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Arctic Cooperation under the BRICS Framework: Exploring the New Pattern of Arctic Scientific Cooperation and Arctic Governance

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ABSTRACT: *In view of the complex geopolitical situation in the Arctic region caused by the Russian-Ukrainian conflict, Russia sees the BRICS cooperation mechanism as an important basis for counteracting the West's isolationist tactics and defending its Arctic interests. Currently, the strategic deployment of the BRICS countries in the field of Arctic science is becoming more and more perfect. This study attempts to map out BRICS actions in the field of Arctic science and to examine carefully how BRICS member states can play a more important role in Arctic governance through Arctic science cooperation. In addition, this study discusses the strategic considerations of BRICS member states in promoting Arctic scientific cooperation from the perspectives of both Russia and other BRICS member states. At the same time, the dilemmas facing scientific cooperation are analyzed in terms of both internal constraints and external constraints of the BRICS countries. The results of this study indicate that the deployment of BRICS countries in Arctic science is getting better, but the lack of substantive activities leads to limited cooperation. The study finds that BRICS efforts in the field of Arctic scientific cooperation appear weak and insufficiently safeguarded. Despite the limitations, the scientific field is the primary strategic pathway for BRICS member states to engage in Arctic governance by promoting deeper Arctic cooperation within the BRICS framework.*

***Key words**: Arctic cooperation, Arctic Council, BRICS, Russia-Ukraine conflict, Scientific cooperation.*

1. Introduction

Since the Cold War, scientists from various countries have begun to carry out research in the Arctic region in a coordinated manner, and at that time, Western countries had already started scientific cooperation with the Soviet Union. (Rachold, 2022)Before the outbreak of the Russian-Ukrainian conflict, the Arctic region maintained a certain balance. “Arctic exceptionalism” has been the basis for the solidity of the Arctic Council and the success of Arctic cooperation (Käpylä, J., & Mikkola, 2015). While the United States and Russia have a central position in the Arctic and dominate Arctic affairs, Arctic stakeholders also have avenues to participate in Arctic governance, particularly through Arctic science issues, and to engage in Arctic development together. After the outbreak of the Russia-Ukraine conflict, the confrontation in the Arctic region has intensified, and Russia has been isolated. In the face of pressure from other Arctic countries, Russia is looking for potential In the face of suppression by other Arctic countries, Russia is extensively looking for potential Arctic partners and focusing on creating a new Arctic mechanism, which coincides with the Arctic demands of Arctic stakeholders such as China and India, and the BRICS countries, which encompass a large number of developing countries and Arctic stakeholders, have become an important potential hand for Russia to unite with its Arctic partners (Kotlova, & Vereina, 2024).

Broadly speaking, “science diplomacy” encompasses all activities at the intersection of science and foreign policy (Ruffini, 2017). Arctic scientific research has a strategic attribute, and relevant studies at home and abroad are extremely rich and pay special attention to “science diplomacy”, national interest is the key driving force of science diplomacy, (Ruffini, 2020)and science diplomacy is an effective means of solving common problems faced by human beings in the 21st century by means of scientific co-operation between

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countries(Fedoroff, 2009). However, there are relatively few studies on Arctic scientific cooperation under the framework of BRICS, and most of them either deal with the Arctic interests and strategies of BRICS member countries, or directly explore the Arctic cooperation among BRICS countries with less reference to the scientific field. Science is neither necessarily disinterested or neutral, nor is it always possible to achieve international consensus on scientific issues (Ruffin, & Ruland, 2022). But given the strategic nature of the Arctic region and the complexity of the international situation, scientific cooperation is more conducive to extensive cooperation among the BRICS countries in the Arctic than in other fields, and therefore it is particularly important to grasp Arctic scientific cooperation under the BRICS framework to understand the future direction of the Arctic. As early as 1987, after Mikhail Gorbachev's Murmansk speech, the Soviet Union not only called for a reduction in military deployments in the Arctic, but also suggested that Arctic countries should strengthen local scientific research and cooperation in pollution control, and called for international cooperation on Arctic issues (Åtland, 2008). Although BRICS member states have different positions in Arctic governance and different depths of involvement in Arctic affairs, they all have the basis for Arctic scientific cooperation. However, although the BRICS countries organise and hold multilateral meetings from time to time, most of the scientific cooperation on the Arctic is carried out on a bilateral basis (Ясинь, 2023), and the mechanism of scientific cooperation on the Arctic among the BRICS countries as a whole still needs to be improved, and research on scientific cooperation on the Arctic under the framework of the BRICS countries needs to be further expanded.

