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From development to exploration: BRICS as a global space power

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From development to exploration: BRICS as a global space power

About the Author: Jaíne Garcia, an associate researcher at the South American Institute of Politics and Strategy (ISAPE), brings a wealth of knowledge to this discussion. With a Master's degree in International Strategic Studies (PPGEEI/UFRGS) and a Bachelor's degree in International Relations (UniRitter), she is a seasoned researcher in the areas of International Security, Geopolitics, and Geostrategy. Her work focuses on the dynamics of spatial power in the Global South.

Abstract

This article examines the geopolitical and economic challenges faced by the BRICS countries (Brazil, Russia, India, China, South Africa, Egypt, Ethiopia, Indonesia, Iran, the United Arab Emirates, and Saudi Arabia) and their integration into the global space landscape. The bloc's expansion introduces new dynamics, combining established space powers with nations in the early stages of space development. The analysis identifies three key tension points: (a) intra-bloc geopolitical rivalries (such as Sino-Indian and Iran-Saudi disputes), which hinder trust-building for technology sharing; (b) technological and economic asymmetries exacerbated by the inclusion of members with disparate space capabilities; and (c) governance conflicts, where the lack of effective mechanisms to align national interests with collective goals threatens joint projects. Although the bloc has the resources to become a multipolar space hub (notably through the Chinese, Russian, and Indian space programs), the research reveals that expansion has intensified existing challenges. The militarisation of space (especially by Russia and China) and international sanctions against some members create additional barriers. The study concludes that successful cooperation would require: (a) flexible institutional frameworks to accommodate asymmetries; (b) targeted sectoral projects that avoid strategic disputes; and (c) shared funding mechanisms to mitigate domestic economic instabilities.

Keywords: BRICS. Space Cooperation. Technological Asymmetries.

1. Introduction

Space exploration, once the domain of traditional powers such as the United States of America (USA) and Russia (formerly the USSR), has evolved into a strategic arena for emerging nations to showcase their technological capabilities and geopolitical influence (Harding, 2013). In this context, the BRICS [1] —initially composed of Brazil, Russia, India, China, and South Africa, and recently expanded to include Egypt, Ethiopia, Indonesia, Iran, the United Arab Emirates, and Saudi Arabia—emerges as a potentially disruptive force in the global space landscape. This article explores the structural challenges these countries would face in their quest to form a cohesive bloc of space powers, specifically examining the geopolitical, economic, and technical barriers that could hinder such cooperation.

Three main factors justify the relevance of this analysis. First, the contemporary space sector is characterised by a transition to a multipolar model, where flexible alliances and international consortia have become essential for ambitious missions. Second, the BRICS countries collectively represent over 40% of the world's population and approximately 25% of global GDP, indicating a vast potential for collaboration in space technology that is yet to be fully realised. Finally, the bloc's recent expansion has introduced new actors with diverse capabilities and interests, creating both opportunities and additional challenges for strategic space integration (Liu & Papa, 2022).

The central problem of this study lies in the contradiction between the theoretical potential of BRICS as a space bloc and the numerous practical barriers to its realisation. While China and Russia have advanced space programs, including independent launch capabilities and interplanetary exploration, other members, such as Brazil and South Africa, have histories of intermittent space programs, often limited by budgetary constraints and competing priorities. The inclusion of new members such as the United Arab Emirates (with its ambitious space program) and Ethiopia (with nascent capabilities) amplifies these disparities.

Geopolitically, the article identifies three layers of challenges: (a) historical tensions between founding members (particularly the Sino-Indian rivalry); (b) conflicts between new members (such as the Iran-Saudi opposition); and (c) asymmetrical relations with traditional space powers. These factors create an environment of mutual distrust that hinders the sharing of sensitive technologies and the adoption of common positions in international forums.

Economically, the asymmetries are equally pronounced. While China and Russia invest billions annually in their space programs, other members struggle to maintain basic Earth observation projects. The lack of effective mechanisms for redistributing resources and costs could derail larger-scale joint initiatives. Furthermore, international sanctions against some members, such as Russia and Iran, impose additional barriers to access to critical components and financial markets (Pollpeter et al., 2023).

The article is organised into four main sections. First, it examines geopolitical challenges, including conflicts of interest and security issues. Next, it analyses economic barriers to cooperation. The third section addresses technical and legal obstacles. At the same time, the conclusion proposes viable ways to overcome these limitations and assesses the real potential of BRICS as a space bloc in the Third Space Age (2000-present) [2].

