

India-China Space Race: The Role of Private Sector

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Summary

India has signalled its ambitions of taking its space programme to the next level with the recently launched Indian Space Association (ISpA). Recognising the need for innovative contributions from entrepreneurs in the private sector, ISpA is envisioned to play a crucial role in opening India's space sector. In the words of Indian Prime Minister Narendra Modi, the Indian space sector has received "new wings". Meanwhile, China's private space sector, which is also still in its nascent stages, is witnessing rapid progress. Amid the latest developments in the space race between the two countries, the private sector is likely to play a significant role in determining the future trajectory of this competition.

Introduction

Space has become a crucial element of a state's economic, military and soft power. Every space accomplishment is not only a matter of national prestige for countries; it also comes with a myriad of security and economic advantages. Therefore, it is hardly surprising that Sino-Indian competition has also been launched into space.¹ India's space sector has seen remarkable growth in the past decade, but China is still in the lead. India is estimated to have spent nearly US\$1.8 billion (S\$2.46 billion) on space programmes in 2019-2020.² Though the jump from previous levels of space expenditure has been impressive, it stands at one-sixth of China's space expenditure.³ If the number of satellites launched by both countries in the five years between 2015 and 2019 is examined, India averages at six satellites per year while China's approximate average is 26.⁴ According to a March 2020 report by the Center for Strategic and International Studies, China owned 13.6 per cent of all earth-orbiting satellites while India's share was only 2.3 per cent.⁵

Even when India's space programme lags behind China's, the former has not shied away from setting new benchmarks. India set a new world record in 2017 by successfully launching 104 satellites in a single rocket (PSLV-C37).⁶ It is also the first Asian country to

¹ C Raja Mohan, "India and the geopolitics of the moon", *The Indian Express*, 6 October 2021, <u>https://indianexpresscom/article/opinion/columns/china-space-mission-moon-quad-meet-isro-india-7552149/</u>.

² Press Release, "Key Highlights of Economic Survey 2020-21", Press Information Bureau, Government of India, 29 January 2021, <u>https://pib.gov.in/PressReleasePage.aspx?PRID=1693231</u>.

³ Economic Survey 2020-21- Volume II, Chapter IX, Ministry of Finance, Government of India, <u>https://www.indiabudget.gov.in/economicsurvey/doc/vol2chapter/echap09_vol2.pdf</u>.

⁴ Average calculated using data mentioned in Economic Survey 2020-21, Government of India; see note 2.

⁵ "How is China Advancing its Space Launch Capabilities?", China Power, Center for Strategic and International Studies, 5 November 2019, Updated 25 August 2020, <u>https://chinapower.csis.org/china-space-launch/</u>.

⁶ Michael Safi, "India launches record-breaking 104 satellites from single rocket", *The Guardian*, 15 February 2017, <u>https://www.theguardian.com/science/2017/feb/15/india-launches-record-breaking-104-satellites-from-single-rocket</u>.

reach Mars orbit successfully and the first in the world to achieve this feat on its first attempt.⁷ One needs to consider its lunar mission plans for a more recent picture of India's space ambitions. With its Chandryaan-3 mission scheduled for next year, India plans to land on the moon's south pole.⁸ Also, India is simultaneously preparing for Gaganyaan – its maiden human space mission; and is aiming for an earth-orbiting space station by 2030.⁹ China, meanwhile, also has enormous ambitions, one of which includes the construction of an International Lunar Research Station in the moon's south pole.¹⁰

Apart from such ever-increasing accomplishments, India and China's space sector is undergoing a significant transformation: the growing involvement of private sector players in their space profile. Traditionally, opportunities for non-state entities aspiring to venture into space were limited in both countries. Space, an expensive and risk-prone domain, was dominated by national space organisations. The presence of unfavourable domestic laws also inhibited the growth of space entrepreneurship. However, with the current high demand for superior and diverse innovations for space missions and applications, the private sector has begun to make its mark in space technology. These private players will be critical in the undergoing space race between India and China.

