



Outer Space as a Global Commons: Competition, Contestation, and Regulation

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Abstract

Outer space has re-emerged as a site of geopolitical contestation and private commercial exploitation, raising urgent questions about its governance as a global commons. This paper examines how existing state and private regulatory approaches address—or fail to address—the risks of a tragedy of the commons in space. Drawing on international relations theory and common-pool resource scholarship, particularly Elinor Ostrom’s principles of commons governance, this research reviews case studies from India, the China-Russia collaboration, Africa, and the U.S., along with initiatives from the private sector such as Sputnix, SpaceX, Isar Aerospace, and LandSpace. Through comparative analysis of these state and commercial initiatives, the paper demonstrates how current governance structures are fragmented, often exclusionary, and lacking in enforcement and adaptability. These weaknesses create vulnerabilities to resource overuse, regulatory gaps, and increased strategic competition. This paper proposes that a polycentric governance model, involving overlapping jurisdictions and inclusive multi-stakeholder participation, offers a more sustainable solution. Such a model would better align with Ostrom’s principles by balancing state interests, integrating private actors, and safeguarding space as a global common for future generations.

Keywords: *Outer Space; Global Commons; Tragedy of the Commons; Space Commercialization; Regulation; Polycentric Space Governance*

Introduction

Outer space, long celebrated as the province of all mankind, now stands at a crossroads between cooperative stewardship and competitive appropriation. It has become a focal point of global economics, law, and politics, as technological advancements drive space commercialization and militarization. Primarily seen as a global common (much like the high seas and the atmosphere), this domain, transcending state sovereignty, has increasingly come under pressure from rapid advances in satellite technology, resource extraction, and military capabilities that expose significant gaps in existing governance frameworks (Jha, 2025). Foundational theories of shared-resource management offer contrasting insights: Hardin’s tragedy of the ‘commons’ forewarns of unregulated exploitation, while Ostrom’s polycentric governance principles point to collaborative, stakeholder-driven solutions (Hardin,

1968; Ostrom, 2015). At the same time, realist scholarship anticipates great-power rivalry over strategic domains in space, and constructivist approaches (Steinsson, 2014). Highlight how shared norms and identities can foster cooperation even in an anarchic environment. These dynamics are already visible in initiatives such as the United States-led Artemis Accords (Low, 2024), the China-Russia International Lunar Research Station (Berkowitz & Williams, 2023), India's Chandrayaan missions (Chandrayaan-3 Details, n.d.), the African Union's emerging space policies, and the growing influence of the private Sector through companies SpaceX and Isar Aerospace.

Traditionally, outer space has not been regarded as a “global commons”, considering it is a domain beyond national sovereignty and accessible to all nations equally (Kaul, 2024). Global Commons are resources in which their domains of exploitation lie largely beyond the sovereignty of any state and are accessible to all humankind. However, this seems to be intrinsically aligned with the broader concept of what we understand as the Global Commons, namely the high seas, the atmosphere, Antarctica, and cyberspace, which are governed by international treaties and norms. What ties these domains together is their multilateral agreement, global nature, and the necessity of collective stewardship to ensure their sustainable use.

Considering that ‘commons’ belong to nobody and are used by everybody, these ‘commons’ are typically governed through multilateral agreements and international law to prevent unilateral exploitation (Baylis & Smith, 2014). Global Commons are distinguished by interdependence, shared responsibility, and the need for multilateral governance frameworks (Hardin, 1968; Buck, 1998). This characterization makes them susceptible to what Hardin (1968) termed the “tragedy of the commons,” where shared resources, coined as commons, are exhausted as individuals acting in self-interest exploit the commons, passing the adverse effects to future generations. However, Ostrom (2015) contested this deterministic view, demonstrating that cooperative and polycentric governance models can help communities sustainably manage common-pool resources. Their ongoing protection is vital as global challenges such as climate change and space militarization escalate, necessitating trust, transparency, and international cooperation, managing these ‘commons’ becomes increasingly complex and essential. However, in today's world, the power dynamics inherently lead to expectations of exception to these agreements, as seen in the U.S. Executive Order (2020) rejecting outer space as a global common (Kaul, 2024).

