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Space Debt Diplomacy: How China's Satellite Loans To Pakistan Encroach On Indian Orbital Slots

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Abstract

This research paper explores the new aspects of 'space debt diplomacy' using the example of China-Pakistan satellite cooperation and what it means for India's control over its orbits. Anchored in Offensive Realism and Dependency Theory, the research explains how China uses the loans of satellite technologies and filings at ITU for orbits to dominate the space infrastructure of South Asia. China's Pakistan geostationary pay load offering of launch, geostationary space filing, and even powered aids through PakSat-MM1R and through dual use aids I Cube-Qamar give China sponsored challenge to India's geostationary domain. Pakistan reliance on China through asymmetric contracts and telemetry overlaps in the contracting for telemetry [1]defines asymmetry dominated cluster orbits. India's space zones are strategically needed and Pakistan's space autonomy. While these norms are voluntary and non-binding, the concerns of space governance have allowed too much maneuverability in the grey legal void. India counter space tries through Artemis alliance and grows domestically, still needs controlled ITU diplomacy. This paper enhances understanding of geopolitical rivalry related to space competition through proxy partnerships and infrastructural dependencies by mapping institutional capabilities, policy narratives, and strategic filings.

Keywords: *Space Debt Diplomacy, Orbital Sovereignty, China-Pakistan Space Collaboration, ITU Filings, Dual-Use Satellites, Geopolitics of Space, Orbital Slot Encroachment, Space Governance, Proxy Partnerships.*

1) Introduction

Space has changed over the years from being an area for scientific exploration to a field where geopolitics, technology, and the projection of international power intersect. The rise of space diplomacy and more recently, space debt diplomacy shows that space is rapidly being conquered by the diplomacy of growing space. powers. This is more so in regions like South Asia, which is a hotspot. Here, the changing relations of China, Pakistan, and India serve as a miniature example of a new "orbital Cold War," that is, a space which is used to further the existing rivalries on the ground (Weeden & Samson, 2022).

At the center of this competition is China's strategic offering of satellite loans to Pakistan under the Belt and Road Initiative (BRI) especially the "Space Silk Road." This goes beyond mere economic cooperation and serves as a more comprehensive framework of astropolitical

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leverage in which satellite dependency, orbital slot congestion, and infrastructure domination serve long-term hegemonic ambitions (Su, 2020; Zhao, 2021).

Astro-politics is described as the use of space in a geopolitical context, particularly for asserting power and influence on a national level (Dolman, 2002). While the space race rivalry between the US and the USSR in the Cold War period is well-known, in the 21st century we are now seeing the rise of a new multipolar "New Space Race." Countries like India and China now play significant roles as regional power, using space for strategic purposes in addition to communication, surveillance, and navigation. Dolman (2002) also states: "who controls low Earth orbit controls near-Earth space, and who controls near-Earth space dominates Earth." This saying has shaped Chinese thinking as it attempts to integrate space into its strategy of comprehensive national power (Chien, 2023). That view of outer space as a binary system is outdated. The Union of Concerned Scientists (UCS) reported that as of 2023 roughly 660 Chinese satellites and 55, 6, and 55 Indian, and Pakistani satellites are active, showing that the number of space actors outside the West is increasing (UCS Satellite Database, 2023). Unlike the rest of the NATO-aligned countries, China uses space development as a part of its Digital Silk Road and its broader "Go Global" strategy, allowing for state-sponsored corporations to lead in the commercial space industry while transparently changing the international norms of space governance (Krolikowski, 2015; OECD, 2020).

India's Indian Space Research Organization (ISRO) has successfully been launching and operating domestic satellites in the areas of communication, earth observation, and navigation (ISRO Annual Report, 2023). In comparison, Pakistan is less developed in the field of space technology and has developed closer ties with China through satellite loans, launch partnerships, and technology transfers from state-owned companies, like China Great Wall Industry Corporation (CGWIC) (Su, 2020; Zhao, 2021).

China's export of space infrastructure began under the BRI umbrella, ultimately leading to the establishment of the "Space Silk Road," through which China seeks to expand dominion via satellite technology, space financing as well as launch services (Su, 2020; Weeden & Samson, 2022). Pakistan has become China's foremost partner in this domain, effectively outsourcing its orbital sovereignty.

Key developments include:

- PAKSAT-1R (2011): Funded via a $297 million loan from China Ex-Im Bank (People's Daily, 2011).
- PRSS-1 & PakTES-1A (2018): Earth observation satellites built and launched in collaboration with China.

PakSat-MM1R & ICUBE-Qamar (2024): Progressing further within Pakistan's "Space Vision 2040" PakSat- MM1R's satellite was launched on a Long March 3B on May 2024 and is operating in C, Ku, Ka and L bands with 48 transponders (~1200 km altitude) in position to cover the Indian ocean region. ICUBE-Qamar is the first deep space mission by Pakistan and was launched on the Chinese Chang'e-6 lunar mission, thus marking the entry of Pakistan on deep space Chinese platforms (Xinhua 2024).

China's model offers concessional loans that come with terms of 2% interest for 20 years with a 5 years grace period, satellite construction, launch services, telemetry support and operational control infrastructure (Su 2020, Zhao 2021). In exchange, China receives telemetry, orbital slot

access, servicing advantage of control, and strategic partnership of the client state for the period of the loan.

Satellites in GEO have to maintain a fixed position granted by the ITU on a first come first serve basis. The region between 55 degrees East to 65 degrees East is heavily sought after for South Asia. India has 2 geosynchronous satellites, GSAT-30 (59.7 degrees) and GSAT-31 (61 degrees) that are operating within this region (ITU BR IFIC 2024). Between 2020 to 2024, Pakistan increased its filings to the ITU from 5 to 16, with many clustering around the positions of Indian satellites. A number of these are termed “paper satellites” files submitted to prevent future claims, rather than satellites being worked on (ITU Filing Records, 2024). According to satellite telemetry from Celes Trak, PakSat-MM1R is said to functionally overlap with India's GSAT-30, although it is registered at 38.2°E (Celes Trak Orbital Database, 2024). Indian authorities point to signal interference concerns, proposing emerging threats of electromagnetic rivalry (ISRO Communications Bureau, 2024).

India's counter strategies incorporate advanced missions like Spa DEX (2024), satellite partnerships such as NISAR (NASA-ISRO), and space privatization via the IN-SPACE Reforms (ISRO Annual Report, 2023). India's 26 months average delay from ITU filing to satellite launch, however, is a stark contrast from China's more streamlined, proxy-driven approach.

