulation of access to space resources is likely to remain within the realm of the state, with limited, if any, international regulation.

As mentioned above, even before the first commercial missions have been launched, the first claim by a major participant, the United States, was made in order to protect the investments of its nationals through the adoption of the U.S. Space Resource Act of 2015. In this claim, the United States unilaterally, under the pretext of interpretation, recognized the property rights of its citizens to extracted space resources. The United States' claim resembles in many ways the claim it made

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352. See Deep Seabed Hard Mineral Resource Act, 30 U.S.C. ch. 26, <https://www.law.cornell.edu/uscode/text/30/chapter-26> (last visited Nov. 2, 2018).

353. See *Deep Seabed Mineral Contractors*, INT'L SEABED AUTH., <https://www.isa.org/jm/deep-seabed-minerals-contractors> (last visited Nov. 2, 2018).

354. See generally McDougal et al., *Enjoyment*, *supra* note 5.



regarding unilateral continental shelf rights in 1945 and its claim to regulate deep-sea resources outside the UNCLOS framework.<sup>355</sup> The former claim became international law and while the legality of the latter is disputed,<sup>356</sup> the United States has issued and recently renewed licenses for deep-seabed mining.<sup>357</sup> The United States' claim may be followed by other space-capable states once they and their corporations attain the capabilities to extract space resources and lead to the development of international law. As a point of reference, as mentioned above, this claim seems to have been internationalized through the Artemis Accords between the United States and other space-capable states.<sup>358</sup>

The United States' claim has been opposed by Russia, Brazil, and Belgium, but supported by other participants, including Luxembourg, an EU member, which made a similar claim.<sup>359</sup> Except for Russia, none of the other space-capable states have voiced any opposition to the United States' claim, and the Russian opposition has been attributed more to overall political tension between the countries than to a genuine belief that space resources should be the common heritage of mankind.<sup>360</sup> The silence of China with respect to the United States' claim is telling, as China itself is working towards a moon program, which may include resources.<sup>361</sup> Australia, another space-capable state, while currently a member of the Moon Treaty and subject to its provisions concerning space resources, is reported to have allegedly considered a withdrawal from that Treaty.<sup>362</sup> Since the Moon Treaty has no substantial provisions except the limitation on space resources, Australia's contemplation of withdrawal can only plausibly be attributed to an intention to follow the United States' claim.

Other participants, while inactive, include the space-incapable states. While only a few space-incapable states have made claims, the claims are diverse with no unified front. Brazil, a significant developing country, has voiced opposition to the United States' Space Resource Act,

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355. See von der Dunk, *Asteroid Mining*, *supra* note 1, at 101.

356. See Charles E. Biblowit, *Deep Seabed Mining: The United States and the United Nations Convention on the Law of the Sea*, 58 ST. JOHN'S L. REV. 267 (1984).

357. Deep Seabed Mining: Approval of Exploration License Extensions, 82 Fed. Reg. 42, 327 (Sep. 7, 2017), <https://www.federalregister.gov/documents/2017/09/07/2017-18994/deep-seabed-mining-approval-of-exploration-license-extensions>.

358. Artemis Accords.

359. See von der Dunk, *Private*, *supra* note 5, at 143.

360. See *id.* at 149.

361. Doshi, *supra* note 1, at 196.

362. LYALL & LARSEN, *supra* note 3, at 166.

urging for an international rather than national regulation.<sup>363</sup> This was supported by Belgium.<sup>364</sup> Opposition may also be inferred from states joining the Moon Treaty, but they are few in numbers. On the other hand, the UAE has shown interests in commercial space resource extraction and Luxembourg has adopted a law similar to that of the United States.<sup>365</sup> The absence of a unified front, combined with the lack of leverages and conflicting interests, leads to the conclusion that the first stage of the regime will likely develop through national legislation by individual space-capable states.<sup>366</sup>

The interactions between the participants are likely to continue, with some space-incapable states choosing to oppose space extractions, while others, such as the UAE and Luxembourg, will attempt to participate either through investments or by attracting investments through legislation recognizing property rights. A possible adverse effect stimulating cooperation between states rests in the potential disruptive effect caused by space resources to developing economies based upon resource exploitation.<sup>367</sup> These interactions will, however, be confined to the Earth, since access to space is limited to those with the requisite technology. Because the space-capable states possess the largest militaries and economies, it is highly unlikely that military or economic pressure will dissuade them from proceeding with space resource extractions.

