The Status of the Principle of the Common Heritage of Mankind in Light of U.S. and Luxembourg National Space Laws and International Space Treaties

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Abstract

With the rapid expansion of the private space industry and the increasing utilization of space resources, international space law and national regulations play a crucial role in guiding and overseeing these developments. The United States and Luxembourg, as examples of states parties to the Outer Space Treaty, have structured their national space laws in a manner that primarily fosters bilateral and multilateral cooperation in the space sector rather than adhering strictly to the principles set forth in the 1967 Outer Space Treaty and the 1979 Moon Agreement, despite the fact that one of them is not a party to the latter. This article seeks to address the question of how national laws can influence the obligations and the spirit of international treaties concerning the exploitation of space resources. Furthermore, legal challenges, such as circumventing treaty obligations under the Outer Space Treaty and conflicts with the principle of space utilization for the benefit of humankind, are examined, particularly with regard to the U.S. Commercial Space Launch Competitiveness Act.

Keywords: International space law, space resources, Outer Space Treaty, national law, private space industry, space resource extraction.

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1. Introduction

With the growth of commercial activities in space, numerous legal challenges have emerged regarding the exploitation of space resources, oversight of private companies, and the coordination of national and international laws. While treaties such as the Outer Space Treaty and the Moon Agreement have sought to establish clear legal frameworks to define the general principles of such activities, the lack of alignment between national laws and international obligations has led to disputes and legal threats to human interests, such as the common heritage of mankind and the space environment. Although some legal scholars, adopting a dualist approach, do not recognize a relationship of conformity or even interaction between international treaties and national laws, international law is now facing a new situation. Unlike the seas and other areas defined under the framework of the common heritage of mankind, outer space is not easily observable due to its vast and boundless nature. Given

the technological limitations of many countries, oversight and monitoring capabilities are restricted to a limited number of space-faring nations with advanced technology. Consequently, a technologically advanced country can enact domestic laws allowing its private entities to engage in and compete within this domain of international space law. Thus, the involvement of private companies in this field has further complicated legal challenges.

For instance, the enactment of the U.S. Commercial Space Launch Competitiveness Act (CSLCA) in 2015, which legalizes private resource exploitation by U.S. nationals, and Luxembourg's Space Resources Exploration and Utilization Act of 2016, which was adopted in 2017, have faced opposition from some countries and legal scholars, who argue that such legislation contradicts the principle of the "common heritage of mankind." This study focuses on the general relationship between national laws and their extraterritorial impact on international space treaties, examining conflicts and exploring potential solutions to improve the interaction between national and international space law. Moreover, it reflects on the legal and philosophical concepts of the principle of the "common heritage of mankind" to enhance international cooperation for the equitable use of space and its resources.

2. The Role of International Treaties in Shaping the Legal Framework of Space Law

The Communications Satellite Act of 1962 was the first legal precedent in U.S. jurisprudence that enabled private companies and entities to engage in space activities. Additionally, this legislation marked the first legal step in a government regulatory framework that covered space activities. It laid the groundwork for shaping the provisions and principles governing market relations in the commercial use of space technology in its "Declaration of Policy and Purpose" section. According to this law, the United States established a global commercial communications system through satellites, stating that "to facilitate this, the development and broadest possible participation of private enterprises should be ensured, with U.S. participation in the global system being carried out through a private entity subject to appropriate governmental regulations" (Denisov, 1992).

The Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, Resolution 1962 (XVIII), adopted by the Eighteenth Session of the United Nations General Assembly on December 13, 1963, is the second significant legal text concerning space law. This resolution, adopted by the General Assembly in 1963, builds upon an earlier key decision in space regulation dating back to December 20, 1961. That earlier resolution, General Assembly Resolution 1721 (XVI), addressed international cooperation in the peaceful use of outer space. The second declaration reaffirmed and expanded the scope of the previous statement. The principles contained within it reflect the consensus and highest level of agreement attainable by the Committee on the Peaceful Uses of Outer Space, which was established by the General Assembly to address technical cooperation among states. The General Assembly emphasized certain fundamental principles that states must consider in the exploration and use of outer space:

1. The exploration and use of outer space shall be carried out for the benefit of all humankind.
2. Outer space and celestial bodies are open for exploration and use by all states on the basis of equality and in accordance with international law.
3. Outer space and celestial bodies shall not be subject to national appropriation by claims of sovereignty, use, occupation, or any other means.
4. The activities of states in the exploration and use of outer space shall be conducted in accordance with international law, including the United Nations Charter, in the interest of maintaining international peace and security and promoting international cooperation and understanding.
5. States bear international responsibility for their national activities in space, whether conducted by governmental or non-governmental entities, and must ensure that their national activities comply with the principles set forth in this declaration. The activities of non-governmental entities in outer space require authorization and continuous supervision by the relevant state. Compliance with the principles set forth in this declaration is the responsibility of international organizations and participating states.

A clearer vision of these principles emerged following the first Apollo landing in 1969 (Davis & Lee, 1999). This treaty, while reiterating several principles set forth in the Outer Space Treaty (OST)—including that the Moon shall be used exclusively for peaceful purposes and shall be freely explored by all states—declares the Moon and its natural resources as the "common heritage of mankind." Article 11(5) of the treaty requires state parties to establish an international regime and

appropriate procedures for the management of lunar resource exploitation, which is now becoming increasingly feasible. However, unlike the OST, the Moon Agreement, which has only 17 state parties and 11 signatories to date, remains a weak agreement, as it has not been ratified by any major space-faring nations. Due to its low ratification rate, the Moon Agreement holds limited weight in international space law, primarily because of disputes over the concept of the common heritage of mankind (Tronchetti, 2009).

The first space launch conducted by the Soviet Union in 1957 took place under the Sputnik 1 project, and in April 1961, Yuri Gagarin became the first Soviet cosmonaut to orbit the Earth. Meanwhile, in December 1961, the United Nations General Assembly adopted its first resolution on space law, laying the groundwork for the 1963 resolution. A historical review of early space activities reveals that technological advancements have generally preceded legal discussions, with legal frameworks developing in response to technological milestones. Consequently, in most cases, space law has lagged behind technological advancements. However, in terms of national space legislation, the United States was a pioneer, enacting the Communications Satellite Act of 1962 five years before the Outer Space Treaty of 1967. To date, U.S. space law has continued to evolve in parallel with the development of its space industry, with nearly 70 years of legal research and scholarship in this field.

3. National Laws and Legal Challenges in the Space Sector

Two distinct phases can be identified in the development of national space law. The first phase corresponds to the beginning of the "Space Age," marked by the adoption of the Declaration of Legal Principles by the United Nations General Assembly in the early 1960s and the ratification of the Outer Space Treaty (OST). During this period, several countries, particularly those engaged in space exploration, enacted general or specific regulations on the subject. The second phase, which began in the 1980s for most spacefaring nations, was characterized by the commercialization of space activities and the involvement of private companies. In this context, governments recognized the need to regulate private entities' space activities, define their rights and obligations, and establish relationships between governments and the private sector. Many countries, in response, enacted relevant laws.

While space activities are regulated both by the principles and norms of public international law and international space law, they are also subject to national laws. However, the exploration and use of outer space largely fall within the domain of private international law, as national laws define the regulatory framework for space activities conducted by their respective states. Nonetheless, it remains a nearly universal principle of national space law that states are directly responsible for the consequences of their space activities. According to Article VI of the Outer Space Treaty, state parties bear international responsibility for their national activities in outer space, including activities on the Moon and other celestial bodies. Furthermore, non-governmental entities conducting space activities, including those involving the Moon and other celestial bodies, must obtain authorization and be subject to continuous supervision by their respective national governments. When space activities are conducted by an international organization, both the organization itself and the participating states are responsible for compliance with the treaty.