India is now building QUAD coalitions for space situational awareness and traffic management, but the lack of a cohesive regional space bloc in South Asia limits deterrence and responsive potential.

The way China manages exports through providing loans, launching products, and managing dual-use clause control rights creates lasting structural dependencies. Drafts from SUPARCO and contracts from CGWIC China suggest that China retains emergency command privileges China retains emergency command privileges under technical anomaly clauses (Ruser & Rayner, 2023). This reflects how Beijing has expanded its infrastructure and port diplomacy into outer space.

China, through allied proxies such as Pakistan, encroaches and expands in strategically important GEO sections. This has critical ramifications for:

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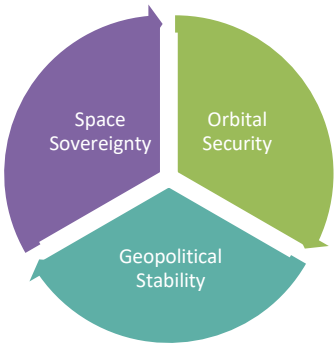


Pakistan grants China a foothold, tightening the noose around Beijing's and Pakistan's independent decision-making freedoms. Overlapping slots sharply increases the potential for interference (cross-signal disruption), necessitating improved coordination through the

International Telecommunications Union (ITU). Space is becoming a new contested arena with contested dual-use ambiguity.

India is advised to promptly pursue ITU filings, contest dubious registrations, and formulate a strategic doctrine for space. Moreover, India is urged to advocate for reform to ITU's opaque governance and propose a South Asian Space Cooperation Charter to mitigate unilateral orbital proliferation.

2) Research Questions

This paper investigates how China's satellite financing facilitates Pakistan's orbital ambitions, which in turn encroach on Indian geostationary assets. The central research questions are:

1. What are the terms, control clauses, and strategic features embedded within China's satellite loan agreements to Pakistan?

2. How do Pakistan's ITU filings and satellite deployments influenced by China impact India's orbital sovereignty and space operations?

3. What legal, and diplomatic policy can India deploy within international law to counter this asymmetric encroachment?

3) Emerging Multipolar Space Race in South Asia

The space competition in South Asia is evolving as China, India, and, to a lesser extent, Pakistan compete for an upper-hand strategically. Wright and Moltz's (2020) most recent scholarship describe this competition as a 'New Space Race' which is not solely based on innovation, but also on the politics surrounding the competition, geopolitics, satellite positioning, frequency control, and orbital occupancy. While the U.S. and Soviet Union competed in the Cold War space industry, the latter is in fact a competition across multiple Asian powers.

- **China's Strategy Focus in Space**

Astro politics has now become one of the essential branches in relation to global issues due to the interplay between space technology and geopolitics. "Astro politics" was first used by Deudney (1983) to emphasize the potential dispute over the control of orbital and lunar resources using classical geopolitics reasoning. With the onset of the Cold War, space transformed from purely a scientific asset to one with significant geopolitical value in competition. In the 21st century, competition over this asset has become more wide-spread and is now centered around the USA and China, Russia, and India.

China's strategy in space is aligned with its national strategies and reflects its comprehensive power in the global arena, indicating its status and the willingness to achieve techno-scientific modernization. Based on the research of both Pollpeter (2015) and Johnson-Freese (2016), Beijing regards space dominion as an imperative for global influence and prestige, military standing, and economic strength. Currently, China is expanding its dual-use space infrastructure to the China National Space Administration (CNSA), a subordinate of the State Council and the PLA (People's Liberation Army) Strategic Support Force.

Based on data from the Union of Concerned Scientists as of 2023, China had approximately 660 operational satellites. These satellites support the Beidou navigation system, which is China's counterpart to the GPS system, as well as the Gaofen high-resolution earth observation

satellites and the Tianlian data relay systems. These systems provide enhanced geospatial intelligence and military command and control as well as civil-military fusion.

With an aim to integrate space cooperation into its economic diplomacy, China initiated the "Space Silk Road," a component of the Belt and Road Initiative (Su & Yang, 2018). This initiative fosters South-South cooperation in satellite technologies, data, and ground station construction. The China-Pakistan Economic Corridor (CPEC) has played a significant role in incorporating Pakistan into this orbital sphere of influence. Beijing financed and launched PakSat-1R, then developed and launched PakSat-MM1 in collaboration with Pakistan's Space and Upper Atmosphere Research Commission (SUPARCO), and is now supporting the MM1R under sovereign credit guarantees.

These projects are not simply technological gifts; they are intricately structured through satellite loan agreements, whereby China retains technological control, granting partners the ability to apply for orbital slots through the International Telecommunication Union (ITU). Strategic considerations involve the granting to client states such as Pakistan the ability to augment geostationary presence within contested zones, for example, the 55°E–65°E Indian Ocean corridor, thereby indirectly impacting India's orbital as well as national security considerations.

- **Satellite Diplomacy and Debt Dependency**

The provision of satellite assistance through opaque concessional frameworks, or embedded within strategic frameworks, becomes one of the modalities of influence referred to as "space debt diplomacy." This is akin to the broader "debt-trap diplomacy" observed in the context of Chinese-funded ports and infrastructure (Brown & Singh, 2020). The space dimension adds a layer of technologically induced dependency that is framed within a long-term strategic context. Concerning Pakistan, the provision of satellite systems such as PakSat-1R and PakSat-MM1 are not grants; rather, they are extended through structured loans under China's state-supported export credit system. Along with repayment, these arrangements commonly require shared ground control infrastructure, data-sharing agreements, and technological black-boxing which limits the operational freedom of the recipient country. Kniep (2021) underscores the dependence these partnerships create with respect to long-term communication and surveillance infrastructure, particularly considering the dual-use satellite platform technology which is applicable in both civilian and military domains.

The lack of public clauses accompanying the agreements exacerbates the inability to evaluate proprietary rights and control over data, reprogramming, and other critical functions. This information vacuum raises the potential risks of cyber military intelligence leakage, and territorial control over satellite filings. For Pakistan, dependence on Chinese satellites limits domestic innovation in space technology, while such encroachments for India may alter the regional power equilibrium in the orbital domain.

- **The Role of China in the Orbital Development of Pakistan**

Pakistan has struggled to achieve any notable advancements in space technology over the years due to a lack of funding, expertise, and even the persistent geopolitical conflicts in the region. Their space program, SUPARCO, struggled to compete on any level with ISRO, which was founded years earlier. Until 2011, Pakistan only had access to one major communications satellite, which was predominantly operated via foreign leases. Afterwards, relations with China due to the BRI (Belt and Road Initiative) program on a more geopolitical level began to change things.