This paper argues that, in view of the international context of the Russia-Ukraine conflict, the bilateral cooperation model among BRICS member states can no longer fully meet the compound needs of Arctic governance within this framework, and overall synergistic participation is particularly urgent, with scientific cooperation becoming the best entry point. The intensification of geopolitical conflicts has accelerated the pace of Russia's exploration of the “Arctic strategic support point”, while the complex situation in the Arctic region has promoted the integration of other BRICS member countries into the process of constructing the “Arctic strategic support point”, and the two aspects of strategic considerations have driven the strong willingness of BRICS countries to cooperate in Arctic science. The two strategic considerations together drive BRICS countries' strong willingness to cooperate in Arctic science. However, through in-depth analyses, we find that the mechanism of Arctic scientific cooperation within the framework of BRICS is not yet sound, and the effectiveness of cooperation is limited and highly dependent on Russia. Faced with the tendency of “bloc confrontation” in the Arctic region and the complex international situation, structural deficiencies, cognitive differences and capacity limitations indicate that the smooth promotion of Arctic scientific cooperation under the framework of BRICS countries still requires long-term efforts.

2.Arctic Scientific Cooperation within the BRICS Framework

Following the outbreak of the Russia-Ukraine conflict, Russia has faced unprecedented sanctions and export controls. Confronted with increasingly severe economic and diplomatic challenges, Russia has no choice but to rely on the support of "friendly countries," seeking to strengthen ties with non-Western nations to alleviate the multiple dilemmas caused by isolation. In the Arctic domain, Russia particularly welcomes BRICS members to participate in Arctic development, with officials repeatedly expressing cooperation intentions and actively "recruiting" BRICS countries. Russia has invited BRICS countries to various Arctic activities and developed bilateral projects with them. At the same time, BRICS members possess the foundation for participating in Arctic scientific collaboration, with existing cooperation mechanisms and platforms providing a foothold for Arctic scientific cooperation within the BRICS framework. Following the expansion of BRICS in 2024, new members will also be able to participate in Arctic scientific activities through BRICS. However, it is important to note that while the deployment of BRICS countries in Arctic science is gradually improving with Russia's assistance, the actual activities conducted are limited, and the over-reliance on Russia has resulted in insufficient cooperation outcomes.

2.1. Cooperation Intentions and Documents

Russia has spared no effort in courting BRICS countries. The BRICS countries have become important actors on the global stage and their influence in world affairs continues to grow (Gavrilenko, & Shenshin, 2024). To gradually bring BRICS into the Arctic region, Russian officials have repeatedly expressed cooperation intentions, demonstrating a positive stance toward Arctic scientific collaboration within the

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BRICS framework. The "Russian Federation Science and Technology Development Strategy," officially promulgated on February 28, 2024, states, "It is necessary to ensure scientific and technological cooperation with friendly countries within the alliance framework, primarily BRICS, the Shanghai Cooperation Organization, and the Eurasian Economic Union." (Официальное опубликование правовых актов, 2024) Russian President Vladimir Putin has also stated that Russia will absolutely unite with BRICS countries (TASS. 2024) . At the 6th meeting of the BRICS "Ocean and Polar Science" thematic working group, Natalia Golubeva, Deputy Director of the Science and Higher Education Ministry's Department of Science and Technology Organization Coordination, emphasized in her speech, "The expansion of BRICS brings more opportunities, and Russia is willing to actively engage in ocean and polar research and cooperation with BRICS countries, contributing to the development of global ocean and polar science with stronger collective wisdom." In recent years, Russia's work within European scientific projects has almost ceased, but Russia's previous positive stance can facilitate the smooth progress of Arctic scientific cooperation within the BRICS framework, increasing the enthusiasm and participation of other BRICS members. Alexander Blagov, Deputy Director of the Kurchatov Institute National Research Center, stated, "Nothing can stop Russia from cooperating with friendly countries."