Any endeavor to affect the policy choices of space-capable states through market pressure or boycotts is likely to fail. First, in international trade and globalization, economic inequality due to technological abilities has never been a source of public outcry, as long as a fair playing field was preserved.<sup>368</sup> Analogically, as long as free access to space is not deprived from space-incapable states, economic inequality is unlikely to generate meaningful public pressure. Second, it would be difficult to distinguish between Earth and space origin resources.<sup>369</sup> Finally, with the world's largest economies participating in commercial

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363. See von der Dunk, *Asteroid Mining*, *supra* note 1, at 98–99.

364. Marboe, *supra* note 53, at 230.

365. von der Dunk, *Asteroid Mining*, *supra* note 1, at 96.

366. See von der Dunk, *Private*, *supra* note 5, at 148.

367. See Neto, *supra* note 37, at 219.

368. See Dani Rodrik, *Populism and the Economics of Globalization*, J. INT'L BUS. POL'Y (2018), [https://drodrrik.scholar.harvard.edu/files/dani-rodrik/files/populism\\_and\\_the\\_economics\\_of\\_globalization.pdf](https://drodrrik.scholar.harvard.edu/files/dani-rodrik/files/populism_and_the_economics_of_globalization.pdf).

369. Space mining operations are targeted at rare Earth resources found in asteroids. See JAKHU, PELTON & NYAMPONG, *supra* note 1, at 15–19.

space resource extractions, any boycott would have limited, if any, effect on the commercial viability of space resources exploitations.

At this stage of space development, international organizations and NGOs are likely to play a limited role as concerns legality of access to wealth, equity, or spurring innovation. Nevertheless, these entities of global governance are likely to participate in monitoring and promoting other values, including safety and health of personnel, and environmental protection. There is no reason to assume that these values, gaining support on Earth, would not be extended to extraterrestrial operations.

With a limited number of participants and assuming a vast amount of exploitable resources, there is no incentive for joint action by the participants. Since extractions of space resources are long-term projects with slow operations, the participants can easily steer clear of each other and avoid any conflicts which could threaten their security. In this sense, the stage of space pioneers will likely be modeled after the United States' claim and include national recognition of property rights, while precluding claims to national sovereignty. With national sovereignty unenforceable, participants are unlikely to make theoretical claims which will precipitate conflict and jeopardize their security for little gain. With the development of international commerce in space resources, these nationally recognized property rights are likely to be internationalized and recognized as lawful under international law<sup>370</sup>; the Artemis Accords constitute evidence of this process. This regime will be similar to that of the early Law of the Sea, where participants were able to exercise the freedoms of the sea, with limited conflicts.

National regulation by major participants will be required to mitigate the adverse effects of any regulatory race to the bottom, gold rush effects, and the tragedy of the commons. While it is unclear whether national regulation can successfully alleviate these concerns, these potential risks do not, as of now, create the necessary incentives for joint action. In addition, due to the vast resources available and the incentive to exploit them, space-capable states will likely adopt policies which would negate any adverse effects on the profitability of their space resource industry. For example, restriction of the flow of capital or technology may limit any regulatory race to the bottom and force corporations from space-capable states to distribute any resources gained from their space projects domestically. In addition to securing their jurisdiction, space-capable states may adopt strong safety and

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370. For the process of internationalization, see Harold Hongju Koh, *Transnational Legal Process*, 75 NEB. L. REV. 181 (1996).

environmental regulations, which may confine the adverse effects of the gold rush, and thus limit any public pressure on the space resource industry. However, as long as the amount of resources is vast, the risks associated with the “tragedy of the commons” would only concern those not participating in the extraction, i.e., space-incapable states, with limited cooperation incentives for the space-capable states. It may, nonetheless, exacerbate the regulatory race to the bottom by incentivizing states to participate by attracting foreign investors.

While space-incapable states have limited leverage at this pioneering stage of development, a claim for equal access to the resources on the market might be acceptable to the space-capable states due to the current veil of ignorance. To recall, the structure of the United States’ Space Resources Act indicated that the United States aspired to preserve the Outer Space Treaty, for the time being, as the framework for space regulation. Furthermore, as mentioned above, a plausible interpretation of the “benefit for all” obligation in Article I of the Outer Space Treaty provides for equal access to the resources on the market.<sup>371</sup> A claim by space-incapable states for equal access on the market to the resources may be acceptable to the space-capable states, primarily the United States in light of its free market approach and its compatibility with the international regulation of trade. Free access to resources may be beneficial to space-capable states as well, since each state or corporation may extract different resources. While the “benefit” component is limited, this claim would promote a bit of equity, with limited, if any, adverse effect on wealth and innovation.

