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TRANSFORMING INDIAN SPACE SECTOR THROUGH PRIVATE PARTICIPATION

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Significant events in April heralded the beginning of the transformation of the Indian space sector through commercialisation and private participation.

- New Space India Limited (NSIL), which has been authorised to commercialise PSLV production, awarded the contract for the manufacture of five Polar Satellite Launch Vehicles (PSLVs) – ISRO's flagship for nearly three decades, to an HAL-L&T consortium.[1]

- One Web, a British satellite operator, in which India's Bharti Enterprises holds near 40% stake, signed an agreement with NSIL for launch of its satellites – part of its planned constellation of 648 satellites for LEO based communication services – onboard a Geosynchronous Satellite Launch Vehicle (GSLV III), a first for the heavy lift rocket of ISRO.[2]

- Pixxel, an Indian start-up, launched the first of its satellite, Shakuntala, claimed to host the 'world's highest resolution hyper spectral commercial cameras that has ever been flown to space', on SpaceX's Falcon-9 rocket. It demonstrated the potential of new-age Indian companies to innovate and develop capability.

Recent years have seen a significant increase in space enabled applications in communications, imaging, navigation etc. and related space-based activities. The demand for these services is seeing an uptick, both from government and civil sectors. This has led to the global space economy, which includes a range of activities related to access to the domain and products and services enabled through it, steadily increasing to ~ US$ 447 billion by 2020.[3] Space related government organisations, the world over, are finding themselves constrained in terms of capacities and budget to meet this rapidly growing demand. This, even as the race to occupy orbital slots in the ever more congested, contested and competitive outer space environment, for strategic and commercial purposes, continues to intensify. Meanwhile, government driven R&D no longer remains the harbinger of technological innovation, as technological advancement and proliferation have allowed private companies to develop capabilities at par with or even better than government agencies. This is especially true for new-age disruptive technologies, such as artificial intelligence, 3D printing, Big Data Processing etc., that have applications across sectors as also dual-use potential. Governments, across the globe, have been encouraging and exploring capability building among private sector and providing assistance in terms of technology, finance and infrastructure. Private sector has also been able to foster a more diverse pool of talent and companies have been seeking and obtaining resources from sources other than the governments.

Consequently, activities in the Space domain too are in a state of transition – from being primarily government driven to an increasing participation of the private sector, mainly with government support. Noteworthy global examples include the UK government that has been enabling satellite production through private entities and facilitating launches. China unveiled a 10-year blueprint to promote the commercial aerospace sector in 2015 and has been supporting private companies in the sector through its Military-Civil-Fusion strategy. Some of its more successful space sector companies are now looking at going public.[4]The best example is that of SpaceX that has grown substantially in the last decade through a favourable environment provided by the U.S. government. It has not only proven itself in undertaking routine missions like satellite launch and manned and unmanned missions to the International Space Station, but has been the trendsetter in the innovative use of reusable rockets and is now launching multiple satellites in Low Earth Orbit (LEO) to provide low latency satellite-based communication. The steady lowering of cost of access to space through commercialisation and private participation would result in greater utilisation and the global space economy is projected to increase to $1.1 trillion or more by 2040.[5]

India's success in the domain of space, spearheaded by the Department of Space (DoS) and Indian Space Research Organisation (ISRO) has put it among the few space faring nations with advanced capabilities in satellites, launch vehicles (LV) and associated technologies. While it began launching foreign satellites in 1999, commercial success has eluded the organisation – largely due to policy constraints and its limited capacities that are more oriented towards meeting national requirements. Currently, Indian efforts constitute only 2-3% of the global space economy, mainly centred on providing launch services, which contributes only five percent of the total global market. There is large scope to expand to satellite-based services and ground-based systems that account for the remaining 95%.While the organisation has had association with nearly 500 private sector entities for manufacturing of rocket engines and supply of materials, components and subsystems, the interaction has not extended to making these entities competent to contribute to Space technology development work or participate in operations. Also, the comfort level of interacting with traditional companies has not extended to start-ups, whose increasing participation in various sectors is already putting forth new challenges in terms of policy and regulation.

