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ABSTRACT

As an emerging space power, how is South Korea engaging with the regional institutional architecture of outer space cooperation in the Indo-Pacific region? This article argues that South Korea's institutional strategies have been influenced by economic opportunities, security interests, and institutional characteristics. Due to these factors, South Korea has focused its engagement on the Japan-led Asia-Pacific Regional Space Agency Forum (APRSAF), and it is considering new opportunities in minilateral dialogs with the US and its allies and partners. In contrast, South Korea has not joined the China-led Asia-Pacific Space Cooperation Organization (APSCO), and it has shown limited or no interest in two other regional space science and technology education institutions led by India and China respectively.

Introduction

South Korea's outer space program has developed considerably since it launched its first satellite in 1992, and its rise as a pivotal new space player in the Asian region has accelerated in recent years.[1] South Korea is one of six countries that can independently launch into high orbits, and it is currently aiming to develop its own positioning, navigation, and timing satellite constellation, which would become only the seventh such system in the world if successful.[2] In 2022, South Korea launched a satellite into orbit using its own rocket for the first time, and it launched its first lunar mission. In 2023 alone, the South Korean space budget expanded by 19.5%, as the government announced that it intended to spend a record $674 million to expand its domestic space industry, develop a next generation launch vehicle, and strengthen its space defense capabilities.[3] Its long-term goals include landing an indigenously developed spacecraft on the moon in 2032 and on Mars in 2045.[4] In 2024, South Korea officially established its space agency, the Korea AeroSpace Administration (KASA), to lead policy and industrial development in its aerospace sector.

This significant expansion of South Korea's space program presents opportunities for the government to enhance its space diplomacy, including its engagement with Asian regional institutions. How is South Korea engaging with the regional institutional architecture of outer space cooperation in the Indo-Pacific? What factors shape South Korea's evolving institutional strategies? Drawing on government documents, institutional records, media reports, and other materials, this article argues that South Korea's institutional strategies have been influenced by factors related to economic opportunities, security interests, and institutional characteristics. As South Korea considers its institutional options for space diplomacy, it must navigate an institutional landscape that has been defined by competitive dynamics among the region's established space powers: China, Japan, India, and the US. The article finds that due to a favorable mix of security, economic, and institutional factors, South Korea has chosen to focus most of its institutional engagement on the Japan-led Asia-Pacific Regional

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Space Agency Forum (APRSAF), and it has sought new opportunities in evolving minilateral dialogs on space that may help facilitate commercial prospects by leveraging connections with the US and its allies and partners. In contrast, South Korea has not pursued cooperation with the China-led Asia-Pacific Space Cooperation Organization (APSCO) due to limited economic benefits, constraining institutional characteristics, and security concerns. South Korea has also shown limited or no interest in the India-led Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) and the China-led Regional Centre for Space Science and Technology Education in Asia and the Pacific (RCSSTEAP) – two regional institutions focused on space education – because they do not align well with these three factors.

This article contributes to the existing literature in several ways. First, it shifts the focus from regional leadership contests between major powers (i.e., the supply side of institutions) to how emerging powers choose among existing institutions (i.e., the demand side of institutions). This enables theory building about how competition among "institution makers" shapes the strategic environment in which "institution takers" try to achieve their goals and exercise their own agency. Second, it introduces new analysis of South Korean diplomacy to a conversation about regional institutional competition that has largely focused on Japan and China. Given South Korea's rise as a space power, it is a fruitful exploratory case study to examine how emerging powers navigate institutional decisions and how space diplomacy fits into broader national strategies. South Korea's expanding "middle power diplomacy" has been examined in areas such as trade, finance, economic governance, development assistance, disaster response, human security, and environmental security.[5] This article extends this line of inquiry to evaluate South Korea's engagement in outer space policy, which is still at a relatively nascent stage. Third, this article expands the discussion of Asian regional space institutions beyond APRSAF and APSCO to include new analysis of institutions that have received less attention, such as CSSTEAP, RCSSTEAP, and emerging minilateral institutions. These additions help to more fully characterize and contextualize the institutional complexity of regional space cooperation.

The article begins by discussing the institutional options for outer space cooperation that currently exist in the Indo-Pacific region and providing context for South Korea's space diplomacy.[6] It then evaluates how economic, security, and institutional factors have shaped South Korea's involvement in regional space institutions to date. The article concludes by discussing how the region's changing geopolitical dynamics may impact South Korea's regional institutional strategies as it continues to become a more prominent actor in space in the future.

Existing Institutional Options for Asian Regional Space Cooperation

Many observers have claimed that the world is entering a "new space race." In contrast to the era of space competition between the US and the Soviet Union during the Cold War, this new space race is occurring in an environment of US-China rivalry and characterized by militarization, commercialization, and an increase in the number of actors active in the domain.[7] As a result, outer space has become commonly described as "congested, competitive, and contested."[8] Countries across the Asia-Pacific region have been part of this trend toward rivalry, pursuing outer space capabilities for the sake of technological ascendancy, political prestige, and security advantages.[9] In this environment of competition in space, governance is very important to state and non-state stakeholders because it defines the conditions under which outer space will develop as a domain and under which its resources and spaces can be accessed. Global space governance includes broadly the "formal and informal laws, institutions, processes, and practices that structure relations, stabilize expectations, guide and restrain behavior, and frame policy responses for stakeholders."[10]

This article focuses on institutions as one important component of space governance and national strategy. As in other areas of military or economic strategy, a state's space strategy often includes diplomacy, which can be defined as processes of dialogs, carried out by actors in preexisting or emerging contexts, structures, institutions, or venues.[11] Once a government has decided that it would

like to pursue cooperation through an institution, it must choose how to proceed. Should it create a new institution, or should it join an existing one? Most individual states will not choose to create a new institution because many institutions already exist and because generally only the most influential states – or groups of states – possess the capacity and will to launch and maintain such institutions. Instead, it most often makes sense for individual states – particularly smaller and middle powers – to join an existing institution.

Globally, a number of options exist for states to engage with agreements and institutions related to space. The global institutional architecture of space was established by a series of treaties, including the Outer Space Treaty (1967), the Rescue Agreement (1968), the Space Liability Convention (1972), the Registration Convention (1976), and the Moon Treaty (1984). Several global institutions were created under the auspices of the United Nations, such as the UN Office for Outer Space Affairs (1958) and the UN Committee on the Peaceful Uses of Outer Space (1959), and the International Telecommunications Union took charge of allocating broadcasting frequencies for satellites and distributing slots in geo-stationary orbit. These institutions constitute the basic framework of space governance, which helps to facilitate the peaceful and sustainable use of space.