The regulation of licensing and insurance for space activities is a primary focus of national space law to ensure that both governmental and non-governmental space activities comply with treaty provisions. The increasing variety of space activities across different countries directly influences the status and nature of corresponding national legal frameworks. Since the 1980s, national space law has been closely linked to the commercialization of space activities. Foreign national laws have expanded regulatory provisions concerning licensing, insurance requirements, certification, and registration of space objects and activities, as well as commercial aspects such as remote sensing, satellite broadcasting, and satellite communications.

Beyond domestic legal processes, improving national regulatory mechanisms for overseeing governments' roles in the global space services market has facilitated multilateral and bilateral relations. This model has inspired the introduction of specific regulatory mechanisms into the global space law market, such as the control of missile technology proliferation, licensing of individual space activities or specific space services and technologies, mandatory liability insurance for space activities, commercialization of space activities, intellectual property protection for developers and suppliers, foreign supplier quotas for space services, anti-dumping measures for space services and technologies, and government support for foreign investment (Bezzubov & Borovyk, 2021).

Some states have introduced legal challenges regarding space resource utilization through national legislation. The United States was the first country to enact national laws on this issue, passing the U.S. Commercial Space Launch Competitiveness Act (CSLCA) on November 25, 2015. Section 16 of this act contains four subsections, with subsection four titled "Exploration and Utilization of Space Resources," commonly referred to as the "Space Resource Exploration and Utilization Act of 2015." Section 402(17) states: "A United States citizen engaged in the 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 the possession, ownership, transportation, use, and sale of such resources, provided they are acquired in accordance with applicable laws, including the international obligations of the United States."

Additionally, Section 402 requires the President of the United States to submit a report to Congress, outlining the necessary authorities for fulfilling the country's international obligations, including licensing and continuous oversight by the federal government, as well as recommendations for allocating responsibilities among federal agencies. Moreover, Section 403 affirms that the U.S. does not claim exclusive sovereignty, jurisdiction, or ownership over any celestial body, ensuring compliance with Article II of the 1967 Outer Space Treaty.

The International Institute of Space Law (IISL) interpreted this U.S. law as follows:

"Given that the Outer Space Treaty does not explicitly prohibit the appropriation of space resources, it can be inferred that the utilization of such resources is permissible. From this perspective, the new U.S. law represents a broad interpretation of the Outer Space Treaty."

On November 11, 2016, Luxembourg also introduced its draft law on space resource exploration and utilization, just one year after the U.S. legislation. Deputy Prime Minister and Minister of Economy, Étienne Schneider, announced that the law was expected to take effect in early 2017. He explained: *"The legal framework we have established fully complies with the Outer Space Treaty. Our new law strictly addresses space resource appropriation within regulatory parameters, without asserting sovereignty over celestial bodies."*

Luxembourg's new space law strongly affirms the country's commitment to becoming a European hub for space resource exploration and utilization. However, a key difference between Luxembourg's space law and U.S. legislation is found in Article 15 of the Luxembourg draft law, which fully holds licensed operators liable for damages without any liability cap, potentially leading to expanded insurance requirements. Additionally, Article 1 of the law states that space resources may be allocated in accordance with international regulations, prompting some commentators to argue that space mining is no different from terrestrial mining or deep-sea fishing (Masson-Zwaan & Richards, 2015).

U.S. space law, particularly since the 1962 Communications Satellite Act, has been periodically updated to align with space industry developments, culminating in the 2015 Commercial Space Competitiveness Act. The U.S. government updated its commercial space laws in 2015, explicitly authorizing U.S. citizens to engage in space resource exploration and commercial utilization. However, space resources such as water and minerals are included, whereas biological entities are excluded from commercial exploitation (United States Commercial Code, 2015).

The International Institute of Air and Space Law (IIASL) formally adopted its official position on December 20, 2015, stating that, due to the lack of explicit prohibition on space resource extraction in the Outer Space Treaty, such activities are lawful. From this perspective, the new U.S. law provides a broad interpretation of the Outer Space Treaty (Position, 2015).

In principle, the Moon and its natural resources are the common heritage of mankind, requiring the establishment of an international regime for resource management as such exploitation becomes increasingly feasible. However, U.S. and Luxembourg legislation, which aims to legalize the extraction, utilization, and appropriation of space resources by private companies, contradicts fundamental principles stating that outer space and celestial bodies cannot be subject to national appropriation by sovereignty claims or other means (Tanja & Palkovitz, 2017).