This paper argues that Outer space should be seen and treated as a global common, just like the other commons; it also has a non-sovereign, transnational character and potentially benefits all humankind (Kaul, 2024). Governed by the Outer Space Treaty of 1967, outer space is designated for peaceful purposes and exploration in the interest of all nations, regardless of their level of development. Its classification as a global commons stems from its open accessibility, collective ownership, and the absence of territorial claims, making it a shared domain akin to the high seas or the atmosphere (Jakhu & Pelton, 2017). The need to recognize it as ‘a common’ struck by tragedy is pressing, considering it faces growing crises threatening its sustainability and equitable use. Chief among these are the increasing risks of space debris, satellite congestion, and the weaponization of space, myriad issues that challenge both environmental safety and geopolitical hegemonies and spheres of influence (Weeden & Samson, 2018). Further, with the continued exponential increase in Space-faring nations, their activities leading to higher rates of satellites, and keen interest in space military developments, we begin to ask what government would stop advancement in the next frontier? These concerns highlight the inadequacy of existing legal regimes and underscore the pressing need for updated, multilateral agreements that preserve outer space as a peaceful and inclusive global commons (Freeland, 2010).

It is in this context that this paper argues that as space activities intensify, questions regarding whether outer space can and should remain a ‘commons’ or whether it will inevitably become subject to territorial claims and the formation of opposing parties’ spheres of influence through control by dominant

state powers are becoming critical. This paper will address these debates in four parts. First, it will situate outer space within the theory of the Global Commons by reviewing Hardin's and Ostrom's frameworks. The second part of this paper will examine geopolitical competition through the lens of offensive realism and consider constructivist alternatives grounded in norm entrepreneurship. Third, it will analyse contemporary case studies, including the fragmentation of lunar governance and commercial actors' role in assessing the strengths and weaknesses of existing treaties such as the Outer Space Treaty and the Moon Agreement, resulting in the second space race. Finally, it will propose a hybrid governance model that combines polycentric institutions, enforceable peer review mechanisms, and inclusive decision-making processes to ensure sustainable, equitable, and peaceful cooperation in outer space.

Outer Space as a Global Commons: Between Tragedy and Governance

The theoretical foundation for understanding 'commons' management stems from Garrett Hardin's (1968) "Tragedy of the Commons," which postulates that shared resources, if left unchecked, will be depleted due to overuse and self-interest. Hardin's model has been instrumental in explaining environmental degradation on Earth, especially in internationally owned areas of Antarctica and the high seas. When resources are open to all, each gains maximum personal benefit by overusing them, while the negative consequences are distributed among everyone. Hence, his call for mutual coercion is exhibited in agreements like the UN Convention on the Law of the Sea (United Nations, 1982) and the Antarctic Treaty (The Antarctic Treaty, 1959), which demonstrate how nations inherently recognize the dangers of overuse and will only take collective action when all parties commit to it.

Additionally, Hardin's model highlights the difficulty of enforcing collective restraint in 'commons' governance. Similar to Earth's oceans and atmosphere, no centralized authority can unilaterally impose regulations in space, but rather a supranational organization, like the United Nations, which creates treaties with immense powers like the USA to enforce its ratification (Rabitz, 2020). Without enforceable restrictions, as seen with no coherent governing body in space, Hardin's theory predicts that the pursuit of national and corporate interests in space will result in long-term harm, such as the Kessler Syndrome, where unchecked satellite proliferation leads to cascading collisions, making low Earth orbit unusable (Pearson, 2024). Thus, under Hardin's framework, outer space fits the definition of a common resource prone to exploitation, necessitating governance mechanisms to prevent irreversible consequences that threaten sustained use of space.

Elinor Ostrom's groundbreaking work provides a crucial counterpoint to Hardin's pessimistic outlook on 'commons' governance, offering eight design principles that have successfully managed shared resources sustainably (Ostrom, 2015). Ostrom's principles include clear stipulations with multiple avenues of action, inadequate recognition of the right to organize, oversight mechanisms, collective decision-making agreements, tiered sanctions, conflict resolution protocols, norms for appropriation and provision aligned with local circumstances, and effective coordination across relevant entities in interconnected enterprises (*Elinor Ostrom & 8 Rules for Managing the Commons*, n.d.). These principles suggest that 'commons' can be governed effectively without centralized authority through what she termed 'polycentric governance', a system characterized by multiple autonomous decision-making centers with overlapping areas of responsibility that both compete and cooperate within commonly agreed-upon rules (McGinnis, 2016; de Filippi et al., 2024). Applied to space governance, Ostrom's framework suggests that rather than requiring a single supranational organization, effective space governance could emerge through decentralized, bottom-up processes where different stakeholders, including states, private companies, and international organizations, develop specialized governance mechanisms for specific space activities while maintaining coordination through shared principles and standards (Tepper, 2022).

