



Promoting Public-Private Synergy in India's Space Sector

This editorial is based on “[Space race: Is competition among Indian startups ready for lift-off?](#)” which was published in The Livemint on 25/06/2025. The article brings into picture the evolving landscape of India's space sector, where ISRO's collaboration with HAL and private startups like Skyroot and Agnikul fosters innovation.

For Prelims:

[Indian Space Research Organisation](#), [National Space Promotion and Authorization Center](#), [Vikram-S](#), [Small Satellite Launch Vehicles](#), [PSLV rocket](#), [NewSpace India Ltd](#), [GSAT-7](#), [Outer Space Treaty \(1967\)](#), [Space Debris Mitigation Guidelines \(2007\)](#)

For Mains:

Role of Private Sector in Expansion of India's Space Industry, Key Concerns Associated with the Integration of Private Entities into India's Space Sector.

India's space sector is witnessing a **transformative phase, driven by enhanced participation of private entities**. The **Indian Space Research Organisation (ISRO)** has **strategically outsourced satellite launcher manufacturing** to Hindustan Aeronautics Ltd (HAL), enabling a focus on advanced technologies like reusable rockets and orbital security. This move complements the efforts of private startups such as **Skyroot Aerospace, Agnikul Cosmos, and Pixxel**. As India aims to become a global space hub, the synergy between public institutions and private enterprises is pivotal in **propelling the nation's space ambitions forward**.

How is the Private Sector Contributing to the Expansion of India's Space Industry?

- **Private Sector Participation through IN-SPACE:** The establishment of the Indian **National Space Promotion and Authorization Center (IN-SPACE)** in 2020 was a landmark shift, enabling increased participation from private players in India's space sector.
 - By fostering collaboration between ISRO and non-governmental entities (NGEs), IN-SPACE has significantly enhanced the private sector's involvement in satellite launches and space-based services.
 - For instance, **Skyroot Aerospace, a private player, became the first to launch a suborbital rocket, Vikram-S, in 2022.**
- **Space Startups and Innovation Surge:** India's space startup ecosystem has witnessed explosive growth, with startups like **Agnikul Cosmos, and Dhruva Space** leading the way in launch vehicle technology, satellite manufacturing, and in-space services.
 - **Agnikul's mobile launchpad Dhanush** exemplifies the technological leap. **Startups received \$68 million in investments in 2021 alone**, marking a 196% year-on-year increase.
- **Enhanced Public-Private Partnership:** Public-private collaborations have been further boosted through partnerships between **ISRO and industry giants like Hindustan Aeronautics Ltd (HAL), Godrej Aerospace, and L&T** for manufacturing critical space infrastructure.

- These companies play a vital role in building components for launch vehicles, spacecraft, and satellite subsystems, enhancing India's self-reliance in space technology.
- For example, **HAL's partnership with ISRO** has been instrumental in **manufacturing PSLV rocket components for over 60 successful launches.**
- **Development of New Launch Vehicles and Infrastructure:** The Indian space sector's collaboration with the private sector has led to innovations in launch vehicles, such as the development of **Small Satellite Launch Vehicles (SSLV) and Reusable Launch Vehicles (RLV).**
 - The **establishment of space parks across the country** will also serve as hubs for small satellite manufacturing and launch services, fostering further private sector involvement.
 - In **2023, SSLV technology saw successful tests**, marking a step toward providing affordable, on-demand launch services for small satellites, essential for commercial applications.
- **International Collaborations and Commercialization:** The opening of the space sector to private players has enhanced India's position in the global space market.
 - With international collaborations through initiatives like the launch of foreign satellites, ISRO's commercial arm **NewSpace India Ltd (NSIL) has helped export India's satellite launch services.**
 - In 2023, **ISRO launched 42 satellites for foreign countries**, contributing to India's growing footprint in global space commercialization.
- **Space-Based Applications and Societal Impact:** Space-based applications, especially in communication, remote sensing, and Earth observation, have seen significant contributions from both ISRO and private sector players.
 - These technologies are driving **digital inclusion, improving agriculture, and enhancing disaster management.**
 - The launch of satellite constellations and Earth Observation satellites by both ISRO and private entities is transforming sectors like agriculture, telecommunications, and urban planning.
 - **Satellite services are expected to contribute 36% of the space economy by 2025**, with remote sensing registering one of the highest growth rates in India's space sector.
- **Technological Advancements and Green Propulsion:** India's space industry is also at the forefront of developing sustainable space technologies, such as green propulsion systems for rockets.
 - Startups like **Bellatrix Aerospace are pioneering these technologies**, aiming to reduce the environmental impact of space missions.
 - This aligns with global trends of adopting eco-friendly technologies in space exploration and satellite launch systems.
 - **Bellatrix Aerospace has already signed deals for propulsion systems with companies in the UK and France**, showcasing India's innovation in space sustainability.

