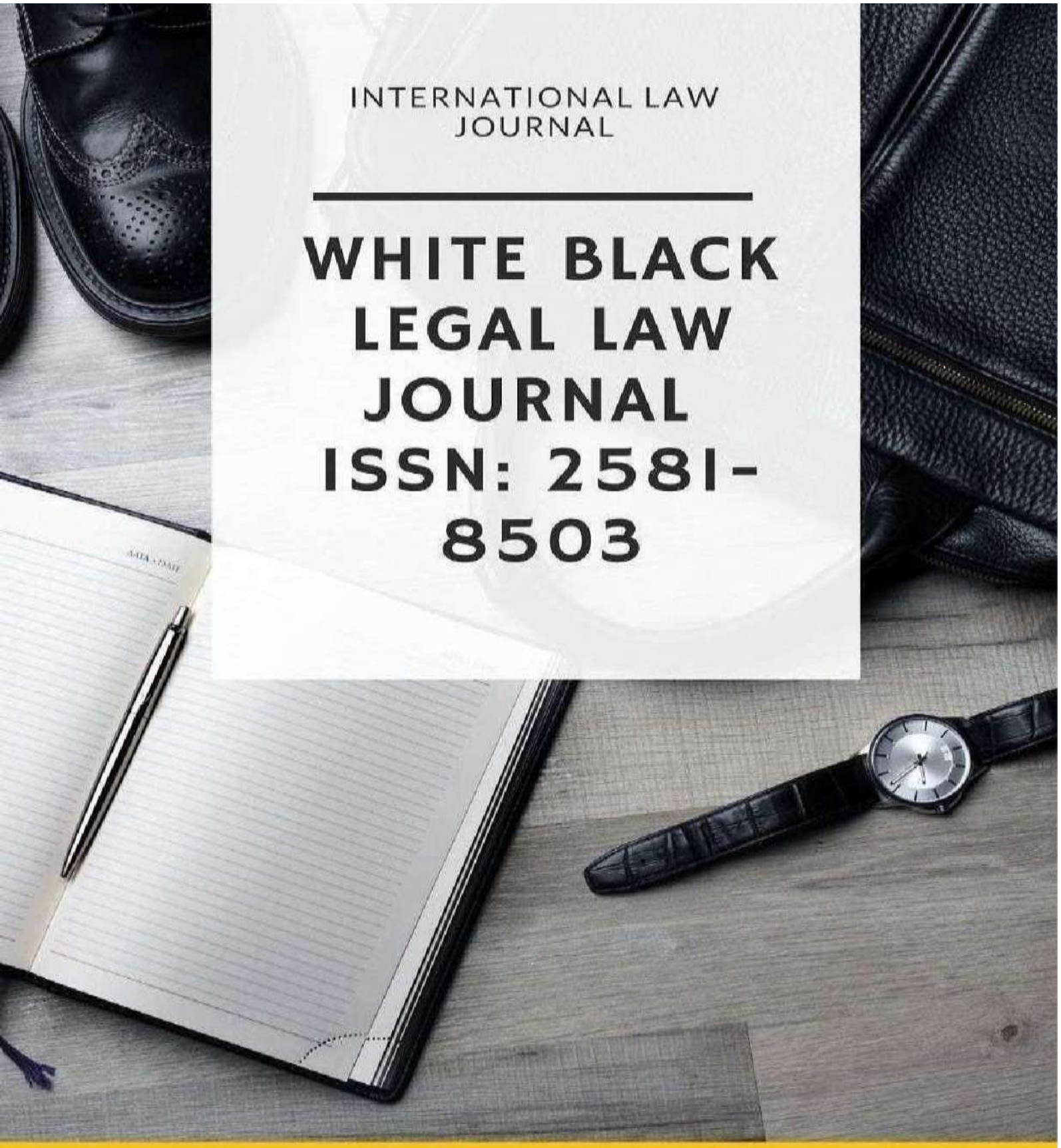

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Subhrajit did his LL.M. in Sports Law, from Nottingham Trent University of United Kingdoms, with international scholarship provided by university; he has also completed another LL.M. in Energy Law from University of Petroleum and Energy Studies, India. He did his B.B.A.LL.B. (Hons.) focussing on International Trade Law.

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LEGAL CHALLENGES IN SPACE LAW: COMMERCIALIZATION AND EXPLORATION

AUTHORED BY - ANJALI

Abstract

The exploration and commercialization of outer space, once the exclusive domain of sovereign states, has evolved into a thriving sector increasingly driven by private enterprises. For India, a rising space power, the transition towards private participation presents profound legal challenges. The absence of a comprehensive domestic space law, complexities around liability, intellectual property rights, and the exploitation of celestial resources demand urgent attention. This research paper critically examines these challenges through the lens of India's international obligations, emerging domestic policies, key judicial developments, and comparative international practices. It argues for a nuanced, forward-looking legal framework to balance innovation with responsible governance in India's space future.