According to Hardin's 'Tragedy of the Commons' model, outer space qualifies as a Global Commons because it is a shared resource that no single entity owns, yet all have access to (Hardin, 1968). Moreover, since we can presume space to be a global common when we apply the tragedy of the commons to space, this model suggests that if space remains unregulated, actors will exploit it for economic and strategic gain without considering long-term sustainability, as there is no mutual coercion (agreed-upon restrictions to prevent overexploitation). This is evident in the rapid expansion of satellite deployments, the growing issue of space debris, and the race to extract extraterrestrial resources, all of which mirror the overgrazing of communal land in Hardin's original example.

While 'commons' are traditionally understood in terms of natural resources, looking at cyberspace, we can draw closer parallels to outer space, and its present unique challenges. Unlike traditional commons, these domains are not exhaustible in a conventional sense, yet they remain vulnerable to monopolization, pollution, and strategic control (Pic et al., 2023). The increasing involvement of private corporations and state-backed enterprises has reshaped outer space governance, with some advocating for market-driven frameworks over cooperative international management (Goswami, 2022). The superposition of commercial and political interests in space must call into question whether the exploitation of economic resources will be done in respect of democratic systems of governance, or must have mutual coercion on any such use of space (whether to militarize or commercialize).

The contestation over space governance parallels similar debates regarding other global commons, such as water resources. Freshwater scarcity has triggered international disputes over transboundary rivers and aquifers, foreseeing how competition for shared resources can lead to geopolitical tensions (Pearson, 2024). In space, analogous conflicts emerge as opposing blocs seek to dominate control over resources and satellite orbits for future exploitation. If space remains an unregulated commons, concerns such as orbital congestion, space debris, and geostrategic rivalries may exacerbate conflicts and hinder long-term sustainability. This will allow the inception of traditional origins of shared responsibility (in the form of limited orbit paths and resources) and create more pugnacious environments, exacerbating geopolitical tensions.

In summary, the predominance of space in legal, environmental, or economic contexts will always be in the limelight; nonetheless, the most persuasive viewpoint is from international relations (IR) theory. When Outer space is contextualized as a common, individual state actors can be simplified down to rational thinking. We can better understand why sovereign nations have predisposed stances on Outer Space when approaching it from the nuance of geopolitical spheres of influence. This conceptual duality makes possible a richer understanding of both the complicated limitations and normative potentialities of space governance, providing new insight into how an entirely inclusive, sustainable, and peaceful Global Commons could be achieved beyond Earth.

Between Power and Principle: Realism, Constructivism, and the Struggle for Space Governance

The Cold War significantly influenced early space governance, culminating in agreements such as the Outer Space Treaty (OST), which established space as a global commons, inaccessible to sovereign appropriation (Stuart, 2013). While legal regimes codify principles and norms, effective governance relies on their ratification and internalization by states. Though powerful actors often shape these regimes to serve their interests, over time, such frameworks can evolve to constrain and guide state behavior (Stuart, 2013). Countries' stances on space governance reflect broader geopolitical alignments. The United States and its allies favor a market-driven, decentralized model emphasizing private sector participation, as seen in NASA's partnerships with commercial space enterprises (Chatzky et al., 2021). In contrast, China and Russia advocate for a state-centric, cooperative approach, positioning themselves against U.S.-led initiatives like the Artemis Accords and promoting alternative governance mechanisms, such as the China-Russia International Lunar Research Station (ILRS) (Goswami, 2022). Meanwhile, developing

nations and middle powers, which lack the financial and technological capacity for independent space programs, champion the principle of space as the "common heritage of humankind," calling for UN-led frameworks to prevent monopolization by space-faring superpowers (Kaul, 2024).