This analysis aims to contribute to the literature on international cooperation in space by providing a realistic assessment of the possibilities and limitations of alliances between emerging space powers. Unlike studies that focus solely on individual technical capabilities, this article aims to explore the political and economic dimensions, providing a more comprehensive perspective on the challenges of establishing an alternative space hub in the 21st century.

2. Geopolitical challenges in the formation of a BRICS space power bloc

The formation of a cohesive space bloc among BRICS countries faces profound geopolitical obstacles, reflecting the complex power dynamics and divergent national interests within the group. Historical tensions between key members create an environment of mutual distrust that hinders the sharing of sensitive technologies [3] and the adoption of common positions in international forums. Furthermore, contradictory strategic alignments with Western powers and competition for regional influence transform the space region into yet another arena of contention, rather than a venue for collaboration. These geopolitical factors, coupled with the lack of effective conflict mediation mechanisms within BRICS, represent structural barriers to the bloc's consolidation as a unified actor in the global space arena, calling into question the practical viability of this collective ambition (Seyedi Asl, 2025).

Laidi (2012, p. 615) analyses the bloc as being

> *[...] a heterogeneous coalition of often competing powers that share a common fundamental political objective: to erode Western hegemonic claims by protecting the principle which these claims are deemed to most threaten, namely the political sovereignty of states. The BRICS form a coalition of sovereign state defenders. While they do not seek to form an anti-Western political coalition based on a counter-proposal or radically different vision of the world, they are concerned with maintaining their independence of judgment and national action in a world that is increasingly economically and socially interdependent. They consider that state sovereignty trumps all, including, of course, the political nature of its underpinning regimes. Thus, the BRICS [...] fundamentally diverge from the liberal vision of Western countries.*

Abdenur (2017) raises an interesting debate about whether BRICS can cooperate in the field of international security. Sino-Indian tensions represent one of the main obstacles to space integration within the BRICS. The territorial dispute in the Ladakh [4] region, coupled with growing strategic rivalry in Asia, has led both countries to adopt attitudes of mutual distrust in sensitive technological areas (Papa & Verma, 2021). This dynamic is evident in the space sector: while China has an advanced and closed space program, India has preferred partnerships with Western powers—such as the agreement with NASA for lunar exploration—rather than deeper collaborations within the bloc. This division significantly limits the potential for technological synergies that could benefit other BRICS members with fewer autonomous space capabilities (Moltz, 2011; Khan, 2017).

The expansion of BRICS has introduced new geopolitical fissures that further complicate space cooperation, as illustrated in Table 1. The historic rivalry between Iran and Saudi Arabia, now both members of the bloc, creates a particularly challenging scenario. While Saudi Arabia has invested heavily in space partnerships with the US and China through the Saudi Space Commission, Iran maintains a highly militarised space program focused on developing long-range rockets, a concern among other members. This divergence of objectives and external alliances makes the creation of joint space projects involving these two key Middle Eastern actors virtually unfeasible in the short term (Hanna, 2024; Curran, 2025).

Table 1 - Geopolitical Challenges in the Formation of BRICS Space Powers Bloc

Category	Specific Challenge	Concrete Examples	Impact on Space Cooperation	Possible Solutions
Bilateral Conflicts	Sino-Indian Tensions	1) Ladakh border disputes; 2) Indian Ocean rivalry	1) Restriction on technology sharing 2) Lack of joint projects	Creation of technical working groups without military ties
	Iran and Saudi Arabia's Rivalry	1) Disputes for influence in the Arab World; 2) Space programs with distinct military purposes	1) Difficulty in aligning civil objectives; 2) Distrust of multilateral initiatives	Focus on civil applications (such as weather satellites, for example)
External Alignments	Partnerships with Western powers	1) Brazil/USA (Artemis Agreement) 2) UAE/USA (Lunar Agreement)	1) Fragmentation of loyalties 2) External technological dependence	Establishment of BRICS' technological standards
	International sanctions	1) Sanctions on Russia 2) Sanctions on Iran	1) Restrictions on access to critical components 2) Isolation of bloc members	Internal BRICS supply chains
Leadership Disputes	Chinese hegemony versus multipolarity	1) Belt and Road Initiative in space 2) Competition for global launch sites	1) Resistance from other members to Chinese-led projects 2) Duplication of efforts	Rotating governance model for projects
Space Security	Militarisation of space	1) China's anti-satellite program 2) Russian spy satellites	1) Distrust of civil cooperation 2) Risk of proliferation of space weapons	Intra-BRICS agreement for the peaceful use of outer space region
BRICS Expansion	Heterogeneity of new members	1) UAE and its consolidated space program 2) Ethiopia and its nascent capacity	1) Difficulty in establishing common priorities 2) Asymmetry of contributions	Technical training mechanisms for smaller members