At the regional level, space cooperation among Asia-Pacific countries has remained relatively weakly institutionalized compared to the global level and to other regions such as Europe, where civil space cooperation deepened and formalized through the European Space Agency. The relatively late developing countries of Asia have cooperated with partners outside the region to acquire technology and engage in joint activities to develop their space programs, but they have been less active in cooperating with one another.[12] For example, the 2016 ASIABASE-1 database identified 63 space agreements and institutions: 23 were global, 36 involved regions besides Asia, and only 6 were intra-Asian in membership.[13]

The relatively few intra-Asian space institutions that exist have been shaped by competition among the region's leading space powers. This kind of institutional competition is not unique to space; it has played out in other issue areas as states have created new and overlapping institutions in an effort to structure cooperation and frame policy discussions by shaping membership based on competing visions of Asian regionalism.[14] This institutional competition has helped to produce regional institutions such as the Asia-Pacific Economic Cooperation (APEC) Forum, the ASEAN Regional Forum, ASEAN + 3, the East Asia Summit, the Asian Development Bank, and the Asian Infrastructure Investment Bank, for example. Similarly, interstate competition among China, Japan, India, and the US has shaped the institutional strategies available to emerging space powers such as South Korea. This section discusses several well-established institutional options available for Asia-Pacific states seeking to deepen space cooperation with their regional neighbors: the Asia-Pacific Regional Space Agency Forum (APRSAF); the Asia-Pacific Space Cooperation Organization (APSCO); the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP); and the Regional Centre for Space Science and Technology Education in Asia and the Pacific (RCSSTEAP). Table 1 summarizes the characteristics of these institutions. The section also touches briefly on emerging space cooperation through small minilateral institutions such as trilateral dialogs and the Quad Space Working Group.

APRSAF and APSCO both cover a broad scope of space-related issues. The Asia-Pacific Regional Space Agency forum was established in 1993 under Japanese leadership in response to the declaration adopted at the Asia-Pacific International Space Year Conference in 1992. Its goal is to promote and expand peaceful uses of space activities and their applications for socioeconomic development by providing a forum for exchange, identifying and undertaking measures to achieve its goal, and promoting and expanding mutually beneficial cooperation among actors in the Asia-Pacific region, including possible cooperation with extra-regional actors.[16] APRSAF is characterized by soft legal rules and an informal underlying institutional structure.[17] Legally, it is an international forum, not an intergovernmental cooperation organization with legal personality.[18] It explicitly embraces several characteristics: an open and flexible regional cooperative framework in which "various entities" (i.e., state and non-state actors) can engage, voluntary and cooperative activities, and concrete cooperative activities to solve regional issues.[19] Since 1993, APRSAF has held annual meetings jointly organized by

Table 1. Characteristics of Asia-Pacific regional space institutions.[15]

	APRSAF	CSSTEAP	APSCO	RCSSTEAP
Year Established	1993	1995	2008	2014
Leadership	Japan	India	China	China
Issue Scope (Issue Domain)	Broad (expanding peaceful uses of space for socioeconomic development; satellite applications; enhancement of space capability; space education; space exploration; space policy; space law)	Narrow (space science and technology education)	Broad (space activities and development; fundamental research on space technology and its applications; extending the applications of matured space technology; education and training activities)	Narrow (space science and technology education)
Type	International forum	UN-affiliated organization	Non-profit independent body with full international legal status	UN-affiliated organization
Structure	Informal	Formal	Formal	Formal
Participants	State & non-state actors	Non-state actors	State actors	Non-state actors
States and Regions Represented	52: Argentina, Australia, Bangladesh, Bhutan, Brunei, Cambodia, Canada, Chile, China, Colombia, Czechia, Estonia, Finland, France, Germany, Hungary, India, Indonesia, Iran, Iraq, Israel, Italy, Japan, Kazakhstan, Kenya, Laos, Malaysia, Mongolia, Myanmar, Nepal, Netherlands, New Zealand, Norway, Pakistan, Philippines, Romania, Russia, Singapore, South Africa, South Korea, Spain, Sri Lanka, Sweden, Thailand, Turkey, Ukraine, United Arab Emirates, United Kingdom, United States, Uzbekistan, Vietnam, Taiwan	16: Bangladesh, Indonesia, Iran, Kazakhstan, North Korea, South Korea, the Kyrgyz Republic, Malaysia, Mongolia, Myanmar, Nauru, Nepal, the Philippines, Sri Lanka, Thailand, Uzbekistan	8: Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand, Turkey	10: Algeria, Argentina, Bangladesh, Bolivia, Brazil, China, Indonesia, Pakistan, Peru, Venezuela

Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT), the Japan Aerospace Exploration Agency (JAXA), and organizations from various host countries across the Asia-Pacific region. In addition to the Space Industry Workshop held at annual meetings, APRSAF promotes common projects through its working groups on Satellite Applications for Societal Benefit, Enhancement of Space Capability, Space Education for All, Space Frontier, and Space Policy and Law. As of November 2019, 844 organizations from 52 countries and regions and 32 international organizations had participated in APRSAF activities.[20]

In contrast, the Asia-Pacific Space Cooperation Organization was established in 2008 under Chinese leadership. It grew out of the Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA) mechanism, which was a flexible, informal mechanism for space discussions established in 1992, also under Chinese leadership. The 2001 AP-MCSTA conference in Beijing conferred APSCO with legal personality. Unlike APRSAF, APSCO is characterized by hard legal rules and a formal underlying institutional structure; it is a nonprofit independent body with full international legal status.[21] APSCO was explicitly modeled after the European Space Agency. All member states are required to participate in APSCO's basic activities:

establishing APSCO's plans for space activities and development; carrying out fundamental research on space technology and its applications; extending the applications of matured space technology; conducting education and training activities concerning space science and technology and their applications; managing and maintaining the branch offices and the relevant facilities as well as the network system of APSCO; and undertaking other necessary activities to achieve the objectives of APSCO. Unlike ESA, APSCO does not require its members to put their national space programs under its own; there is no clear requirement for domestic space policy to be consistent with its own space policy. In addition, there are "optional activities" that can be organized by APSCO, which are carried out according to the principle of fair return, which means that the return from an optional activity shall be obtained in proportion to the investment by the participating member states; this is intended to encourage member states to participate by balancing investment and risk but to also reward them with technological capability and economic return in cooperation. APSCO membership is restricted to state actors and currently includes Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand, and Turkey. Indonesia signed the 2005 APSCO Convention but has yet to formally accede, and Mexico is an observer state.