The period for this stage of the regime could be measured in years or decades. While the number of participants is low enough and the quantity of available resources is high enough that participants may extract the resources absent conflicts which threaten their security, participants would have no incentive to form a cooperative regime. However, as soon as the number of participants increases, and/or the availability of resources decreases to the point where conflicts jeopardize wealth and security, an incentive will be created for cooperation.

An incentive for cooperation could also be created independently due to potential market flooding of resources. As Lee explains, space resources are likely to be delivered to Earth in large quantities with long intervals between deliveries.<sup>372</sup> This will have an adverse effect on

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371. *See supra* Section II.A.1.

372. LEE, *supra* note 4, at 289–90.

the Earth's economic markets, with a sudden increase in supply of certain resources driving down their prices, thus precipitating large price fluctuation.<sup>373</sup> To confront this problem, Lee proposed to form an authority to buy and distribute the resources.<sup>374</sup> This is, however, analogous to swinging a sledgehammer to kill a fly. Controlling the release of resources to the market to affect prices has been widely used for fossil fuels through simple means of coordination at OPEC.<sup>375</sup> In addition, the existence of coordination as a means to control market prices is the *raison d'être* behind anti-trust regulation. Thus, while cooperation may be incentivized to control prices on the market, this type of coordination, is post extraction and does not require coordinating the access to the resources themselves, with which this Article is concerned.

It is, however, important to note that other forms of coordination (and even regulation) may develop, even though their effects on the regulation of access itself may be limited. The Artemis Accords, for example, include a recognition of evolving "safety zones" around installations,<sup>376</sup> which may develop in a manner similar to that of safety zones around artificial ocean-based installations.<sup>377</sup> This demonstrates that the international law governing outer space in general, and access to space resources in particular, will develop in stages as this Article proposes. The anticipated recognition of property rights and limited safety zones is a response to the expected interactions between the participants at this stage, and the fact that these have been negotiated between developed states demonstrates the lack of incentive by such nations to concede to any demands of space-incapable states. In contrast to UNCLOS, as discussed above, the interactions concerning space-resources do not, as of this stage, justify a parliamentary diplomatic arena, but rather favor the establishment of rules between the active participants. Such anticipated rules are intended to confront the likely interactions in this stage, promoting wealth and innovation through the recognition of property rights, while protecting health, the environment, and security through safety zones. The development of these rules is accordingly attuned to the process of interactions and the incentives present. Such a process, as this Article proposes, will govern

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373. *Id.*

374. *Id.*

375. See, e.g., *OPEC, Allies Agree Not to Further Increase Oil Production*, ASSOCIATED PRESS (Algiers) (Sep. 23, 2018), <https://www.apnews.com/9e55b130b1124d7bb2e6dd6e07f99767>.

376. Artemis Accords, § 11.

377. UNCLOS, *supra* note 24, art. 60(4).

the development of the regime governing space resources into the stage of coordination and beyond.

B. *The Stage of Coordination*

The stage of coordination will begin once conflict between the participants threatens their access to wealth or security. Coordination of access to space resources will balance the values of access to wealth and security. While coordination of access will require some participants to seek alternative resources even after initial explorations (thus adversely affecting their access to wealth), coordination would prevent conflict, which would increase the security of the participants. Since, however, there will still be plenty of resources available, the effects on wealth will be limited while the advantages in security will be high.

At this stage, the participants will have an incentive to coordinate their actions between themselves through formal or informal mechanisms. The coordination is intended to ensure that different corporations, from different countries, do not clash over the same resource. Since states are responsible for supervising the actions of non-governmental entities in space, and considering the risks posed by the non-arbitrary access to resources, the participating space-capable states would be incentivized to coordinate their efforts to prevent disputes.