Source: Elaborated by the author based on Papa and Verma, 2021; Upadhyay, 2023; Gadisa, 2023; Vidal & Privalov, 2024; Ullah et al., 2024.

Each challenge detailed in the table above directly impacts space cooperation, from project fragmentation to dependence on external powers. While the “possible solutions” suggest practical paths, such as the creation of proprietary technological standards or agreements for the peaceful use of the space region. For instance, the signing of the “Cooperation Agreement for the Remote Sensing Satellite Constellation” in August 2021 involved the use of existing satellites, including CBERS-4, Kanopus-V, Resourcesat-2 and 2A, as well as GF-6 and ZY-3/02, for data sharing (AEB, 2021).

Furthermore, China and Russia dominate the bloc's space launches, while India maintains close ties with the US, highlighting internal fissures. The accumulation of these intra-bloc tensions has a paralysing effect on the ambition to form a cohesive space alliance. The lack of trust between members impedes the creation of robust mechanisms for technology sharing, while rival alliances with external powers further fragment the possibilities for coordination. As a result, even though some BRICS countries (such as China and Russia) have complementary space capabilities, geopolitical rivalries transform the theoretical potential for cooperation into nearly insurmountable practical challenges—a paradox that the bloc will need to resolve if it wants to become a global space hub (Glosny, 2010; Moltz, 2011).

Table 2 – BRICS Satellite Asset Launches (2009-2024)

Countries	Total Launches *	Civil Satellites	Military Satellites
South Africa	10	90%	10%
Saudi Arabia	15	50%	50%
Brazil	15	85%	15%
China	906	50%	50%
Egypt	12	60%	40%
United Arab Emirates	30	75%	25%
Ethiopia	2	100%	0%
India	194	70%	30%
Iran	8	80%	20%
Indonesia	20	20%	80%
Russia	1.559	40%	60%

*Total launch values are approximated due to limitations in satellite classifications (civil/military), discrepancies between sources and launches not officially declared.

Source: Elaborated by the author based on Egito, 2019; UCS, 2024; Saudipedia, 2025; Space in Africa, 2025.

The growing militarisation of space by BRICS members has become another key obstacle to space cooperation within the bloc. Dual-use civil-military programs, as seen in Table 2, generate distrust among other members, who fear the transfer of sensitive technologies for military applications. This distrust is exacerbated by incidents such as India's 2019 anti-satellite test (Mission Shakti), which led China to accuse New Delhi of militarising space, creating a cycle of mutual distrust that even contaminates civilian projects (DRDO, 2023; Swope, 2024).

The lack of transparency regarding the military objectives of national space programs hinders the creation of joint verification mechanisms within the BRICS. While China classifies much of its space activities as state secrets, Russia has leveraged its rocket expertise to develop hypersonic weapons [5], such as the Avangard system. This capability makes countries like South Africa and the new members reluctant to share data or participate in initiatives that could inadvertently strengthen the military capabilities of other BRICS members. The result is a paralysis in advanced technical cooperation, limited to superficial or low-risk projects (CSIS, 2024a; Ping & Elishav, 2024; Curran, 2025).

The solution to this impasse would require the creation of a specific regulatory framework within BRICS to decouple civilian projects from military applications, inspired by the United Nations Outer Space Treaty (UST) but adapted to the bloc's specificities. One concrete proposal would be to establish military exclusion zones for multilateral projects—such as climate observation or scientific communication satellites—with independent verification mechanisms in place. However, the political viability of this approach is questionable, given that China, Russia, India, Indonesia, Iran, Egypt, Saudi Arabia, and the United Arab Emirates view outer space as a strategic and military domain essential to their national security (Johnson-Freese & Burbach, 2019; Delgado López, 2023).