Although APRSAF and APSCO share common participants and some similar goals, the two institutions do not generally engage with one another; instead, they are often regarded as rival regional institutions that reflect competition for leadership and influence between Japan and China.[22] The governments of these two countries have been willing to commit resources to leading these two institutions not only for potential gains from cooperation and to shape the future trajectory of regional space cooperation, but also as a tool to provide benefits to other regional countries and thereby strengthen partnerships and enhance their reputations.[23] In addition to embracing two different sets of organizing principles – soft rules and informal structure versus hard rules and formal structure – the two institutions also reflect different sets of geopolitical relationships.[24] APRSAF's broader participant pool includes the United States and many of its allies and partners who are notably absent from APSCO's membership roster.

Unlike the broad remit of APRSAF and APSCO, the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) and the Regional Center for Space Science and Technology Education in Asia and the Pacific (RCSSTEAP) are more specialized institutions, both of which are nested within the United Nations framework. CSSTEAP and RCSSTEAP are similar to APRSAF and APSCO in that they reflect competitive tendencies between major regional space powers: India and China. Despite their overlapping institutional domains, the two institutions do not collaborate directly. Following the passage of UNGA Resolutions 45/72 and 50/27, the Programme of Space Application set objectives and an action plan for the establishment of regional centers in each region covered by the UN Economic Commission and undertook a series of evaluation missions to assess the viability of potential host institutions.[25] Through this process, India was selected as the host for CSSTEAP, which was established in 1995. China initially rejected the UN's choice of India as the host for CSSTEAP, though it eventually acknowledged the decision.[26]

CSSTEAP headquarters is located at the Indian Institute of Remote Sensing, and it also has operational establishments at three other locations in India. Funding is mainly provided by India's Department of Space, with some contributions from its Ministries of Finance and External Affairs of India, the UN Office for Outer Space Affairs (UNOOSA), the UN Economic and Social Commission for Asia and the Pacific (ESCAP), the UN Educational, Scientific and Cultural Organization (UNESCO), and the UN Development Programme (UNDP). CSSTEAP's activities address topics such as: remote sensing and geographic information systems; satellite communications; satellite meteorology and global climate; space and atmospheric science; and global navigation satellite systems.[27] Its governing board includes representatives from Bangladesh, Indonesia, Iran, Kazakhstan, North Korea, South Korea, the Kyrgyz Republic, Malaysia, Mongolia, Myanmar, Nauru, Nepal, the Philippines, Sri Lanka,

Thailand, Uzbekistan, and UN-OOSA. Participants in its post-graduate courses are drawn from a broader pool of 27 different countries.

In contrast, China leads RCSSTEAP, which was established in 2014 and is headquartered at Beihang University in Beijing. China's Ministry of Industry and Information Technology (MIT) is the leading organization, while the China National Space Administration (CNSA) is its operational guiding organization. RCSSTEAP's activities overlap significantly with those of CSSTEAP, addressing topics such as remote sensing and geographic information systems (GIS), application of meteorological satellites, satellite communications, Global Navigation Satellite System (GNSS), space and atmospheric sciences, and space law. However, its membership is quite different from that of CSSTEAP in that it encompasses Latin American and African countries and only a few Asia-Pacific countries. Its members include Algeria, Argentina, Bangladesh, Bolivia, Brazil, China, Indonesia, Pakistan, Peru, and Venezuela. Like CSSTEAP, participants in its training programs are drawn from a much broader pool of countries. As of September 2021, RCSSTEAP had trained 319 participants from 27 developing countries.[28]

In addition to these four institutions, much of the energy of institution building in the Asia-Pacific has recently been focused on small minilateral institutions that facilitate cooperation between a few states. This process was particularly driven by the US during the Biden administration, which sought to deepen ties with its key regional allies and partners as part of strategic competition with China. Some countries have signed bilateral agreements on space, such as the US-Japan Framework Agreement on Space Cooperation and the US-ROK Agreement for Cooperation in Aeronautics and the Exploration and Use of Airspace and Outer Space for Civil and Peaceful Purposes. Bilateral space cooperation has been seen as a pathway for strengthening the US-ROK alliance.[29] Trilaterally, the Japan-US-Australia Space Security Dialogue has met since 2011 to exchange information and views related to space policy.[30] The Quad grouping of Australia, India, Japan, and the US has also created a Space Working Group to increase quadrilateral cooperation on civil and commercial activities, including improving information sharing on climate and space situational awareness.[31] These are just a few examples of the US-centric minilateral groupings that are beginning to emerge, which are creating new possibilities for space cooperation.

This section has outlined some of the major institutional options for Asian regional space cooperation, which have been spearheaded by the established space powers of the region. As emerging space powers think about how to best pursue space diplomacy through institutions, choosing one of these existing institutions is generally a better fit than trying to create a new institution with limited resources. However, existing institutions have been strongly shaped by broader geopolitical tensions and rivalries in the region, so these security factors must also be taken into consideration alongside economic interests and institutional characteristics.

South Korea's Evolving Engagement in Regional Space Institutions

This section builds on the previous discussion of existing institutions by examining how South Korea evaluates existing options and formulates its own institutional strategy as an emerging space power. South Korea has been frequently discussed as a "middle power" by academics and policy practitioners since the 2000s, and the South Korean government has come to embrace this middle power identity as an explicit part of its foreign policy.[32] Although the definition of "middle power" has been the subject of much debate, the term has generally been applied to states weaker than the great powers in the system but among the top 20–30 most powerful countries in the world.[33] These middle powers are not powerful enough to be "system-determining" on their own, but they can affect or influence the international system, particularly by working with others to solve problems through coalitions or through regional or international multilateral institutions.[34] Over the past 20 years, South Korea has expanded the scope and depth of its regional and international engagement in areas such as trade, finance, economic governance, development assistance, disaster response, human security, and environmental security.[35]

This article extends this line of inquiry to examine South Korea's engagement with outer space policy. Although middle powers often work through multilateral institutions, limited resources mean that a state cannot engage in every possible institution. Instead, it must make strategic choices about the specific form that its engagement will take in terms of which institutions to join and how best to structure its participation. Furthermore, in the case of South Korea, the country is still emerging as a space power, so its conceptualization of its space diplomacy is at an early stage, as is its engagement with related institutions.