As proposed by some, this coordination may be based on a first-come first-served approach with a certain proof of feasibility requirement and may be subject to reconsideration due to inactivity.<sup>378</sup> At this stage, incentives and circumstances start to resemble those in relation to satellites in Earth's orbit, but the number of participants would still be low enough to sustain effectiveness absent firm regulation. Specifically, with more participants in the game and higher risks of participants clashing over resources, it will become necessary to prevent participants from attempting to extract the same resource. Besides the potential randomized clashes, participants would be required to account for a potential free-rider problem, i.e., when a corporation has invested significant funds in determining the commercial viability of a resource, only to have another corporation then begin extracting the same resource.<sup>379</sup> In the same sense that two satellites and frequencies may not co-exist at the same spot, resource extraction cannot be conducted from the same exact resource. But in contrast to the ITU regime, with a

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378. See, e.g., *Larsen, Asteroids*, *supra* note 5, at 307–08; *Reinstein*, *supra* note 5, at 85.

379. The Deepsea Ventures incident provides for an example of this problem. See W. REISMAN, MAHNOUSH ARSANJANI, GAYL WESTERMAN, & SIEGFRIED WIESSNER, *INTERNATIONAL LAW IN CONTEMPORARY PERSPECTIVE* 721–25 (2004).

low number of participants and vast resources, coordination, rather than allocation, may be sufficient to prevent conflict.

At this stage, states still have no incentive to subject their decision-making to any form of international regulation limiting their action, but the incentive is rather to cooperate in order to ensure that there is no conflict between their activities. Such coordination may be sustained through a type of “space club” which new space-capable states would be allowed to join, or through treaty mechanisms between some or all space-capable states as with the Artemis Accords. After a claim to a resource is made, absent genuine progress, reconsideration may be necessary to ensure that certain, more valuable resources are not left unexploited. Nevertheless, as long as the resources remain more abundant than the participants may reasonably exploit, there is no need for allocation of access, but only prevention of conflict. Under such circumstances, any reconsideration must be voluntary, so as to prevent an unnecessary conflict over sufficiently abundant resources.

It is worth considering an example for this regime. For this example, imagine two states, A and B, with the corresponding private corporations (or a subsidiary) registered in each state, labeled “entity A” and “entity B”. Let us assume that both entity A and entity B set their sight on object X. One of the entities or both invested certain amounts to explore the potential of object X and to show feasibility. The state of entity A (“state A”) then lays claim to exploit object X before the state of entity B (“state B”). As long as the costs associated with entity B shifting focus to object Y with similar resources are less than the costs of dispute between state A and state B, the regime of coordination will be successful. In the same sense, even if entity A fails to exploit object X, if there are many accessible objects Y, there is no incentive to force entity A to relinquish object X. While the initial claim for exclusivity may be dealt with in a manner similar to that of intellectual property, due to the high quantity of resources available and low number of participants, there are no incentives to subject the exclusivity to a mandatory expiration, thus avoiding the risks associated with a “gold-rush” mentality.

In addition to preemptive coordination, a certain dispute settlement mechanism is likely to be established. Since states such as China are likely to be participating side-by-side with corporations, a dispute settlement mechanism will need to incorporate public-private in addition to private-private dispute settlement and include an agreement on the applicable law. Whether voluntary or mandatory, at this point a dispute settlement mechanism is necessary to establish coordination as the basis for a global order. Absent dispute settlement, preemptive coordination may fail to prevent conflicts between states and corporations. In

the above example, if states A and B lay claim simultaneously, a conflict may occur. More importantly, since most states have limited control over private corporations, states will be incentivized to create a mandatory dispute settlement mechanism between private space investors in order to prevent any dispute escalating to the inter-state level. Moreover, if the dispute settlement mechanism will extend to the initial claim, e.g., which of A and B shown more capability to succeed, such a mechanism will incentivize innovation by investors on the one hand and may postpone the necessity of firm allocation on the other.

The stage of coordination will be an intermediary stage. The duration of this stage will depend upon the nexus between the increase in participants, decrease in resources, and increase in conflicts. Once the number of participants and the amount of conflicts becomes too great to be addressed by a preemptive coordination system, states will be incentivized to allocate zones of jurisdiction. In other words, when X and Y are scarce resources, or when there are many instances of entities being forced to internalize the costs of others due to an increased number of participants, the regime of coordination will no longer be sufficient, and a pre-investment allocation will be necessary.

### *C. The Stage of Allocation*

In order to prevent conflicts between entities A and B and reduce the costs associated with entity B's loss of X, pre-investment allocation of jurisdiction will be necessary. Allocation is therefore likely to be the first stage of any firm international regulatory regime. While allocation in space would be different than maritime allocation because it is not linked to any land sovereignty, the basic concept of exclusive resource rights is similar. Allocation differs from coordination in the sense that while coordination still preserves the non-arbitrary access to resources, allocation begins to erode this perception, conforming the regulation of outer space activities to international law's arbitrary access to resources.