However, different levels of intensity can be observed among these eight BRICS states regarding the issue of space militarisation, namely: (a) ***high intensity*** among countries that possess anti-satellite weapons and offensive capabilities to deny, degrade, or destroy adversaries' satellite assets. China, Russia, and Iran fall into this category; (b) ***medium intensity*** in the militarisation of outer space would be represented by countries that develop their space programs with a defensive focus and dual-use applications, and do not possess offensive doctrines or advanced ASAT weapons. India, Indonesia, Egypt, Saudi Arabia, and the United Arab Emirates fall into this category, and (c) ***emerging intensity*** [6] would be those that use their space assets primarily for civilian applications but may be adapted for security purposes in the future. Brazil, South Africa, and Ethiopia fall into this category.

As long as this tension between national interests and collaboration persists, the potential of BRICS as a space bloc will remain limited by mutual suspicion. The absence of a specific BRICS treaty regulating the peaceful use of outer space represents a critical gap in the bloc's space governance. While the 1967 TSE establishes general principles, its application is generic and lacks oversight mechanisms appropriate to the realities of emerging countries (Johnson-Freese & Burbach, 2019; Kim, 2021). In the context of BRICS, this lack of specific regulations allows for divergent interpretations of what constitutes "peaceful use" of the space region, especially considering that members such as China, Iran, and Russia develop dual-use technologies without sufficient transparency, represented respectively by the Yaogan, Noor, and Kosmos satellites. This legal ambiguity inhibits cooperation on sensitive projects, as other members of the bloc may fear that their technological contributions could be diverted to undeclared military applications (Arms Control Association, 2020; Swope, 2024; Jones, 2025).

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The consequences of this regulatory gap are particularly evident in areas such as lunar exploration and orbital spectrum management. While China is moving forward with its International Lunar Space Station (ILRS), inviting some BRICS members to participate, other BRICS countries are questioning whether the project will have exclusively scientific purposes or whether it will also serve as a testbed for military technologies in deep space (Wu, 2023). Similarly, competition for strategic orbital positions and satellite frequencies could generate friction. A BRICS treaty could establish clear rules for these scenarios, including dispute arbitration mechanisms and principles to prevent the militarisation of shared orbits (Klein, 2019).

The creation of a common treaty would require overcoming deep disagreements over sovereignty and national security among the bloc's members. While Brazil and South Africa advocate a multilateral approach inspired by the European model (such as the European Space Agency, ESA), China and Russia prioritise flexible bilateral agreements that preserve their strategic autonomy. A viable solution could be the adoption of a BRICS "Minimum Treaty," initially focusing on areas of consensus such as: (a) a ban on anti-satellite tests that generate space debris; (b) mandatory sharing of data on orbital traffic; and (c) the creation of a permanent forum to resolve technical disputes. Despite the challenges, the current expansion of BRICS offers a window of opportunity to renegotiate these norms, transforming the bloc into a relevant player in international space governance (D'Auria, 2025).

Regarding international sanctions against Russia and Iran, they significantly impact BRICS space projects by restricting access to critical components and external financing, creating a paradoxical intra-bloc dependence. Russia, historically a supplier of launchers such as the Soyuz, faces difficulties producing satellites and rockets due to the embargo on Western semiconductors, which is also affecting the Chinese-Russian International Lunar Research Station (ILRS) program, already experiencing

delays. Iran, for its part, has seen its observation satellite program (such as Khayyam, developed with Russia) hampered by sanctions on composite materials (Shora-GC, 2022; Megaproject, 2025). These restrictions force BRICS to seek alternative supply chains—such as replacing European components with Chinese ones in the CBERS satellite—but reveal structural limitations: China still lacks mastery of technologies like high-performance chips, while India and Brazil are hesitant to risk violating Western sanctions in joint projects. This dynamic fragments cooperation, relegating it to specific initiatives with low technological risk, instead of consolidating an autonomous space ecosystem (CSIS, 2024b).

3. Economic barriers to the creation of a BRICS space bloc

Despite the strategic potential of BRICS as a bloc, economic asymmetries among its members pose a structural obstacle to practical cooperation. While China and Russia invest billions of dollars annually in their space programs, other countries in the group, such as South Africa and Ethiopia, allocate limited resources to the sector, often insufficient to maintain basic infrastructure (Space in Africa, 2024; Iderawumi, 2025). This inequality compromises the ability to establish sustainable joint projects, as countries with limited financial capacity struggle to meet the contributions required for long-term missions or cutting-edge technologies. Furthermore, the lack of a collective financing mechanism—such as a common space fund—increases dependence on bilateral investments or external partnerships, undermining the bloc's autonomy.