As outer space becomes more integral to global politics, economic growth, and national security, international relations (IR) theory provides insight into the changing dynamics of its governance. Two leading paradigms in IR theory - realism and constructivism - offer different but complementary interpretations of how states engage in the international context. While realism highlights the quest for power and strategic hegemony, especially among great powers, constructivism underlines the place of shared norms, identities, and cooperation in defining state actions, oftentimes characteristic of states with minimal or no spacefaring capabilities. This section discusses how these theoretical frameworks offer a deeper insight into outer space as an international common, noting the competitive nature of states and the possibility of norm-led cooperation in establishing future governance models.

Realism (as a school of thought), prioritizing power competition and national interests, suggests that states seek dominance over space as a strategic and economic asset (Morgenthau, 1948; Waltz, 1979; Zakaria, 1998; Mearsheimer, 2001). John Mearsheimer's theory of offensive realism provides a compelling lens through which to analyze the emerging competition in space, positioning outer space as the next inevitable domain of great power rivalry. According to Mearsheimer, the anarchic nature of the international system compels great powers to continuously seek opportunities to gain power at each other's expense, aiming to achieve regional hegemony and prevent the rise of peer competitors (Mearsheimer, 2001). In the context of space, this theory suggests that major powers like the United States and China will inevitably view space as a strategic domain that must be controlled or dominated to maintain their security and global influence (Mearsheimer & Walt, 2016). Mearsheimer's framework predicts that states will not be content with merely accessing space resources or maintaining peaceful cooperation; instead, they will seek to establish dominant positions in key orbital regions, lunar territories, and space-based infrastructure that could provide strategic advantages over potential rivals (Steinsson, 2014; Mearsheimer, 2001). The establishment of competing space programs like the U.S.-led Artemis Accords and the China-Russia International Lunar Research Station exemplifies how opposing nations form differing frameworks to maintain dominance, as each represents an attempt by major powers to establish spheres of influence in space and secure access to critical resources and strategic positions.

Conversely, constructivism emphasizes the role of shared norms, identities, and cooperation in shaping international behavior (Onuf, 1989; Wendt, 1992). It creates a dichotomy between wealth and military power, and a nation's or people's social values in investing power within a country. When examining space, the generally perceived values shift according to a nation's interests. Constructivism offers a more optimistic perspective on space governance by emphasizing how shared norms, identities, and cooperative frameworks can shape state behavior and create possibilities for collaborative space exploration. Unlike realist approaches that focus on material power and competition, constructivist theory argues that the structures of human association are determined primarily by shared ideas rather than material forces, and that these socially constructed norms can evolve to promote cooperation even in anarchic systems (Ahmad, 2020; Mengshu, 2020).

In the space domain, constructivists point to the successful establishment of norms for peaceful space exploration embodied in treaties like the Outer Space Treaty, which demonstrates how shared understandings about space as the "province of all mankind" can constrain state behavior and promote collaborative rather than competitive approaches (*The Outer Space Treaty*, 1966). The role of non-governmental organizations, international scientific communities, and multilateral institutions in promoting space cooperation illustrates the constructivist emphasis on how norm entrepreneurs can shape state preferences and identities in ways that privilege cooperation over conflictual approaches (Ahmad,

2020). Examples such as the International Space Station, international satellite consortia, and collaborative scientific missions demonstrate that states can construct shared identities as space-faring nations committed to peaceful exploration rather than viewing space primarily as a domain for strategic competition (Mengshu, 2020; *The Outer Space Treaty, 1966*).

The Tragedy of the Commons in Space: The Second Space Race

The establishment of the U.S. Space Force (2019), China's rapid development of anti-satellite (ASAT) technology, and Russia's continued investment in space-based weaponry represent a shift to strategic space competition through rapid militarization (Chatzky et al., 2021). Meanwhile, private and public sectors' lunar and asteroid mining ventures have raised questions over distributing resources and space-based property rights (Kaul, 2024). Further, the continued emphasis on ordnance in space raises concerns about the propagation of nuclear-armed ASAT systems, as reports of Kremlin-funded projects aimed at such weapon systems. If done so, it would violate the treaty, undermine space security, and worsen the technological and nuclear arms race, causing the degradation of space as an avenue of advancement and sustainable development.

The emergence of an economically and strategically competitive Second Space Race has raised controversy over space governance to a new level. The private space industry, driven by SpaceX, Blue Origin, and OneWeb, is revolutionizing space access. The trillions of dollars in the potential economic value of asteroid mining have led to national policies favoring private claims to space despite legal uncertainty at the global level, and concerns of political prioritization (Goswami, 2022). With differing stances on who has the authority to grant sovereignty in space, the validity of economic exploitation in the future raises concerns about the sustainability of current unchecked progress.