The passage of U.S. and Luxembourg space laws has raised concerns about violating principles of space sovereignty and enabling reckless private-sector competition, suggesting that these governments are leveraging their private sector's agility to secure long-term space resources for their nations.

The "necessity" or "practical and legal need" for national space law arises on three levels:

1. Facilitating private-sector participation in space activities through licensing systems.
2. Ensuring government oversight over private space activities and imposing necessary restrictions.
3. Defining regulatory responsibilities for national space agencies.

Some governments, however, fail to establish national space agencies within the correct institutional framework, often placing them under military or defense ministries, which may not be appropriate for regulating private-sector space activities (Pour Qasabi Amiri & Vashti, 2015).

Given the difficulty of adopting legally binding international regulations, national space laws play a critical role in guiding space activities and supporting the development of international regulations. The rapid commercialization of space necessitates a hybrid approach, incorporating hard law and soft law mechanisms, combining national regulations with international treaties, and integrating contributions from international and intergovernmental organizations to establish a sustainable legal framework for commercial space activities (Soroka, 2021; Yuzbashyan, 2009).

4. Legal Challenges of Space Resource Extraction and Human Settlements on Celestial Bodies

An initial examination of the historical and comparative foundations of the concept of common property and its impact on space law requires a brief review of Roman law. According to Roman law, some things were considered suitable for private ownership, while natural law deemed others to be common to all and not subject to individual ownership. Air, flowing water, the sea, and the seashore were classified as common property:

"The ocean, air, and light, unlike land, are naturally and fundamentally owned by all of humanity. They remain unappropriated and are common to all." (Gaius, 1890).

Several provisions in international space law help determine the appropriate status of national space agencies. These provisions primarily relate to the responsibilities and obligations of states. Additionally, they govern private sector space activities and the jurisdictional scope of national laws. Article VI of the Outer Space Treaty (OST) establishes state jurisdiction and continuous oversight over national activities carried out by private entities and individuals. This article specifically requires states to supervise their national space activities and accept international responsibility for them. Article VII of the OST further clarifies the link between state liability and space activities, emphasizing that governments bear responsibility for the space activities of their private companies, which are conducted under state supervision. This article suggests that states should assume accountability within their national space laws and fulfill their international obligations under the Liability Convention.

In this context, the criteria for attributing a space object to a responsible state are defined under the provisions of the Liability Convention. The material consequences of liability can also be assigned to the private operator responsible for damages, and compensation for damages resulting from these activities is anticipated. The Convention on Registration of Objects Launched into Outer Space reinforces Article VIII of the OST, mandating the formal registration of space objects. This convention specifies certain parameters through Article IV, which serves as a legal basis for tracking and monitoring space objects.

A second issue concerns the need for national space laws at the domestic level to regulate private sector space activities. These activities involve domestic liabilities, including damage-related consequences and civil liabilities. Different countries need national space laws to address these issues, either through specific legislation for space or through other legal and regulatory mechanisms incorporated within their existing legal frameworks.

A third issue is the non-legal necessity of national space laws in terms of policy implementation and national interests at the political level. National space laws can implement various national policies, including those related to satellite communications, Earth observation, and other specific operational sectors. This aspect of national space law is especially significant for countries that do not wish to support private-sector space activities within their jurisdictions. In developing countries, concerns about limited economic resources and the need for direct investment in economic and social development may make space-related expenditures appear challenging. Therefore, national space laws serve as an incentive mechanism for the private sector, offering financial incentives, legal exemptions, and other support measures to promote positive engagement in the space industry (Denisov, 1992).

In international space law, states are responsible for supervising their own space activities as well as those of their private sector. The OST and related conventions, such as the Registration Convention, clearly emphasize state responsibility for space activities. National space laws are essential for regulating and overseeing commercial space activities. Particularly in developing countries, national space law can serve as a mechanism for encouraging and supporting the private sector, ensuring national interests are protected while also fulfilling international obligations.

