



Sovereignty and space governance: Emerging legal and policy issues

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Abstract

The specific dynamics of change in the character of space activities have been caused by technological developments and the expanded activity of the private sector and have dramatically altered the management of outer space. This dissertation outlines the processes of state sovereignty, global commons principles and the private actors involved in the ever-evolving system. International instruments including the Outer Space Treaty (1967) and the Moon Agreement (1979) declared that space is the common preserve of humankind not subject to appropriation, however recent domestic laws including the US Commercial Space Launch Competitiveness Act of 2015 directly invites private mining. The increase in use of space and satellites through militarization and population of satellite constellations underlines the necessity for strong international regulation. This research critically assesses a framework for the coexistence of sovereignty and international cooperation in relation to issues such as resource rights, militarization, and equity on benefits. It also examines the effects of the privatization of space, its relation to the regulation of it and the conflict that might be present over space resources. In view of this legal and policy analysis, this study seeks to support the realization of sustainable models of governance that are conducive with the provision of space as the repository of distinct individual freedoms through which conflict does not necessarily follow.

Keywords: Space Governance; Sovereignty; Global Commons; Private Actors; Resource Extraction; International Cooperation

1. Introduction

1.1. Background and Context

Outer space activities have evolved significantly in the last few decades, with increasing involvement from both governmental and non-governmental (private sector) actors (Ferreira-Snyman, 2021). Historically, outer space was considered a domain of peaceful exploration, governed by international treaties such as the Outer Space Treaty of 1967. However, the rapid technological advancements and the growing role of private companies in space exploration have introduced new dynamics into the governance of outer space.

The geopolitical and economic importance of outer space cannot be overstated. Space-based technologies are integral to global communications, navigation systems, weather forecasting, environmental monitoring, and national security (Leib, 2015). The military and economic uses of space, such as satellite systems and space-based weapons, have heightened geopolitical competition. As nations vie for strategic advantages in space, the governance of outer space has become a crucial issue for international relations.

Another key development has been the involvement of private actors in space exploration and commercial ventures, such as resource extraction and satellite deployments (Jakhu & Pelton, 2017). Companies like SpaceX, Blue Origin, and Amazon have not only advanced space technologies but have also made substantial investments in space tourism,

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mining of asteroids, and space infrastructure. These activities present challenges to traditional governance structures, as private actors operate under national laws but increasingly have global impacts.

The concept of global commons has emerged as a critical framework in space governance. Traditionally, the global commons refer to natural resources and domains (like the high seas and the atmosphere) that lie outside any single nation's jurisdiction and are thus subject to international governance (Stilwell ET AL., 2020). Space, particularly beyond Earth's orbit, is seen by some as a shared resource, requiring cooperative governance to prevent exploitation and ensure the benefit of all. However, this raises important questions about state sovereignty—the right of states to control the use of their territory and space activities under their jurisdiction. With the growing involvement of the private sector and the exploration of space resources, questions of sovereignty, property rights, and international cooperation become more complex and urgent (Jayasuriya, 1998).

1.2. Research Problem and Rationale

The increasing involvement of private actors in space activities presents new challenges to the framework of state sovereignty and international cooperation. While the traditional view of space governance is largely rooted in the idea of global commons, modern space exploration, resource extraction, and private-sector involvement in satellite operations have led to a reexamination of this principle (Smith, 2001). State sovereignty, once thought to be absolute within a nation's territorial domain, is now questioned in the context of space activities that often transcend national borders and require international cooperation.

The Outer Space Treaty (OST), which forms the backbone of space governance, establishes that space is free for exploration and use by all states. However, it also emphasizes that space should be used for peaceful purposes and that activities should be conducted for the benefit of all nations, avoiding harmful interference with other countries' space activities (Havercroft & Duvall, 2009). In recent years, as private companies push the boundaries of space activities—especially in terms of resource extraction and satellite proliferation—the principles of the OST seem increasingly difficult to reconcile with national and corporate interests.

Tensions between state sovereignty and global commons principles come to the forefront when discussing the mining of space resources, such as water from the moon or minerals from asteroids (Ehrman, 2022). As private companies aim to extract and profit from these resources, questions arise as to who owns these resources—the state, the private actor, or the international community. Space-faring nations assert that their sovereignty extends to the areas around their satellites, and potentially even celestial bodies. Meanwhile, the idea of space as a global commons suggests that activities in outer space must prioritize international cooperation and benefit-sharing.