China changing the aged PakSat-1 with their leased PakSat-1R in 2011 marked a significant turning point in Pakistan's orbital satellite ownership. China's PakSat-1R replaced the aging US-leased Pak 1 satellite in 2011 which alongside serving as a fully owned satellite of Pakistan also provided the opportunity for China to advance their interests. This partnership deepened with the launch of PRSS-1 (Pakistan Remote Sensing Satellite) and PakTES-1A in 2018, which provided Earth observation and remote sensing capabilities. Furthering national security, surveillance of domestic unrest, disaster management, monitoring of resources, and even advanced agricultural planning were enhanced which in return vertically embedded the reliance on Chinese systems and launch services.

PakSat-MM1 and the forthcoming PakSat-MM1R for enhanced broadband and communication capabilities are ongoing developments. PakSat-1R and PakSat-1 are China-1R, China's leased Pak-1R is set to launch seasons after 1's completion, servicing as a replacement for Pak-1 in the 1.5-2.5 alt. zone is providing China to propel their systems downward to geo-orbit 1b within the US. Per the observation of Hassan (2022), the collaboration displays a dual-relational touch highlighting combined dependency besides observing it as important for recovering neutrality over deepened as a satellite loan agreement entrenched. China provides ground station integration, software systems, operational training, and even hardware, leading to deep interdependence. While this relationship benefits Pakistan's space aspirations, it poses sovereignty concerns and invites regional, particularly Indian, scrutiny pertaining to data sharing, military dual-use technology, and possible orbital congestion in contested geostationary regions.

- **ITU Slot Allocation and Orbital Sovereignty**

The ITU is critical in controlling the allocation of geostationary orbital slots and associated radio frequencies. It uses a first come, first served approach. Historically, space orbital resources were dominated by the West and spacefaring nations, but this is changing due to emerging actors, especially China and its allied states, which have heightened the competitive landscape. The geostationary arc over the Indian Ocean Region, specifically between 55°E and 65°E, is becoming a contested region due to its strategic and commercial value. With the assistance of China, Pakistan has made several submissions to the ITU regarding orbital slots associated with PakSat-MM1 and the subsequent MM1R missions. These submissions, as noted by Bhatt (2020), cause concern among Indian strategists because they interfere with India's intended satellite placements in the adjacent longitudinal region. Rajagopalan (2021) contends that these moves could be utilized by China to indirectly curtail India's orbital freedoms by filling critical portions of the geostationary belt with satellites from Pakistan, which are ostensibly under Pakistani control. While the term "orbital sovereignty" does not have a grounded definition in international space law, it is increasingly being used in policy debates to define boundaries that protect satellites in operation. The undermining of freely accessible orbits will have consequences for the long-term national space strategies and the security frameworks.

- **India's Strategic Concerns and Responses**

Administered by ISRO, India's space program has primarily focused on fostering peace through satellite-based weather forecasting, remote sensing, telemedicine, and rural healthcare. However, burgeoning geopolitical factors, especially China's aggressive activities in outer space, have triggered a reorientation of India's space doctrine. The execution of an anti-satellite (ASAT) weapon test in March 2019 during Operation Shakti was a watershed moment. It showcased India's ability to kinetically intercept low Earth orbit satellites, which fortifies deterrence posture concerning space assets vulnerabilities.

Venkatraman (2019) and Lele (2021) support the claim of a shift in India's space posture and its move towards a dual-use framework that integrates development with defense. This shift is marked by increased satellite reconnaissance, space situational awareness (SSA), and the establishment of the Defence Space Agency (DSA) and the Indian National Space Promotion and Authorization Center (IN-SPACE).

One of the issues of concern for India is the suspected proxy infringement upon its geostationary belt through ITU filings by Pakistan, often facilitated through Chinese financial and technological aid. This approach, while legally permissible, poses concerns regarding the strategic "international" manipulation of the system of international rules for regulatory purposes to achieve some geopolitical goals. India has issued diplomatic complaints in ITU meetings and advocates for equitable and unencumbered access. In addition, India actively participates in the development of space policies and advocates for the misuse of the Guidelines for the Long-Term Sustainability of Outer Space Activities. India is also concerned with orbital space debris and the weaponization of space. This has resulted in India employing a combination of high-level technological readiness, diplomatic outreach, and legal activism to defend its geopolitical standing and space interests.

The International Telecommunication Union (ITU) manages orbital slots and radio frequencies using a 'first come, first served' rule based on records in the BR IFIC (International Frequency Information Circular) or, in simpler terms, 'who files first gets served.' As pointed out by Dempsey and other experts, this system is becoming easier to abuse by technologically advanced countries that utilize proxy lesser developed countries. The sluggish, overly bureaucratic ITU filing and registration system, paired with weak enforcement bodies, allows powerful players to forward occupy access to orbital slots through proxy filings. This is especially troubling in, limited orbital spaces considered geo-strategically sensitive, the 55°E–65°E arc in the Indian Ocean basin, where filings made by Pakistan with support from China could undermine Indian space sovereignty.

With more than 600 satellites in space, China is the regional leader and is now expanding space exports to allied or dependent countries via concessionary loans and tactical alliances. Pakistan's dependency on China, especially the China National Space Administration (CNSA) for the construction and launch of satellites such as PakSat-1R and PRSS-1, illustrates a dependency paradigm that deepens Chinese influence in South Asia's astropolitical order. In contrast, India's ISRO operates autonomously and gained global stature through successful missions, including Chandrayaan-3 and Gaganyaan.

The development of China's space program and its collaboration with countries like Pakistan has triggered a new scholarly debate on how and why developing countries use space technology to project influence. While numerous disciplines have grappled with South Asia's geopolitics–for instance, the international political economy or security studies–there's a notable absence of research on South Asia's nexus of debt diplomacy, space governance, and proxy satellite services.

Much of the existing literature on China's Belt and Road Initiative (BRI) is concerned with the construction of ports, railways, or energy infrastructure. One of the leading scholars on China and Africa, Deborah Brautigam, dissects the "debt trap diplomacy" argument and makes the case that funding offered to Africa is largely driven by profit motives and not strategic coercion. Still, this argument is limited to infrastructure situated on the surface of the Earth. The new phenomenon of space-based lending satellites, in which China builds, launches, and, on occasion, operates satellites for debtor nations such as Pakistan, requires its own theoretical framework. China's dominance over satellite hardware, launch logistics, and even orbital

filings is strategically significant and follows a logic similar to that of ground-based influence, yet it remains poorly studied.