National security concerns have also complicated governance debates. The development of hypersonic glide vehicles, space jamming technology, and counter-space operations illustrates the increasing militarization of space (Chatzky et al., 2021). The absence of a robust international mechanism to regulate such advancements heightens the risk of conflict escalation, through shows of power analogous to the first space race. While countries aim to gain overwhelming superiority, accordingly establishing a hegemony in space will splinter the frameworks, leading to differing ideas and falling into the tragedy of the commons.

Looking at the current geopolitical landscape of outer space, it becomes clear that we are heading toward a divide between the U.S.-led coalition and the China-Russia bloc. However, as Hardin's tragedy of the commons and realist theory suggest, when powerful actors compete to dominate a shared domain without cooperation, the result is overuse and eventual degradation. We saw this during the Cold War, when arms races and proxy conflicts were driven less by necessity and more by the fear of falling behind. The same logic applies to space. These powers may not launch more satellites because they genuinely need them, but because not doing so would be seen as weakness, a loss of prestige, of image, and ultimately of global influence. This kind of competition leads to a numbers-driven space race, not one focused on efficiency or sustainability, but on appearance, economic signaling, and strategic posturing. While this might accelerate innovation and economic returns in the short term, it will almost certainly escalate international tensions. Moreover, others will follow if one state violates a treaty or agreement to gain an upper hand. Without trust or accountability, treaties collapse under the pressure of self-interest, and the commons, outer space in this case, is left vulnerable to irreversible harm.

Commercialization of space: Private Enterprise as De Facto Competitors

Private space firms have developed quickly from government contractors to influential players defining the future of the international space industry. Spurred by unprecedented rates of private

investment—projected to hit over \$1 trillion by 2030—and driven by technology advances, these companies are no longer satisfied with supporting roles; instead, they actively seek to establish industry standards, dominate market access, and shape regulatory environments to their benefit (*A New Space Economy on the Edge of Liftoff*, n.d.). The emergence of the "NewSpace" economy has attracted a wave of startups and tech behemoths, all vying for control of markets like satellite internet, launch services, and space tourism (Space Foundation, 2021). As the number of private launch providers expands and their market share rises, private agencies are more and more likely to become de facto regulators, using their technological leadership, commercial dominance, and international partnerships to influence the rules and destiny of the space industry.

The fast expansion of US commercial space firms, especially industry titans SpaceX and Blue Origin, has brought about a scenario where private enterprises increasingly act as de facto regulators of space activity through their market dominance and technological capabilities. SpaceX's leadership as the globe's industrious launch provider, with multiple military and civilian missions, confers considerable leverage over access to space and the real-world application of space policies, essentially transforming corporate-level decisions on launch schedules, cost, and service availability into regulatory decisions impacting the whole space economy (The Global Centre for Risk and Innovation, 2024; Roulette & Taylor, 2025).

China's space commerce industry is controlled by firms that, although technically private, are inextricably linked to state interests. Galactic Energy, iSpace, OneSpace, LandSpace, Linkspace, Space Trek, for instance, have been at the forefront of China's low-cost, mass-produced communications satellites, establishing industry standards and affecting national standards (Sénéchal-Perrouault, 2023). Companies such as LandSpace have emerged as dominant players, utilizing significant government assistance and preferential policies to dominate satellite production and launch services. LandSpace, the pioneer that released a rocket powered by methane to orbit, has defined propulsion technology standards and pulled in a significant amount of state and private capital (Mansfield, 2024; Sénéchal-Perrouault, 2023). Still, such companies are in an environment that is state-directed with regulatory power finally with government agencies, short of actual market monopoly, but enabling the companies to be de facto regulators by their technological superiority and commitment to national interests (Tronchetti & Liu, 2021).

Russia's space industry continues to be controlled by the state through Roscosmos and its affiliates, monopolizing launches, production, and regulatory activities. Private firms such as Sputnix and Dauria Aerospace have appeared, but their size and power are limited to small satellite ventures and dependent on state contracts (McClintock, 2017). Private expansion is limited by the absence of venture capital, ongoing regulatory hindrances, and foreign sanctions (McClintock, 2017). Instead, technical and operational norms are established by Roscosmos, and private companies function as subcontractors rather than autonomous regulators. This framework kills competition and innovation, with the central state position preventing any private monopoly from forming (Luzin, 2024).