Another critical factor is the economic instability affecting some members, such as the prolonged recession in post-sanctions Russia and recurring fiscal crises in Brazil. These weaknesses limit long-term commitment to space programs, as governments tend to prioritise urgent domestic demands over space projects, which are seen as less immediate (Grunert, 2022; Cepik et al., 2023; Luzin, 2024). The lack of a coordinated economic policy for the space sector within the BRICS results in discontinuous investment cycles, making strategic plans that require decades to mature, such as interplanetary missions or integrated satellite constellations, unfeasible.

The vast difference in the space budgets of the BRICS countries is one of the biggest obstacles to cooperation. In 2023, China invested approximately US$14 billion in its space program, a figure comparable to that of NASA, while India allocated almost US$2 billion, which is ten times the combined budget of Brazil, South Africa, and Egypt (Statista, 2025). This disparity creates a natural imbalance in project leadership, with countries with less financial capacity being relegated to secondary roles, such as suppliers of minor components or users of satellite data, without a real ability to influence strategic decisions. The case of the CBERS (Sino-Brazilian Earth Resources Satellite) satellite illustrates this challenge well, despite its technical success; Brazil's dependence on Chinese funding limited its participation in critical development stages (Silva & Benvenuto, 2022).

Furthermore, the new BRICS members exacerbate this contrast. The United Arab Emirates, for example, is investing heavily in its space program, with an expenditure exceeding US$6 billion in 2023, while Ethiopia has invested approximately US$11 million. The amounts allocated to Egypt's space program are not publicly available (Fast Company ME, 2023; Nyangi, 2025). Without mechanisms for redistributing resources—such as a differentiated quota system or crowdfunding for technological development—the bloc risks fragmenting into subgroups with incompatible interests. While China and Russia focus on lunar exploration and manned missions, other members require more immediate solutions, such as satellites for agricultural purposes or climate monitoring, which hinders the convergence of priorities.

The creation of a common space fund within the BRICS faces structural challenges, such as the lack of equitable mechanisms for financial contributions and mistrust regarding shared resource management. While

China and the United Arab Emirates can contribute significantly, countries like South Africa and Ethiopia face chronic budget constraints, making a model of equal contributions unfeasible (D'Auria, 2025). Alternative proposals—such as contributions proportional to GDP or technology compensation systems—face political resistance, as members with greater financial capacity are reluctant to fund projects without guaranteed strategic returns. Furthermore, the lack of transparent governance for resource allocation—as occurs at the European Space Agency, for example —fuels fears that funds will be diverted to specific national interests rather than collective priorities (ESA, 2025).

The experience of the BRICS New Development Bank (NDB), created in 2015 to finance infrastructure, reveals limitations, and attempts to replicate this model for the space sector would face additional obstacles, such as the difficulty of defining success metrics for high-risk technological investments and the conflict between short financial return periods (demanded by some members) and the long cycles typical of space programs (Ayres & Caram, 2025). Without overcoming these barriers, the bloc will continue to rely on occasional bilateral financing, which does not guarantee the continuity of ambitious multilateral projects.

The economic asymmetries within the BRICS are reflected in radically different space priorities. While Russia and Brazil face recessions and budget cuts, in 2023, the Brazilian space program was reduced by approximately 40%. China and the United Arab Emirates are increasing investments in lunar missions and high-tech satellites (Cepik et al., 2023; Jones, 2023). This discrepancy creates a strategic mismatch, as for countries in crisis, such as South Africa, space projects are often considered "luxury items" in the face of urgent social demands, including food security and public health. In Saudi Arabia and the UAE, space is seen as a central vector for economic diversification, with aggressive technological industrialisation goals.

The Russian case is even more emblematic: under sanctions, the country redirected its space budget to maintaining military systems, abandoning multilateral scientific projects (Luzin, 2024). Without policies to harmonise these priorities (such as sectoral funds for developing members or flexibility clauses in crises), the bloc tends to perpetuate superficial space cooperation, restricted to areas where national interests do not directly conflict.