A Blooming Commercial Opportunity

States are increasingly focusing on the commercial aspects of the private space industry. In spite of not having a massive commercial space sector, China has demonstrated excellent efficiency in cashing in on its private space firms. In 2014, China kickstarted its private space industry after the State Council's report formally encouraged private capital's participation in civilian space infrastructure.¹¹ From there on, China has seen a boom in space-technology start-ups. It has established over 100 companies in the last seven years, and its commercial space organisations have raised around US\$6.5 billion (S\$8.88 billion).¹² China now hosts more than 15 commercial launch companies that account for 50 per cent of the total funding received since 2014.¹³ Earth observation activities and satellite manufacturing received 20 per cent each of the total financing during this time.¹⁴ The rapid growth that these private ventures have made can be gauged from the example of Beijing Interstellar

⁷ "Mangalyaan: India's race for space success", *BBC News*, 24 September 2014, https://www.bbc.com/news/world-asia-india-29307123.

⁸ "Chandrayaan-3 mission likely late 2022", *The Hindu*, 28 July 2021, <u>https://www.thehindu.com/news/national/chandrayaan-3-likely-to-be-launched-during-third-quarter-of-2022-jitendra-singh/article35578074.ece</u>.

⁹ Chaitanya Giri, "Artemis Accords propel India's space ambitions", Gateway House: Indian Council on Global Affairs, 12 May 2020, <u>https://www.gatewayhouse.in/indias-artemis-moon/</u>.

¹⁰ C Raja Mohan, "India and the geopolitics of the moon", op. c it.

¹¹ "Guiding Opinions of the State Council on Innovating the Investment and Financing Mechanisms in Key Areas and Encouraging Social Investment", China Public Private Partnerships Center, 16 November 2014, <u>http://www.cpppc.org/en/zy/994006.jhtml</u>.

¹² "Chinese Space Sector Continues World-Leading Post-Covid Rebound: Euroconsult Quarterly Report", Euroconsult, 10 May 2021, <u>https://www.euroconsult-ec.com/press-release/chinese-space-sector-continues-world-leading-post-covid-rebound-euroconsult-quarterly-report/</u>.

¹³ Ibid.

¹⁴ Ibid.

Glory Space Technology Ltd (iSpace) – China's first private firm to achieve orbit. Within three years of its establishment, this company launched the Hyperbola-1 rocket in 2019.¹⁵

The advent of space-technology start-ups in India has been promising, but the growth has not been as rapid as that of China. A 2019 report had found that though India has more than 120 active space-technology start-ups, space venture funding in India remained at low levels.¹⁶ Last year, the Indian government established the Indian National Space Promotion and Authorisation Centre (IN-SPACe) as an independent nodal agency to oversee the availability of the Indian Space Research Organisation's (ISRO) facilities to private players for their innovative ventures.¹⁷ With the launch of Indian Space Association (ISpA), India has taken another step forward to boost its private space sector. Additionally, the country is revising its foreign direct investment (FDI) policy for the space sector.¹⁸ A recent analysis projects that the Indian commercial space-technology market may offer opportunities worth over US\$77 billion (S\$105.15 billion) by 2030.¹⁹ With these developments, it appears that New Delhi has set its eyes on solidifying its space economy and also on expanding the outreach of Indian space-technology companies abroad.

According to Merrill Lynch, the size of the space industry would touch almost US\$3 trillion (S\$4.10 trillion) within three decades.²⁰ Today, the majority of the revenue earned in the space sector is from the earth-for-space economy. The earth-for-space economy²¹ involves the use of space-based assets for applications such as telecommunication, geospatial data acquisition, satellite internet services in under-served regions, surveillance, navigation and geopositioning, among others. While China is taking massive strides in gaining from this booming sector, India's private sector is also gearing up. However, it remains to be seen how effective India's recent initiatives will be in helping its private space sector catch up with China's.

Nevertheless, India has the edge over China in making the most of space commerce opportunities. Apart from its domestic market, India can cater to a more extensive international base as security concerns hamper China's ability to procure orders from

¹⁵ Andrew Jones, "Chinese iSpace achieves orbit with historic private sector launch", *SpaceNews*, 25 July 2019, <u>https://spacenews.com/chinese-ispace-achieves-orbit-with-historic-private-sector-launch/</u>.

¹⁶ Ankan Das, "To Infinity And Beyond: India's Aerospace Startups Are Starting To Blow Their Thrusters", DataLabs by Inc42, 25 October 2019, <u>https://inc42.com/datalab/to-infinity-and-beyond-indias-space-technology-startups-are-starting-to-blow-their-thrusters/</u>.