Among BRICS countries, apart from Russia, which is deeply involved in Arctic affairs as an Arctic state, China and India have shown significant Arctic activities, while Brazil and South Africa have demonstrated lower levels of Arctic participation and scientific cooperation presence. In recent years, during close interactions between Chinese and Russian leaders, both sides have repeatedly expressed intentions for Arctic scientific cooperation, issuing multiple joint statements between 2017 and 2024 that clarify the continuity of Sino-Russian Arctic scientific collaboration. From the content of these statements, polar joint research, polar expeditions, and Arctic shipping routes have been key focuses of Sino-Russian Arctic scientific cooperation. India is another important partner for Russia in expanding its counter-Western coalition, with both sides frequently mentioning deepening Arctic cooperation in the scientific field. Conscious of the importance of scientific research in the Arctic, India hopes to undertake joint scientific research on issues such as melting of Arctic ice, climate change, conservation of marine life and biodiversity (Government of India Ministry of External Affairs, 2016). Following the 22nd India-Russia Annual Summit, a joint statement issued on July 9, 2024, specifically mentioned the Arctic region and BRICS, stating that both countries support cooperation in developing shipping routes via the Northern Sea Route. To this end, both sides expressed willingness to establish a joint working body within the India-Russia Intergovernmental Commission on Trade, Economic, Scientific, Technological, and Cultural Cooperation (IRIGC-TEC) to promote cooperation on the Northern Sea Route. Currently, Brazil has completed its Arctic scientific expedition (Dipanjan, 2024). The Federal University of Rio de Janeiro and the Russian Academy of Sciences have agreed to conduct approximately 20 parallel studies on the indigenous peoples of both countries. The BRICS PLUMPLAS project involving Brazil, Russia, and China has also achieved certain results (Zavialov, Moller Jr, & Wang, 2020). For new members following the 2024 BRICS expansion, Russia sees them as an important opportunity to expand polar influence, expressing willingness to actively engage in ocean and polar research cooperation with BRICS countries, contributing to the development of global ocean and polar science with stronger collective wisdom.

2.2. Cooperation Mechanisms and Platforms

Currently, the BRICS cooperation mechanism has formed a structure led by leaders' meetings, supported by ministerial meetings such as the Security Affairs Senior Representatives Meeting and Foreign Ministers' Meetings, and engaged in practical cooperation across multiple levels and fields. Among these, the science and technology innovation cooperation mechanism has undoubtedly expanded the depth and breadth of BRICS cooperation in polar science and technology. At the first BRICS Science, Technology, and Innovation Ministerial Meeting in 2014, the five BRICS countries jointly issued the "Cape Town Declaration," identifying key areas and cooperation mechanisms for science and technology innovation within the BRICS framework. In March 2015, at the second ministerial meeting, the five BRICS countries signed the "BRICS Memorandum of Understanding on Cooperation in Science, Technology, and Innovation" (hereinafter referred to as the "MoU"), identifying 19 key cooperation areas, including ocean and polar science. The MoU sets four main objectives (BRICS Information Centre, 2015) , one of which specifically mentions the participation of non-BRICS actors: "To promote, where appropriate, the establishment of joint partnerships in science, technology, and innovation between the BRICS countries and other strategic actors in the developing world."

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Through various cooperation methods such as scholar exchanges, specialized training, workshops, project programs, joint funding, and institutional collaboration, and by establishing management bodies, funding mechanisms, and intellectual property management arrangements, the MoU explores the cooperation mechanisms and future models for BRICS countries in ocean and polar science, laying the groundwork for advancing polar scientific cooperation and jointly addressing global issues.