Europe's space industry has a blend of giant players and up-and-coming startups, but no private monopoly or de facto regulator exists. Arianespace has traditionally dominated the region as the launch provider of choice, establishing technical and pricing benchmarks, but is increasingly threatened by new entrant startups such as Isar Aerospace and Orbex (Aliberti & Tugnoli, 2016; Cellerino, 2023; *European Space Companies Isar Aerospace and EnduroSat Sign Firm Launch Agreement*, n.d.). The national governments and the European Space Agency (ESA) coordinate, subsidizing multiple players to ensure that no single provider is relied upon and to promote innovation (Aliberti & Tugnoli, 2016; Cellerino, 2023). This deliberate fragmentation, regulatory control, and joint infrastructure dissuade any single company from being able to monopolize the marketplace or dictate industry rules (Cellerino, 2023).

The concentration of launch capabilities in a few major companies creates dependencies that extend beyond simple market dynamics to questions of space governance, as these companies' policies regarding payload acceptance, orbital destinations, and pricing structures can effectively determine which space activities are feasible and which are not (Space Foundation Editorial Team, n.d.; Roulette & Taylor, 2025). Recent regulatory battles, such as Blue Origin's legal challenges to NASA's SpaceX contract awards and ongoing disputes over launch service contracts, illustrate how commercial space companies are actively shaping the regulatory environment through litigation, lobbying, and market competition rather than simply operating within established regulatory frameworks (Roulette & Taylor, 2025).

This situation raises important questions about democratic accountability and public interest representation in space governance, as key decisions about space access and development are increasingly made by private corporations responding to market incentives rather than by public institutions responsible to democratic constituencies (Goehring, 2022). The challenge for space governance is to develop regulatory frameworks that harness the efficiency and innovation of commercial space companies while ensuring that broader public interests, including equitable access, environmental sustainability, and international cooperation, are adequately represented in space development decisions (Goehring, 2022).

With the rise of powerful private companies in the space sector, outer space is increasingly complex to manage as a true global commons. Unlike the past, when only states competed, today's landscape includes private firms driven by profit and market dominance, complicating unified governance. Hardin's "tragedy of the commons" warns that when multiple actors pursue self-interest without shared rules, resources are overexploited—mirrored now in the rush for orbits and lunar resources (Hardin, 1968). Ostrom's research suggests sustainable commons management is possible if stakeholders cooperate, monitor, and enforce collective rules. However, this requires trust and shared commitment, which are challenging amid profit motives and geopolitical rivalry (Ostrom, 2015). Without a coordinated international framework, space risks becoming another example of Hardin's tragedy, played out on a cosmic scale.

Regulatory Framework: Multilateralism and collaboration

Regulation refers to establishing and enforcing rules or standards intended to guide the behavior of individuals, organizations, or entire sectors. Regulations are typically designed to protect public interests, ensure safety, maintain fair competition, and prevent abuses or negative externalities. Governments, independent regulatory agencies, or self-regulation within industries can implement them. Effective regulation balances the need for oversight and accountability with the flexibility to adapt to changing circumstances and emerging challenges (Baldwin et al., 2011). Regime theory provides essential insights into the potential and limitations of international cooperation in space governance, particularly regarding the persistent challenge of enforcement in international regimes (Krasner, 1982). Krasner defines international regimes as "principles, norms, rules, and decision-making procedures around which actor expectations converge in a given issue-area," emphasizing that regimes can facilitate cooperation even in the absence of supranational enforcement mechanisms (Bradford, 2007; Krasner, 1982). However, regime theory also acknowledges the fundamental weakness of international regimes: their reliance on voluntary compliance rather than centralized enforcement, which creates persistent problems of free-riding and non-compliance.

