USHERING THE NEW ERA FOR INDIAN SPACE SECTOR

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INTERNATIONAL SPACE CONFERENCE

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knowledge Partner

THEME PAPER
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India is one of the few nations in the world, to have developed the capability to carry out end-to-end space missions for various services as well as interplanetary missions. Our advances in space programs and simplicity in operations have been highly appreciated the world over. These achievements speak of dedicated and determined efforts of ISRO, along with industry.

The recent announcements of reforms by Government, as a part of the Hon’ble PM’s call for new and bold reforms to promote the ‘self-reliant India’ mission, are yet another endeavour to accelerate the advancements in space activities, spur the growth of Indian private companies, improve space industry revenues and India’s share in the global space market.

Taking the vision of the government of making Indian private sector a co-traveller in India’s space sector journey, Confederation of Indian Industry (CII), in association with the Indian Space Research Organization (ISRO) and the Antrix Corporation Limited (ANTRIX), supported by NewSpace India Limited (NSIL) is organizing the International Space Conference scheduled from 15-17 September 2020.

The theme of the conference is ‘Ushering the new era for Indian space sector’.
Objectives of the Conference

1. To facilitate and strengthen Indian industries who wish to venture into various space products and services.

2. To highlights the initiatives taken by Indian government and Space agency to encourage & engage Indian Industry in space sector and showcasing opportunities for Indian industry.

3. To create a platform for Indian industry and entrepreneurs to build technology as well as partnerships with International players to cater not only to Indian demand but also to access global market.
3. Status of the Indian Space Sector

3.1 Snapshot of the Space Economy

The Space Value Chain consists of Upstream, Midstream and Downstream activities, as depicted below\(^1\) -

**Figure 1: The Space Value Chain**

The current global space economy is pegged at USD 360 billion and the approximate split between upstream, midstream and downstream activities is as follows\(^2\):

**Figure 2: Global Space Economy Snapshot**

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3.2 Structure of the Indian Space Ecosystem

The Indian Space Sector consists of key government entities & various private players including established firms as well as space-tech startups:

3.3 Key Government Entities in the Indian Space Sector

In India, the key governmental entities which are critical to the sector include ISRO, Antrix Corporation Limited, NewSpace India Limited (NSIL) & the recently established Indian National Space Promotion and Authorization Centre (IN-SPACe).

In terms of Government spending in the sector, the Union budget for 2020-2021 provides an allocation of INR 13,479.47 Crore for the Department of Space (DOS). This is 7.5% higher than last year’s budget, thus indicating the growing focus on space activities in the country. Until recently, Indian space activities were primarily

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3 https://science.thewire.in/space/department-of-space-newspace-nsil-isro-gaganyaan-budget-2020-dsa-dsro-pslv-production/#:~:text=On%20February%202015%20Minister%20of%20Space%20and%20Aerospace%20Affairs%20Announced%20the%20Budget%20for%20the%20Current%20Year%20Which%20Includes%20An%20Increase%20of%207.5%20in%20Space%20Activities%2C%20indicating%20the%20Growing%20Focus%20on%20Space%20Programmes%2C%20Announced%20by%20Finance%20Minister%20Mr%20Arjun%20Ray%20On%20February%201%2C%20Finance%20Minister%20the%20allocation%20in%202015%2D2016.
driven by the government to meet national needs with a high focus on self-reliance and security. Commercial activities were driven by ISRO through its commercial arm, Antrix Corporation, and depended on the availability of spare capacity. Also, all commercial space activities were closely regulated and controlled by the Department of Space (DoS).  

However, the Government has taken a decision to open its doors to the Private Sector recently, with the creation of the Space Activities Bill & IN-SPACe. The new entity is set to act as a facilitator & regulator, and provide an interface between ISRO and private parties, & assess how best to utilise space resources and increase space activities.

### 3.4 Private Participation in the Indian Space Sector

There are ~500 private companies operating in the space technology sector in India. The Indian Space-tech startup ecosystem is also booming, with over 120 active Indian space-tech startups. Of these, around 64% were launched in or after 2014.

In the past, India has seen various SMEs involved in supplying parts and components for satellite and launch vehicle manufacturing. These companies generally act as providers contracted by ISRO for meeting its demands. ISRO also adopted public private partnership (PPP) policies to encourage companies to take up more production activities rather than being part/component manufacturers. Further, ISRO formed a consortium of private industry players for Assembly, Integration and Testing (AIT) of 30–35 satellites.

However, while the primary method of engagement with the private sector in the past has been sub-contracting, the recent announcements by the Government are expected to create a more conducive environment for private sector players due to the structured policy and regulatory environment coupled with incentives. These initiatives will strongly impact both MSMEs as well as startups.