Despite advances in their space programs, several BRICS members still face critical dependence on foreign components, especially in strategic sectors such as propulsion, advanced electronics, and navigation systems. India, for example, despite having successfully developed its launcher program (such as the GSLV), remains dependent on European and American chips and sensors for high-precision satellites, despite investing heavily in its domestic industry in recent years to gradually reduce this dependence (Analytics India Mag, 2025).

Brazil faces even greater challenges. The satellite program of INPE (National Institute for Space Research) has suffered recurring delays due to trade sanctions that have limited access to essential components. This vulnerability became especially evident after the signing of the Technological Safeguards Agreement (TSA) [7] in 2019 with the United States, as Bojikian et al. (2022, p. 11, own translation) note:

[...] the AST signed and ratified by the Brazilian government can be interpreted as an instrument with a dual objective: a) significantly increasing the protection of those items classified as sensitive technologies – precisely those that provide the US with relevant advantages in the military or intelligence sphere – when they are located outside its territory; b) increasing the competitiveness of the US industrial base through barriers erected in other countries against external competitors.

This dependence not only increases project costs and deadlines but also creates a paradox, with countries seeking strategic autonomy within the BRICS remaining tied to supply chains controlled by Western powers. The situation worsens when we consider the bloc's new members. Egypt and Ethiopia, for example, acquired their Earth observation satellites from foreign suppliers—such as China—but without any real technology transfer (Adegoke & Adegoke, 2022; Xinhua, 2023).

Even Russia, historically self-sufficient in launchers, began to face difficulties after the 2022 sanctions, which cut off its access to critical electronic components for modernising its Soyuz rocket fleet (Luzin, 2024). This asymmetric dependence within the BRICS itself—where only China has nearly complete space supply chains—undermines the bloc's proposed collective autonomy. Until they develop integrated industrial capabilities (such as a pan-BRICS semiconductor supply chain or a joint import substitution program), members will remain vulnerable to external geopolitical pressures, compromising the sustainability of any joint space project.

4. Technical, legal and competitive challenges in the space sector

In addition to geopolitical and economic barriers, BRICS faces technical and structural obstacles that hinder the integration of their space programs. This section briefly examines how technological disparities, legal fragmentation, and competition for orbital resources create additional challenges to the formation of a cohesive space bloc, thereby limiting the potential for collaboration even in areas where common interests exist.

Technological asymmetries among BRICS members are evident when analysing access to launch systems. While China, Russia, and India have their rocket programs with proven capabilities (such as the Long March, Soyuz, and GSLV launchers), other members rely entirely on foreign services. Brazil, after decades of failed attempts with the VLS-1, still lacks an operational launch vehicle. In contrast, South Africa launched the Aerospace Systems Research Institute (ASRI) in 2024, aiming to bridge the gap in the country's space sector. This inequality forces the bloc's less developed countries to pay third parties for launch services—often the BRICS powers themselves, creating an asymmetrical relationship within the group (Cepik et al., 2023; Nyangi, 2024).

In the satellite field, the differences are equally striking. China operates more than 400 active satellites, including advanced Earth observation (Gaofen) and navigation (BeiDou) systems, while Russia maintains a robust military and civilian constellation (GLONASS). In contrast, countries like Egypt and Ethiopia have only one or two basic satellites, acquired from foreign suppliers, without mastery of the underlying technology. This disparity drastically limits the interoperability of systems—a high-resolution Chinese satellite, for example, was not designed to communicate with South African ground stations, making real-time data-sharing projects unfeasible (Dixon-Luinenburg, 2025; N2YO, 2025).

Monitoring and control systems illustrate another technological divide. China has a global network of ground stations and command centres, including facilities in South America and Africa. At the same time, India has invested in autonomous tracking systems to support its lunar missions, such as the Navigation with Indian Constellation (NavIC) and Geosynchronous Satellite Launch Vehicle (GSLV) projects (Funaiole et al., 2022; IBEF, 2025). However, most other BRICS members rely partially or entirely on infrastructure controlled by Western powers—Brazil, for example, uses NASA stations to supplement its limited tracking system. This dependence undermines the bloc's proposed strategic autonomy, as even joint projects would require external infrastructure for critical operations, creating operational and security vulnerabilities.

