



# Demystifying space business in India and issues for the development of a globally competitive private space industry



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## ABSTRACT

India has been an early adopter of space technology via sustained investments in developing indigenous infrastructure in space, launch and ground systems for a national mission of utilising societal applications from space assets. The continued support from the Government of India in establishment of an ecosystem for the development of space industry for over four decades has created several hundred industries catering to the national space programme. The present work provides a systematic overview of the value chain of the space ecosystem in India with pointing to some inherent challenges in the current value chain that needs to be addressed to explore the full potential of commercial exploitation, while respecting and fulfilling the needs of the civil society at large. Despite having a successful space program that resulted into many spin-offs, India is yet to have a globally reputed private commercial space company, or at least an internationally competitive industry landscape. An effort has been made to identify specific issues of space policy for the further development of the private space industry to establish a stronger presence of the Indian space industry in the international market.

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## 1. Introduction

Establishment of a value chain in the space sector involves development of technological, regulatory, and policy infrastructure, which performs with synergy and delivers with high reliabilities. Most space-based services are essentially built over the two pillars of space infrastructure – heritage and reliability. Although much of the initial development of space technology was dual-use in nature, it has found tremendous applications for civilian benefits. To this end, creation of a value chain in the space domain has been systematically proven in several space faring nations to be possible by sustained investments over longer periods, which are typically two to three decades.

The Indian space programme has been built over litmus tests conducted in the areas of remote sensing and communications, with experiments such as detection of coconut root-wilt disease, Satellite Instructional Television Experiment (SITE), Satellite Telecommunication Experiments Project (STEP), and the Satellite Launch Vehicle (SLV) project. These have led to the development of

the Indian Remote Sensing (IRS) and INSAT (Indian National Satellite System), as a part of ISRO's operational space infrastructure, the Polar Satellite Launch Vehicle (PSLV) and later, the Geosynchronous Launch Vehicle (GSLV) and its variants as a part of its launch infrastructure [1]. These assets of the Indian space programme have established a foundation for space-based services and development of an ecosystem for the participation of local industries.

## 2. The space value chain in India

The Indian government has been investing in the space ecosystem since the 1960s and alongside the crucial delivery of services to the citizens; it has enabled space commerce to take off since the 1990s [2]. With the continued backing of the government, the Indian space programme is one of the very few among its peers in the emerging economy group to have capabilities in turn-key development of space, launch and ground systems. This space supply chain in India is predominantly steered by the requirements of ISRO, which has been gaining momentum in the number of missions as well as its budgets over the past decade from the previous 10–13 missions [3] in each of the 8th, 9th and 10th plan periods to 58 missions in the 12th plan period [4]. Much of the fuel

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of business for the Indian space industry has therefore seen an increase due to this phenomenon of number of missions (both launch vehicles and satellites) over the past five-year periods.

India is one of the unique destinations where one can argue that the Technology Readiness Level (TRL) and the maturity in delivering turn-key solutions is better in the space sector than the aviation sector. The technological success that the Indian space programme has achieved despite the early phase sanctions imposed by the U.S. in launches, space and ground systems, is unprecedented. The Indian space programme has witnessed maturity of technology in the space and the ground segments with the IRS and INSAT platforms, and the network of ISRO's satellite tracking and control stations. Alongside the continued success of the PSLV, the success of the cryogenic engine, a critical technology of for launching telecommunications satellites, seems to have created new inroads for ISRO, while advancing commercial utilisation of the launch systems [5].

The space ecosystem is driven by the mandate of the Space Commission and the Department of Space (DoS), constituted by the Government of India in 1972. The DoS has a primary objective of promoting development and application of space science and technology to assist in all-round development of the nation, and brought ISRO as its functionary in September 1972 [6]. Fig. 1 illustrates the participation of various ISRO centres in the space ecosystem [7]. The various centres of ISRO have evolved over the course of the past three decades in aiding the development of

technologies for satellites, launch vehicles, ground systems, and application-oriented services. ISRO Satellite Centre in Bangalore heads the space segment Assembly, Integration and Testing (AIT). The Vikram Sarabhai Space Centre (VSSC) is the largest centre of ISRO, and also the lead centre for launch vehicle development. The Liquid Propulsion Systems Centre (LPSC) develops propulsion systems for both launch vehicles and satellites. The launch segment is performed at Satish Dhawan Space Centre in Sriharikota (SHAR). There are several ISRO centres that support satellite and launch vehicle development which ultimately are involved in realising the maturity in technology for implementation. Units like the National Remote Sensing Centre (NRSC) and North-East Space Applications Centre (NE-SAC) focus on civilian applications of space assets; Antrix Corp is established to market ISRO's capabilities to domestic and international customers, with the motive of generating revenues and easing the transfer of technology. Scientific research and educational activities are conducted under centres such as the Physical Research Laboratory (PRL), National Atmospheric Research Laboratory, Indian Institute of Remote Sensing (IIRS) and Indian Institute of Space Science and Technology (IIST) [8].