The primary focus of this article is South Korea's regional engagement, but it is important to note the broader context of South Korea's ongoing international space cooperation.[36] According to the Korea Aerospace Research Institute, South Korea participates in around 23 major multilateral space cooperation institutions, which are listed in Table 2. Most of these institutions are international or trans-regional in scope. Of the four major Asia-Pacific regional space institutions discussed in Table 1, South Korea participates in two: the Asia-Pacific Regional Space Agency Forum (APRSAF) and the Center for Space Science and Technology Education in Asia and the Pacific (CSSTEAP).

South Korea has been involved in regional space dialogs from the early days of their inception, and its space policy is embedded in its broader domestic and foreign policy. In general, public opinion does not play a large role in the specifics of Korean space policy. Periodic surveys conducted during the implementation of major space programs in Korea show that the majority (around 60–90%) of the public supports these programs, though interest tends to fluctuate over time.[38] Public interest in and support for outer space programs could play a role in influencing overall spending, but policymaking tends to be dominated by political, economic, and science elites. The substance of outer space policy tends to be technical in nature and therefore less likely to be politicized than some other issues.

This article evaluates three potential explanations for South Korea's pattern of participation in regional space institutions: economic opportunities, security considerations, and institutional design.

Table 2. Multilateral space institutions with South Korean membership (2024).[37]

Short Name	Full Name of Institution	Issue Domain
AIAA WG	American Institute of Aeronautics and Astronautics Working Group	Satellite-Space Simulation
APRSAF	Asia-Pacific Regional Space Agency Forum	Space Policy; International Cooperation
CCSDS	Consultative Committee for Space Data Systems	Satellite
CEOS	Committee on Earth Observation Satellites	Satellite Data
CSSTEAP	Center for Space Science and Technology Education in Asia and the Pacific	Space Education
EUROCAE	European Organization for Civil Aviation Equipment	Aviation
GEO	Group on Earth Observation	Satellite Data
GUTMA	Global UTM Association	Unmanned Aircraft Systems Traffic Management
IAC	International Astronautical Congress	International Cooperation
IADC	Inter-Agency Space Debris Coordination Committee	Space Debris
ICG	International Committee on Global Navigation Satellite Systems	Navigation System
IFAR	International Forum for Aviation Research	Aeronautics
IOAG	Inter-agency Operations Advisory Group	Missing Operation
ISABE	International Society for Air Breathing Engines	Aeronautics
ISEB	International Space Education Board	Space Education
ISECG	International Space Exploration Coordination Group	Space Exploration
OECD Space Forum	Organisation for Economic Cooperation and Development Space Forum	Space Economy
SFCG	Space Frequency Coordination Group	Frequency Operation
SpaceOps	International Committee on Technical Interchange for Space Mission Operations and Ground Data Systems	Mission Operation
––	Space Symposium	Space Industry; International Cooperation
––	The International Charter Space and Major Disasters	Satellite Data
UN COPUOS	United Nations Committee on the Peaceful Uses of Outer Space	Space Policy; International Cooperation
UNOOSA	United Nations Office for Outer Space Affairs	Space Policy; International Cooperation

The first two factors emerge from the existing literature on international regimes and bargaining that assumes that states are motivated to join institutions for substantive gains from cooperation.[39] In the case of space, these substantive gains could come in the realm of either economics or security due to the dual-use nature of space technology, which can be used for civilian or military purposes. In terms of *economic opportunities*, a state may be able to use institutions to help boost its economy by strengthening relevant domestic industries in the space technology supply chain, building its space capacity, and pursuing economic prospects abroad. With respect to *security considerations*, potential gains from cooperation include strengthening domestic military capabilities and bolstering military alliances. The category of security considerations also incorporates the concept of geopolitical alignment, which newer studies identify as an important variable in determining institutional membership; military alliance membership is generally used as one of the proxies for geopolitical ties, so the two are closely related.[40] Conversely, the economic-security linkages present in space technologies mean that cooperating with potentially unreliable partners or strategic competitors of one's military allies can be risky, particularly for a smaller or middle power.

The third factor, *institutional design*, affects the ability of an institution to further a state's goals, leading governments to engage in forum shopping to find the mix of rules, membership structure, decision-making processes, and activities that is most favorable.[41] Formal rules and binding agreements can help to ensure gains from cooperation on one hand, but they can also trap a state in undesirable circumstances on the other. Governments sometimes deliberately choose informal institutions for their relative simplicity, speed, flexibility, and lower profile.[42] Informal structure and soft rules can ease barriers to cooperation and promote confidence building, which can help to facilitate coordination in ways that are complementary with existing formal institutions.[43] In some cases, informal institutions such as small minilateral dialogs can speed up discussions by excluding specific states who would have to be consulted under formal rules of existing institutions but who might make bargaining more difficult.[44]

All three of these factors influence South Korea's institutional strategies, as will be demonstrated in the case studies to follow. First, economic motivations have been a significant driver of the recent expansion in South Korea's space program and its regional institutional choices. Space development is now one of Korea's largest-scale R&D programs for achieving national science and technology aspirations, and the government has targeted the sector with industrial policy as part of plans to boost economic competitiveness.[45] The South Korean government has become increasingly aware of the salience of the space industry to the broader global economy and the lucrative potential of joining the supply chain of the US space industry. Although China is usually an attractive partner for economic cooperation with South Korea, strategic competition between the US and China across both economics and security has prompted South Korea to try to position itself as an important partner for the US and like-minded countries in the space industry.[46]

Second, decisions about space policy are embedded in the context of South Korea's broader security considerations. Acquisition of space capabilities bolsters South Korea's independent domestic military capacity, and space cooperation is also an increasingly important means of strengthening its military alliance with the US, which addresses threats from an unpredictable North Korea and concerns regarding an increasingly assertive China.[47] In July 2024, South Korean Foreign Minister Tae-yul Cho stated, "Space cooperation between the two countries, based on the South Korea-US alliance, is a core aspect of our space diplomacy."[48] Under the Biden administration, the US government actively encouraged its like-minded allies and partners to cooperate with one another in issues such as space in order to transform its traditional hub-and-spokes alliance structure into a "latticework."[49]

Third, institutional factors shape South Korea's decisions in ways that often amplify or mitigate the economic and security considerations described previously. Asia's regional space institutions contain a mix of soft rules and informal structure versus hard rules and formal structure, allowing the South Korean government to manage its level of commitment and flexibility in advantageous ways. Informal regional space institutions are seen as complementing other institutions such as global institutions or bilateral military alliances. Newer multilateral dialogs such as the US-Japan-ROK trilateral speed up

Table 3. Summary of case study findings.