Following the identification of "Ocean and Polar Science" as a key cooperation area in the MoU, the "Ocean and Polar Science" thematic working group was officially established at the 5th BRICS Science, Technology, and Innovation Ministerial Meeting in 2017. Since 2018, the BRICS "Ocean and Polar Science" thematic working group has begun discussing Arctic scientific research topics. The working group's mission is to promote cooperation among BRICS countries in ocean and polar science and technology through joint activities involving governments, universities, research institutions, and industries, aiming to create new knowledge, develop human capital, innovate technologies and applications, and enhance public understanding of ocean and polar science. To date, six meetings of the "Ocean and Polar Science" thematic working group have been held, with the most recent meeting taking place in Murmansk, hosted by the Russian Ministry of Science and Higher Education, the Russian Ministry of Foreign Affairs, and the Murmansk Regional Ministry of Arctic Development and Economy, and co-organized by the Shirshov Institute of Oceanology of the Russian Academy of Sciences. In addition to the "Ocean and Polar Science" thematic working group, other working groups have gradually extended their reach into the Arctic region. At the 6th meeting of the BRICS "Disaster Risk Management" thematic working group, participants shared experiences on natural emergency monitoring systems in their respective countries and explored possibilities for cooperation in the Arctic region.

Furthermore, Russian scientific organizations, teams, and scientists have become more active in establishing cooperation with colleagues from BRICS and other friendly countries, leveraging the "BRICS+" cooperation mechanism to host the "BRICS+ Academy of Sciences Presidents Meeting." (TASS, 2024) The Russian Academy of Sciences and many scientists maintain constructive personal connections with researchers from BRICS countries. Currently, Russia is actively developing bilateral Arctic projects with BRICS countries in scientific research, logistics, environmental protection, and maritime cooperation. China has responded positively to Arctic scientific cooperation within the BRICS framework. As the Chinese lead unit for the BRICS "Ocean and Polar Science" thematic working group, the China 21st Century Agenda Management Center established the "Chinese Secretariat for the BRICS Ocean and Polar Science Thematic Working Group" in 2021. The establishment of the secretariat connects government and academic departments, serving as a bridge to link ocean and polar-related institutions across BRICS countries.

2.3. Cooperation Outcomes

The aforementioned BRICS Arctic scientific cooperation mechanisms and platforms have not only facilitated information sharing and technological exchange among member states in Arctic scientific research, environmental protection, and climate change response but have also enhanced the collective voice and influence of BRICS countries in Arctic affairs through coordinated joint research projects, monitoring networks, and scientific expeditions. These efforts have provided BRICS members with new platforms to participate in international Arctic governance. Although BRICS countries are gradually integrating into the Arctic, with their scientific deployment steadily improving, it is important to note that the actual activities conducted by BRICS countries remain limited. Arctic scientific cooperation within the BRICS framework is still in its preparatory stages, with only modest contributions to the new Arctic governance landscape. Additionally, since Russia is the only Arctic state within BRICS, other BRICS members' participation in Arctic scientific cooperation heavily relies on Russia. While this has granted them some Arctic participation capabilities, they still struggle to fully establish themselves. Currently, China and Russia play key roles in Arctic scientific cooperation within the BRICS framework, while other BRICS members, though participating, have not reached the level of China and Russia.

Due to Russia's repeated invitations to BRICS countries to participate in Arctic scientific activities, BRICS members have been able to join the Arctic Floating University project, with plans to test equipment during Arctic exercises scheduled to be held in Russia in 2025. They are also collaborating with the Kurchatov Institute National Research Center to explore climate change issues. However, overall Arctic scientific participation within the BRICS framework remains limited. Since Russia is the only Arctic state

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within BRICS, other BRICS members primarily engage in Arctic scientific cooperation through bilateral partnerships with Russia. Among these, Russian research institutions have already identified China as an indispensable partner. Ruslan Yunusov, co-founder of the Russian Quantum Center (RQC), stated, "Russia can become an important scientific partner for China." Currently, China, leveraging Arctic scientific cooperation within the BRICS framework, has participated in Arctic scientific projects and scholar exchanges, including those related to Arctic security. China and Russia have signed a "Memorandum of Understanding on Maritime Search and Rescue Cooperation," which opens the door for maritime law enforcement collaboration between the two countries.