¹⁷ "Indian National Space Promotion and Authorization Center (IN-SPACe)", Indian Space Research Organisation, <u>https://www.isro.gov.in/indian-national-space-promotion-and-authorization-center-space/roles-and-responsibilities</u>.

¹⁸ "India to revise FDI policy for space sector, says Isro chief Sivan", *Business Standard*, 13 September 2021, <u>https://www.business-standard.com/article/economy-policy/india-to-revise-fdi-policy-for-space-sector-says-isro-chief-sivan-121091301182_1.html</u>.

¹⁹ Nikhil Subramaniam, "Startups Grab The Spacetech Baton", *Inc42*, 16 October 2021, <u>https://inc42.com/features/indian-spacetech-startups-ready-to-grab-the-baton/</u>.

²⁰ Michael Sheetz, "The space industry will be worth nearly \$3 trillion in 30 years, Bank of America predicts", *CNBC*, 31 October 2017, <u>https://www.cnbc.com/2017/10/31/the-space-industry-will-be-worth-nearly-3-trillion-in-30-years-bank-of-america-predicts.html</u>.

²¹ Matt Weinzierl and Mehak Sarang, "The Commercial Space Age Is Here", Harvard Business Review, 12 February 2021, <u>https://hbr.org/2021/02/the-commercial-space-age-is-here</u>.

abroad.²² It is worth noting here that the United States (US) Intelligence Community's 'Annual Threat Assessment' report for 2021 has listed the Chinese space programme as a major security concern.²³ Although critics have argued that it is unfair to place China's military and civilian space ventures on the same plane, such allegations by the US can damage the credibility of the Chinese civil space programme, at least among the former's allies.

Security Implications

Apart from the crucial role private space firms play in space commerce and trade, the India-China space competition also has a security angle. India had previously expressed worries over China's technological advancement in space-technology, citing it as more than a military concern – one that transcends to include national infrastructure too.²⁴ Broadly speaking, China's Military-Civil Fusion strategy²⁵ aims to employ civilian innovation to further the advancement of its military capabilities. The private space sector is also a vital part of this strategy and start-ups that support China's strategic technology needs get more money and resources.²⁶ An example is the Zhuhai satellite of the Harbin Institute of Technology that comprises a constellation of high-quality satellites for earth's monitoring.²⁷ The Harbin Institute of Technology, which specialises in satellite technology, is one of China's top defence research universities that enjoys closeness with the state-owned China Aerospace Science and Technology Corporation.²⁸

In India's case, it has been argued that the lack of a solid framework for military-civil cooperation is hindering large-scale innovation and manufacturing of next-generation space technology.²⁹ Opening the space sector to private players may prove advantageous for the defence sector. First, this will ease out the burden on ISRO, which has limited in-house capacity to address the expanded objectives of India's space programme, including defence

²² Narayan Prasad, "India must boost start-ups to catch up with China's private space firms", *The Print*, 15 July 2019, <u>https://theprint.in/science/india-must-boost-start-ups-to-catch-up-with-chinas-private-space-firms/262712/.</u>

 ²³ "2021 Annual Threat Assessment of the U.S. Intelligence Community", Office of the Director of National Intelligence, United States of America, 13 April 2021, <u>https://www.odni.gov/index.php/newsroom/reports-publications/reports-publications-2021/item/2204-2021-annual-threat-assessment-of-the-u-s-intelligencecommunity.
</u>

²⁴ Aksheev Thakur, "China's technological advances in cyber, space domain worrying: CDS Bipin Rawat", *The Indian Express*, 22 October 2021, <u>https://indianexpress.com/article/cities/bangalore/bipin-rawat-china-technological-advances-cyber-space-domain-worrying-7585704/.</u>

²⁵ Elsa B Kania and Lorand Laskai, "Myths and Realities of China's Military-Civil Fusion Strategy", Center for a New American Security, 28 January 2021, <u>https://www.cnas.org/publications/reports/myths-and-realities-of-chinas-military-civil-fusion-strategy</u>.

²⁶ Blaine Curcio, "Developments in China's Commercial Space Sector", The National Bureau of Asian Research, 24 August 2021, <u>https://www.nbr.org/publication/developments-in-chinas-commercial-space-sector/</u>.

²⁷ Ibid.

²⁸ "China Defence Universities Tracker: Harbin Institute of Technology", Australian Strategic Policy Institute, 4 May 2021, <u>https://unitracker.aspi.org.au/universities/harbin-institute-of-technology/</u>.