James Moltz (2022) explains the idea of "soft militarization" concerning space, where countries use dual-purpose satellite technologies and orbits to gain advantages without crossing military lines. This includes remote sensing, satellite reconnaissance, and secure communications, which are disguised as civilian, but are significantly useful to the military. He analyzed orbital positioning as a soft power lever but does not look at how proxy states, especially those with stagnant domestic space programs, can be employed by greater powers to surveil or crowd adversaries. China's partnership with Pakistan in space development presents this asymmetry, but it remains underdeveloped in this scholarly literature. Instead of seeing space power as just the quantity of satellites or launch vehicles a country has, Bowen (2020) sees space power as the capability to conduct space mic operations through a web of allies and clients. His analysis, still centered on Western coalitions, suggests a model that could be applied to the Sino-Pakistani partnership. In South Asia, the idea of strategic space power through proxies is largely overlooked, even as the evidence suggests it's being put into practice. While Pakistan does not possess the industrial capacity of India or China, he does possess critical geostationary real estate largely due to China's sponsorship. Still, there is a lack of scholarly effort to move the relationships into mainstream space power theory.

The Asia-centric space competition remains unrepresented in global security frameworks, so the absence of this focus in mainstream agenda and international relations (IR) theory space still creates room for concern. This absence invites the need for a shift in the construction of Astro-politics in relation to the developing rivalry in South Asia.

The scholarly works about China's debt diplomacy alongside the India-China space rivalry are growing, but they still lack depth, especially with regards to the satellite-based encroachment through orbital slot occupation. The geopolitical manipulation of the ITU's (International Telecommunications Union) procedures to exert authority in the contested orbital regions, most notably in the Indian Ocean, remains underdeveloped. A majority of the studies concentrate on the loans for the ground-level infrastructure, which entirely ignore the strategically space-based infrastructure assets that could be used to foster dependency. In addition, Pakistan's growing role as a sponsor of the Chinese orbital ambitions is often ignored, especially in relation to the ITU filings backed by Chinese technology. The purpose of this paper is to address such issues by including the pertinent information on the satellite launches, geolocation filings, and the bilateral contracts of China and Pakistan. It does so in the context of realist theories, which relate spatial positioning to rational geopolitical control, regional influence, and power dynamics in South Asia.

The literature review shows that South Asia bit by bit changes as China uses its satellite loans for its political gains. Through technology aid and loose lending, China is not only increasing Pakistan's satellite presence, but also indirectly trying to challenge India's spatial and strategic boundaries. This emerging pattern portrays a new front of debt-trap diplomacy space debt diplomacy where satellite deployments serve geopolitical purposes. Pakistan's dependency on China-backed satellites and the ITU filings pose problems of orbital dominance and strategic takeover, especially concerning the Indian Ocean orbital region. The ambiguity of the ITU's enforcement mechanisms alongside the absence of geo-specific space governance exacerbate the potential for spillover conflict. This is why I have added to the strategic literature on orbital slot competition by, using China's increasing influence in outer space, arguing from a realist perspective.

4) Theoretical Framework

This paper integrates two theoretical frameworks, Offensive Realism and Dependency Theory, to analyze the strategic motivations behind China's satellite diplomacy with Pakistan and its subsequent impact on India's orbital dominance. These frameworks help explain the intersectional complexities of the dominant spacefaring powers and the structurally dependent states of geopolitics, particularly in the context of space.

- **Offensive Realism**

Proponent and Assumptions: John J. Mearsheimer articulated one of the dominant international relations theories, Offensive Realism, in his book The Tragedy of Great Power Politics (2001). Core tenets of Offensive Realism include: International system is anarchic with no central governance. States operate as rational entities seeking survival. All states have some form of offensive military capability. There exists uncertainty about other states' intentions. Maximizing relative power best ensures security.

Mearsheimer asserts that great powers actively seek to dominate entire regions, actively opposing the emergence of other dominant powers. This drives international relations, including space, towards competition instead of cooperation.

In the scope of this essay, China's activities in the realm of outer space can be examined using Offensive Realism as a theoretical framework. China, as a great power in the global arena, is not only advancing its space program for peaceful purposes, but is also using "space diplomacy" to extend its geopolitical influence. Rather than open militarization of space, China prefers to aid its weaker allies like Pakistan through technology transfer, satellite launches, and orbital filings. This form of indirect expansion allows Beijing to sidestep international legal barriers while gradually cementing control in loosely regulated areas like geostationary orbit (GEO). China's provision of dual-use satellites, such as PikPak-MM1R and PRSS-1, and hosting of Pakistani payloads under China ITU filings is a form of "orbital statecraft" which is a non-kinetic method of exerting influence in space.

Through the provision of space infrastructure and services, China facilitates Pakistan's access to space infrastructure which allows Beijing to position itself within South Asia's orbital theater, deliberately intruding upon Indian influence while retaining deniability. This is in line with Mearsheimer's assertion that great powers seek to alter the balance of power through the exploitation of gray zones and asymmetrical partnerships.

- **Dependency Theory**

Proponent and Assumptions: Dependency Theory stems from the work of structuralist economists and sociologists from Latin America, notably Raúl Prebisch, Andre Gunder Frank, and Theotonio Dos Santos in the mid-20th century. It counters the modernization thesis by suggesting underdeveloped nations are economically and technologically reliant on the developed world, thus economically subordinated to these dominant nations.

Key Dependency Theory assumptions include: The global system is "core" and "periphery" divided, where the former exploits the latter. Development in the peripheral zone is conditioned and constrained by its relationship to the core. Control on technology, institutions, and finance sustains the asymmetric dependency.

Dependency Theory is particularly useful in the context of space geopolitics pertaining to Pakistan's satellite collaboration with China. Pakistan's lack of indigenous capabilities in launch vehicles, deep space telemetry, satellite design, and orbital spectrum management

technology makes it reliant on China for end-to-end space infrastructure. China's systems significantly scaffold Pakistan's orbital presence, from the launch of PRSS-1 and PakSat-MM1R to data relay and ground control services.