International allocation of jurisdictions between states A and B will promote security and access to wealth. With greater threats to security and wealth due to increased disputes, states would be incentivized to relinquish more of their access to wealth in order to protect their security. In the same sense, the territorial sea and the initial continental shelf<sup>380</sup> were recognized to balance the security of the state and access to resources. While the freedom of navigation and the resources available

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380. Convention on the Continental Shelf, Apr. 29, 1958, 433 U.N.T.S. 311.



for inclusive use were reduced, each state was recognized with a protective zone and exclusive jurisdiction over certain resources. This balanced the security of the state and prevented conflict on the one hand and secured certain access to wealth on the other. A similar balance between access to wealth and security through allocation of exclusive use is likely to develop with respect to space resources. While it is unclear what model this allocation will take, it will likely allocate access to either specific space resources or to areas of space where resources are found. In other words, through a certain mechanism driven by the active participants, states would be recognized with exploitation rights to either specific space resources or all resources in certain parts of space.

This mechanism will likely be developed on the foundation of the coordination mechanism and thus employed between space-capable states. In other words, instead of state A laying a claim after entity A proved feasibility, state A would be allocated a certain jurisdiction in which entity A would conduct surveys. While this will limit entities A and B to certain resources, thus adversely affecting their access to wealth, the conflict between A and B, and thus between state A and state B, would be averted. It will be necessary to take account of multi-national corporations and ensure that this type of system is not taken advantage of. Nevertheless, as long as the allocated state may ensure its benefit through taxation or royalty payments, any adverse effects can be limited.

While voting rights and allocations may eventually be equal for all participants (e.g., when the balance of incentives produces a parliamentary diplomatic arena, as occurred during the Third United Nations Conference on the Law of the Sea), initial allocations are likely to depend upon economic power and feasibility in order to promote access to wealth and encourage innovation. In other words, for the dominant participants to have an incentive to limit their access to wealth in return for security, they are likely to ensure either a larger portion of the pie for themselves or at least make sure that allocations are not wasted. As a point of reference, the extent of the initial recognition of exclusive access to continental shelf resources was subject to a vague “exploitability” criterion.<sup>381</sup> This allocation may be performed through a licensing mechanism as proposed by some,<sup>382</sup> or auctioning as proposed by others.<sup>383</sup> In any case, the allocation would produce

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381. *Id.* arts. 1–2(2).

382. *See, e.g.,* TRONCHETTI, *supra* note 5, at 244–85; *von der Dunk, Private, supra* note 5, at 149.

383. *See, e.g.,* Roth, *supra* note 1, at 862; Tennen, *supra* note 5, at 828; Reinstein, *supra* note 5, at 88–93.

exclusive jurisdictions of the participants over specific resources or regions of space.

This form of allocation of jurisdiction resembles maritime sovereign rights more than sovereignty. Nevertheless, the allocation of access erodes the last pieces of the non-appropriation principle and will precipitate claims of equity and human dignity from states which would still lack space capabilities and those states which will have less-developed space capabilities. With more participants possessing the ability to exploit the resources, thereby decreasing the availability of resources and increasing the number of conflicts, the balance of leverages will begin to resemble that of the second half of the twentieth century in the oceans. The tipping point in favor of a comprehensive international regime would come once the weaker participants have leverage over the stronger participants. As with the Law of the Sea, once the less-developed space-capable states have something to offer to the more developed space-capable states, a comprehensive regime for space resources is then likely to develop. Whether this process takes decades or longer, until conflicting interests are accompanied by conflicting gains, a comprehensive regime is unlikely to be adopted.

#### D. *The Stage of Regulation*

The final stage of development will come through a balance of interests between the weaker and stronger states, as all or most states will be space-capable by this stage. Weak and strong are unclear adjectives; these distinctions are likely to be states with very developed space resource industries and states with less developed, or developing, space resource industries. For the ease of the discussion they will be referred to as developed and developing states because the similarities of interests will likely resemble those of present-day developing and developed states with respect to Earth-based industrialization.