In 2015, the government of Luxembourg launched a six-part initiative to attract space mining companies through financial support and a favorable domestic legal framework. This initiative was the first of its kind in Europe, granting private companies ownership rights over space resources under international law. Moon Express, a U.S.-based company, announced its plan to send a robotic spacecraft to the Moon, claiming that it would usher in a new era of commercial lunar exploration and unlock the Moon's vast resource potential. The company argued that water extracted from the Moon could be highly valuable, effectively turning the Moon into "a gas station in the sky."

Similarly, Shackleton Energy, another U.S. company, has focused on lunar water resources, asserting that billions of tons of frozen water exist at the Moon's poles and could be extracted, converted into rocket fuel, and stored in orbital refueling stations. The company claimed that what humanity can achieve in space is largely dependent on securing a reliable water supply and that this innovation could revolutionize the space industry, generating trillions of dollars.

Several national space agencies have also planned missions related to space resource extraction. However, commercial space mining by private companies presents a more complex legal challenge for existing space treaties (Masson-Zwaan & Richards, 2015). While such private-sector initiatives drive scientific and technological progress, they also raise legal concerns regarding private ownership of space resources. If some governments fail to effectively prevent environmental degradation on Earth, how can we expect the private sector to uphold the principles of the common heritage of mankind in space?

The first instances of national space resource exploitation could lead to the development of an international legal regime, facilitating international space cooperation and benefiting all of humanity. Consequently, similar laws currently being drafted in other countries, alongside bilateral and multilateral agreements, will likely shape the future governance of space resources. Under existing international legal frameworks, including the OST, any entity in any country can claim space objects, extract minerals, and exploit other space resources (Ilyashevich, 2021). Thus, the legal regime for space resource exploitation and its impact on international cooperation remains a critical legal concern.

The vision of a multi-planetary future, while promising, presents significant legal and ethical challenges. It raises concerns about the unequal distribution of social and environmental benefits and the risk of legitimizing private-sector dominance in space activities. Some companies may seek to monopolize space resources for the benefit of a select few. For example, Elon Musk announced that SpaceX, a private commercial company, intends to establish its own "self-governing principles" on Mars. While this may not be as straightforward as he envisions, his statements have sparked concerns about the current inadequacy of space governance, especially given the rapid growth of space activities (Lefeber, 2016).

Although such ideas may not be immediately feasible, considering the accelerating pace of technological development over the past 50 years, it is crucial to address the legal and social challenges posed by private-sector space settlements. The relationship between national and international law in space resource governance is particularly significant, as both the U.S. and Luxembourg are parties to the OST and are bound by its provisions. Their national laws explicitly acknowledge this international commitment. The intent of these regulations is not necessarily to reinterpret existing international law or to promote (or prevent) new laws but rather to serve as an initial step toward the evolution of international space law.

From an international cooperation perspective, Luxembourg's explanatory note on its draft space law emphasized its commitment to continued collaboration with other countries in the space sector, particularly through its ongoing partnership with the European Space Agency (ESA). Additionally, Luxembourg is a member of the Hague International Working Group on Space Resources Governance. However, some argue that national space laws, while potentially useful for interpreting international treaties, should not be considered definitive legal instruments. According to the International Institute of Space Law (IISL), a national law such as the U.S. Space Law may provide an interpretation of treaty law, but it does not constitute a definitive expression of state practice (Lefeber, 2016).

The rapid development of the private space industry has intensified the need for space laws that balance commercial interests with the long-term sustainability of space activities. Ensuring that humanity's collective interests are preserved under the common heritage principle requires a robust international legal framework that prevents unilateral state and corporate actions from undermining global cooperation in space exploration and resource utilization.

5. Legal Challenges and the Necessity of Developing International Space Law

The Legal Subcommittee held its 56th session in 2017 at the United Nations Office in Vienna (UN Document A/AC.105/1122). During this session, some delegations expressed concerns about certain states attempting to conduct space activities while circumventing their obligations under the Outer Space Treaty (OST). These delegations highlighted two fundamental issues as examples of such practices:

1. Legitimizing space resource exploration activities conducted by non-governmental national entities, which contradicted the provisions of the OST.
2. Establishing a registry or suitable flag system for private commercial entities interested in engaging in space resource utilization.