Keywords-

Space Law, Commercialization, Private Sector, Space Exploration, India, IN-SPACe, Liability, Antrix Case, Outer Space Treaty.

Introduction

The cosmos, once the untouched frontier, has rapidly transformed into a domain of strategic, economic, and scientific significance. Historically monopolised by national agencies such as NASA and ISRO, space activities are now increasingly pursued by private corporations, universities, and start-ups. In India, governmental initiatives such as the establishment of IN-SPACe and the opening of the space sector to private players mark a new era. However, this evolution outpaces the country's legal infrastructure.

While India is a signatory to pivotal international treaties like the Outer Space Treaty, 1967, and the Liability Convention, 1972, it lacks comprehensive domestic legislation to regulate private and commercial activities in space. The Draft Space Activities Bill, 2017, remains pending, leaving a critical gap at a time when private players are actively designing, launching,

and operating space assets.

This paper seeks to explore the principal legal challenges India faces in regulating the commercialization and exploration of space. By weaving through international law, Indian policy, judicial precedents, and comparative international practices, the study highlights urgent areas for reform and proposes potential pathways for a robust Indian space law regime.

Historical Background of Space Law An Indian Perspective

The conceptual underpinnings of space law can be traced to the aftermath of the Second World War, when technological advancements rendered the exploration of outer space a tangible reality. Globally, the launch of Sputnik I by the Soviet Union in 1957 marked a watershed moment, prompting urgent debates about the legal status of outer space. It was during this era that the foundational principles of international space law were negotiated, culminating in key treaties such as the Outer Space Treaty of 1967.

India, having achieved independence in 1947, was still in the process of shaping its scientific and strategic identity when these global developments unfolded. Nevertheless, India recognized early the potential of space technology not only as a tool for scientific advancement but also as an instrument for socio-economic development. The establishment of the Indian National Committee for Space Research (INCOSPAR) in 1962, under the visionary leadership of Dr. Vikram Sarabhai, laid the foundation for India's formal engagement with space activities. By 1969, the creation of the Indian Space Research Organisation (ISRO) signaled India's serious commitment to space exploration.

Despite active participation in global space forums, India's approach to space law remained cautious and principle-driven. Rooted in ideals of peaceful exploration and equitable access, India consistently supported international norms that emphasized space as the "province of all mankind." It ratified crucial treaties such as the Outer Space Treaty (1967), the Rescue Agreement (1968), the Liability Convention (1972), and the Registration Convention (1975), affirming its commitment to international cooperation and peaceful uses of outer space.

Domestically, however, India's legal infrastructure for space activities remained limited. The emphasis was primarily on developing technological capabilities under direct governmental

control, with ISRO operating as both the scientific authority and de facto regulator. The Department of Space (DoS), constituted in 1972, coordinated space-related activities directly under the Prime Minister's Office, reflecting the strategic importance assigned to space.

In the initial decades, the absence of private sector involvement meant that legislative inertia did not pose immediate challenges. ISRO's focus was firmly on satellite technology for communication, meteorology, and remote sensing—technologies intended to address developmental priorities such as education, disaster management, and agriculture. Notable milestones like the Aryabhata satellite (1975) and the INSAT series reflected India's commitment to using space technology as a developmental catalyst rather than a commercial enterprise.

However, by the late 20th and early 21st centuries, as global trends shifted towards the commercialization of space, the limitations of India's purely government-centric model became increasingly apparent. Internationally, the growth of private launch providers, satellite communication firms, and even proposals for asteroid mining began to test the adequacy of traditional space law principles.

In India, early experiments with commercialization, such as the establishment of Antrix Corporation in 1992 as ISRO's commercial arm, indicated a growing recognition of the economic potential of space activities. Nevertheless, these developments took place without corresponding legislative innovations. The Antrix-Devas controversy later exposed the risks inherent in operating in a largely policy-driven, rather than law-driven, regulatory environment.

Recognizing these emerging challenges, the Government of India drafted the Space Activities Bill, 2017, aiming to regulate private sector participation, delineate liability, and fulfill international obligations more systematically. Yet, despite the bill's tabling, it has not been enacted into law, leaving India without a comprehensive space statute even as private entities like Skyroot Aerospace and Agnikul Cosmos achieve significant technological breakthroughs.

In sum, the historical development of space law in India reflects a trajectory shaped by pragmatism, developmental priorities, and principled internationalism. However, as India transitions from a purely public-sector-driven model to a mixed ecosystem involving private

innovators, the need for a coherent and future-ready legal framework has become more urgent than ever. The historical legacy provides a solid foundation of commitment to peaceful exploration, but adapting that legacy to the realities of commercialization and global competition remains one of India's most pressing legal challenges in the space sector.