The Montreal Protocol offers a valuable comparison for space governance, demonstrating how international regimes can achieve relatively high compliance rates through reporting requirements, monitoring systems, graduated sanctions, and financial incentives for developing countries (Andersen et al., 2007; Parson, 2003). Nevertheless, even this successful regime relies primarily on peer pressure and reciprocal arrangements rather than binding enforcement (UNEP, n.d.). Applied to space governance,

regime theory suggests that while international agreements like the Outer Space Treaty can establish important principles and create expectations of behavior, their effectiveness will ultimately depend on the continued willingness of major space powers to abide by these agreements, particularly when doing so conflicts with perceived national security interests or economic opportunities (Bradford, 2007).

a. Global South Perspectives: India's Chandrayaan Program and Balanced Approach

India's Chandrayaan lunar exploration program exemplifies how Global South nations pursue a balanced approach to space development that combines technological advancement with commitments to shared resource principles and common heritage concepts. Since launching Chandrayaan-1 in 2008, India has demonstrated remarkable progress in space capabilities, culminating in the successful soft landing of Chandrayaan-3 at the lunar south pole in August 2023, making India the fourth country to achieve a soft lunar landing and the first to successfully land in the lunar south polar region (Chandrayaan-3 Details, n.d.). India's approach to space development reflects a distinctive Global South perspective that seeks to balance national technological advancement with international cooperation and equity principles, as evidenced by its signing of the Artemis Accords while simultaneously maintaining commitments to space as the "common heritage of mankind" (Fatimah, 2025). The country's space program has consistently emphasized the dual goals of technological self-reliance and international collaboration, with missions designed to demonstrate national capabilities and contribute to global scientific knowledge and sustainable development goals (Press Information Bureau, 2025; Baradhan, 2025). This balanced approach contrasts with the more competitive strategies of traditional space powers. It reflects broader Global South concerns about ensuring equitable access to space benefits and preventing the monopolization of space resources by technologically advanced nations.

b. The Artemis Accords: U.S.-Led Multilateralism

The Artemis Accords, launched by the United States in 2020, have become a cornerstone of contemporary space governance, reflecting a vision of cooperative, transparent, and sustainable lunar exploration. As of May 2025, 55 countries from every continent have signed the Accords, including major spacefaring nations and emerging space actors (Low, 2024). Drafted by NASA and the U.S. Department of State, the Accords build upon the foundational principles of the 1967 Outer Space Treaty and other United Nations space law conventions, aiming to elaborate and operationalize norms for civil exploration and peaceful use of the Moon, Mars, and beyond (Low, 2024). The Accords emphasize key principles such as transparency, interoperability, non-interference, scientific data sharing, and the long-term sustainability of outer space activities (Low, 2024; Mohler, 2024). Regular meetings among signatories further these goals, fostering trust and cooperation while encouraging the participation of emerging space nations (Low, 2024; Mohler, 2024). The Artemis framework notably supports public-private partnerships and market-driven resource utilization, allowing commercial involvement within agreed legal boundaries (Chatzky et al., 2021). However, this approach also risks creating parallel legal regimes and standards that may not be universally accepted, raising concerns about fragmentation in international space governance.

c. The ILRS: China-Russia State-Led Collaboration

In contrast to the Artemis Accords, the China-Russia International Lunar Research Station (ILRS) represents a state-centric, alternative model for lunar governance. Announced as a joint initiative between China and Russia, the ILRS aims to establish a permanent lunar research base powered by nuclear technology, with a focus on government-to-government collaboration and technology sharing among its 17 participating countries (Berkowitz & Williams, 2023; Luzin, 2024). Unlike the Artemis Accords, which encourage commercial partnerships, the ILRS emphasizes centralized state leadership and

collective scientific advancement, reflecting a different philosophical approach to international cooperation. This model positions China and Russia as leaders of a bloc that offers an alternative to the U.S.-led Artemis system, appealing to nations seeking a more state-controlled framework for space activities (Berkowitz & Williams, 2023). These two parallel initiatives highlight growing geopolitical divisions in space governance, raising the risk of conflicting claims, incompatible standards, and diminished prospects for unified international cooperation. As both frameworks expand, the challenge of ensuring interoperability and preventing regulatory fragmentation in lunar and deep space exploration becomes increasingly urgent.