In response, the Legal Subcommittee emphasized the need for clarification and precise definition of the following key terms:

1. Common Heritage of Mankind
2. Global Commons
3. National Appropriation of Outer Space
4. Exploitation/Exploration of Space Resources (Leon, 2018)

The discussions within this committee underscored concerns about certain countries' attempts to bypass their obligations under the OST and the necessity of clarifying key terminology in the 2017 session of the UN Legal Subcommittee.

Perhaps the strongest reaction to the U.S. Space Resource Law was observed during the 2016 session of the Scientific and Technical Subcommittee on the Peaceful Uses of Outer Space. Russia, in a conference document presented on November 25, 2015, stated:

"By passing the U.S. Commercial Space Launch Competitiveness Act, the United States has clearly undermined the role and authority of the committee and demonstrated complete disregard for the international legal order." (UN Doc A/AC.105/C.1/2016/CRP.15).

In this context, Dr. Gbenga Oduntan, a senior lecturer in international commercial law at the University of Kent, argues that the 1967 Outer Space Treaty fundamentally prohibits the exploitation of potentially limited resources for purposes other than scientific research and without territorial allocation. The treaty also prohibits private individuals and companies from owning celestial bodies. According to him, these aspects contradict the principle of using outer space for the benefit of all humanity. He further emphasizes that space could play a crucial role in assisting developing countries and enhancing their capabilities. Oduntan refers to an ancient Roman legal principle, stating:

"What affects all should be considered and approved by all." (Lefeber, 2016).

Tanja Masson-Zwaan, President of the International Institute of Space Law (IISL), takes a different stance, arguing that the new U.S. Space Resource Law benefits commercial interests. She asserts that this law explicitly codifies and expands rights for the private sector that were only implicitly present in the 1967 OST. The United States, through this law, has provided a solid foundation for establishing additional regulatory frameworks, increasing investor confidence and creating a favorable environment for extraterrestrial resource extraction, particularly for private commercial activities focusing on the Moon and other space resources (Masson-Zwaan & Richards, 2015).

To address deficiencies and develop international law, the principle of analogy from domestic legal systems has often been applied. Legal positivism, which is based on formalism, opposes this approach. However, the reality remains that international law cannot exist independently of domestic legal principles (Shamloo & Shamloo, 2017).

The absence of legal behavioral rules for individuals in space leads to two primary consequences:

1. The lack of clear regulations on private ownership of space objects: This could result in unlawful appropriation of celestial bodies by individuals, leading to unjust claims over space objects and the potential for space-related conflicts and disputes.
2. Uncontrolled private-sector use of near-Earth space: This lack of regulation poses threats to human life and health on Earth, environmental hazards, and legal conflicts between states and private entities (Halunko & Didenko, 2019).

6. The Relationship Between National Space Laws and International Space Law

International public space law must be developed through procedures and processes that enable state adoption and international ratification of public space regulations. Such legal rules would become binding for all international legal entities

involved in space activities. Additionally, as part of cosmic space development, sovereign states adopt national laws based on general international regulations. Provided that these national regulations do not contradict international law, they integrate into the broader framework of international public space law. However, the application of these norms remains limited to the jurisdiction of the specific sovereign state.

From this perspective, a deep understanding of legal doctrine in international law is crucial for distinguishing between legally binding rules and mere legal interpretations or claims in space law. This distinction helps separate mandatory regulations from non-binding principles and different legal interpretations within space law. Even though a powerful spacefaring nation's national space laws may influence space activities, such laws do not affect foreign companies or international space relations among sovereign states.