	APSCO	APRSAF	CSSTEAP	RCSSTEAP	Minilaterals
Economic Factors	X	△	X	X	△
Security Factors	X	O	△	X	O
Institutional Factors	X	O	△	△	O

O = favorable; X = not favorable; △ = indeterminate.

discussions among the US and two of its key Asian allies without the presence of other actors who could slow down or complicate matters.

This section proceeds by examining South Korea's participation in each of these institutions in turn, demonstrating that South Korea has chosen to focus most of its institutional engagement on the Japan-led APRSAF due to its favorable mix of security, economic, and institutional factors, and it has sought new opportunities in evolving minilateral dialogs on space that may help facilitate commercial prospects by leveraging connections with the US and its allies and partners. However, South Korea has chosen not to pursue formal inter-governmental cooperation with the China-led institutions APSCO and RCSSTEAP due to limited economic benefits, institutional characteristics, and security concerns. South Korea has also shown limited interest in the India-led CSSTEAP because it does not align well with these three factors. These findings are summarized in Table 3.

AP-MCSTA and APSCO

In February 1992, China signed a Memorandum of Understanding with Pakistan and Thailand to initiate the Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA), and it hosted a workshop in December 1992 with representatives from states such as Australia, India, Indonesia, Japan, and South Korea. AP-MCSTA was intended to facilitate Asia-Pacific cooperation in space applications, to spread small satellite technology, and to promote space capacity building. South Korea participated actively in AP-MCSTA from 1992 to 2003, during which time six additional AP-MCSTA conferences were convened. South Korea hosted the third AP-MCSTA conference in 1996. Through AP-MCSTA, South Korea signed a MOU in 1998 with China, Iran, Mongolia, Pakistan, and Thailand to develop a Small Multi-Mission Satellite (SMMS) for environmental monitoring and disaster management; Bangladesh joined the program in 1999. Between 1998 and 2001, five Project Committee meetings were held to discuss distribution of responsibilities and working plans.[50] However, when AP-MCSTA became formalized as the Asia-Pacific Space Cooperation Organization (APSCO) in 2005, South Korea chose not to sign the convention to join the new inter-governmental institution, and it has not since expressed interested in joining APSCO, despite invitations.[51]

This decision might appear to be puzzling in light of South Korea's early involvement in AP-MCSTA, but closer examination reveals that South Korea has not joined APSCO because the institution does not align with its goals in terms of economics, security, or institutional factors. First, it is not clear that APSCO would provide South Korea with concrete economic benefits. On the surface, APSCO has the potential to help with South Korea's desire to cultivate its domestic space industry. Like its model institution the ESA, APSCO operates on a principle of "fair return," which means that the proportion of contracts under a particular program awarded to firms from a given country is in proportion to the funding that this country has contributed to the program. Essentially, this supports industrial policy in member countries since it pools resources and subsidizes the national space infrastructure of the states that participate in APSCO programs. APSCO has made progress on projects related to data sharing, satellite and ground-based optical space observation system development, and other projects since its inception.[52] However, although capacity building is a fundamental pillar of APSCO, a concrete regime has not been established to facilitate this process, and clear gaps in the scientific and technological capacities of APSCO member states persist.[53] The potential economic benefits for South Korea are limited because

APSCO members are predominantly developing countries, and existing programs rely substantially on Chinese support.

Second, APSCO presents South Korea with potential security liabilities due to Chinese leadership of the institution. South Korea has concerns about the extent to which APSCO is dominated by China, which is currently engaged in intense strategic competition with its key military ally, the US. Given the current geopolitical situation, entering into a formal, binding institutional arrangement dominated by China would put South Korea in a constrained position, and it would undoubtedly attract criticism from the US.

Moreover, South Korea would face criticism for joining a regional space institution that includes China because the latter is not a member of the Missile Technology Control Regime (MTCR), which poses problems due to the dual-use nature of space technology. The MTCR aims to restrict proliferation of potential weapons of mass destruction delivery systems such as ballistic missiles, unmanned air vehicles, and related technology, including space launch vehicles. It currently has 35 members, including South Korea, which joined in 2001. The US has already blocked past South Korean attempts to cooperate with China due to MTCR considerations. For example, after signing a launch agreement with China in 2001, South Korea was told that the presence of US components on the Korean satellite meant that it could not use China as a launch provider. The US also said that it would not supply satellite parts in the future if South Korea abided by the agreement, since such technology could be transferred to China, which was a country with proliferation potential.[54] A similar incident occurred in 2007 when South Korea had to withdraw from a small multi-mission satellite program involving China for the same reason.[55] Since APSCO is likely to play a role in internationalizing Chinese space technology along with its Belt and Road Space Information Corridor initiative, these concerns are will persist in the future.[56]

Third, the institutional characteristics of APSCO exacerbate the potential problems mentioned in the economic and security arenas. Since APSCO operates with hard rules and a formal structure, for example, South Korea would be obligated to pay its membership fees, and it would need to engage in all basic activities of APSCO regardless of actual economic benefits. The formality of the institution also codifies Chinese leadership, and it would bind South Korea to decisions made within the institution. Consequently, joining APSCO poses risks to South Korea without clear benefits.