d. African Union Space Policy and Equity Promotion

The African Union's approach to space governance, embodied in the establishment of the African Space Agency and continental space policies, represents a distinctive Global South contribution to discussions about equitable space governance and the need for inclusive participation in space activities. The African Space Agency, headquartered in Egypt and established as the continental space agency for the African Union, explicitly aims to coordinate space activities across Africa while promoting equitable access to space-derived benefits and ensuring that space development serves broader developmental goals (African Outer Space Programme, n.d.; Our History, n.d.). The African Union's space policy framework emphasizes several key principles that align with common heritage concepts: the promotion of global benefit from space activities, the importance of capacity building and technology transfer, and the need for governance frameworks that prevent the monopolization of space resources by technologically advanced nations (African Outer Space Programme, n.d.; Our History, n.d.). Recent initiatives demonstrate the practical implementation of these principles, including the successful development of "digital twins" of capital cities in Ghana and Tonga using satellite data and AI, and the participation of several African nations in CubeSat programs that provide hands-on experience with space technology (Baradhan, 2025). These efforts reflect a broader Global South strategy of using international cooperation and capacity-building programs to ensure meaningful participation in space activities rather than remaining passive consumers of space-derived services, while simultaneously advocating for governance frameworks that prioritize global equity and sustainable development over competitive resource extraction (UNIDIR, 2025).

We can draw on lessons from the Law of the Sea and the Montreal Protocol: binding commitments backed by peer review, capacity building for smaller actors, and flexible rules updating as technology evolves. The *Outer Space Treaty* (1967) prohibits national sovereignty claims but lacks enforcement mechanisms. The *Moon Agreement* (1979), which called for collective management of space resources, has been ratified by only a handful of countries. The *Liability Convention* (1972) and *Registration Convention* (1976) do not address contemporary challenges such as commercial spaceflight and space traffic management.

The Polysentric Approach: The Future of Space

Polycentric government refers to a system where several semi-autonomous decision-making centers exist across different levels, local, national, and global, engaging through cooperation, competition, and conflict resolution (Baldwin et al., 2024). Unlike hierarchical governance, polycentric systems allow for overlapping jurisdictions and a degree of autonomy for each center, making room for more adaptive and context-sensitive rule-making. This strategy is particularly appropriate for regulating intricate collective goods, like ecosystem resources, where one authority may not be adequate to respond to the varied needs and issues involved (Behnke, 2024).

Modern research identifies that polycentric governance does not merely involve government institutions; administrative institutions, non-government organizations, and stakeholder organizations are

also part of it, each with the ability to create and implement rules within their sphere (Djosetro & Arts, 2024; Baldwin et al., 2024). This form of organization encourages participatory decision-making, facilitates adaptability, and enables resilience by enabling local players to scale solutions to particular challenges while maintaining coordination within larger networks (Behnke, 2024). Polycentric governance has been most effective because there is a need to work across several sectors and scales, such as nature conservation, climate change adaptation, and urban governance (Djosetro & Arts, 2024).

The development and use of polycentric governance have increased in the last few decades, spurred by growing complexity in transnational challenges and the demand for responsive and adaptable decentralized actions (Baldwin et al., 2024). Empirical evidence indicates that although polycentric arrangements are highly beneficial (e.g., they yield better learning, innovation, and responsiveness), they are also plagued by coordination, accountability, and the likelihood of fragmented authority issues (Behnke, 2024; Baldwin et al., 2024). However, the increasing evidence indicates that polycentric governance gives a strong structure for handling collective action problems in varied and dynamic contexts (Djosetro & Arts, 2024; Behnke, 2024).

Ostrom's eight principles offer a roadmap for making a 'commons' work without a single world government. Imagine a supranational space authority whose council is elected by all spacefaring and space-dependent nations. Member states would set clear boundaries for resource use, design appropriation rules that match sustainability goals, create on-site monitoring and graduated sanctions for infractions, and resolve conflicts through transparent mechanisms. This structure channels rivalry into institutional debate rather than unilateral grabs, turning offensive realist predictions on their head by making strategic competition part of the governance process.

Conclusion

In retrospect, this paper has argued that outer space clearly qualifies as a global commons: no single state owns it, all actors have access, and without shared rules, it will suffer the tragedy of unregulated exploitation that Hardin described. Considering the rapid evolution of space operations, current agreements are increasingly seen as inadequate. We already see signs of this in the clutter of satellites, growing debris fields, and private ventures racing to claim resources. Realist theory tells us that great powers pursue dominance when they smell opportunity, keen to convert strategic advantage into lasting hegemony. At the same time, constructivist insights remind us that new norms can emerge to reshape state behavior if only actors agree on shared expectations and identity.

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