Additionally, space activities raise significant concerns around the potential for militarization and national security risks (Jacobini, 1958). As governments increase investments in military satellite systems and space-based weaponry, the peaceful use of space outlined in the Outer Space Treaty is increasingly difficult to maintain (Liaropoulos, 2017). The growing space race between nations, combined with the expanding reach of private corporations, creates an environment where national and international regulations may struggle to keep pace with the rapidly evolving landscape of space activities.

This research will examine how sovereignty and international space governance frameworks interact and how the global commons principles must be reconciled with national and commercial interests (Ferreira-Snyman, 2015). Specifically, it will explore how state sovereignty can be effectively balanced with the need for global cooperation in the exploration and use of space. It will also analyze how international treaties, such as the Outer Space Treaty and the Moon Agreement, are currently addressing these issues and where gaps in governance remain.

1.3. Research Question

The primary research questions this dissertation seeks to answer is:

How can sovereignty be reconciled with the global governance of outer space activities?

Sub-questions will address specific aspects of this issue:

- How effective are current international legal frameworks, such as the Outer Space Treaty and the Moon Agreement, in balancing state sovereignty and the global commons principles in space governance?
- How do private sector actors impact the balance between national interests, space exploration, and global governance?

- What legal and policy challenges arise from resource extraction in space, and how do these challenges relate to sovereignty and international cooperation?
- How can international governance mechanisms be strengthened to ensure equitable and responsible space activities in the context of state sovereignty?

1.4. Research Objectives

1.4.1. The research aims to:

Analyze the effectiveness of international legal frameworks: Assess how international space treaties, particularly the Outer Space Treaty (OST) and Moon Agreement, address the tension between state sovereignty and the global commons in space. This will include evaluating the potential for these frameworks to support the sustainable and equitable use of outer space.

Explore the tensions between sovereignty and global commons principles: Investigate how the competing interests of sovereign states and private actors challenge the principles of space as a shared resource. Focus will be placed on areas like space resource extraction and military use of space.

Assess the challenges posed by private sector participation: Evaluate the role of the private sector in space exploration, satellite deployment, and resource extraction. Analyze how private sector activities complicate the balance of sovereignty and international cooperation.

Propose legal and policy recommendations: Develop recommendations for legal frameworks and policy reforms that balance sovereignty with global cooperation in space governance. This will involve examining best practices in international space law, including the potential for new agreements or modifications to existing frameworks.

In sum, this dissertation will aim to contribute to the ongoing discourse on space governance by addressing how we can reconcile sovereign rights with the need for collective international cooperation in outer space activities. It will explore the evolving role of both governmental and private actors in space and suggest how international legal frameworks can be strengthened to meet the challenges of a rapidly advancing space sector.

2. Literature Review

2.1. The Concept of Sovereignty in Outer Space

Sovereignty, in its traditional form, refers to a state's supreme authority over its territory, people, and resources, within its borders. This concept, rooted in the Treaty of Westphalia (1648), establishes that a state has full control over its territory and the power to legislate within its jurisdiction. However, the application of sovereignty in outer space presents challenges due to the lack of territorial boundaries and the shared nature of the domain (Sachdeva, 2017).

The Outer Space Treaty (OST) of 1967, which remains the cornerstone of space governance, directly addresses the concept of sovereignty in space. The OST's principles assert that space is not subject to national appropriation or ownership, aligning space governance with the idea of shared global commons (Zhao, 2004). This means that no state can claim sovereignty over celestial bodies, and space itself is open for exploration and use by all states. The principle of non-appropriation under Article II of the OST explicitly prevents states from asserting territorial sovereignty over outer space or any celestial bodies, ensuring that the vast expanse remains free from national control.

Despite these provisions, the concept of sovereignty still applies in outer space to the extent that states have jurisdiction over their national space activities and the objects they launch into space (Zhao, 2004). For instance, states are responsible for national space programs, and their space activities must comply with international agreements. The OST, while promoting the notion of space as a shared domain, maintains state sovereignty in areas such as regulating the use of national space infrastructure, overseeing private sector activities within national borders, and ensuring compliance with international norms. Therefore, while the Outer Space Treaty limits sovereignty over celestial bodies, it retains the state's authority over its national space programs and operations (Erlank, 2015).