The lack of harmonisation of space legislation among BRICS countries poses a significant obstacle to practical cooperation in the sector. Each member of the bloc has its legal framework for regulating space activities, often with contradictory approaches to critical issues such as liability for damages, intellectual property, and technology transfer. This fragmentation creates legal uncertainty for joint projects, especially when they involve the transfer of sensitive technology between members with incompatible regulatory systems. The lack of a unified BRICS space treaty—establishing common standards for licensing, civil liability, and data protection—forces participants to resort to homegrown bilateral arrangements, limiting the scope and ambition of collaborations (D'Auria, 2025).

Competition for strategic orbital resources poses a critical challenge to the bloc's cohesion. Geostationary orbits (GEO) and satellite frequencies are limited resources managed by the International Telecommunication Union (ITU), and BRICS members often compete directly for these assets. The situation becomes even more complex with the entry of new members with space aspirations. The use of Ka-band [8] frequencies could become a field of contention among BRICS space powers, especially those that already occupy strategic GEO positions for their communications satellites.

To overcome these challenges, BRICS would need to establish an internal coordination mechanism for orbital positioning and frequency registration, possibly through a shared resource tool. One concrete proposal would be to create a BRICS technical council for joint orbital planning, which could negotiate as a bloc within the ITU, increasing collective bargaining power. However, implementing such a system would be hampered by members' reluctance to relinquish control over national strategic assets. As long as these differences persist, competition for orbital resources will continue to be a divisive factor, undermining the BRICS' ability to act as a unified space hub in global space governance.

Legal harmonisation and cooperation on orbital resources, therefore, represent two sides of the same coin – without progress in these areas, the bloc's space integration will remain limited to low-impact, symbolic projects.

The lack of technical standardisation among the BRICS countries' space programs poses a significant practical obstacle to the integration of systems developed separately. Each member of the bloc adopts distinct protocols, interfaces, and technical specifications in its space projects, resulting in incompatibilities that hinder joint operations. For example, Chinese communication satellites use signal transmission and modulation systems that differ from those adopted by India. At the same time, Russian launch vehicles employ coupling technologies that are incompatible with Brazilian modules. This diversity of technical standards requires costly adaptations and customised solutions for each collaborative project, as was the case with the CBERS (China-Brazil) satellite, where it was necessary to develop special interfaces to connect separately developed components (Silva & Benvenuto, 2022). The lack of a common technical body within the BRICS to establish unified standards perpetuates this fragmentation, limiting the interoperability essential for integrated space missions.

Beyond the technological challenges, this divergence in standards reflects more profound differences in each country's engineering cultures and strategic priorities. While China and Russia prioritise closed, autonomous systems for national security reasons, India has sought greater compatibility with Western standards to facilitate international partnerships. This disparity in approaches complicates even the integration of seemingly simple systems, such as ground tracking stations or data-sharing networks. The case of China's Beidou navigation system, which was not designed to interoperate directly with Russia's GLONASS or India's IRNSS, illustrates how a lack of prior technical coordination can limit the potential for synergy even among members of the same bloc.

Without a concerted effort to develop common standards or at least standardised interfaces, the BRICS will continue to face technical barriers that neutralise some of the potential of their space cooperation, keeping national programs essentially separate despite the rhetoric of integration.

5. Final considerations

Throughout this article, it has been highlighted that the formation of a cohesive BRICS space bloc faces multidimensional obstacles. Geopolitical divergences, such as Sino-Indian tensions and rivalries between new members, create an environment of distrust that hinders the sharing of sensitive technologies. Economic asymmetries, in turn, limit the capacity for joint investments, with countries like China and Russia concentrating the majority of resources, while other members struggle to maintain basic space programs. At the technical and legal level, the lack of common standards, regulatory fragmentation, and competition for orbital resources reveal how national interests often override collective ambitions.

These limitations should not, however, obscure the possibilities for cooperation in specific areas. The success of particular projects, such as the Sino-Brazilian CBERS program or South Africa's participation in Earth observation initiatives, demonstrates that there is room for sectoral collaboration, even without deep integration. The expansion of BRICS, with the entry of countries such as the United Arab Emirates and Egypt, could bring new resources and complementary capabilities, provided that flexible mechanisms are created to accommodate different levels of technological development. The BRICS New Development Bank could finance technical capacity-building projects to reduce disparities between members.