Currently, Russia is promoting the establishment of a new Arctic scientific center on the Svalbard Archipelago, involving BRICS countries. Arctic scientific cooperation within the BRICS framework is gradually expanding. In April 2023, Alexei Chekunkov, Minister of the Russian Far East and Arctic Development, stated that the Russian state-owned company Arcticugol Trust would collaborate with BRICS partners to develop an international Arctic scientific center. As a key Russian official, Chekunkov's statement can be seen as reflecting the official Russian stance on cooperation. However, Russia has not yet formally invited BRICS countries to jointly establish the station. Additionally, this initiative will face close scrutiny and potential obstruction from Norway. Prior to the signing of the Svalbard Treaty, Russia had significant economic activities on the Svalbard Archipelago, including the establishment of the Barentsburg settlement, and has consistently opposed Norway's efforts to exclude other countries under the guise of environmental protection. Russia's substantial presence on Svalbard, including coal mining, coupled with its traditionally firm diplomatic style, has granted Russia "privileges" on the archipelago that exceed those of other treaty signatories, allowing it to freely access Svalbard without Norwegian approval. However, leading BRICS countries in establishing a station would severely challenge Norway's exclusive jurisdiction over Svalbard, and subsequent scientific deployments by BRICS countries in the region are likely to face a series of restrictions and opposition.

3. Motivations for Arctic Scientific Cooperation within the BRICS Framework

3.1. Russia

The Arctic has become increasingly politicized, with geopolitical tensions between Russia and the "Arctic Seven" (A7) intensifying. On one hand, the West has imposed unprecedented comprehensive economic sanctions on Russia. These sanctions, numbering nearly 20,000, include freezing over $300 billion of Russia's international reserves, excluding it from the global banking financial telecommunications system (SWIFT), suspending commercial cooperation, banning imports and exports, and boycotting Russian energy and even cultural products. Major Western oil and gas companies and shipping firms have halted cooperation with Russia, significantly hindering Russia's Arctic development. As a result, Russia urgently needs assistance in financing, exploration technology, and equipment. The BRICS countries, as representatives of emerging market economies, possess substantial economic scale and growing international influence. By strengthening cooperation with other BRICS members, Russia can not only enhance its weight in international affairs but also provide more diversified perspectives and solutions for addressing Arctic issues. On the other hand, Russia has been isolated in multiple Arctic platforms. Russia has announced its withdrawal from key Arctic cooperation platforms such as the Barents Euro-Arctic Council and the Council of the Baltic Sea States. The Nordic Council of Ministers has also suspended cooperation with Russia, and the University of the Arctic temporarily revoked Russia's membership in 2022, halting collaboration with Russian universities and research institutions. Although other Arctic-related platforms still exist, Russia finds it increasingly difficult to endure the "pain" of being gradually excluded from the Arctic region and is eager to initiate and drive BRICS cooperation.

By strengthening cooperation with international partners, particularly through scientific collaboration and resource sharing among BRICS members, Russia can build a broader Arctic cooperation network to alleviate the geopolitical tensions caused by NATO's eastward expansion. Russia sees the Arctic as a region of special national interest, and Russia's core interest is the economic development of Russia's Arctic territories (Kristensen, & Sakstrup, 2022). These priorities are closely tied to the development of the Arctic's abundant resources, maintaining the Arctic as a zone of peace and cooperation, protecting its ecosystems, and utilizing the Northern Sea Route as a new channel for national transportation and communication. Given that Arctic stakeholders face significant barriers to participating in Arctic affairs, scientific cooperation-which has lower

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entry barriers and a global reach-can help Russia consolidate its Arctic partnerships, counter external sanctions, and safeguard its Arctic interests against Western actions. In summary, Russia regards the Arctic as a region of national security interest (Nikita, 2023) , viewing the actions of Western countries and NATO's eastward expansion as direct threats to its national interests. Engaging in Arctic cooperation within the BRICS framework is a strategic move by Russia to ensure the long-term stability of its Arctic interests, aiming to establish an "Arctic strategic support point" capable of countering the isolationist policies of the "Arctic Seven." Scientific cooperation, in this context, serves as the most stable entry point.