2.2. Legal Frameworks Governing Outer Space

The Outer Space Treaty (OST), signed in 1967, establishes a framework for the peaceful use and exploration of space. Its key principles include the non-appropriation of outer space, freedom of exploration, international cooperation, and

the use of space for peaceful purposes. While it promotes the idea of space as a shared common, it also underscores that states retain jurisdiction over their space objects and activities (Neto, 2015).

The Moon Agreement (1979), a supplement to the OST, expands on the governance of celestial bodies, particularly the moon. It stipulates that the moon and its resources are the common heritage of mankind, thereby reinforcing the idea that no state or individual can lay claim to ownership of the moon or its resources. Instead, the Moon Agreement calls for equitable sharing of the benefits derived from the use of lunar resources, which introduces the notion of common heritage as a guiding principle for space governance (Hobe & de Man, 2017).

The Liability Convention (1972) and the Registration Convention (1975) further clarify the responsibilities of states for space activities. The Liability Convention holds states liable for damage caused by their space activities on the surface of the Earth or in outer space, establishing a system for accountability (De Man, 2017). Similarly, the Registration Convention requires states to register space objects with the United Nations, fostering transparency and responsibility in space operations. Together, these agreements complement the OST by outlining state responsibility for activities conducted in outer space, including the actions of private sector actors operating under national jurisdiction.

While these legal instruments have been instrumental in space governance, they are often seen as inadequate in addressing the complexities of modern space exploration, particularly regarding private sector involvement and resource extraction.

2.3. Global Commons vs. Sovereignty in Space Governance

The concept of global commons holds that certain domains, such as outer space, the high seas, and the atmosphere, are not owned by any one state but are instead available for shared use by all. This principle is enshrined in the Outer Space Treaty, which designates outer space as a global common and emphasizes cooperation in space activities (Steer, 2019).

However, the idea of space as a global common has come under strain as sovereign states assert their jurisdiction over activities in space. With the increasing participation of private companies in space exploration, including resource extraction and satellite deployment, questions about the ownership of celestial resources arise (Tronchetti, 2015). Some states, such as the United States, have passed national laws that permit private actors to claim ownership over resources extracted from celestial bodies, such as asteroids and the Moon, despite the non-appropriation principles outlined in the OST.

The debate over exclusive jurisdiction vs. collective ownership in space is a critical issue. On the one hand, proponents of the global commons model argue that space activities should be conducted for the benefit of all humankind, with resource extraction benefiting all states (Williams, 1989). On the other hand, nations like the US and Luxembourg have taken steps to establish national laws allowing private actors to extract and claim resources, creating tension between national sovereignty and the global commons principles. This dichotomy raises the question of how to balance national sovereignty with the overarching need for international cooperation and equitable access to space resources (Bourbonnière & Lee, 2007).

2.4. The Role of Non-State Actors in Space Activities

The increasing participation of private companies in space activities represents a significant shift in space governance. Companies like SpaceX, Blue Origin, and Amazon are at the forefront of a new space race, conducting launches, satellite deployments, and even planning space tourism (Freeland, 2016). The rise of the private sector has introduced several governance challenges, particularly regarding regulatory frameworks, national sovereignty, and international cooperation.

One of the key challenges is how to regulate the activities of private companies operating in space while ensuring compliance with international treaties. National governments, particularly those with space programs, have attempted to regulate private sector activities within their borders, but these companies often operate in ways that transcend national jurisdictions (Vereshchetin, 1984). As private actors have interests that extend beyond national borders, it becomes more challenging to maintain international accountability and responsibility for space activities.

Private sector involvement also raises concerns about militarization and the potential for conflict over space resources. As private companies extract resources from celestial bodies or deploy vast constellations of satellites, tensions may arise between private entities and sovereign states over jurisdiction, resource rights, and the use of space for peaceful purposes (Jakhu, 2006). This intersection of state sovereignty and non-state actors underscores the need for updated legal frameworks to address the challenges posed by private space activities.

2.5. Case Studies in Space Governance

To better understand the dynamics of sovereignty and space governance, two case studies illustrate the evolving relationship between national laws, private sector involvement, and international norms:

The US Commercial Space Launch Competitiveness Act (2015): This piece of legislation granted private companies the right to extract resources from celestial bodies, particularly asteroids. This law directly challenges the non-appropriation principle of the Outer Space Treaty, raising questions about whether states have the right to legislate ownership of extraterrestrial resources and whether such activities are consistent with international law (Su, 2010).