In order to avoid confusion with UNCLOS, this theoretical regime will be referred to as the United Nations Convention on Space Activities ("UNCSA"). UNCLOS codified much of the existing Law of the Sea and was based upon previous conventions and customary international law; it is thus reasonable to predict that the regime of the UNCSA will similarly rely upon the previous interactions between the participants. It would be imprudent at this point to attempt to outline the various competing interests that would need to be balanced by the regime. Additionally, attempting to outline, even in broad terms, the various elements of this regime would be unhelpful to scholars and policymakers as it would be an exercise of pure imagination—

technologies will develop, discoveries will be made, and participants will change. What is evident, however, is that this regime is likely to resemble the Law of the Sea in the comprehensive and broad sense, rather than the narrow sense of the Area.<sup>384</sup> While this developed space regime will likely be a comprehensive regime engulfing many inclusive and exclusive uses of space besides resources, including, for example, freedom of travel and its regulation, this Article is solely concerned with the regulation of access to resources.

As argued, this regime will inevitably be based upon the previous regimes. This means that the regime of UNCOSA will likely incorporate both exclusive state jurisdictions and inclusive international jurisdictions, as was the case with UNCLOS. Since the interactions between the participants are likely to develop an allocation of exclusive jurisdiction, this stage of regulation will develop such exclusive allocations in the same sense that UNCLOS recognized and developed claims by states to exclusive jurisdictions over ocean resources. While the method of allocating this exclusive jurisdiction is unknown and impossible to predict, it would necessarily develop based upon the initial coordination and then allocation at previous stages of the regime's development.

An intervening element, which may alter the development of the regime and take it into an unforeseeable direction, is the prospect of sovereignty. To recall, under the current U.S. claim, sovereignty claims in space are to remain unlawful. As mentioned above, this makes sense, as there is no incentive to stir up conflict over theoretical and unenforceable sovereignty claims. The previous stage of allocation, however, may destabilize this principle, and should space capabilities reach the point of military exclusion of others, a participant may diverge from the accepted practice and lay a claim to sovereignty. Sovereignty, either in the sense of a "territorial sea" (with rights for others) or even as terrestrial domain, may also become necessary to fulfil needs that are currently unimaginable. While this scenario may crystalize at some point in time, its consideration for steering policy choices will only become relevant at the transition between coordination and allocation; with too many unknown variables at the beginning of the first stage, it is impossible to measure its effects.

## VI. FINAL REMARKS

International regulation should be dynamic and attuned to the incentives and interactions of the participants. Thus, rather than a static comprehensive regime, this Article proposes to adopt a novel

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384. *See supra* Section IV.C.

regime evolution approach to the international law governing space resources. As has been shown, the proposals for the immediate implementation of a comprehensive regime, especially those which employ cherry-picking, are inconsistent with the likely evolutionary development of the regime. While visionaries are critical to human technological and social development, policy visions must have a firm foundation in reality in order to sway policy choices towards the desired objectives and the promotion of most values. Proposing a comprehensive regime when incentives for such a regime are absent disregards the dynamics of international policymaking and regulation.

As explained, tracking the likely development of the regime governing outer space resources, based upon the participants involved, their interactions, and the values the regime would be required to promote, illustrates that the adoption of a static comprehensive regime is inappropriate and improbable at this time. Rather, building on the New Haven School of International Law, the regime evolution approach demonstrates that the development of a comprehensive regime for space in general, and resources in particular, would be dynamic, would develop in stages, and would include both exclusive and inclusive jurisdictions for space resources. While this approach was applied in this Article to the regulation of space resources, it should also apply *mutatis mutandis* to other regulations of outer space activities.

The regime regulating access to space resources will likely develop in four stages, each stage building upon its predecessor. While development is currently only at the beginning of the first stage, the United States' claim has begun the process of interactions which will lead to further development of the first stage and set the tone for the stages to come. Each stage of development, as this Article attempted to sketch, is feasible, effective, and manageable in relation to the interactions at each stage of development. Once each stage becomes unmanageable or ineffective, the regime will develop to the next feasible stage, which will then be effective and manageable, until it no longer provides for the optimum gain in values for participants and develops further.

This Article's analysis provides a roadmap for scholars and policymakers to follow when responding to the claims made by the United States and in the Artemis Accords. Accordingly, it is crucial to propose policies to steer the development of the regime to provide for more equity through participation, increased security through dispute settlement and coordination, and greater health, safety, and environmental protection through domestic and international monitoring and regulation, rather than confronting the tide of access to wealth and innovation through comprehensive and unattainable regimes.