APRSAF

Since APRSAF's founding in 1993, South Korean government and private actors have participated in its flexible, open framework, primarily through its flagship annual meetings. Participating government ministries include the Korea Aerospace Research Institute, which attends on a regular basis, as well as the Ministry of Education, the Ministry of Science and ICT (MSIT), the National Disaster Management Institute (NDMI), and various Korean embassies located in APRSAF host countries. Several Korean government-funded institutions have participated, such as the Korea Astronomy and Space Science Institute (KASI), the Electronics and Telecommunications Research Institute (ETRI), and the Korea Association for Space Technology Promotion (KASP). Academic institutions such as the Korea Advanced Institute of Science and Technology (KAIST), Korea Aerospace University (KAU), the Korea Institute of Ocean Science and Technology (KIOST), and Hankuk Aviation University have also participated. Private sector participants from Korea have included Korean Air, Asiana Airlines, Korea Aerospace Industries, Satric Initiative (a satellite manufacturing company), and Soletop (a company that develops software and engineering capabilities for applications in satellites and unmanned crafts).[57] Much of APRSAF's activity is focused on its flagship annual meetings. South Korea hosted the 9th annual meeting in 2003 in Daejeon, which offered many South Korean actors an opportunity to engage with the institution. For example, KARI held the 2003 meeting at its headquarters, and KAIST hosted a technical tour during this time. Representatives from South Korean organizations have spoken and given presentations at many other annual meetings.

South Korea has participated in APRSAF because aligns well with its goals in terms of economics, security, and institutional factors. First, although there are no binding economic agreements in APRSAF, the forum offers South Korean actors an opportunity to build relationships with state and non-state actors across the region. This has the potential to yield economic benefits through collaborations. Such collaborations are possible within the bounds of APRSAF working groups or outside the bounds of the institution. For example, South Korea and Thailand signed an implementation agreement for a feasibility study on constructing a space launch site in Thailand in 2023. The official press release from the South Korean government cited previous collaboration with Thailand in APRSAF as one of the steps leading to this agreement.[58] Although South Korea's bilateral cooperation with Japan has been limited, the two countries have consistently worked together through the auspices of APRSAF, such as exchanging researchers for the Satellite Technology for the Asia-Pacific Region (STAR) program to develop small satellites. South Korea has also participated in APRSAF working groups and projects.

Second, the broader participant network of APRSAF is more compatible with South Korean security interests, since it includes US allies and partners such as Japan and Australia. For example, in 2012, KARI president Kim Seung-jo stated, "Thus far, our collaborative relationship with JAXA has been built primarily through our membership in APRSAF as a member country."[59] APRSAF informally provides South Korean participants an opportunity to network with participants and to further initiatives outside of APRSAF. Although China is technically an APRSAF member, it does not have a significant presence in the institution. There are also some potential benefits to South Korean security through its participation in APRSAF programs such as the Sentinel Asia Program, which aims to improve disaster preparedness and early warning to minimize the number of victims and social and economic losses resulting from disasters.[60]

Third, the institutional characteristics of APRSAF offer more strategic benefit than those of APSCO. APRSAF's informal structure and soft rules mean that there is very little downside to participation. The opportunity for flexible engagement allows South Korean state and non-state actors to pick and choose when they engage with APRSAF. South Korea can gain expertise and enhance its connections through association with APRSAF without committing itself to any large costs or binding agreements. The structure of APRSAF activities, specifically the high-profile annual meetings, also allows South Korea to showcase its space achievements through country reports and other presentations. For example, KARI representatives have spoken on topics such as space exploration and space policy at the annual meetings, and MSIT representatives have spoken about space technology in working group sessions.[61]

CSSTEAP and RCSSTEAP

Both the India-led CSSTEAP and the China-led RCCSTEAP focus on offering space science and technology education to Asia-Pacific countries. South Korea is a member of CSSTEAP, and as such, it has a representative on the Governing Board that administers the institution. The Governing Board consists of one representative from each country who has signed the agreement with the Centre, along with representatives of UN-OOSA and the International Institute of Geo-information Science and Earth Observation (ITC) as observers. From 1995 to 2020, CSSTEAP offered 61 post-graduate courses in five areas: remote sensing and geographic information systems (RS&GIS); satellite communications (SATCOM); satellite meteorology and global climate (SATMET); space and atmosphere sciences (SAS); and Global Navigation Satellite Systems (GNSS). During that 25-year period, it also organized 60 short courses on recent and advanced technology and its applications related to the five areas listed previously and Small Satellite Missions (SSM).

Although South Korea is a Governing Board member, its participation in CSSTEAP courses has been notably low. Figure 1 illustrates the number of participants in CSSTEAP post-graduate courses by country. Over the entire 25-year period since CSSTEAP's creation, South Korea sent just two participants. Moreover, all South Korean participation occurred during the 1995–2010 period; since 2010, no South Korean participants have engaged in CSSTEAP post-graduate courses.[62] Similarly, only two South Korean participants engaged in CSSTEAP short-term courses over this 25-year period.

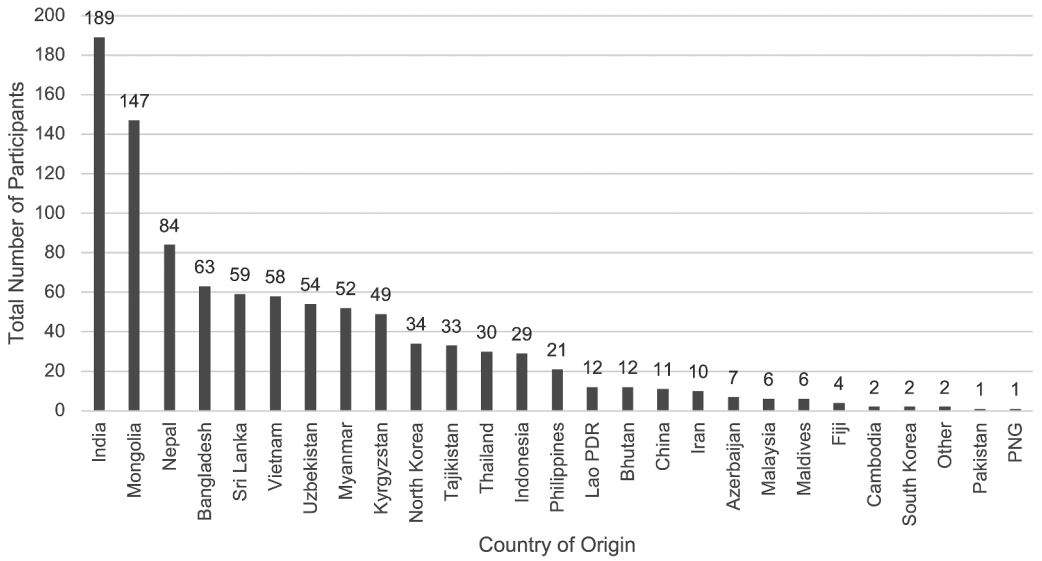

Figure 1. Participants in CSSTEAP post-graduate courses by country (1995–2020)[63].