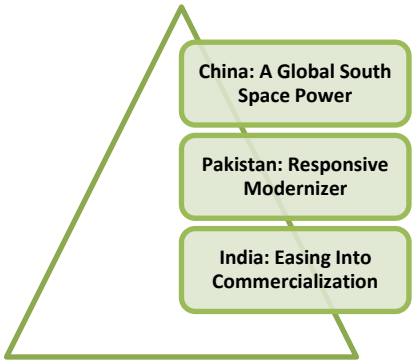
This dependency limitation further reduces Pakistan's strategic autonomy and makes its orbital activities subordinate to Chinese preferences. Pakistan's endorsement of China's International Lunar Research Station (ILRS) initiative, alongside its participation in the I Cube-Qamar CubeSat mission, illustrates the cooperation alongside structural alignment due to capability asymmetries. Pakistan's lack of capacity to unilaterally apply for and manage ITU satellite slots reinforces the dependency further.

This dependency asymmetric relationship, in line with the Dependency Theory, restrains the space program in Pakistan and links its orbital policies to the strategic goals of China, thus hindering the development of a more self-reliant sovereign space program. Such dependency is augmented with regional India's positioning itself as an autonomous and compliant space player with domestically developed GSLV launchers, lunar missions, and satellite navigation systems.

Although Offensive Realism and Dependency Theory stem from different epistemological roots realist geopolitics and critical political economy, respectively both provide meaningful insight when analyzing China-Pakistan space collaboration. Offensive Realism focuses on the dominant powers' actions, postulating that China, as a rising hegemon, seeks to wield orbital alliances as a tool to amplify its reach without engaging in direct conflict. At the same time, Dependency Theory highlights the bounded visibility of peripheral states such as Pakistan, which is incapable of launching its satellites without relying on foreign technology and infrastructure, thus undermining its strategic autonomy. The complementarity of these perspective rests in their asymmetry: one from the top-down (hegemonic expansion) and the latter from the bottom-up (institutional dependency). In this paper, I integrate both perspectives to fill the gap between motive and constraint China's "why" and Pakistan's "why" conform. In unison, they depict the shifting framework of regional orbital politics, which cannot be approached as behavioristic. Instead, power is relational: China's "orbital proxies" are structurally shaped agents who are not passive wielders of power, but their decisions are conditioned by external dependency. Therefore, the theories deepen the political outer space discourse in South Asia by integrating strategic intent alongside systemic constraints.

5) Regional Space Politics & National Stances

The changing South Asia space politics reflects a wider global competition not only on the ground but also in space. With China, Pakistan, and India stepping up their space activities, policies and global alliances begin to reflect the strategic approaches taken on the ground. By the end of 2024, the space activities of the countries will have taken clear shapes determined by strategic relations, advancement of local technology, cooperation on a global scale.



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- **China: A Global South Space Power**

By the end of 2024, China was the de facto Global South space leader having entered into almost 200 space cooperation agreements with more than 50 countries. This aggressive outreach forms part of Beijing's "open space diplomacy" which is in stark contrast with the U.S. position and space policies on the Artemis Accords. China's space policies are outlined in the White Papers, the latest in 2021 with guidance updates issued in 2024 which advocates diplomacy based on and emphasizes the peaceful utilization of space, cooperation, along with the development of shared space infrastructures.

An important part of the plan is the International Lunar Research Station, which is a multilateral lunar base project that is currently being co-led by China and Russia. As of 2024, core participants also included Pakistan, the UAE, Belarus and Venezuela. The ILRS aims for a fully operational lunar base by 2035, preceding human presence with robotic infrastructures. This project serves as an example for China's attempts in trying to counter US dominance in the Artemis program by proposing an alternative focused on the Global South. Additionally, China is still seeking to use its space station, Tiangong, as a diplomatic asset, preparing for partnered crewed missions with countries like Pakistan and Egypt. These movements show China's intent to alter the space governance and orbital norms into a non-Western, multipolar way.

- **Pakistan: Responsive Modernizer**

Unlike most nations, Pakistan has had a clear space trajectory in 2024 which marks its increasing reliance on Chinese technology and strategic partnerships in space. The country's major milestones in the past few years show a leap from being passive satellite consumers to engaging in symbolic and functional space projects.

In October 2023, Pakistan officially joined the ILRS, aligning itself with China's lunar ambitions. The subsequent operational launch of I Cube-Qamar, Pakistan's nanosatellite integrated with the Chang'e 6 mission, marked Pakistan's entry, albeit modestly, into the realm of deep space exploration. This gave the impression of Pakistan willing to take on the supporting role in China's space narrative. In comparison, the launch of Pak Sat MM1R on May 30, 2024, scheduled to begin commercial operations in September, appears to be a more substantive accomplishment. This satellite enhances the Pakistan geostationary communications satellite constellation and is an important addition to the nation's space assets in the ITU-governed orbital belt. While ostensibly civilian in nature, Pak Sat MM1R contributes to Pakistan's orbital presence in the politically sensitive region near Indian slots.

In the news, Pakistan is close to finalizing contracts to send the country's first astronaut to the Chinese space station, Tiangong, which deepens the integration with the Chinese space infrastructure. Pakistan, however, is still behind in the space race with no detailed space policy and lacking in domestically developed capabilities. As of now, the country is viewed to be strategically dependent on other countries under the guise of technological collaboration.

- **India: Easing Into Commercialization**

India's space policy for 2024 is more self-initiated and commercially motivated compared to its neighbors. India's participation in the Artemis Accords in June 2023 made her the 27th participant. This strengthens further alignment with the United States on space governance, norms of trust, and conflict-free operations. This is both ideological and practical for India since it provides access to Western technology and launch markets.

A focal point of Indo-American collaboration is the NISAR mission, an Earth observation satellite set for launch in 2024, along with a planned NASA-ISRO astronaut exchange mission to the ISS. These partnerships reflect India's deepening credibility as a space partner for Western democracies, and continue to pursue an independent development model through ISRO.

India's Space Policy 2023 focused on commercialization, along with satellite services and faster ITU filings to enhance global competition. The policy also enabled private sector participation, aiding the creation of startups like Sky root and Agnikul. Still, although India has achieved some milestones, such as the successful test of indigenous docking technology Spa DEX in December 2024, India lacks a clear orbital defense doctrine or formalized military space policy. This creates a strategic ambiguity, especially in contrast to China's dual-use action Blender and Pakistan's growing space activity. India's space policy illustrates a balancing act collaborating with the West, building indigenous capacity, and keeping defense-related applications low-profile, at least officially.