What are the Key Concerns Associated with the Integration of Private Entities into India's Space Sector?

- **Regulatory and Policy Challenges:** One of the key concerns surrounding the integration of private entities into India's space sector is the **absence of a comprehensive, clear regulatory framework.**
 - While **IN-SPACe has been established to facilitate private participation, there is still a need for transparent policies** that address key areas like space debris management, intellectual property rights, and liability issues in space missions.
 - According to the **Economic Survey 2023-24, over 300 applications were submitted by private entities to IN-SPACe**, signaling a desire for clearer guidelines.
 - However, **only 51 MoUs have been signed**, suggesting hesitance due to regulatory concerns.
- **Intellectual Property (IP) Concerns:** Private companies often develop proprietary technologies for space applications, but the **existing collaborations with ISRO limit their ownership rights.**
 - This restriction may **discourage private players from making significant**

investments in innovation, as they risk losing control over their technologies, limiting long-term growth.

- Critics have highlighted the concern that **ISRO's current model limits private companies to manufacturing roles, with limited IP ownership**. This issue is delaying greater private sector involvement, according to several startup founders.
- **Financial Sustainability and Investment Gaps:** Private players in India's space sector face significant financial challenges, including limited access to risk capital and high upfront investment costs.
 - Despite the **government's Rs. 1000 crore [Venture Capital Fund](#)**, space startups continue to struggle with raising the necessary funds, particularly in **early-stage developments where the financial risks are highest**.
 - The market's slow acceptance of risk makes it harder for space companies to secure sustainable investment.
 - According to an analysis by Space Capital, investment in the space industry dropped from a **peak of \$47 billion in 2021 to \$20 billion in 2022**.
- **National Security and Strategic Concerns:** Space technologies have dual-use capabilities—**both civilian and military**—which raise national security concerns when private companies become involved.
 - India's space activities are closely linked to national defense, with satellites like **GSAT-7 serving military purposes**.
 - The risk of **sensitive data or technologies falling into the wrong hands** increases with private sector participation.
 - Thus, ensuring that private entities do not compromise national security interests is a key issue for India.
- **Technological Gaps and Expertise Constraints:** Many private entities in India's space sector lack the deep technological expertise that ISRO has built over decades.
 - While **startups are innovating in areas like launch vehicles and small satellites**, there remains a significant gap in advanced technologies such as **in-orbit refueling, propulsion systems, and space science instrumentation**.
 - These gaps restrict the ability of private players to scale up and diversify their space missions.
 - For instance, **Agnikul and Skyroot are pioneering low-cost rockets** but lack capabilities for large-scale missions.
- **Fragmented Industry and Lack of Ecosystem:** India's space industry is still dominated by isolated segments, with over **200 space startups focusing on different components like satellite subsystems, propulsion, and launch vehicles**.
 - This fragmentation leads to inefficiencies, as coordination between different players, especially public and private entities, remains a challenge.
 - Integration challenges persist, slowing down the commercialization of space services.
- **Workforce Skill Deficiency:** The rapid expansion of India's private space sector faces a major hurdle in the form of a skilled workforce.
 - The **complexity of space technology** requires expertise across various domains, including aerospace engineering, propulsion, and satellite communication.
 - However, **India's education and training infrastructure in space technology remains insufficient to meet the growing demand** for highly skilled professionals.

How can India Promote Active Public-Private Partnership in the Space Sector?

- **Streamlining Regulatory Framework for Private Players:** India should expedite the development of a clear and comprehensive regulatory framework that addresses key concerns like **satellite licensing, space debris management, and intellectual property rights**.
 - Establishing a streamlined, **single-window approval process for private companies will reduce delays** and foster a more efficient working relationship between public and private entities.
 - Clearer guidelines on **liability and safety standards**, along with incentivizing adherence to international regulations, would instill confidence and reduce operational uncertainties

for private players.