Fig. 2 provides an illustration of the current supply chain for the space infrastructure development and utilisation for civilian applications in India [9]. ISRO makes a mark with its involvement in the ecosystem from the upstream (development of the space/launch/ground systems) to the downstream applications that involve commercialisation of space assets and delivering civilian

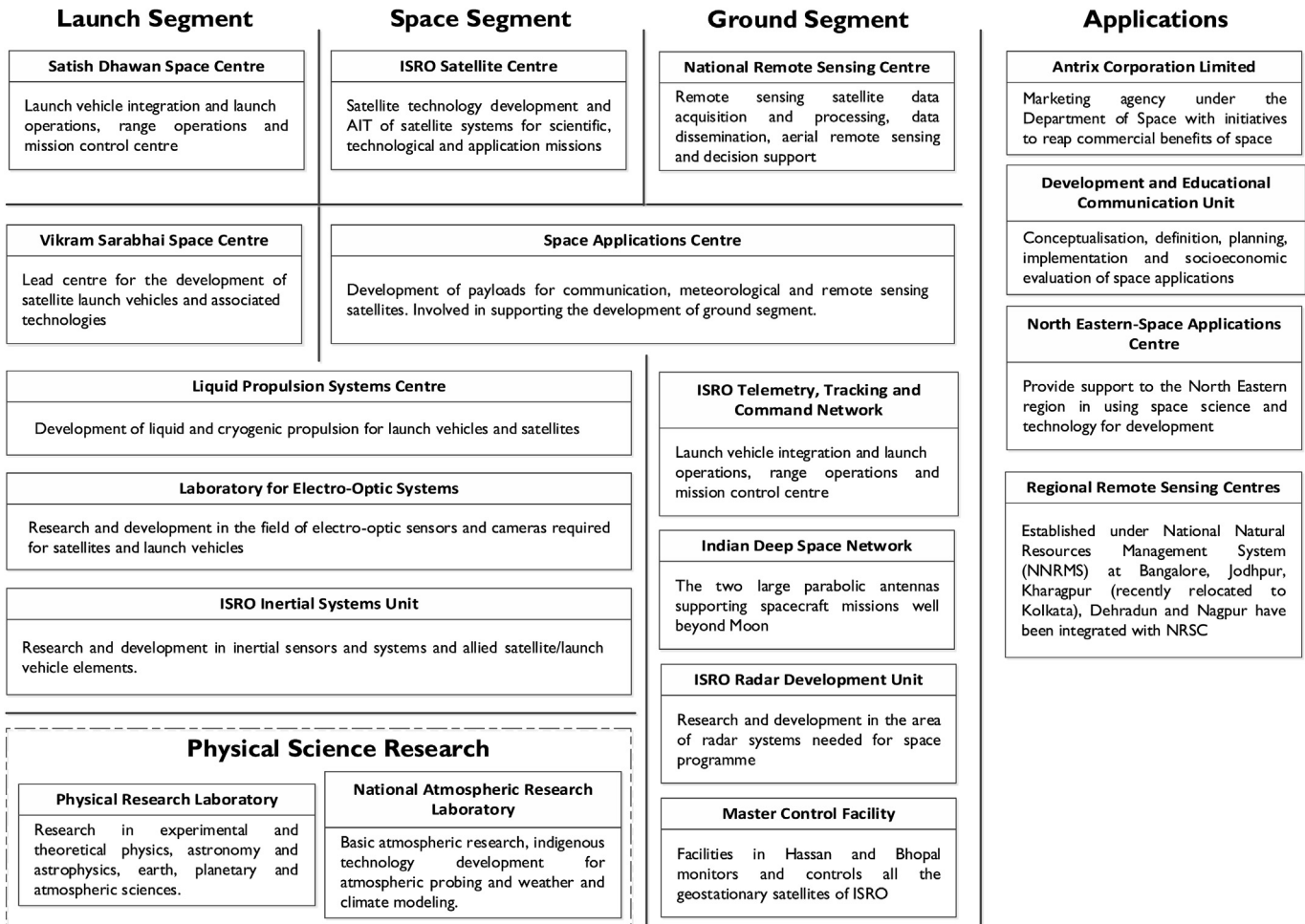


Fig. 1. Participation of various ISRO centres in development of the space ecosystem.

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