The government has realised that commercial exploitation of ISRO's capabilities would be best achieved through the participation of Non-Government/Private Entities (NGPEs). It has undertaken a process of reforms for their larger participation in space-related manufacturing, space-based activities and space-enabled applications. Inaugurating the Indian Space Association (ISpA), the Prime Minister, Narendra Modi said that the government can no longer act as a handler for the Space sector, but rather has to work as an enabler. He highlighted the four pillars of Indian Space reforms – the freedom of innovation to the private sector, the role of the government as an enabler, to prepare the youth for the future and to see the space sector as a resource for the progress of the common man.[6]

The domain is capital and technology intensive and private participation would be best achieved through diffusion of space technology. As part of handholding and promoting the private players, ISRO has been permitted to share its technology, data, expertise and facilities. The goal is to enable the private sector progress from the traditional vendor role to participation in a range of space activities, such as building and launching satellites and LVs, establishment and operation of ground infrastructure and making space-based applications and services more widely accessible to everyone. The increasing role of private entities in ancillary or routine activities would allow ISRO to gradually move to concentrating on its primary role of science, research and development, interplanetary exploration and strategic use of space.Private companies are also expected to contribute to space

technology development through independent innovations or collaborative efforts with ISRO.

Private participants would seek commercial returns for their investment, for which the government demand would not be sufficient. Commercial viability would come through scaling up, building up resilient supply chains and enabling policy that would allow competitive participation in the global market. This would expand sources of investments and global interactions and collaborations would contribute positively towards technology advancements and novel applications. Increasing private participation would provide benefits of a competitive market in terms of economics, innovation and human resource development. Initial progress would lead to creation of data and better understanding of the sector that in turn would guide financing and policy making.

The government has established new organisations under the administrative control of the Department of Space that would work dedicatedly towards commercialisation of capabilities and provide a boost to private sector participation in the entire range of space activities.

- **New Space India Limited (NSIL)** was established in March 2019 to promote commercialisation of spin off technologies and products and services emanating out of ISRO activities, for which it has been given the ownership of operational launch vehicles and space assets of ISRO. It has also been authorised to transfer technology to industry, including those related to small satellites (India Mini Satellite-1 (IMS-1) Bus), building and operationalising LVs, providing launch services and providing space-based services. The most important aspect is the reorientation from a 'supply-driven model' to a 'demand-driven model', wherein NSIL shall act as aggregator of user requirements and obtain commitments.[7] In addition to the agreements signed in April, NSIL will acquire three ISRO manufactured communication satellites, GSAT 20, GSAT 22 and GSAT 24[8], the last already dedicated for utilisation by TataSky.[9]

- **IN-SPACe**. Formation of a national level autonomous nodal agency namely Indian National Space Promotion and Authorization Centre (IN-SPACe) was cleared in June 2020.It is the single-point interface between ISRO and NGPEs to permit, regulate, promote, hand-hold, monitor and supervise Space Activities.[10] The month of April also saw IN-SPACe establishing three directorates – of promotions, technical and programme administration-and-authorisation and appointed respective administrators, to take the process further.[11]

- **Antrix Corporation Limited** will continue to handle ISRO's commercial deals for satellites and LVs with foreign customers.

Indian Space Association (ISpA). Government organisations, mainly led and staffed with ISRO scientists and bureaucrats, need inputs from the industry for progressing reforms and processes towards ease of operations and doing business. In October 2021, the Prime Minister announced the formation of the Indian Space Association (ISpA), a body comprising Indian private companies and start-ups. The voluntary association would act as the intermediary between the government and private entities and academia and act as the advisory and advocacy group for the Space industry in India. It would articulate the industry's views on space sector reforms that would guide policy formulation related to Space related technology and operations. It is also expected to help build up talent and skill pool with a more integrated approach, focus on capacity building and promote Space economic hubs and incubators in India.