A notable facet of CSSTEAP is that North Korea is also a member of its Governing Board, and it sent 34 participants to its post-graduate courses during the 1995–2020 period. North Korea's membership in CSSTEAP has attracted some criticism. For example, in 2016, India was accused of violating UN sanctions by aiding North Korea because North Korean students were trained at CSSTEAP on topics such as remote sensing technology and went on to occupy high government positions. India denied this charge and reiterated its position that "the courses offered by CSSTEAP are very general and cover basic principles . . . available in open-source."[64] However, the dual-use nature of many space technologies sometimes makes it difficult to draw these lines clearly.

Similar to CSSTEAP, the China-led RCSSTEAP focuses on offering space science and technology education to Asia-Pacific countries. South Korea is a not a member of RCSSTEAP, so it has no part in its leadership. RCSSTEAP has a Governing Board like CSSTEAP, which consists of one representative from each country who has signed the agreement with the Centre (China, Algeria, Argentina, Bangladesh, Bolivia, Brazil, Indonesia, Pakistan, Peru, and Venezuela), along with representatives of UN-OOSA and APSCO as observers. However, a significant difference is that RCSSTEAP is linked to China's other regional space institution APSCO in various ways. Both institutions have facilities at Beihang University, for example, and APSCO is also the main entity that recommends participants for participation in RCSSTEAP courses. In this way, RCSSTEAP seems to be a way for China to extend its engagement with regional actors beyond the narrow confines of APSCO, allowing it to conduct some of the capacity building activities that are accessible to Japan through APRSAF.

RCSSTEAP offers post-graduate courses on a similar set of topics as CSSTEAP: remote sensing and geographic information systems; satellite communications and Global Navigation Satellite Systems; space technology and its applications; space science and environment; and space law and policy. In addition, providing services to member states is one of the main objectives of the Centre, so the Chinese government offers scholarships for students from member states each year and offers at least three short training programs specifically for member countries annually.

Due to the structure of this institution, there is no need for Korea to join the board of RCSSTEAP in order to gain benefits; representatives from nonmember states are technically allowed to attend RCSSTEAP courses if accepted. However, no South Korean participants have engaged in its courses to date. As of September 2021, RCSSTEAP had trained 319 participants from 27 developing countries.[65] A detailed breakdown of all participants is not available, but Figure 2 shows the number of participants in RCSSTEAP post-graduate courses by country for the year 2020 as an illustrative example.

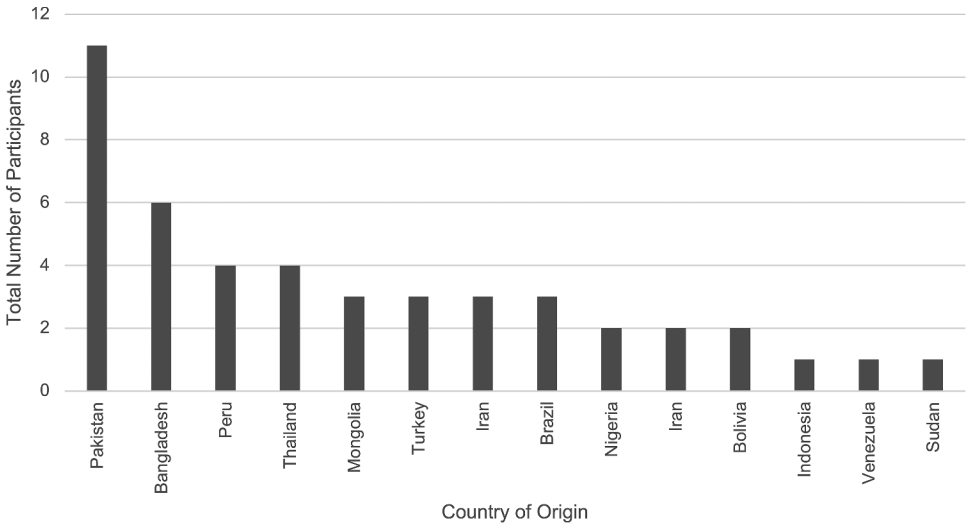

Figure 2. Participants in RCSSTEAP post-graduate courses by country (2020)[66].

There are several reasons for South Korea's limited engagement in CSSTEAP and total lack of engagement in RCSSTEAP. First, neither institution offers meaningful economic benefits to South Korea. The general courses offered by CSSTEAP and RCSSTEAP are primarily directed toward states with less developed space programs than South Korea, so they are of limited use in building its space workforce and capacity.

Second, in terms of institutional characteristics, CSSTEAP and RCSSTEAP are relatively flexible in nature, but the focus on educational activities means that they do not offer South Korea significant opportunities to showcase its achievements or to demonstrate leadership. CSSTEAP is primarily run by India, which has the opportunity to highlight its own significant space knowledge and capacity through its courses. RCSSTEAP is primarily run by China, and the institution is clearly linked to China's larger goals of building influence through APSCO as well as through space-related projects in its Belt and Road Initiative. Therefore, in both cases South Korea's engagement is limited largely to sending students to participate in the institution's courses.

Third, security concerns exist with respect to both institutions. In the case of RCSSTEAP, China's leadership of the institution and the nesting of RCSSTEAP with APSCO – which has its own associated security concerns, as discussed previously – is not well matched to South Korea's security alignment with the US and its allies and partners in the region. Although the India-led CSSTEAP has a membership that is more geopolitically aligned with the US, North Korean membership is a potential concern, though this may also be seen as an opportunity for engagement by some in South Korea. Given the large substantive overlap between CSSTEAP and RCSSTEAP, and the limited benefit to South Korea from engagement with either of them, it makes sense for South Korea to participate in CSSTEAP on a limited basis and to forego participation in RCSSTEAP entirely.

Other Minilateral Institutions

In recent years, the Indo-Pacific region has experienced a wave of minilateralism, as countries have pursued bilateral, trilateral, quadrilateral, and other similar small groupings to bring together like-minded partners for cooperation on specific issues. This process has been particularly pushed by the US, driven in part by frustration with the slow rate of progress in larger multilateral groupings. In the case of South Korea, its growing bilateral space cooperation with the US has the potential to broaden into minilateral cooperation with other US allies and

partners. For the purposes of this article, two possible frameworks are relevant for discussion: South Korea-Japan-US trilateral space cooperation and South Korea-Quad space cooperation.