Luxembourg Space Resources Initiative (2017): Luxembourg has enacted a national framework to allow private companies to mine resources from celestial bodies. This initiative, like the US law, raises concerns about the jurisdictional boundaries of national laws in space and the conflict between state sovereignty and global commons principles. Luxembourg's initiative highlights the need for international agreements to address the potential for resource extraction and the equitable sharing of benefits (Su, 2010).

2.6. Literature Gaps

While there has been significant literature on the legal frameworks governing outer space, there are notable gaps in the scholarship, particularly regarding the intersection of sovereignty and private sector roles in space activities. Few studies have comprehensively addressed how national laws allowing resource extraction and private space exploration align with international treaties like the Outer Space Treaty and the Moon Agreement. Additionally, there is a limited analysis of how to effectively enforce international obligations on non-state actors, particularly those with the capacity to bypass traditional state-centric governance structures.

Furthermore, there is a lack of discourse on how to reconcile state sovereignty with the need for global cooperation and equitable space governance in an era where private companies are likely to play an increasingly dominant role in space exploration and resource exploitation.

3. Methodology

3.1. Research Design

The research adopts a qualitative approach, combining doctrinal legal analysis with comparative case studies to examine the evolving relationship between state sovereignty, international space governance, and private sector participation in outer space activities. This methodology allows for an in-depth exploration of the legal frameworks, challenges, and tensions between state sovereignty and the global commons principles in space governance.

Legal analysis will form the core of the study, focusing on interpreting key international treaties and national legislation, as well as understanding their implications for sovereignty and governance. The comparative case study method will be employed to explore specific instances where national sovereignty, international norms, and private sector interests intersect, providing insights into the complexities of space governance. This mixed approach ensures a comprehensive understanding of the legal landscape surrounding outer space activities.

3.2. Data Sources

The research will rely on both primary and secondary sources to gather the necessary data for analysis.

3.2.1. Primary Sources

- **International Legal Instruments:** The Outer Space Treaty (1967) and the Moon Agreement (1979) will be analyzed to examine the foundational legal principles governing outer space. These treaties will provide insight into the rules around sovereignty, resource extraction, and space as a global common.
- **National Legislation:** Specific national laws, such as the US Commercial Space Launch Competitiveness Act (2015) and Luxembourg's Space Resources Initiative (2017), will be studied to understand how these legal frameworks align with international treaties and how they define sovereignty and the rights of private actors in space.

- **International Coordination:** Reports and documents from the UN Office for Outer Space Affairs (UNOOSA) will be used to analyze the role of international organizations in regulating space governance and promoting global cooperation.

3.2.2. Secondary Sources

- **Academic Journals:** Peer-reviewed articles from law, international relations, and space policy journals will provide theoretical perspectives on sovereignty, global commons, and space governance.
- **Books:** Scholarly books focusing on space law and policy will provide a historical and conceptual framework for understanding the evolution of space governance and the role of sovereignty in this context.
- **Policy Papers:** Reports from governmental and non-governmental organizations (e.g., the Space Foundation, the European Space Agency, and International Institute of Air and Space Law) will offer insights into current policy debates and recommendations for future governance.
- **Reports from International Bodies:** Documents produced by the United Nations and other international organizations, such as the UNOOSA, will be used to examine how international cooperation is being structured and promoted in space governance.

3.3. Case Study Selection

To illustrate the tension between state sovereignty, global commons principles, and private sector involvement, the following case studies will be examined:

US Commercial Space Launch Competitiveness Act (2015): This legislation is significant as it allows private companies in the US to extract resources from outer space, such as from asteroids, and asserts national sovereignty over these resources. This case will be analyzed to assess how national laws can conflict with international treaties and principles like the non-appropriation clause in the Outer Space Treaty.

Luxembourg's Space Resources Initiative (2017): Luxembourg's laws on space resource extraction also challenge the non-appropriation principles of international space law, promoting private sector activities in space. This case study will explore how national sovereignty is used to regulate private space activities and how such policies align with international norms.

International Coordination under UNOOSA: This case will examine the role of UNOOSA and other international bodies in promoting global cooperation, creating frameworks for shared space governance, and addressing challenges posed by private sector participation. This will help illustrate the broader efforts to balance sovereignty and collective action in space.