Under the ITU's Fixed-Satellite Service Plan guided by Appendix 30B satellite applications need to be really well-coordinated among any country whose orbit slots fall into "coordination arcs" that are usually plus or minus 6 degrees in the Ku-band (International Telecommunication Union [ITU], 2024). This rule helps interference to a minimum and makes sure all countries have a fair chance at the same orbital spots and frequency bands. Pakistan, which looks to Appendix 30B to orbit its PAKSAT satellites, has spent the last seven years sorting out the same old arguments with India. Those ongoing show us that what starts as a list of tech filings can quickly get wrapped up in regional politics.

The trouble kicked off in 2016–17. India's Department of Telecommunications (DoT) officially pushed back against Pakistan's new filings specifically the Appendix 30B Plan updates and a bunch of related Part I-S notices. India only raises these flags when it sees a filing it believes will mess with its already running or planned networks. By doing so, the DoT set up a legal roadblock in front of Pakistan, which meant the two countries had to chat and sort things out before Pakistan's application could get the ITU's stamp of approval (Department of Telecommunications [DoT], 2017). This is more than a technical spat; it's a clear spotlight on the ongoing India-Pakistan rivalry and how it extends into the ITU's decision-making rooms.

Another sticking point is that the two countries' orbital slots are tightly packed. India's advance publication notice sits at 41.8°E, which is only 3.6° away from Pakistan's main slot at 38.2°E for the PAKSAT-MM1 satellite. The Ku-band coordination arc stretches out ±6°, so both countries are right inside each other's radii. According to the rules, this closeness pushes both

governments to sort things out face-to-face, running interference calculations and possibly tweaking power settings (ITU, 2024). Since India and Pakistan's filings overlap so clearly, the coordination talks aren't a courtesy they're the law. The forced proximity shows how an already tense political climate gets even worse when empty space starts to fill up.

A new wrinkle appeared in 2023 after India switched on the INSAT-KUP-FSS setup at 48°E. Once the satellite went live, the ITU logged it in Part I-S/II-S, which automatically kicks off coordination steps under Appendix 30B. Pakistan's applications at 38.2°E are just 9.8° away, so the country must go through interference assessments. The ITU doesn't post detailed coordination sheets, but its guidelines are plain: Pakistan must be in the room when India conducts the analysis (ITU, 2023). These cases show how the ITU's seven-year filing rule and the Appendix 30B steps double as a technical cushion and a stage for geopolitics. India's lodged complaints, the 3.6-degree orbital squeeze, and the coordination rules for the INSAT-KUP and FSS make it clear: talks are not optional, they are built into the system. Off the record, our files say that whenever Pakistan's plans for satellites get serious, they can't move ahead on their own they bump into India's applications, its formal complaints, and the way its satellites are already set up to work. This pattern screams for Pakistan to get ahead of the curve with quiet, early talking, clear modeling of any possible radio signal trouble, and a regular seat at the ITU coordination meetings. That's how the country can stake its long-term claim to the orbital zone it wants.

Category	China	India	Pakistan
Governing Body	China National Space Administration (CNSA)	Indian Space Research Organization (ISRO)	Space & Upper Atmosphere Research Commission (SUPARCO)
Budget (2024)	$12 billion+	~$2 billion	~$65 million (approx.)
Launch Capability	Fully autonomous: Long March series	Fully autonomous: PSLV, GSLV, LVM3	No indigenous capability; relies on China
Satellite Fleet	500+ active satellites, including Beidou (GNSS)	~120+ satellites including IRNSS, RISAT, Carto Sat	~6–8 satellites, mainly Chinese-made
Recent Developments	Tiangong Space Station, Chang'e-6 (Moon), ILRS (Moon)	Chandrayaan-3 (Moon), Aditya-L1 (Sun), Gaganyaan (crew)	I Cube-Qamar (CubeSat, Chinese launch), PRSS-1, Pak Sat MM1R
International Collaborations	Belt & Road Space Cooperation (BRI), Russia (ILRS)	NASA, JAXA, CNES, EU	China (satellite tech, launch, ITU filings)
Policy Direction	Space dominance, dual-use tech, global space governance	Strategic autonomy, peaceful use, space tech for dev.	Symbolic prestige, limited tech goals, reliant diplomacy

Category	China	India	Pakistan
ITU Orbital Filing Capacity	High; controls orbital slots for itself and allies	Moderate; autonomous filings for NAVIC, communication	Minimal; depends on Chinese filings
Military Use of Space	ASAT test (2007), growing military-space integration	ASAT test (2019), missile tracking, military satellites	Limited; relies on China for surveillance/data support
Educational/Research Inst.	CAST, Harbin Institute of Technology, National Defense U	IIST, ISRO centers, DRDO, IITs	IST Karachi, SUPARCO Institutes, sparse R&D

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6) Space Vision 2040 and UN Guidelines Regarding Space Politics

The 21st century brought new ways of thinking about outer space as not only a place of scientific attention but also a new area for countries to compete against one another for power. Spacefaring capabilities advanced. Space became a heavily contest area vital for military structure, economic infrastructure, and even regional dominion. For its part, the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) tried to promote a more collaborative approach to space governance focused on debris mitigation, transparency, and peaceful utilization through its 2019 Long-Term Sustainability (LTS) Guidelines. Unfortunately, there is still a wide gap between national interpretations of space sustainability and development.

China plans to achieve and maintain dominance in space with its "Space Vision 2040" by utilizing infrastructure sharing, space diplomacy, and creating technology dependencies with other countries. India, with its 2023 Space Policy and alignment with the Artemis Accord, showcases a commercially integrated, rules-based approach that highlights responsible and self-driven innovation. Conversely, Pakistan, marked by its participation in China's ILRS and dependency on Chinese-built satellites, aligns itself as a supporting regional actor to China's multipolar vision. These converging and diverging strategic approaches suggest that by 2040, space may be controlled not by global agreement, but by competing techno-political associations. Without stronger enforcement tools, the lack of a binding UN agreement renders normative frameworks more prone to reinterpretation, manipulation, and geopolitical leverage.

- **UN Guidelines: Normative but Non-Binding Framework**

The United Nations' Guidelines for the Long-Term Sustainability (LTS) of Outer Space Activities, adopted by the Committee on the Peaceful Uses of Outer Space (COPUOS) in 2019, marks a milestone in fostering a mutual global framework around responsible action in space. Comprised of 21 voluntary best practice principles, the guidelines strive for cooperation, transparency, and prevention of debris in space. Guiding A.2 suggests the building of national regulatory frameworks for space activities, and Guiding B.1 suggests proactive sharing of

orbital data to avert in-orbit collisions and enhance situational awareness in space (UNOOSA 2024).