States cannot impose national public space laws beyond their jurisdiction, as international regulations govern the scope and consequences of each sovereign state's actions. This means that no state can impose its domestic laws on another. This principle serves both as a limitation on national sovereignty and as a safeguard for sovereign rights. In addition to being strongly emphasized by states, this principle is enshrined in Article 2(7) of the United Nations Charter, which states: *"Nothing in this Charter shall authorize the United Nations to intervene in matters that are essentially within the domestic jurisdiction of any state, nor shall it require member states to submit such matters for settlement under the Charter."*

In recent decades, an increasing number of non-state actors, including international organizations, corporate entities, and individuals, have played a significant role at the international level across various legal domains. These fields include human rights, environmental law, the law of armed conflict, international investment law, and trade law—all of which are strongly connected to space activities.

Today, international law is recognized as the governing framework for international and transnational relations, including those involving non-state actors. However, the formal understanding of international lawmaking still regards states as the primary legislative entities. Nevertheless, a significant portion of the international private community believes that non-state actors should have a right to participate in international lawmaking.

A prominent example of this influence is the role of commercial and private companies in space law. These companies operate as "sectoral members" of the International Telecommunication Union (ITU), where they contribute to regulations governing orbital slot allocation and radio frequency protections (Routledge Handbook, 2016).

Coordination between international law, national regulations, and the regulatory initiatives of international organizations is essential to prevent legal and security crises (Ilyashevich, 2021). Regarding the relationship between national space laws and international space law, the 1969 Vienna Convention on the Law of Treaties provides fundamental interpretative principles.

One particularly relevant provision is Article 26, which establishes the principle of "pacta sunt servanda" (agreements must be kept). Additionally, Article 27 emphasizes that domestic law cannot be used as justification for failing to implement international obligations. This principle is especially important in areas such as space activities and space resource extraction, which occur outside the territorial jurisdiction of states.

On a more specific level, the absence of comprehensive national laws regulating private space activities can create challenges, such as falling behind in commercial space competition and facilitating the unlawful appropriation of celestial bodies and environmental threats by other states. This legal gap increases the risk of international disputes due to the lack of long-term foresight in domestic legal protections. Furthermore, the non-binding nature of international treaties and the competitive nature of space activities among states contribute to legal challenges.

Strengthening national space laws not only facilitates better regulation of space activities but also enhances international cooperation and the commercialization of space. By developing legal frameworks based on predictive legal models, nations with domestic space laws can anticipate potential challenges and proactively shape space governance to ensure that international legal principles, particularly the common heritage of mankind, remain protected in the evolving space economy.

7. Conclusion

The findings of this study indicate that, given the rapid expansion of space activities and the increasing involvement of private actors, particularly commercial enterprises, there is an urgent need for a comprehensive and harmonized legal framework that aligns national laws with international treaties. While key treaties, such as the Outer Space Treaty and the Moon

Agreement, have established fundamental principles of space law, the lack of alignment between national regulations and international legal frameworks has created legal and diplomatic challenges.

On one hand, the development of the private space industry and the exploitation of space resources necessitate the regulation and continuous updating of national space laws to ensure that, in addition to protecting national interests, the principle of the common heritage of mankind is upheld. This is because intergenerational rights and justice require a simultaneous legal, ethical, and intersubjective approach, which is an inherent characteristic of the common heritage of mankind—a principle that constitutes a fundamental and inalienable right.

On the other hand, it is essential that international treaties also undergo revision and updates in accordance with advancements in space technology to address emerging legal needs. The U.S. Space Resource Law serves as an example of the rapid evolution of space law, which, while viewed by some as an opportunity for economic growth in space, raises concerns regarding its inconsistency with international treaties (including those not ratified by the U.S.) and its potential conflict with the principle of equal access for all states to the fair exploitation of space resources in accordance with the common heritage of mankind.

To prevent future international legal disputes, several measures must be implemented, including clarifying space activities, fostering effective international cooperation, promoting adherence to the Moon Agreement, developing oversight and self-reporting mechanisms for actors engaged in space resource utilization, and ensuring peaceful and equitable use of space resources. Additionally, the establishment of an international organization similar to the International Seabed Authority under the 1982 United Nations Convention on the Law of the Sea is necessary before the commencement of space resource exploitation to ensure legal stability and avoid international conflicts.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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