These case studies will provide concrete examples of how sovereignty is applied in practice in outer space governance, and they will highlight the challenges posed by the increasing involvement of private actors in space exploration and resource extraction.

3.4. Ethical Considerations

Ethical considerations will be paramount in conducting the research, particularly in addressing the intersection of state interests, corporate interests, and global commons principles. The following ethical considerations will be taken into account:

- **Transparency:** The research will strive for transparency in assessing the interests of states and corporations, ensuring that the analysis fairly reflects the complexities of the legal and policy landscapes in space governance. A critical approach will be adopted to assess whether state laws and international treaties are equitable and just, particularly in how they affect developing countries and marginalized communities.
- **Avoiding Bias:** Given the tension between sovereignty and global commons principles, care will be taken to avoid bias in evaluating claims of sovereignty by states versus the need for shared global governance. The research will aim to provide a balanced analysis that accounts for both national interests and the collective need for sustainable and equitable space governance. Special attention will be paid to how private actors may undermine the principles of international cooperation and the non-appropriation of celestial resources.
- **Cultural and Geopolitical Sensitivity:** In analyzing space governance, the research will be mindful of geopolitical and cultural dynamics, particularly in regions where space exploration may not yet be a priority or where the stakes in space governance are perceived differently. The findings will avoid assuming a universal approach to

space governance, recognizing the diversity of perspectives and the potential for inequalities in the distribution of space resources.

By addressing these ethical considerations, the research aims to offer a comprehensive and fair analysis of sovereignty in space governance, keeping in mind the broader goal of ensuring a just and sustainable future for all space-faring nations and actors.

4. Data Analysis, Presentation and Interpretation

4.1. Sovereignty in the Context of Outer Space Governance

The question of sovereignty in outer space governance is central to understanding the legal and policy challenges that emerge from the increasing use of space by states and private actors alike. Under the Outer Space Treaty (1967), the core principle is that no state may claim sovereignty over outer space, celestial bodies, or their resources. Specifically, the non-appropriation principle (Article II of the Treaty) prohibits any nation from claiming sovereignty over the Moon or other celestial bodies or their resources. This raises a direct tension with traditional sovereignty concepts, where states hold absolute rights to territory and resources within their borders.

The Treaty emphasizes that outer space is a global common, available for peaceful exploration and use by all states. While states have the right to explore and use space for peaceful purposes, the ownership of space resources remains a contentious issue. Sovereignty, therefore, is redefined in space governance, moving away from territorial ownership towards a system that prioritizes cooperation, peaceful use, and international law.

Despite these principles, the Outer Space Treaty does acknowledge state responsibility for activities in outer space. States are accountable for their space activities, whether conducted by governmental or private entities, and must avoid harmful interference with other countries' space operations (Article VI). These obligations reinforce state sovereignty in managing space activities, but also impose constraints to ensure that activities in space do not harm the global commons.

The tension between state sovereignty and the global commons principle becomes particularly evident as more states and private companies venture into space. Sovereignty is thus not entirely curtailed but transformed into a shared responsibility for space governance that respects international norms and collective interests.

4.2. Sovereignty vs. Global Commons: Legal and Policy Tensions

The Moon Agreement (1979), although not widely ratified, provides an important attempt to address the tension between state sovereignty and the global commons in space governance. The Agreement specifies that the Moon and other celestial bodies are the common heritage of mankind, and that resources extracted from them should be used for the benefit of all countries, with a particular focus on developing nations. This reinforces the concept of shared resources in space and limits the notion of exclusive state sovereignty over celestial bodies.

However, state sovereignty is not fully eliminated by the Moon Agreement. While it emphasizes global cooperation, states still retain jurisdiction over their activities in space. The conflict arises when state-driven policies contradict the Moon Agreement's call for equitable resource-sharing. For instance, spacefaring nations such as the United States, Russia, and China have generally resisted provisions that limit their sovereign rights in space resource extraction, fearing that such limitations would undermine their ability to compete in the space race.

A case study in this context is the US approach to commercial space resource extraction. The US Commercial Space Launch Competitiveness Act (2015) legalized the extraction of resources from celestial bodies and granted US private companies the right to claim ownership of extracted resources. This law appears to directly conflict with the non-appropriation principle of the Outer Space Treaty, as it allows private companies to claim ownership over celestial resources. While the US government argues that the law is in compliance with international law—emphasizing that it does not claim sovereignty over celestial bodies—it still raises questions about the extent to which national sovereignty can be applied to space resources.