Furthermore, the continuous pursuit of a voice in Arctic affairs by Arctic stakeholders provides Russia with a strategic opportunity to maintain its position in the Arctic amid intensifying geopolitical tensions. India is actively involved in international scientific research programmes on Arctic climate and biodiversity (Kharina, & Strelnikova, 2024). China, on the other hand, possesses navigation rights, resource development rights, scientific exploration rights, and environmental protection rights in the Arctic. Although these rights are grounded in international law, their realization currently faces numerous obstacles. Brazil has completed its Arctic scientific expedition and is gradually seeking to enhance its Arctic participation. For Brazil, engaging in polar cooperation is a way to increase its role in global affairs, and BRICS, as a negotiating platform, is seen in this context as a promising tool to achieve this goal (Borba, Maria, & Capella, 2020). Although, apart from China and India, other BRICS members have relatively weak participation and influence in Arctic affairs, the participation goals and achievements of China and India in the Arctic have fully demonstrated their potential, prompting Russia to view BRICS as a key "Arctic strategic support point" for maintaining its Arctic strategic position.

3.2. China

The Arctic is a strategic space integrating scientific research, ecology, shipping, energy, and military interests. Countries are actively vying for their Arctic rights, with BRICS countries often being overlooked or even met with hostility by the "Arctic Seven." Participation in the Arctic is a basic means, but safeguarding Arctic rights is the ultimate goal. Within BRICS, China is the most active member in Arctic affairs after Russia, making China and Russia the primary targets of U.S. vigilance. As an important Arctic stakeholder, China, despite being closer to the Arctic than other BRICS members (excluding Russia), still plays a limited role in Arctic governance. China's Arctic participation has consistently relied on scientific cooperation as a key approach, but this has been accompanied by Western suspicion and resistance. The U.S. Department of Defense's 2024 Arctic Strategy claims that the Arctic situation is rapidly changing, labeling China as a "pacing challenge" and Russia as an "acute threat." (U.S. Department of Defense, 2024)To ensure the Arctic's peace, stability, and sustainable development, and to provide BRICS countries with more flexible operational space in the Arctic while safeguarding their Arctic rights, other BRICS members are gradually increasing their participation in Arctic governance by integrating into Russia's "Arctic strategic support point" initiative. This move also further consolidates cooperation among BRICS members, pushing the BRICS cooperation mechanism to a higher level.

3.3. India

India, as a long-time active participant in Arctic affairs, has continuously deepened its research in areas such as Arctic climate monitoring, glacier changes, and biodiversity protection through its strong scientific capabilities and international cooperation networks. Fundamentally, India's actions aim to seek more diversified Arctic partnerships to consolidate its Arctic position. On one hand, India's Arctic participation is closely tied to Russia. As an Arctic stakeholder, India relies on Russia, an Arctic state, to play its role as an observer in the Arctic Council. Additionally, India's Arctic activities are primarily concentrated in bilateral cooperation with Russia, with Russian scientific laboratories, equipment, and data being indispensable to India's Arctic endeavors. On the other hand, India has long been committed to promoting multilateral cooperation mechanisms, having established Arctic cooperation with countries such as Denmark, Finland, Iceland, Norway, the United States, Canada, Japan, and South Korea. To further participate in Arctic affairs, India not only needs to strengthen bilateral cooperation with Russia in the Arctic but also expand its cooperation within the BRICS framework. Arctic scientific cooperation under the BRICS framework can provide India with a platform to collaborate with other members on Arctic research projects, enhancing

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exchanges and cooperation in science, technology, and policy, reducing India's over-reliance on Russia in Arctic affairs, and increasing India's influence in Arctic matters.

3.4. Brazil

Although Brazil is located in the tropics, it has begun to focus strategically on the Arctic. Currently, Brazil's first Arctic scientific expedition concluded in July 2023. The previous action plan of Brazil's PROANTAR (2013-2022) advocated for closer official interaction between the Brazilian government and the Arctic region (Fei, Giannattasio, & Peiqing, 2023) , indicating Brazil's growing Arctic vision. However, Brazil's platforms for realizing its Arctic cooperation vision remain limited. Currently, the BRICS PLUMPLAS project, in which Brazil participates under the BRICS framework, has achieved certain results, and BRICS will be a crucial step for Brazil to further engage in the Arctic. Although South Africa has not yet shown significant interest in Arctic affairs, its deep accumulation in Antarctic scientific research cannot be ignored. South Africa not only possesses rich scientific achievements but also has advanced research equipment, including polar research vessels, and a pool of polar research talent. Additionally, under the BRICS cooperation mechanism, South Africa and Russia have engaged in extensive bilateral cooperation, even in space-related fields. However, to date, these collaborations have rarely touched on Arctic issues, leaving ample room for potential future cooperation in polar science and policy.