Facilitating commercialisation and private participation in the domain would require revising existing policies and regulation as also formulation of new ones, to factor in novel applications and participation by MSMEs and start-ups. The government's intent is evident in the number of new draft policies released by the DoS between October 2020 and August 2021 for public consultation, which are in various stages of formulation or discussion. These cover various space sectors and applications, such as Space Com, Remote Sensing, Technology Transfer, Navigation, Space Transportation, Space Exploration and Space Situational Awareness[12], as also a policy on Foreign Direct Investment (FDI) in Space. Access to space is governed by international treaties and regulations and these would have to be a part of the larger policy framework. In order to address these aspects, DoS is also in the process of enacting a national legislation. The draft Space Activities Bill has completed Public and Legal consultations and is being processed for further approvals for inter-ministerial consultations.[13] The new policies are expected to provide a comprehensive framework and regulatory environment for the contemporary ecosystem as well as that of emerging technologies and applications. For example, Space Com Policy, which is at the final stages of deliberations, is expected to provide a framework for companies operating in the Space Com domain to launch space broadband services in India via the low-earth orbit (LEO) and medium-earth orbit (MEO).The expectation is that the overall policy framework would be enabling for the industry, encourage greater participation, address issues related to IPRs and commercialisation of the sector, while ensuring standards and safety.

Already, the positive intent towards reforms has resulted in a steady growth in participation by private entities in the sector. The economic survey of 2021-22 stated that the number of start-ups in the sector increased to 47 in 2021 from 11 in 2019.[14] Till April, IN-SPACe had received close to 55 proposals from large industries, MSMEs, start-ups and academia[15] covering a broad range of upstream (launch vehicle/satellite manufacturing) as well as downstream (Earth Observation applications, communications, etc.) activities. The funding into the sector has also jumped 198.67 percent, from $22.5 million in 2020 to $67.2 million in 2021.[16]

According to a report by Space Tech Analytics of May 2021, India is now home to 368 private Spacetech firms, compared to 35 firms in Feb 2020[17], well-surpassing a number of countries, such as China (288), France (269) and Spain (206).[18]Companies like Earth2orbit and Team Indus were the pioneers in the sector. They have now been joined by others, like Skyroot Aerospace, AgniKul, Digantara and Bellatrix in the more capital-intensive upstream segment. Prominent companies in the downstream segment are Kawa Space, SatSure and BlueSky Analytics, while Dhruva Space is working on multiple space engineering solutions. In September 2021, a consortium called Indian Space Technologies and Application Design Bureau (I-STAC.DB), led by IIT Madras' Pravartak Foundation and comprising five start-ups, was formed to pursue varied technologies for Development & Commercialisation of Space and Deep Space.[19]Most new-age companies are seeking innovation through the use of disruptive and futuristic technologies. AgniKul Cosmos is developing a rocket engine, Agniban and has produced and tested a 3D printed engine, Agnilet, at facilities provided by ISRO. Bellatrix Aerospace successfully tested India's first high-performance green propulsion system for satellites in April and again in May. Astrogate Labs is working on optical/laser high speed communication through satellites.

DoS is also pursuing engagement with academic institutions and research organisations to increase interest in the sector with an aim to widen the pool of talent available for future developments. Besides the Indian Institute of Space Science and Technology at Trivandrum, ISRO has helped establish Space Technology Cells (STCs), Regional Academic Centres for Space and Space Technology Incubation Centres [S-TIC] at several premier institutes across the country to encourage R&D in space science, technology & applications.[20] The more recent additions have been Kalpana Chawla Centre for Research in Space Science and Technology (KCCRSST) at Chandigarh University in January 22 and Satish Dhawan Centre for Space Sciences at Central University of Jammu in March 22.[21]Plans are afoot to set up more research hubs and a grant of Rs 2 crores per 12 months to these establishments has been approved by the government.[22]