This case highlights the legal and policy tensions between state sovereignty and the principles of the global commons. On the one hand, states assert their sovereign rights to regulate and control space activities, including resource extraction. On the other hand, international agreements such as the Moon Agreement stress the need for equitable access to space resources, emphasizing that they should benefit all of humanity, not just a few powerful states.

4.3. Challenges Posed by Private Sector Involvement in Space Activities

The rise of private companies in space activities, particularly in areas like satellite deployment and space resource extraction, presents significant governance challenges. Unlike governmental space programs, which are typically bound by international treaties and regulatory frameworks, private companies operate with profit motives that may not always align with global norms or environmental considerations. This creates a regulatory gap, as international space law was originally designed to address state-based activities, not corporate operations.

One prominent example is SpaceX, which has revolutionized the space industry with its Starlink satellite constellation. While the satellite network provides global broadband services, it also raises concerns about space debris, the saturation of low Earth orbit (LEO), and unequal access to space. The rise of private companies like SpaceX creates a new frontier in space governance, where the boundaries of state sovereignty become blurred, especially in the commercial exploitation of space.

A key concern is the potential for commercial monopolies over celestial resources and orbital infrastructure. Companies like SpaceX and Blue Origin are moving ahead with plans for resource extraction and space colonization, potentially creating unilateral control over resources that were traditionally considered part of the global commons. This raises questions about fair access to space and the need for international regulations to prevent space exploitation by a few private entities.

In the absence of comprehensive international regulations, the expansion of private sector activities could lead to space privatization, where states lose control over space resources and governance, undermining the principles of shared responsibility and global commons.

4.4. International Cooperation and Governance Mechanisms

While the challenges of sovereignty and private sector involvement in space activities are significant, international cooperation remains crucial for ensuring that space exploration and resource extraction are governed in ways that benefit all of humanity. The role of UNOOSA (United Nations Office for Outer Space Affairs) is pivotal in mediating governance tensions and promoting international cooperation in space.

UNOOSA facilitates dialogue between states on space law, offering frameworks for the peaceful use of outer space and promoting the long-term sustainability of space activities. However, despite its role in fostering cooperation, there remains a need for an updated international space governance framework that can address the rapidly evolving landscape of space activities, especially as private sector involvement increases.

Lessons from multilateral cooperation models like the International Space Station (ISS) agreements can inform future governance approaches. The ISS is a prime example of how states can collaborate in space for mutual benefit while respecting sovereignty. However, as space activities become more commercialized, similar collaborative models will need to be developed to ensure that private actors adhere to international obligations and contribute to the global commons.

4.5. Policy Recommendations

To address the legal and policy challenges surrounding sovereignty and space governance, the following policy recommendations are proposed:

Develop Clearer Legal Definitions of Resource Extraction Rights: International space treaties, particularly the Outer Space Treaty and the Moon Agreement, should be updated to provide clearer definitions regarding the rights to space resources and resource extraction. This would help to balance the claims of state sovereignty with the principle of global commons.

Enhance International Enforcement Mechanisms: There is a need to strengthen international enforcement mechanisms to hold both states and private actors accountable for their space activities. This could include the establishment of international regulatory bodies with the authority to ensure compliance with international law and resolve disputes over sovereignty and resource rights.

Establish Public-Private Governance Partnerships: Public-private partnerships should be encouraged to ensure that private sector activities are aligned with international norms and contribute to sustainable space exploration. These partnerships could include joint ventures between states and private companies that focus on ensuring equitable access to space resources and addressing global challenges, such as space debris management.

These recommendations are critical for ensuring that sovereignty in space governance is not an obstacle to global cooperation but rather a means of ensuring that space benefits are shared equitably and sustainably among all nations.

5. Summary, Recommendations and Conclusion

5.1. Summary of Key Findings

Space governance operates within a complex web of tensions between state sovereignty and the principles of the global commons. While sovereignty remains a cornerstone of international law and space activities, the Outer Space Treaty (1967) introduces the principle of non-appropriation, aiming to prevent territorial claims over celestial bodies. However, in practice, this balance proves challenging, especially as state interests often conflict with the shared resource model envisioned by international treaties.