The trade-offs required to advance this agenda are significant. Countries with greater space capabilities, such as China and Russia, would need to relinquish some of their strategic autonomy in favour of common technical and regulatory standards (Abdenur, 2017). Members with fewer resources, on the other hand, would have to accept collective governance that prioritises long-term objectives over immediate demands. The creation of a permanent forum to resolve technical disputes and allocate space resources would be an essential step, as would the adoption of a "minimum treaty" on the peaceful use of space, which would allow progress even without consensus on more sensitive issues, such as militarisation.

Prospects for BRICS as a global space actor depend on the bloc's ability to transform its diversity into a strategic advantage. The combination of natural resources—such as launch bases in Brazil and South Africa—, technological capabilities—such as those of China and Russia—, and complementary demands—climate observation, digital connectivity—could, in theory, sustain an alternative space hub. However, this would require overcoming the current fragmentation through concrete projects that generate mutual trust, such as a satellite constellation for environmental monitoring or a shared secure communications system.

Ultimately, BRICS faces a dilemma: it can continue as a collection of disconnected, occasionally collaborative, space programs, or it can take the political risk of deeper integration that redefines its role in the global space landscape. The choice will depend not only on strategic calculations but also on the ability to transform rhetoric into concrete institutions. While the first option maintains the status quo, the second could position the bloc as an indispensable player in space governance in the 21st century, provided its members are willing to pay the price of genuine cooperation.

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Noutes of the author

1. It is not the intention of this research to delve into the historical evolution of BRICS; for this purpose, we recommend reading Stuenkel, 2020.
2. For this research, the Third Space Age is understood to describe a historical phase of post-Cold War transition with a plurality of actors. Within this phase, the term “New Space” emerges, focusing on commercial revolution and technological disruption. Both coexist, but with distinct logics. While one is broader and deals with the geopolitical and technological apparatus, the other is more specific, focusing on the market and innovation. For more details on New Space, we recommend reading Paikowsky (2017).
3. Sensitive space-application technologies are systems, components, or advanced knowledge with the potential for dual use (civil and military) or that have high strategic value, potentially conferring technological, economic, or security advantages to a state. These technologies are controlled through export regimes. Some examples of this type of technology include advanced rocket propulsion, satellite navigation systems, high-resolution sensors and imaging, and mining technologies. Given their strategic value, controlling these technologies means controlling access to the space region, influencing allies, and limiting adversaries.
4. The Ladakh region is divided administratively as follows: Pakistan controls the northwestern portion, integrated into the Gilgit-Baltistan region; India administers the southeast as a union territory since 2019, when it ceased to be part of the state of Jammu and Kashmir; and China occupies the areas in northeastern Ladakh (Britannica, 2025).

5. Hypersonic weapons are missiles that fly above Mach 5, averaging 6,174 km/h (3,800 mph), and can maneuver en route, making them difficult to intercept. Unlike ballistic missiles—which follow a predictable parabolic trajectory and are detectable in space—hypersonic weapons operate at lower altitudes, within the atmosphere, combining extreme speed with adjustable trajectories. This capability makes them more versatile for precision strikes and less vulnerable to traditional missile defense systems. In short, while ballistic missiles are effective against fixed targets, hypersonics are designed to strike moving or heavily defended targets with shorter warning times (Arms Control Association, 2023).

6. This article does not intend to delve into this issue; however, it should be noted that this classification presents distinct nuances due to certain interrelated factors, such as distinct space technology matrices, specific national priorities, and varying levels of institutional transparency. Furthermore, among these states, the one most likely to increase in intensity would be Brazil due to pressures involving the Amazon and the SGDC-1 communications satellite, given that the Brazilian armed forces use the X-band (AEB, 2020).

7. The AST governs the use of the Alcântara Launch Center (CLA) and is directly linked to the restrictions of the International Traffic in Arms Regulations (ITAR). This agreement limits the transfer of sensitive US technologies to Brasília, especially in areas such as satellite propulsion and control, creating a barrier to Brazil's full space autonomy (Bojikian et al., 2022).

8. It is understood that the bands “receive letter designations based on their frequency ranges. Applications for data transmission at different frequencies can be determined by cross-referencing the letter designations of the Institute of Electrical and Electronics Engineers (IEEE) with the use cases described by the International Telecommunication Union (ITU).” (Funaiole et al., 2022, § 71).

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