- **Creating a Unified Space Innovation Ecosystem:** The government can facilitate the creation of space innovation hubs, where startups, established space companies, and academic institutions collaborate in a cohesive ecosystem.
 - These hubs should provide shared infrastructure, such as **testing facilities, manufacturing plants, and research labs**, supported by both public and private sector funding.
 - Additionally, these hubs can foster knowledge transfer from ISRO to private entities, enabling them to build cutting-edge space technologies while maintaining synergies between the two sectors.
- **Incentivizing Space Technology Innovation with Financial Support:** To encourage private sector innovation in space technologies, India should establish dedicated funding schemes tailored to **high-risk, high-reward space projects**.
 - This includes low-interest loans, grants, and tax **incentives for startups and MSMEs developing next-gen propulsion systems, reusable rockets**, and advanced satellite technologies.
 - Establishing public-private joint R&D funds that match industry contributions will further motivate private players to invest in groundbreaking technologies.
- **Leveraging Government Contracts to Stimulate Private Growth:** The government can play a proactive role by offering long-term, guaranteed contracts for private companies involved in **satellite manufacturing, space-based services, and launch vehicles**.
 - These contracts should be tied to public-sector requirements in areas like **communication, weather monitoring, and defense**.
 - By becoming the **primary customer for space services**, the government can provide private companies with consistent revenue streams, **thus encouraging them to expand operations, innovate, and scale up their businesses**.
- **Developing a Specialized Space Workforce:** To support the growth of public-private partnerships, India must invest in developing a highly skilled workforce that **can bridge the gap between academic research, industry demands, and space missions**.
 - Establishing specialized educational institutions, training programs, and industry-academia partnerships will **equip engineers, scientists, and technicians with the skills** necessary for advanced space technologies.
 - By fostering a workforce that is equally adept in both the public and private sectors, India can ensure a steady stream of talent to support future space endeavors.
- **Incentivizing Private Investment in Space Infrastructure:** The government should incentivize private investment in space infrastructure by offering public-private partnership (PPP) models for developing **spaceports, satellite testing facilities, and research centers**.
 - This can be achieved through **Public-Private Partnership (PPP) funding mechanisms**, where private entities invest in infrastructure development with the assurance of **shared ownership, operational rights, or revenue-sharing models**.
 - This will create a sustainable infrastructure base that supports both private sector growth and the government's space missions.
- **Establishing a Clear IP and Technology Transfer Policy:** India should implement a robust intellectual property (IP) and technology transfer policy that enables private companies to **retain ownership of innovations they develop in collaboration with public sector entities like ISRO**.
 - Such a policy will incentivize private players to invest in R&D while ensuring they benefit commercially from the technologies they develop.
 - This approach will **encourage more partnerships by aligning the interests of both sectors** and enabling private entities to leverage IP for commercial purposes, thus boosting innovation.
- **Promoting Export of Indian Space Technologies:** To enhance global competitiveness, India should foster the export of space technologies developed by private entities.
 - This can be achieved by **facilitating partnerships between Indian private players and foreign governments** or corporations for satellite launches, Earth observation services, or space-based communication systems.
 - Public-private partnerships can help create platforms to showcase India's space capabilities internationally and **attract foreign investment**, thereby boosting the global presence of India's private space industry.

Conclusion:

India's space sector is poised for significant growth through **enhanced public-private partnerships**. By streamlining regulations in line with the [Outer Space Treaty \(1967\)](#) and the [Space Debris Mitigation Guidelines \(2007\)](#), India can foster innovation and ensure international compliance. Prioritizing workforce development and intellectual property rights will help integrate India more effectively into the global space economy while safeguarding national interests.

Drishti Mains Question:

Q. Examine the role of the private sector in the expansion of India's space industry. Discuss the challenges associated with increasing private participation, and suggest measures to promote effective public-private partnerships in the sector

UPSC Civil Services Examination, Previous Year Question (PYQ)

Q.1 What is India's plan to have its own space station and how will it benefit our space programme? (2019)

Q.2 Discuss India's achievements in the field of Space Science and Technology. How the application of this technology helped India in its socio-economic development? (2016)

Q.3 What is the main task of India's third moon mission which could not be achieved in its earlier mission? List the countries that have achieved this task. Introduce the subsystems in the spacecraft launched and explain the role of the 'Virtual Launch Control Centre' at the Vikram Sarabhai Space Centre which contributed to the successful launch from Sriharikota. (2023)

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