The international legal frameworks governing outer space, including the Outer Space Treaty and Moon Agreement, provide essential guiding principles for space governance, but they remain largely ineffective in addressing the rapidly evolving realities of space activities. These frameworks lack enforcement mechanisms, allowing for gaps in implementation and compliance. In particular, the growing private sector role in space exploration and resource extraction presents new challenges. Companies like SpaceX and Blue Origin are now pushing the boundaries of space commercialization, often operating in areas where regulatory clarity and international consensus are still developing. This lack of regulation leads to uncertainties around resource rights and governance structures, raising concerns about the potential for monopolistic control over space resources and infrastructure.

5.2. Contribution to Knowledge

This study contributes significantly to the understanding of how sovereignty, private sector involvement, and global commons principles intersect in the evolving governance of outer space. The analysis underscores the gaps in the current legal frameworks, highlighting the need for updated treaties and stronger enforcement mechanisms to ensure that space activities are managed equitably and sustainably.

The research brings to light the challenges of aligning state sovereignty with international agreements that seek to regulate space activities for the collective benefit of all nations. In particular, the role of private corporations in space exploration and resource extraction has not been sufficiently addressed in existing space law. The research also explores the need for clearer definitions around resource rights in space and the establishment of more robust legal structures to accommodate private sector participation while protecting the interests of less technologically advanced nations.

5.3. Recommendations

The study offers several key recommendations for improving space governance:

Strengthening International Legal Frameworks: Outdated space treaties like the Outer Space Treaty and Moon Agreement need to be revised to address the growing challenges of private sector participation and space resource extraction. Updated treaties should define the ownership and use of space resources more clearly, balancing state sovereignty with the principle of the global commons. This would provide a clearer regulatory framework for states and private actors alike, ensuring that space resources are utilized responsibly and equitably.

Increased Transparency and Accountability: Given the increasing role of private companies in space activities, there is an urgent need for greater transparency and accountability in the commercial space sector. Corporate compliance with international obligations, such as adherence to the non-appropriation principle and the prevention of harmful interference, should be enforced through stronger national and international regulatory frameworks. International cooperation should be encouraged to ensure that private companies do not exploit space resources in ways that undermine the broader goals of space law.

Enhanced Multilateral Cooperation: The role of UNOOSA (United Nations Office for Outer Space Affairs) in promoting international cooperation should be strengthened, particularly in resolving conflicts between sovereign states and private sector actors. UNOOSA can serve as a platform for dialogue and coordination on space governance, facilitating

the development of international norms and ensuring that all states, particularly those from the Global South, have an equal voice in shaping space law. Strengthening multilateral cooperation would also help in addressing issues such as space debris, orbital congestion, and resource management.

5.4. Future Research Directions

Future research in space governance should focus on several key areas:

Technological Innovations in Space Resource Extraction: As technological advancements continue to reshape the space industry; further research is needed to explore the regulatory implications of new extraction technologies. This includes innovations in mining celestial bodies and harnessing energy from space, as these developments could significantly alter the balance between state sovereignty and global commons principles. Research should explore how international treaties can address emerging technologies while ensuring equitable distribution of resources.

Emerging Space-Faring Nations and Global Governance: As new space-faring nations such as India, Japan, and the UAE continue to develop their space programs, it is crucial to examine their roles in global space governance structures. Future research could explore how these countries contribute to the development of space law and governance, and how their sovereign interests intersect with the collective goals of the international community. This research could lead to a more inclusive, multilateral approach to space governance that reflects the interests of both established and emerging space powers.

5.5. Final Reflections

The reconciliation of state sovereignty and global commons principles is essential for ensuring equitable and sustainable space governance. While sovereignty remains a foundational principle in international law, it must evolve to meet the demands of space exploration and commercialization. Space governance must adapt to accommodate private sector innovation while protecting common interests and ensuring that space resources are utilized for the benefit of all humanity.

As space exploration progresses, it is crucial to establish legal frameworks that balance the rights and responsibilities of states with the need for global cooperation. By revising outdated treaties, enhancing regulatory mechanisms, and strengthening international cooperation, the international community can create a more effective, inclusive, and sustainable model of space governance that reflects both the sovereign rights of states and the common heritage of outer space.

Compliance with ethical standards

Statement of ethical approval

Ethical approval was obtained.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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