²⁹ "Lack of military-civil cooperation framework impeding innovation in space tech: IAF Vice Chief", *The Hindu*, 8 September 2021, <u>https://www.thehindu.com/sci-tech/technology/lack-of-military-civil-cooperation-framework-impeding-innovation-in-space-tech-iaf-vice-chief/article36361278.ece</u>.

and security requirements.³⁰ Second, space technology can bolster the Indian armed forces' operational capabilities by augmenting capabilities for surveillance and reconnaissance, space situational awareness, intelligence gathering, etc. Former Chief of Defence Staff of India, General Bipin Rawat, urged the Indian private industry to "step in and step forward" with "cutting-edge space technologies" during the launch ceremony of ISpA.³¹

India appears keen to create synergies between ISRO and the private space-technology sector to attend to the country's expanding defence needs, most of which can be attributed to deteriorating relations with China.

Regional Space Diplomacy

Space diplomacy is also a reality that becomes more relevant as India and China vie for stronger ties with the South Asian countries. ISpA's aim of contributing towards the vision of an *Atmanirbhar Bharat*³² that emerges as a global leader in the space arena will surely need to pass the litmus test of regional diplomacy. India's last concrete success in regional space diplomacy was when ISRO launched the South Asia Satellite (GSAT-9) in 2017. It was heralded as a sound geopolitical move where India shared the benefits of its space-technology expertise with its neighbours (except Pakistan, which did not participate in the collaboration), having a minor presence in space.³³ China has also been active in the region, having assisted Pakistan and Sri Lanka in launching their communication satellites.³⁴

With a boom in the number of private actors in the space ecosystem in both countries, new avenues for regional space diplomacy will be available. China's Belt and Road Initiative (BRI) involves the Digital Silk Road, whose objectives are to deepen space cooperation among the BRI countries.³⁵ For example, SpaceOK, a private firm based in Shanghai, is known to support the BRI and also uses its satellite data to provide services to countries that are part of this initiative.³⁶ With a sturdy private space sector, China will enhance its footprint in

³⁰ Rajeswari Pillai Rajagopalan, "India's Space Programme: A role for the private sector, finally?", Observer Research Foundation, 24 May 2020, <u>https://www.orfonline.org/research/indias-space-programme-a-role-for-the-private-sector-finally-66661/</u>.

³¹ "Indian private industry must step in to provide cutting-edge space technologies to armed forces: Bipin Rawat", *The Economic Times*, 11 October 2021, <u>https://economictimes.indiatimes.com/news/defence/indian-private-industry-must-step-in-to-providecutting-edge-space-technologies-to-armed-forces-bipin-rawat/articleshow/86931188.cms?from=mdr.</u>

³² "Hon'ble PM Shri Narendra Modi launches the Indian Space Association (ISpA)", Indian Space Research Organisation, 11 October 2021, <u>https://www.isro.gov.in/update/11-oct-2021/hon%E2%80%99ble-pm-shri-narendra-modi-launches-indian-space-association-ispa</u>.

³³ Amitabh Sinha, "South Asian diplomacy lifts off on 2230-kg ISRO satellite GSAT-9", *The Indian Express*, 6 May 2017, <u>https://indianexpress.com/article/india/isro-gsat-9-satellite-launch-propels-modi-govts-satellite-diplomacy-in-the-neighbourhood-4642042/.</u>

³⁴ Ananth Krishnan, "Satellite launch for Pak signals China's growing space ambitions", *The Hindu*, 12 August 2011, <u>https://www.thehindu.com/news/international/satellite-launch-for-pak-signals-chinas-growing-space-ambitions/article2351214.ece</u> and Ajey Lele, "China to Launch Satellite for Sri Lanka: India's Missed Opportunity?", Manohar Parrikar Institute for Defence Studies and Analyses, 16 November 2012, <u>https://idsa.in/idsacomments/ChinatoLaunchSatelliteforSriLankaIndiasMissedOpportunity alele 161112</u>.

³⁵ Chan Jia Hao, "China's Digital Silk Road: A Game Changer for Asian Economies", *The Diplomat*, 30 April 2019, <u>https://thediplomat.com/2019/04/chinas-digital-silk-road-a-game-changer-for-asian-economies/</u>.

³⁶ "China Focus: Sunrise for China's commercial space industry?", *Xinhua Net*, 13 May 2018, http://www.xinhuanet.com/english/2018-05/13/c 137175948.htm.