Implementation has been inconsistent, and these standards are still voluntary. Mostly developed spacefaring countries, including Japan, the U.S., Germany, and South Korea, have adopted the principles of the Long-Term Sustainability (LTS) guidelines into law. Only 23 states, including spacefaring countries, had adopted these principles by 2024. China supports sustainability rhetoric but continues to obscure dual-use military launch details. Pakistan has not published a debris mitigation framework or supplied unclassified orbital data due to reliance on Chinese aid. Partial adoption of the LTS by India has only been seen in ITU coordination and collision avoidance. India does not have overarching national laws that require compliance, which deepens global enforcement gaps. Responsible space governance these gaps impact are a long-term challenge.

7) China's 2040 Space Vision: Multipolarity and Hegemonic Leasing

As noted in China's 2021 White Paper and Space Vision 2040, China intends to be a center of attraction for developing countries with a Multipolar Space Vision. It includes the following projects: Construction of the International Lunar Research Station (ILRS) with Russia, Pakistan and Venezuela, set for completion by 2035. Auxiliary competitors of the United States GPS and EU's Galileo: Beidou Navigation Satellite System Activation (BDS) set for 2030. Construction of Solar Power Stations for use in space and robotic refueling satellites for use in space by 2040 to maintain upper hand in long term construction and infrastructure for space robotics.

As of 2024, China's operational satellites had reached over 620, placing them second to the United States (UCS Satellite Database, 2024). The 2021 collision risk with a SpaceX star-link satellite also showcased China's lack of orbital regulation and coordination. (ESA Conjunction Reports, 2022).

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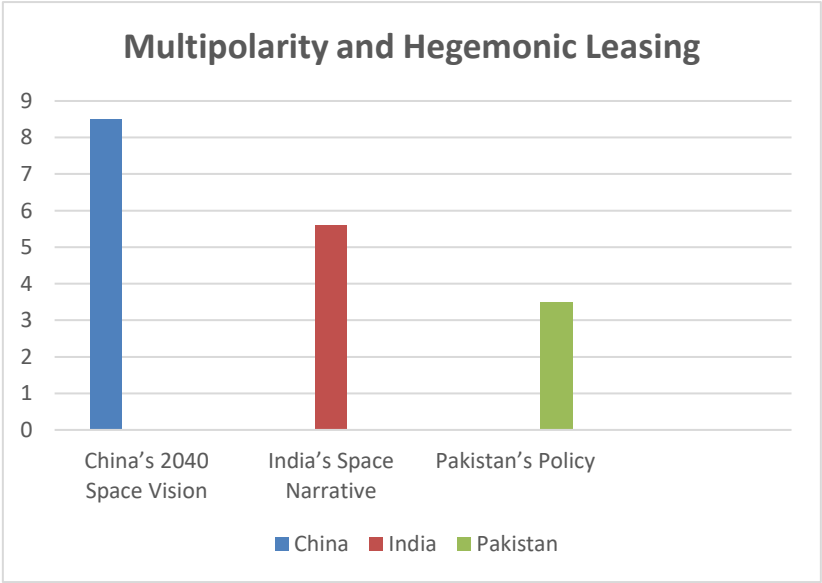

China's "orbital leasing" model which involves offering ITU filings and satellite leasing to allied nations serves a strategy. A good example is Pakistan's PakSat-MM1R which was launched in May 2024. It is claimed to be in Pakistan's owned-ship, however, it was fabricated,

launched, and is currently being controlled by Chinese agencies. This satellite is also positioned at 63°E to 66°E which is close to India's orbital belt. Hence, it is a satellite form of orbital capture which limits India's expansion (ITU Filing Records, 2024).

China is a party to many international agreements on space sustainability, however, has failed to incorporate UN LTS Guidelines into Chinese law. Supported in principle, the other side of the coin is the Chinese enacted suspension of space launch arms control that supports non-peaceful space activities through PLASSF, which is a concern for transparency and space arms race.

8) India's Space Narrative: Strategic Autonomy and Global Integration

With the 2023 Space Policy and the signing of Artemis Accords in the same year, India has demonstrated a focus on space governance for democracy, access to data and space, and advanced education and training. The Indian Space Research Organization (ISRO) through IN-SPACE is granting infrastructure access to the new space actors such as Sky root Aerospace and Agnikul Cosmos which allows for a balance between government control and private creativity.

India is one of the few Asian countries to actively adopt the UN Long Term Sustainability (LTS) Guidelines. In December of 2024, India's Spa DEX (Space Docking Experiment) mission performed robotic docking and debris-reduction technologies that fulfilled Guideline C.1 on servicing and debris mitigation (ISRO Annual Report, 2024). Moreover, India still upholds Guideline B.1 on orbital transparency, maintaining open-access satellite ephemeris data on Bhuvan, MOSDAC, and ISRO's Satellite Data Portal.

India's smartphone and satellite ecosystem is powered by over 130 operational satellites and growing international partnerships like the joint lunar missions with Japan's JAXA and the European Space Agency, as India is starting to embrace space as a new frontier of international relations. It also reinforces India's commitment to a space order based on international law. The Gaganyaan human spaceflight in 2025 and the Indian Chandrayaan-4 sample return mission in 2027 further underlines the autonomous and peaceful ambitions of India's space policy.

India does not follow China's practice of proxy satellite filings. India's ITU orbital slot management is open and undisputed as the country also publicly discloses frequency coordination conflict. This enhances India's reputation as a responsible space actor and creates a stark contrast with China's space leasing approach.

9) Pakistan's Policy: Alignment with China and Orbital Delegation

Pakistan does not have a standalone national space policy. Its space activities are directed by SUPARCO and historically aligned with China. In 2023, Pakistan officially aligned with China's move towards establishing an International Language and Research Center (ILRS) lunar base and subsequently relied on Chinese funding and expertise to expand its orbital footprint.

As of mid-2024, Pakistan was operating 6 satellites, 4 of which were Chinese including PakSat-MM1R, PRSS-1, and PakTES-1A. While these satellites are registered under Pakistan's name with the International Telecommunications Union (ITU), the China-based command and control systems dominantly employed in operations are aligned with China's broader "space debt diplomacy" strategy of assisting allies with occupying adversarial orbital slots to restrict movement and expansion (ITU Filing Database, 2024).