Defining supportive policies and providing institutional support would help incentivise private participation in the sector. The biggest perceived impediment remains overcoming entrenched mindsets that have been influenced by the largely government dominated technology development of the last century, especially in sectors related to national security. The government agencies thus tend to distrust private capability and intentions, leading to a lack of comfort with private participation in government dominated and controlled sectors. Globally, this has caused a reluctance to share technology, data, control and revenue through bureaucratic hurdles and IPR issues. In India, the new government organisations, predominantly manned and controlled by scientists from the organisation, would need to provide a level playing field, while ensuring adherence to defined standards and regulations by the private participants and avoiding any conflict of interest. This would be better achieved with a greater diversity in staffing, through lateral absorption of specialists who better understand policy, economics and legal aspects related to commercial use of space.

The pace of reforms, including formulation of policy and processing of requests, needs to be speeded up. Lack of clarity would limit the NGPEs' ability to obtain financing, adversely affecting technology maturation and capability building. While single-window clearances are desirable, such a complex domain cannot be without its permissions, authorisation and licences from multiple agencies. For example, companies wishing to operate space enabled internet services in India would require clearances from the Department of Space, Department of Telecommunications and IN-SPACe to operate satellite internet services. This would vary for other space related activities. Also, the highly dynamic environment of the sector that is undergoing radical transformation would be better served through an adaptive approach, rather than aiming for an overly stable regulatory environment.

With the opening up of technology intensive sectors to private companies, there is an increasing pressure on them to show results, with failures being highlighted. An example is that of the U.S.' Defence Innovation Unit, an organisation focussed exclusively on fielding and scaling commercial technology across the U.S. military, whose success rate has been around 23 percent – projects that ended up in actual applications.[23] The NGPEs would need to show results, while ensuring adherence to safety standards and protocols and adopting best practices associated with this demanding sector.

The expansion of the global space economy and opening up of new avenues within the domain is offering huge commercial opportunities. India seeks a 10 percent share (US$ 50 billion) of the global space economy by 2030, at a CAGR of nearly 48 percent.[24] It has been well recognised that

this would not be possible without private participation augmenting capacities, as well as seeking and providing innovative options. The private sector can no longer be seen as just an absorber of technology, but as a potential collaborator and source of innovation in foundational and futuristic technologies. The 'predictable, forward-looking, well defined and enabling regulatory regime for space activities policy reforms'[25] that has been set in motion needs speeding up or India would slowly lose the advantage of being a leading space faring nation. Only a vibrant and thriving Indian space industry would be able to garner a bigger share of the global market, provide job opportunities and generate revenue that would finance further growth. In the future, opportunities for the NGPEs should be expanded to planetary exploration missions and in strengthening India's strategic space capability.

CERTIFICATE

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[1] Chethan Kumar, "HAL-L&T wins over Rs 824-crore contract for making 5 polar space launch vehicles", Times of India, Apr 9, 2022, accessed at https://timesofindia.indiatimes.com/india/hal-lt-wins-over-824-cr-contract-for-making-5-pslvs/articleshow/90736339.cms

[2]Chethan Kumar, "In a first, GSLV-Mk3 will be used for commercial mission; NSIL to launch OneWeb satellites", Times of India, Apr 24, 2022accessed at https://timesofindia.indiatimes.com/home/science/in-a-first-gslv-mk3-will-be-used-for-commercial-mission-nsil-to-launch-oneweb-satellites/articleshow/91055331.cms

[3] "Economic Survey - 2021-2022", Ministry of Finance, Government of India, accessed at https://www.indiabudget.gov.in/economicsurvey/

[4] Cheng Yu, "Race on for 1st domestic satellite listed firm", China Daily, Apr 13, 2022, accessed at http://global.chinadaily.com.cn/a/202204/13/WS625631eda310fd2b29e56ae1.html

[5] "Space: Investing in the Final Frontier", Morgan Stanley, Jul 24, 2020 accessed at https://www.morganstanley.com/ideas/investing-in-space