South Asia. Meanwhile, the space-technology start-ups of India are on an impressive trajectory. If the latest space reforms can nurture the potential of private industry, India can employ space to strengthen its neighbourhood diplomacy. For instance, consider the Bangla-Bharath students satellite launch, a joint initiative of students from India and Bangladesh.³⁷ At the forefront of this project is SpaceKidz India, a leading private aerospace company that will be training five students from Bangladesh in the satellite's building. ISRO will be involved in the launch of this satellite.

Developments in space technology also carry positive implications for digital connectivity. Contributions from the private sector in facilitating space infrastructure can help enhance digital connectivity between India and its neighbours. In the past, digital connectivity has been vital in India's efforts to strengthen its neighbourhood ties. For example, the Indian government had endeavoured to boost its digital connectivity efforts by extending its National Knowledge Network (NKN) to other Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation countries.³⁸ NKN is a pan-India network with multi-gigabit capability that provides high-speed connectivity to all educational institutions in the country.³⁹ India's rising private space sector and domestic space reforms can assist New Delhi in similar policies to compete with Beijing's space-related engagement in South Asia.

The Quad in Outer Space

The first-ever physical summit of the Quadrilateral Security Dialogue (Quad) leaders, convened in September 2021, was deemed historic for reasons more than one. This summit also marked the beginning of new cooperation on outer space issues. Post-summit, the joint statement highlighted opportunities to collaborate on peaceful purposes and address challenges common to the four-member states.⁴⁰ These challenges include climate change and natural disasters, among others. From India's perspective, the inclusion of space as a domain in the Quad's agenda implies that it collaborates more closely with the American space programme – one with the most considerable private sector contribution. America's SpaceX, arguably the most decorated space services company worldwide, has launched satellites to monitor disaster relief, climate change, resource management, etc.⁴¹ The Quad's commitment to strengthen cooperation in space can mean a more significant role for India's private space sector in similar initiatives.

³⁷ Sidharth M P, "50 years of India-B'Desh ties: Students from both countries to jointly build Satellite, launch by ISRO", *Wion News*, 26 January 2021, <u>https://www.wionews.com/india-news/50-years-of-india-bdeshties-students-from-both-countries-to-jointly-build-satellite-launch-by-isro-359486</u>.

³⁸ "Address by Foreign Secretary at the Regional Connectivity Conference : South Asia in the Indo-Pacific Context", Ministry of External Affairs, Government of India, 1 November 2018, <u>https://www.mea.gov.in/Speeches-</u> <u>Statements.htm?dtl/30556/Address+by+Foreign+Secretary+at+the+Regional+Connectivity+Conference++S</u> <u>outh+Asia+in+the+IndoPacific+Context.</u>

³⁹ For more details, see <u>https://nkn.gov.in/en/about-us-en</u>.

⁴⁰ "Joint Statement from Quad Leaders", The White House, United States of America, 24 September 2021, <u>https://www.whitehouse.gov/briefing-room/statements-releases/2021/09/24/joint-statement-from-quad-leaders/</u>.

⁴¹ William Hardwood, "SpaceX launches 3 satellites to monitor Canadian territory, impact of climate change", CBS News, 12 June 2019, <u>https://www.cbsnews.com/news/spacex-launches-three-canadian-earth-observation-satellites/</u>.

With the Quad's close cooperation on outer space, the Indian space-related start-ups can benefit from collaborative arrangements with their counterparts. For instance, Australia is aiming to triple its space industry from A\$4 billion to A\$12 billion (S\$3.91 billion to S\$11.73 billion) by the next decade. This could open doors for collaborations between Australian and Indian companies in space-related technology and applications.⁴² For example, Pixxel – an Indian space data company constructing a constellation of hyperspectral earth imaging satellites to obtain data and predict global phenomena⁴³ – is pursuing potential partnerships with data application providers in Australia, which has remarkable expertise in satellite data applications.⁴⁴

There are multiple avenues for innovation where the Indian space-technology start-ups fit brilliantly. The issue of space debris is a case in point. The Quad's joint statement had expressed commitment towards the sustainable use of outer space.⁴⁵ Space debris is the dark side of the increasing human activity in outer space. Collisions between satellites, rocket exhaust particles, paint particles and other such fragments cause debris or space junk that accumulates in the earth's orbit. Tackling this problem is central in ensuring the sustainable use of space. Digantara is a promising Indian space start-up that works on cost-effective solutions to monitor space debris.