Recent improvements in Japan-Korea relations have created new possibilities for trilateral South Korea-Japan-US cooperation in space.[67] Given President Yoon's push to develop South Korea's space industry and the implications of space for security, discussions were ongoing during his administration. Space technology was discussed at the South Korea-Japan-US economic security dialogue convened in Hawaii in February 2023.[68] The August 2023 joint statement issued by President Yoon, Prime Minister Kishida, and President Biden declared that the three countries would " ... further enhance trilateral dialogue on space security cooperation, particularly regarding threats in the space domain, national space strategies, and the responsible use of space."[69] In June 2024, the Trilateral Technology Leaders Training Program was launched to train and connect policymakers focusing on a number of areas including space. However, although the three countries have much to offer each other in the arena of space policy, South Korea-Japan relations have often been characterized as the "weakest link" in potential trilateral cooperation.[70]

The Quad grouping of Australia, India, Japan, and the US created a Space Working Group in September 2021 to increase quadrilateral cooperation on civil and commercial activities, including improving information sharing on climate and space situational awareness.[71] South Korea has not engaged in any space cooperation with the Quad as an institution or with its working groups, but it has deepened its bilateral cooperation with the United States and begun to build ties with Australia and India.[72] In 2021, South Korea and Australia signed an MOU to discuss and identify potential areas of cooperation, including in areas such as space science, exploration, earth observation, space situational awareness, launch services, satellite navigation, space manufacturing, use of space infrastructure, policy and legislation, and personnel training.[73] In 2022, South Korea's KARI and the Indian Space Research Organization also agreed to cooperate in the areas of lunar exploration, satellite navigation, and space science and its application.[74] These bilateral initiatives could be seen as potential building blocks toward South Korea's future cooperation with the Quad.

Although South Korea is currently not at the forefront of minilateral space cooperation, ongoing discussions indicate that there is compatibility between these institutions and its security, institutional, and economic concerns. First, security seems to be the primary motivator of these minilateral groupings, which were promoted prominently by the US and its allies in the region during the Biden administration. Space cooperation through these small institutional formats enables South Korea to build upon its ties with the US to broaden relationships with like-minded countries. Notably, South Korea has not pursued similar cooperation with China. Second, the informal nature of these minilateral institutions offers South Korea a great deal of strategic flexibility in how it moves forward. Third, although there are no concrete economic benefits currently associated with these institutions, they enable South Korea to build ties with established space powers and relative peers, which suggests that there may be greater potential economic benefit than from institutions primarily geared toward developing countries.

However, South Korea is only beginning to take small steps in terms of minilateral space institutions, primarily at the bilateral level. Broadening space cooperation further will be challenging. Although the Yoon administration expressed interest in cooperating with the Quad in the past, for example, this is generally seen as a move that would upset Beijing; also, the Quad countries are not currently interested in expanding their membership or engaging outside countries in working groups due to their desire to strengthen the internal workings of the institution first.[75] However, as tensions continue to intensify in the region, and as space continues to be securitized, these minilateral formats may grow in importance.

Conclusion

What factors shape South Korea's evolving regional institutional strategies? How is South Korea engaging with the existing and emerging regional institutional architecture of space cooperation

in the Indo-Pacific? This article has argued that South Korea's institutional strategies have been influenced by factors related to economic benefits, security interests, and institutional characteristics. Due to its favorable mix of security, economic, and institutional factors, South Korea has chosen to focus most of its institutional engagement on the Japan-led APRSAF, and it has sought new opportunities in evolving trilateral and minilateral dialogs on space that may help facilitate commercial prospects by leveraging connections with the US and its allies and partners. However, South Korea has not pursued formal inter-governmental cooperation with the China-led APSCO due to limited economic benefits, constraining institutional characteristics, and security concerns. South Korea has also shown limited interest in the India-led CSSTEAP and no interest in the China-led RCSSTEAP because they do not align well with these three factors.

These patterns of institutional engagement are likely to be further accentuated in the future as South Korea continues to expand its domestic space industry and becomes a more active player in the domain. Space has becoming increasingly intertwined with the economic and security strategies of countries in the region, and geopolitical divides are deepening due to intensifying US-China strategic competition. As South Korea considers its institutional options for space diplomacy, it is unlikely to have the capacity for or interest in creating new institutions for space cooperation. Instead, it will navigate an institutional landscape that has been defined by competitive dynamics among the region's established space powers. Currently, the characteristics of the available institutions all point South Korea toward engagement with APRSAF, though minilateral formats may grow more attractive in the future.

The findings of this article contribute to the growing body of literature analyzing how South Korea's foreign policy engagement has expanded regionally and globally over the past 20 years. South Korea's participation in outer space institutions generally follows a pattern similar to other issue areas where its engagement has increased along with its national capabilities and resources. However, South Korean space policy is still in the relatively early stages of development compared to other areas of its "middle power diplomacy;" this supports the findings of Cho and Büthe (2021) and others that diplomacy may be best examined on an issue-by-issue basis since government strategy changes as a state gains "issue-specific strength."[76] Moreover, the configuration of factors influencing South Korea's institutional choices is somewhat distinct from the domains of trade or finance, for example, due to the dual-use nature of space, where both economic and security considerations are in play, as well as concerns about institutional design. These findings can be built upon in future studies comparing South Korea's foreign policy across multiple issue areas.

More generally, this article contributes to the existing literature by shifting the focus from regional leadership contests among major powers to how middle and smaller powers decide how to navigate existing institutions. Although great powers are vying for influence in the international system, it is their ability to persuade and influence middle and smaller powers to join in their efforts that will eventually determine the outcome of this competition. Therefore, it is important to examine the evolving foreign policy of states like South Korea to understand how they are pursuing their strategies and exercising agency amid this complex institutional landscape. The findings of this article support previous literature showing that substantive gains from cooperation, geopolitical alignment, and institutional factors influence states' choices. Moreover, as states begin to pursue the creation of new minilateral institutions, it is beneficial to think more broadly about the pathways to cooperation that are emerging in the region. As more actors engage in space cooperation, APRSAF and APSCO are likely to remain the two major regional space institutions, but other more specialized institutions may provide additional avenues for collaboration in this increasingly complex environment.

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