4. Challenges in Arctic Scientific Cooperation within the BRICS Framework

Although the breadth and depth of Arctic scientific cooperation within the BRICS framework are gradually expanding, the internal structural, cooperative willingness, and research capacity imbalances among BRICS countries, coupled with the complex interplay of external "bloc confrontation" tendencies in the Arctic and the significant political event of the Russia-Ukraine conflict, collectively constitute multidimensional cooperation challenges. These factors interact and reinforce each other, resulting in relatively weak and insufficiently supported efforts in Arctic scientific cooperation within the BRICS framework.

4.1. Structural Defects

Although BRICS countries have established mechanisms such as the "Ocean and Polar Science" thematic working group and the Science, Technology, and Innovation Ministerial Meetings, specific implementation rules and operational procedures for Arctic scientific cooperation still require improvement. There is a certain structural imbalance in BRICS cooperation in the field of science, technology and innovation (Kiselev, & Nechaeva, 2018).The processes for initiating and executing joint Arctic research projects need further refinement. According to the "BRICS Memorandum of Understanding on Cooperation in Science, Technology, and Innovation," BRICS countries can formulate and implement cooperative research plans. Currently, although the BRICS Science, Technology, and Innovation Framework Program (BRICS STI Framework Programme) has largely established standards for project initiation, fund allocation, execution supervision, and outcome evaluation, it has not yet addressed Arctic research (National Natural Science Foundation of China, 2023) . Although the "Ocean and Polar Science" thematic working group focuses on polar science and has proposed priority research topics in ocean and polar science and technology for BRICS members under the BRICS STI Framework Programme (BRICS, 2021), very few Arctic research projects have been approved. For example, none of the 33 projects approved in the fifth batch of the BRICS STI Framework Programme were related to Arctic research (BRICS STI FRAMEWORK PROGRAMME, 2021), which is inconsistent with the thematic group's name, "Ocean and Polar Science." In the future, BRICS countries should pay more attention to the application and approval of joint Arctic research projects, ensuring the quality and effectiveness of Arctic research initiatives.

4.2. Cognitive Differences

BRICS members have varying strategic goals and priorities in the Arctic, which limits the breadth and depth of cooperation. As an Arctic state, Russia's Arctic strategy integrates multiple objectives, including resource development, shipping route utilization, and national security, with a tendency to maintain its dominant position in the Arctic, characterized by regional and exclusive features. In contrast, China adopts a more global perspective, focusing on Arctic climate change, scientific exploration, and potential economic benefits, with a broader and longer-term strategic orientation (Mammadli, & Kalfaoglu, 2021). At the same

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time, the long-standing historical border dispute between India and China, as well as Russia's misgivings about China's intentions for its activities in the Arctic, constitute notable obstacles on the road to Arctic scientific cooperation (Sagild, & Elgsaas, 2024). India has long pursued a "pragmatic policy," and the spillover effects of the Russia-Ukraine conflict have left it wavering in the Arctic situation. Under the leadership of Prime Minister Narendra Modi, India has increasingly strengthened its Arctic presence, deepening partnerships with Arctic countries and continuously focusing on shipping route development and scientific research, particularly the impact of Arctic climate change on its domestic agriculture. Currently, India conducts research activities on Svalbard through the Ny-Ålesund research station operated by the Norwegian company Kings Bay AS. However, India is also acutely aware of the geopolitical complexities in the Arctic, especially the uncertainties brought by the Russia-Ukraine conflict, and has therefore adopted a relatively cautious approach in its Arctic strategic deployment, avoiding excessive involvement in regional disputes. Brazil has also shown increasing interest in the Arctic, signaling emerging powers' renewed recognition of the Arctic's strategic value. In contrast, South Africa and new BRICS members have limited interest in the Arctic and have not fully integrated into the Arctic interest landscape. These differences in strategic cognition and positioning lead to divergent priorities, path choices, and cooperation models among BRICS countries in Arctic cooperation, limiting the breadth and depth of collaboration and making it difficult to form effective synergies.