Similarly, the Quad's cooperation in space-related domains also aims to enable capacitybuilding initiatives for sustainable development in other countries of the Indo-Pacific.⁴⁶ Since many countries in the Indo-Pacific are vulnerable to risks and challenges posed by climate change and natural calamities,⁴⁷ private players specialising in this domain will be in demand. It opens up multiple opportunities for Indian space entrepreneurs to engage with a broader audience in the Indo-Pacific. Moreover, Indian space-technology start-ups have shown promising results while focusing on sustainability. For example, a Mumbai-based start-up Manastu Space has developed a sustainable and safe propulsion system, I-Booster, which can provide an alternative to environmentally hazardous chemical propulsions containing toxic fuels.⁴⁸ Another example is Bangalore-headquartered Bellatrix Aerospace Pvt Ltd, which leads the development of a fully reusable micro launch vehicle – Chetak.⁴⁹

⁴⁵ For more details, see <u>https://nkn.gov.in/en/about-us-en</u>.

⁴² "India's space sector offers huge scope for foreign companies to tie up with Indian companies: Dr. K. Sivan", India Science Wire, Vigyan Prasar, Department of Science and Technology, Government of India, 14 September 2021, <u>http://vigyanprasar.gov.in/isw/Indias-space-sector-offers-huge-scope-for-foreign-</u> companies-to-tie-up-with-indian-companies-dr-k-sivan.html.

⁴³ For more details, see <u>https://www.pixxel.space/about-us</u>.

⁴⁴ Bhavna Sharma, "India, Australia set to strengthen Space partnership", *Geospatial World*, 23 September 2021, <u>https://www.geospatialworld.net/article/india-australia-set-to-strengthen-space-partnership/</u>.

⁴⁶ "Fact Sheet: Quad Leaders' Summit", The White House, United States of America, 24 September 2021, <u>https://www.whitehouse.gov/briefing-room/statements-releases/2021/09/24/fact-sheet-quad-leaders-summit/</u>.

⁴⁷ "No Time to Wait: Climate Change in the Indo-Pacific", A Joint Series by Asia Society Switzerland and Swiss Re Institute, <u>https://asiasociety.org/switzerland/no-time-wait-climate-change-indo-pacific</u>.

⁴⁸ Roshni Balaji, "[Tech30 Special Mention] This spacetech startup is attempting to propel satellites in a costeffective and sustainable manner", *YourStory*, 5 November 2020, <u>https://yourstory.com/2020/10/tech30spacetech-startup-satellite-sustainable-system/amp</u>.

⁴⁹ "National Startups Awards 2020- Space Startups: Bellatrix Aerospace Private Limited", Government of India, <u>https://www.startupindia.gov.in/nsa/space.html</u>.

If for India, the Quad's space ambitions present greater opportunities for its private sector, China's private space sector too would need to step up to counter the collaborative strength and efficiency of the Quad's space ventures.

The Promise of International Collaborations

International collaborations and tie-ups with other players worldwide can go a long way in helping a start-up stay competitive. One of the most striking developments in China's private space ecosystem was when some Chinese start-ups forged tie-ups with their European counterparts.⁵⁰ A notable example is an agreement between China's Spacety and France's ThrustMe to develop low-cost satellite propulsion fuel.⁵¹ The two have been working on an Iodine-based propulsion technique for small satellites – a game-changing alternative that significantly reduces risks related to the propulsive performance of spacecraft.⁵² Interestingly, Spacety established its international headquarters in Luxembourg in 2019 – just within three years of its launch.⁵³ The example of Spacety's achievements and global networking speaks volumes of the value addition that international collaborations bring to budding start-ups.