Literature Review

Although scholarly discourse on space law globally is rich, India's space law literature remains relatively nascent. Early discussions predominantly focused on India's participation in the global legal framework, particularly through multilateral treaties. Scholars like Dr. V.S. Mani and Dr. Ranjana Kaul have emphasized India's commitment to the peaceful uses of outer space. In recent years, with the growth of India's private space sector, commentators have increasingly stressed the need for comprehensive domestic regulation.

International Legal Framework Governing Space Activities

The international legal regime forms the bedrock of national space laws. India's obligations primarily emanate from the following treaties:

The Outer Space Treaty, 1967

The OST lays down foundational principles: outer space shall be free for exploration by all states; it is not subject to national appropriation; and activities must be carried out for the benefit of all mankind. India ratified the treaty in 1982, aligning its national policies with these global norms.

The Liability Convention, 1972

This convention elaborates on the liability regime for damage caused by space objects. It establishes absolute liability for damage on Earth and fault-based liability for incidents in space. As a party, India bears responsibility not only for governmental activities but also for private actions.

The Registration Convention, 1975

The convention obliges states to register objects launched into outer space. India's compliance is visible through ISRO's practices, though registration mechanisms for private actors remain undeveloped.

The Moon Agreement, 1979

India is not a signatory to this agreement, which attempts to regulate the exploitation of lunar resources, viewing it as premature in the absence of consensus among major space- faring nations.

The Indian Legal and Policy Framework

Institutional and Policy Developments

India's space sector is primarily governed by the Department of Space (DoS) and ISRO.

Recent initiatives to encourage private participation include:

Establishment of IN-SPACe (Indian National Space Promotion and Authorization Center) Formation of NewSpace India Limited (NSIL) to handle commercial aspects Drafting of the Space Activities Bill, 2017, which remains pending legislative approval The draft bill proposes a licensing regime for private players, addresses liability and insurance, and outlines governmental control over strategic space assets. However, critics argue that it remains overly centralized and lacks detailed mechanisms for dispute resolution and private sector incentives.

Absence of Binding Legislation

Currently, private participation is managed through MoUs, contracts, and administrative approvals, resulting in ambiguity. There are no binding statutory obligations that define rights, responsibilities, or enforcement mechanisms for non-governmental space activities.

Legal Challenges in Commercialization Licensing and Authorization

The licensing mechanism proposed under the Draft Bill is intended to ensure that private operators conform to international obligations. However, without formal enactment, there remains uncertainty regarding:

- Criteria for licensing
- Oversight mechanism
- Scope of governmental liability for private acts.

In contrast, the U.S. and Luxembourg have enacted clear licensing procedures, enabling greater private sector confidence.

Liability and Insurance

Under international law, India remains liable for all space activities conducted from its territory. Therefore, a clear legal requirement for insurance and indemnification from private

players is crucial. The Draft Bill proposes mandatory insurance but lacks specifics regarding minimum coverage, claims handling, and cross-border enforcement.

Intellectual Property Rights

Space technologies often involve significant proprietary advancements. Questions regarding ownership of innovations developed or utilized in space, patenting processes, and dispute settlement remain largely unaddressed in Indian law.

Environmental Concerns

Space debris and contamination of celestial bodies pose significant risks. India's policies currently lack robust environmental impact assessment (EIA) requirements for space launches, contrary to emerging international best practices.

Key Legal Challenges

1. Property Rights and Resource Exploitation.

   The Outer Space Treaty prohibits national appropriation, but it is silent on private ownership of extracted resources. This ambiguity fuels debates:

   Proponents argue that ownership rights are essential for investment and innovation.

   Opponents warn that unchecked exploitation could mirror historical patterns of colonialism and resource depletion.

2. Liability and Accountability

   Under the "Liability Convention" (1972), states are liable for damage caused by their space

   objects. However, questions arise when:

   - Private entities operate independently
   - Multiple parties collaborate on missions.
   - Damages occur indirectly (e.g., space debris from decommissioned satellites).

   Space Traffic Management and Debris Mitigation

   With thousands of satellites and growing mega-constellations, collision risks have intensified. There is no binding international framework for space traffic management, leading to:

   - Increased risks of accidents
   - Regulatory overlaps and inconsistencies

3. Militarization and Security Concerns

   Although the Outer Space Treaty prohibits weapons of mass destruction in orbit, it does not ban conventional weapons or the militarization of space assets. The emergence of "space forces" by several nations escalates tensions and complicates peaceful cooperation.