[6] "Government's approach to space reforms is based on 4 pillars: PM Modi", Official Website, Narendra Modi, October 11, 2021https://www.narendramodi.in/text-of-prime-minister-narendra-modi-s-address-at-launch-of-indian-space-association-557818

[7] "Opening Up Indian Space Sector For Private Sector –Reforms", Indian Space Research Organisation, accessed at https://www.isro.gov.in/unlocking-india%E2%80%99s-potential-space-sector/opening-indian-space-sector-private-sector-%E2%80%93reforms

[8] n3

[9] Surbhi Pathak, "India to launch communication satellite GSAT-24 for Tata Sky", Zee News, Oct 03, 2021,https://zeenews.india.com/india/india-to-launch-communication-satellite-gsat-24-for-tata-sky-2399237.html

[10]"IN-SPACe: Roles and Responsibilities", Indian Space Research Organisation, accessed at https://www.isro.gov.in/indian-national-space-promotion-and-authorization-center-space/roles-and-responsibilitieswhat it means to the future of space exploration

[11] Chethan Kumar, "IN-SPACe forms 3 directorates, to clear 8 pvt proposals soon; vetting 55 in all",

Times of India, Apr 7, 2022, accessed at https://timesofindia.indiatimes.com/india/in-space-forms-3-directorates-to-clear-8-pvt-proposals-soon-vetting-55-in-all/articleshow/90712591.cms

[12] Reply to Lok Sabha Unstarred Question No. 1293,February 09, 2022, "Private Players in Space",

Accessed at http://164.100.47.194/Loksabha/Questions/QResult15.aspx?qref=33789&lsno=17

[13] "Government plans to open FDI in space sector: Jitendra Singh", Business Standard, February 9, 2022, accessed at https://www.business-standard.com/article/economy-policy/government-plans-to-open-fdi-in-space-sector-jitendra-singh-122020901539_1.html

[14]n3

[15]n11

[16]Debangana Ghosh, "Funding into space tech start-ups grew 198 per cent y-o-y in 2021", The Hindu, Feb 06, 2022, accessed at https://www.thehindubusinessline.com/info-tech/funding-into-space-tech-start-ups-grew-198-per-cent-y-o-y-in-2021/article64969678.ece

[17] "SpaceTech Industry 2021 / Q2:Landscape Overview", Space Tech Analytics, May 2021, accessed at https://analytics.dkv.global/spacetech/SpaceTech-Industry-2021-Report.pdf

[18]Resham Suhail, "Indian Space-Tech Sector: Evolving & Attracting Investors", BWDisrupt, March24, 2022, accessed at http://bwdisrupt.businessworld.in/article/Indian-Space-Tech-Sector-Evolving-Attracting-Investors/24-03-2022-423336/

[19] "IIT Madras Pravartak Foundation-led Consortium to develop Technologies for Development & Commercialization of Space and Deep Space", PIB Chennai, Sep 30, 2021, accessed at https://pib.gov.in/PressReleasePage.aspx?PRID=1759644

[20]Reply to RajyaSabha Unstarred Question No. 2223, Dec 16, 2021, "Private Players in Space Sector", accessed at https://rajyasabha.nic.in/rsnew/Questions/QResult.aspx

[21] Reply to Rajya Sabha Unstarred Question NO. 4135, April 07, 2022, "Space Centre at Central University, Jammu", accessed at https://rajyasabha.nic.in/rsnew/Questions/QResult.aspx

[22]Reply to LokSabha Unstarred Question No. 5681, Apr06, 2022, "ISRO Space Missions", accessed at http://164.100.47.194/Loksabha/Questions/QResult15.aspx?qref=38366&lsno=17

[23] John Beckner, "The West's Military Technology Imperative: Public/Private Partnerships", MilSatMagazine, April 2020, accessed at http://milsatmagazine.com/story.php?number=1592616838

[24] "Major reforms transforming Indian space sector", India Brand Equity Foundation, Nov 17, 2021, accessed at https://www.ibef.org/blogs/enhancing-private-sector-participation-in-india-s-commercial-space-sector

[25] n3