Indian space-related start-ups have also shown a penchant for such tie-ups. High-technology products and services offering low-cost solutions make the Indian private space ecosystem attractive for space-related firms worldwide. The Hyderabad-based Skyroot Aerospace Pvt Ltd recently signed an agreement with Italy's D-Orbit for a joint pilot mission.⁵⁴ Another prominent Indian space start-up – AgniKul Cosmos Pvt Ltd, has tie-ups in Europe and Japan with players involved in space applications ranging from using satellites for planet imagery to providing data storage in space.⁵⁵ Similarly, Digantara, has signed Memoranda of Understanding with a Taiwanese space start-up, Tensor Tech Ltd, to develop high-quality satellites and a Germany-based company named OKAPI Orbits GmbH to work on a sustainable space environment, among others.⁵⁶

If India's space programme is to come close to matching the Chinese, its start-ups will need to bag the best of opportunities for international collaborations.⁵⁷ The Indian government's latest policies regarding the opening up of its space sector may result in an environment more conducive to such global collaborations. In addition, the same argument about the scepticism around China's space programme that raises doubt about its potential to procure

36057291f2fe.filesusr.com/ugd/64a0e4 130aafa247de4199986799cb0722e3d0.pdf.

⁵⁰ Kartik Bommakanti, "The Chinese space programme marches ahead: Implications for India", Observer Research Foundation, 27 November 2020, <u>https://www.orfonline.org/expert-speak/chinese-space-programme-marches-ahead-implications-india/</u>.

⁵¹ Ibid.

⁵² Ibid.

⁵³ For more details, see <u>https://directory.eoportal.org/web/eoportal/satellite-missions/s/spacety</u>.

⁵⁴ "D-Orbit Signs Agreement with Commercial Indian Launch Operator Skyroot Aerospace", DOrbit.space, 3 November 2021, <u>https://75a8451e-2fb7-4c8f-830f-</u>

⁵⁵ Huma Siddiqui, "Single fully 3D printed cryogenic rocket engine launched by space startup", *Financial Express*, 6 October 2021, <u>https://www.financialexpress.com/lifestyle/science/single-fully-3d-printed-cryogenic-rocket-engine-launched-by-space-startup/2345097/.</u>

⁵⁶ More details on <u>https://nkn.gov.in/en/about-us-en</u>.

⁵⁷ Kartik Bommakanti, "The Chinese space programme marches ahead: Implications for India", op. cit.

international orders can be extended in the case of international collaborations too.⁵⁸ It has been observed that even the private Chinese space companies need to submit to some level of government interference and control, making the distinction between genuinely private companies and the ones which, in reality, function as state actors sometimes fuzzy.⁵⁹ This could lead to a lack of trust from international partners.⁶⁰ Consequently, this can be detrimental to the intentions of space-related start-ups to establish significant collaborations with their counterparts abroad. In the long run, this can even translate into the Indian private space sector gaining an edge over the Chinese in securing international collaborations.

Conclusion

Today, the space sector is thriving with commercial possibilities, and it is destined to become more competitive with time. Space-related achievements are not only a symbol of national prestige; they are also critical for a nation's security and its overall growth and development. Therefore, space makes up for an essential domain in the Sino-Indian competition. With a fresh impetus to their respective private space sectors, the two rivals have charted out a new trajectory for their space race. Since space is not immune to contemporary geopolitics, this watershed moment caused by the entry of budding private space ventures will greatly shape the rivalry between the two Asian giants.

Apart from introducing reforms such as IN-SPACe, ISpA and FDI revision, the Indian government is focusing on boosting participation from young entrepreneurs and students. One initiative in this direction is the Atal Tinkering Lab space challenge, jointly launched in September 2021 by ISRO and National Institution for Transforming India Aayog.⁶¹ According to ISRO chairman, K Sivan, the number of proposals from the private sector has increased by 30 per cent in 2021 compared to the previous year.⁶² In sum, a favourable environment for space-technology innovation in India seems to be on the rise. Effective implementation of its domestic space reforms will be vital in determining the sustainability of a vibrant ecosystem for India's private space sector. The success of these reforms and the intensity of their subsequent impact on the India-China space race remains to be seen.

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⁵⁸ Matt Weinzierl and Mehak Sarang, "The Commercial Space Age Is Here", op. cit.

⁵⁹ Neel V Patel, "China's surging private space industry is out to challenge the US", *MIT Technology Review*, 21 January 2021, <u>https://www.technologyreview.com/2021/01/21/1016513/china-private-commercial-space-industry-dominance/</u>.

⁶⁰ Ibid.

⁶¹ "Major Reforms Transforming Indian Space Sector", India Brand Equity Foundation, Ministry of Commerce & Industry, Government of India, 17 November 2021, <u>https://www.ibef.org/blogs/major-reforms-</u> <u>transforming-indian-space-sector</u>.

⁶² Ibid.

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