4. Equity and Access

   The principle that outer space should benefit all humankind faces challenges from commercial interests dominated by a few wealthy nations and corporations. Developing countries risk being marginalized in future space economies.

Legal Challenges in Exploration

Sovereignty and Resource Utilization

While the OST prohibits sovereignty claims, it remains silent on the extraction of resources. The U.S. and Luxembourg assert that resource ownership is permissible under the principle of "use and exploration." India has yet to formulate a stance, leaving its private entities without legal certainty.

Jurisdiction and Control

Activities like establishing lunar bases or asteroid mining involve complex jurisdictional issues. Indian law does not currently delineate the extent of jurisdiction over objects or habitats established by Indian entities beyond Earth.

The Artemis Accords

India's recent signing of the Artemis Accords indicates alignment with a vision of cooperative exploration. However, reconciling these commitments with India's traditional emphasis on multilateralism and non-appropriation principles will require careful legislative crafting.

Case Studies.

Case Laws and Judicial Precedents

Antrix-Devas Case

One of the most significant disputes in Indian space history is the Antrix-Devas Multimedia Ltd. V. Antrix Corporation Ltd.

In 2005, Devas Multimedia entered into an agreement with Antrix (ISRO's commercial arm)

to lease S-band satellite spectrum. The contract was unilaterally annulled by the government citing strategic needs, leading to international arbitration.

Devas secured favorable arbitral awards from ICC and PCA tribunals, and enforcement actions were pursued in various jurisdictions, highlighting the risk of governmental overreach and contractual instability in India's space sector.

This case underscores the urgent need for transparent, fair, and legally binding regulatory frameworks to attract private investments in space activities.

Other Relevant Disputes

TataCommunications v. Union of India (telecom spectrum disputes), while not directly related to space, provide analogous insights into spectrum allocation legalities.

Videsh Sanchar Nigam Limited (VSNL) disputes on international satellite communication agreements offer parallels regarding governmental obligations towards private enterprises.

Comparative Analysis

Comparing India's regulatory environment with that of the U.S., Luxembourg, and UAE reveals stark contrasts:

U.S.: Clear domestic laws (e.g., Commercial Space Launch Act) govern private participation, liability, and resource extraction.

Luxembourg: Space Resources Law, 2017, explicitly grants rights over extracted resources.

UAE: The UAE Space Law, 2019, establishes a licensing and oversight mechanism that balances state control with private sector incentives.

India must similarly move beyond policy declarations to substantive legal enactments.

Proposed Legal Reforms

- Updating the Outer Space Treaty
- An updated treaty could address: Clarifying resource rights and ownership.

Establishing a standardized liability regime for private actors

Defining peaceful uses and prohibiting conventional weapons in space

International Space Resource Authority

Drawing inspiration from the "International Seabed Authority" under the Law of the Sea Treaty, a similar body could:

- Regulate resource extraction
- Issue licenses
- Ensure equitable benefit-sharing **Space Traffic Management Agreements**

Multilateral agreements are needed to:

- Coordinate satellite orbits
- Share collision data
- Impose debris mitigation standards
- Capacity Building for Developing Nations

To ensure equitable access, initiatives should:

- Provide technology transfer
- Offer funding and training
- Facilitate participation in space governance discussions

Recommendations

1. Enact Comprehensive Space Legislation: Codify clear rules for licensing, liability, insurance, environmental compliance, and dispute resolution.
2. Encourage Public-Private Partnerships (PPP): Facilitate collaborations between ISRO and private players through formalized, transparent frameworks.
3. Develop a Space Insurance Market: Support insurance providers in developing space-related products to manage launch and operational risks.
4. Adopt Environmental Safeguards: Integrate mandatory EIAs for space missions to minimize orbital debris and planetary contamination.
5. Promote International Cooperation: Engage actively in international for a to shape emerging space governance norms, ensuring India's strategic interests are protected.

Implications for the Future

Commercial Opportunities vs. Regulatory Risks

While commercialization promises economic growth and innovation, weak governance structures could lead to conflicts, environmental degradation, and inequities.

Security Dilemmas and Arms Race Potential

Without clear prohibitions, the militarization of space could trigger an arms race, undermining the peaceful character of outer space envisioned in early treaties.

Ethical and Environmental Stewardship

The nascent space economy must integrate ethical considerations, such as preventing contamination of celestial bodies and preserving outer space for future generations.

Conclusion

The legal architecture governing space activities, forged during an era of state-centric exploration, is increasingly inadequate for today's dynamic and commercialized environment. Without significant reforms, the gaps in property rights, liability regimes, and security arrangements could lead to disputes, inequities, and environmental harm Collaborative international efforts are imperative to modernize space law, ensuring that outer space remains a domain of peaceful exploration and shared benefit.

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