4.3. Capacity Limitations

There is a significant imbalance in the research capabilities of BRICS members. Russia's natural geographical advantages have allowed it to accumulate extensive experience and data in Arctic research, giving it a clear lead in scientific capabilities. Geographically, as a key Arctic state, Russia possesses vast Arctic territories and direct research conveniences, enabling more direct observation of Arctic environmental changes and on-site research. The Arctic has always been a priority area for Russia's science and technology development strategy. Since 2010, Russia has invested 2 billion rubles (approximately $70 million) annually in Arctic research and expeditions, making it the world's largest investor in Arctic research. Although China, India, and Brazil are Arctic stakeholders, they face challenges in accessing research resources. China and India only became Arctic Council observers in 2013, while Brazil and South Africa have not yet joined the Arctic Council and are located in the Southern Hemisphere. Although these countries have made significant progress in Arctic research in recent years, they are still in the early stages, with deficiencies in research equipment, professional capabilities of researchers, and data accumulation. South Africa possesses certain polar research capabilities but has long focused on Antarctic research. In 2021, South Africa established the South African Polar Research Infrastructure (SAPRI), making ocean and Antarctic research a major national initiative, but it has yet to make strides in the Arctic. The disparities in Arctic research capabilities among BRICS countries create a capacity gap in cooperation. As seen from the current cooperation status, Arctic scientific cooperation within the BRICS framework primarily takes the form of "bilateral" and "Russia+" collaborations, with Russia remaining at the core of Arctic scientific cooperation.

4.4. Arctic "Bloc Confrontation"

Since the full escalation of the Russia-Ukraine conflict, the "Arctic Seven" (A7) countries have adopted a firm exclusionary stance toward Russia based on geopolitical considerations, directly promoting the formation of a "bloc confrontation" dynamic in the Arctic region. Western countries have suspended scientific cooperation with Russia on multiple platforms, impacting Russia's research resources. Given Russia's central role in Arctic scientific cooperation, this limits the autonomy of BRICS countries in Arctic scientific collaboration, making it difficult for them to play a more significant role in Arctic science. Currently, Western Arctic researchers are cut off from over 60% of research areas and cannot exchange data with former Russian partners, while Russia also faces challenges in accessing funding and technological support (ZOiS, 2024). Additionally, the sanctions imposed by the U.S. government on October 30, 2024, targeting nearly 400 entities and individuals, including BRICS members and partner countries such as India, Malaysia, Thailand, Turkey, and the United Arab Emirates, have significantly increased the resistance faced by BRICS countries (The United States Government, 2024). These "deterrence" strategies implemented by the U.S. and its Western allies may force BRICS countries to adopt a more cautious approach in handling matters related to Russia.

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5. Conclusion

Given the profound and complex changes in the Arctic geopolitical environment triggered by the Russia-Ukraine conflict, Russia has identified BRICS as a crucial Arctic cooperation mechanism. Strengthening Arctic scientific cooperation within the BRICS framework has been elevated to a strategic priority for BRICS members to deeply engage in and integrate into the Arctic governance system. In the future, promoting Arctic scientific cooperation within the BRICS framework will require leveraging various Arctic legal instruments and platforms, using the Russia-Ukraine conflict as an opportunity to expand BRICS countries' Arctic participation and maintain peaceful development in the Arctic region. The addition of new members such as Saudi Arabia, Egypt, the United Arab Emirates, Iran, and Ethiopia following the 2024 BRICS expansion provides an opportunity for BRICS to expand its cooperation network. BRICS members need to pay more attention to and promote internal coordination and cooperation, quickly establishing a dedicated internal mechanism for Arctic scientific cooperation to jointly address external challenges such as Arctic "bloc confrontation" and the turbulence caused by major political events. In summary, Arctic scientific cooperation within the BRICS framework not only reflects the close collaboration and knowledge sharing among BRICS members in scientific research but also signifies an active exploration and innovation of multidimensional governance models in the Arctic, contributing to the construction of a new Arctic governance landscape based on scientific consensus and emphasizing multilateral principles.

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