Pakistan's engagement with UN Long Term Sustainability Guidelines (UN LTS) remains shallow. Pakistan does not have an issued national framework on the mitigation of space debris, and does not possess a self-sufficient space situational awareness (SSA) system, let alone share orbital ephemeris data. In contrast with India, Pakistan does not grant public access to satellite telemetry data which makes assessing its space sustainability efforts impossible. Furthermore, Pakistan's ITU filings from 38°E to 65°E are in close proximity to Indian strategic geostationary satellites which is indicative of geopolitical rather than peaceful intentions.

In particular, Pakistan's lack of response to international calls for conjunction alerts regarding its satellites, as noted in the 2022 ESA report, raises concerns about the country's involvement in space traffic participation.

- **Geopolitical Consequences and UN LTS Division**

The gap between space policies of China, India, and Pakistan reflects stark space governance fragmentation. China's 2040 Vision articulates a goal of space-based influence as a techno-authoritarian leader with orbital leasing and infrastructure development. India's international relations are characterized as a liberal-internationalist approach, emphasizing rule-based multilateralism, transparency, and commercial capacity strengthening. Meanwhile, Pakistan acts like a junior partner to China's multipolar coalition, receiving orbital real estate in exchange for diplomatic alignment.

These differences have a direct impact on the UN LTS Framework. While India endorses guideline implementation and Artemis coordination, China and Pakistan choose to ignore these norms in favor of the ILRS and South-South cooperation models. The absence of binding obligations results in a situation in which the LTS Guidelines could be advanced in bad faith by powerful nations, turning them into strategic instruments.

The congestion of satellites over India's geostationary orbit—due to proxy spacecraft launched by Pakistan along with China and Pakistan's unclear management of orbital space traffic puts the UN's orbital traffic management efforts toward peaceful and sustainable governance in perpetual jeopardy. Without an international treaty, space verification policy, and enforcement system, the existing structure fosters discordance instead of cooperation in space governance.

10) Findings & Hypothesis Testing

This part looks at the main hypotheses of the study through the lenses of contract analysis for satellites, orbital filings, and policies. It investigates how China sponsoring Pakistan's space program is, in turn, transforming the dynamics of regional orbital access sovereignty and India's counter moves. Evidence overwhelmingly supports H1: China's strategic satellite loans to Pakistan are laced with clauses for dual-use control and strategic dual-use leverage. The 2024 PakSat-MM1R, which is to be launched with the support of China Great Wall Industry Corporation (CGWIC), is reported to carry dual-use communications and surveillance payloads accessible to both nations during strategic contingencies. The Stockholm International Peace Research Institute SIPRI (2024) and the Pakistan Telecommunication Authority PTA leaks suggest opaque clauses of "shared usage rights" and "emergency rerouting" which are akin to China's practiced embedding of military-grade systems in missiles disguised as civilian satellites for states like Nigeria and Venezuela (Zhao & Porras, 2023). Pakistan's dependence on Chinese TT&C infrastructure gives China latent operational control. H2 is also validated: ITU records show Pakistan's filings, which include PakSat-MM1R and PakSat-1C, are clustered with India's INSAT and GSAT positioned between 74°E and 84°E, several of which were filed through Chinese proxy. ITAR also associates transmission and reception points

(uplink/downlink) with interference and congestion in India's 77°E corridor crucial for secure communication.

Due to their lack of independent tracking, telemetry, and command (TT&C) infrastructure, Pakistan's filings seem more operational for the sake of operational filings serving as a facade to further China's proxy expansion strategy into the neighborhood of India's orbit space. Supporting to some extent H3, India's 2023 Space Policy Order favors more public-private satellite collaboration, sponsored development of satellite systems alongside NASA, ESA, and JAXA, and released Artemis Accords alignment. While these actions do bolster India's technological and diplomatic stance, the country's reactive approach to ITU filings puts them at risk, especially without a regional 'slot defense' coalition. No formal ITU objections have been filed contesting Pakistan's overlaps. India, however, has failed to rally a South Asian consortium for space governance. All things considered, China's strategic embedding is quietly enabling encroachment because Pakistan's space program is advancing, and India fails to provide doctrinal advances that need comprehensive multilateral collaboration to fully counter sovereignty challenges.

Conclusion

Analyzing China's satellite loan diplomacy with Pakistan reveals how it strategically seeks to further India's orbital footprint and indirectly undermines India's geostationary dominance. Using both Offensive Realism and Dependency Theory, it is clear China's diplomacy is more than passive technological cooperation. China's relations with Pakistan are those of a dependent proxy where Beijing acquires orbital slots through lease satellites, launch services, and ground control systems. China is able to expand its presence in space without significantly breaching international regulations. This approach enables China to apply soft orbital dominance on regional competitors like India while preserving the narrative of benign collaboration.

Pakistan's structural dependence on China has greatly impacted its strategic autonomy in space. China controls almost every facet of Pakistan's space program including satellite construction, telemetry, launching, and orbital filings. A prime example is PakSat-MM1R, which is positioned near India's GEO belt. The overlapping telemetry and clustered ITU filings demonstrate a form of disguised orbital colonization where China uses Pakistan's nominal autonomy to further its own strategic goals. Such orbital acquisition of real estate through loan contracts creates confusion regarding the regulatory jurisdiction and exposes the lack of governance and frameworks on an international scale. India is a technologically capable country and is emerging as an international leader in space forums like the Artemis Accords, but still lacks a coherent multilateral counterstrategy. Although there has been progress on the national policy front, and India is deepening ties with the U.S. and other space-faring democracies, India is still acting reactively instead of proactively. To defend its orbital space, India needs to quickly raise its filings with the ITU and more actively work toward creating a strategic "Quad-Space" alliance with the U.S, Japan, and Australia. The alliance would work together to protect orbital space, counter adverse filings, and uphold transparent governance.

Aside from the regional issues posed by the research, it also highlights the lack of sufficient governance regarding outer space which is a global concern that requires immediate attention. The current structure of the ITU does not have the capability to supervise and regulate the sources of funding, dual-used payloads, or the covert control of satellites. Without requirements and the ability for actors to be held accountable, systems can be engineered to serve national goals and manipulate collective sustainability in the orbits. For this reason, India and other affected countries need to push for governance under the ITU and UNCOPUOS to require

substantiated claims, verification of the documents submitted, and punitive actions for claims that are intentionally false.

This research in particular shows how space is being militarized indirectly and provides options for developing to protect orbital sovereignty and equitable governance around the globe.

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