With greater private sector participation, the sector is witnessing the emergence of disruptive business models. Instead of a single entity providing a wide range

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5 Indian Express
7 [https://thebluecircle.co/2020/08/12/5-indian-spacetech-startups-reaching-the-stars/](https://thebluecircle.co/2020/08/12/5-indian-spacetech-startups-reaching-the-stars/)
9 [https://thebluecircle.co/2020/08/12/5-indian-spacetech-startups-reaching-the-stars/](https://thebluecircle.co/2020/08/12/5-indian-spacetech-startups-reaching-the-stars/)
of Space Services, private players are consolidating their service offerings around key focus areas such as satellite manufacturing, ground support, launch services or downstream applications. With a larger number of private service providers, ISRO will be able to dedicate a larger share of its efforts towards science, R&D, space exploration, strategic launches, etc.\textsuperscript{10}

Some of the key trends being witnessed in the Space Sector driven by the private ecosystem include -

- Miniaturization of satellites is resulting in the development of refrigerator sized micro satellites. These are highly cost effective as they have the potential to monitor the earth with high precision at only around one-tenth the cost of multi-purpose big satellites launched by government agencies.\textsuperscript{11} With a focus on affordability, a prominent startup has developed an application agnostic 10-kg multi-payload nanosatellite platform.\textsuperscript{12}

- Leading Indian Space Startups are planning to launch constellations of small satellites which are expected to make data more accessible & develop strong use cases in sectors such as agriculture, defence, disaster management, oil & gas, and so on.\textsuperscript{13}

- Indian startups have also established strategic collaborations with key global entities including European Space Agency, Glavkosmos, NASA, Maxar and Skymet Weather, Leaf Space, etc.\textsuperscript{14}

- In the Launch segment, startups have been working towards reducing launch waiting periods for Small Satellite makers by offering smaller rockets with quick launch timelines. They have also been able to secure global launch contracts.\textsuperscript{15}

- Further, Indian firms are excelling in new avenues due to innovative solutions such as 3-D printed rocket engines. Recently, a key Indian Startup has successfully test fired a domestically manufactured upper-stage rocket engine.\textsuperscript{16}

- While the Upstream segment’s hardware, testing & manufacturing requirements have been impacted by COVID-19 due to a contraction in global supply chains,

\textsuperscript{10} Indian Express
\textsuperscript{12} https://thebluecircle.co/2020/08/12/5-indian-spacetech-startups-reaching-the-stars/
\textsuperscript{13} https://www.businesstoday.in/current/corporate/indian-space-tech-startup-prepares-to-launch-24-satellites-aims-to-send-first-one-by-dec/story/406095.html
\textsuperscript{14} https://thebluecircle.co/2020/08/12/5-indian-spacetech-startups-reaching-the-stars/
the post-pandemic scenario is expected to result in a higher demand for space services due to the need for global connectivity.\(^\text{17}\)

- Space startups are already working towards increasing access to the internet by developing a technology to beam high bandwidth internet from Space. On these lines, the sector has a scope for commercialization of satellite broadband gateways & 5G backhauling.\(^\text{18}\)

The increase in privatization & entrepreneurial activity is set to result in innovations across the Space Value Chain, thereby enabling lower costs, higher accessibility, rapid market growth and increased Indian market share in the global Space Sector.

**3.5 Private Investments into Space Sector Start-ups**

**3.5.1 Global**

Globally, Space Sector start-ups attracted USD 5.7 billion of funding (of all forms) in 2019. Of this, 71% (USD 4 Billion) came from VC funding, 23% from seed funding and the rest from debt financing/acquisitions.\(^\text{19}\)

A total of 135 Space Startups received investments in 2019, which is a 34% increase over 2018. There has been an increasing number of non-U.S. based start-ups receiving funding, with 79 in 2019 as compared to 47 in 2018.\(^\text{20}\)

**3.5.2 India**

Indian VC investment into the Indian space startup sector from 2015-2019 stands at ~USD 21 million.\(^\text{21}\) Over the past five years, ~ two dozen Indian startups have expanded into unicorns due to increased support & access to funding.\(^\text{22}\)

ISRO initiatives, Role of Indian Industry and Start-ups

In recent years, it has been seen that ISRO is ramping up its efforts to create a sustainable space ecosystem, and at the same time encourage collaboration and partnerships with the private sector industries. In parallel lines, ISRO is also making significant strides in facilitating the development of NewSpace Indian start-ups. The critical initiatives or rather tools that ISRO is deploying to encourage the Indian space ecosystem are:

- Technology Transfer: Motivating industry to find commercial spin-offs of technologies developed by ISRO.
- Indigenization and Industrialisation: Facilitating the private sector in developing indigenise items on a Government Owned and Company Operated (GOCO) basis.

4.1 Role of Indian Industry within the Indian Space Ecosystem

The private Indian space ecosystem is not as evolved as that of other space faring nations such as the US, France, UK, Germany or South Korea. The concept of privately-owned prime satellite manufacturers is yet to materialize in India. It is rather government-owned and led by ISRO and its commercial arms NSIL and Antrix that are dubbed as “Primes”.

However, India does have a large pool of SMEs, and a few large companies that are involved in provisioning satellite components and parts to ISRO - these SMEs are usually tier 1, tier2, or tier3 OEMs.

The overarching effect of this is that the private Indian industry lacks the technological prowess of developing end-to-end
solutions on a systems level. However, there have been some initiatives undertaken by ISRO that aim to tackle this challenge. For instance,

- ISRO issued a tender aimed at the private industry to Assemble, Integrate and Test (AIT) up to 35 satellites.\(^{23}\)
- ISRO assisted Alpha Design Technologies Pvt Ltd., in developing their first satellite, as such providing with the technical know-how to develop the second satellite independently at ISRO’s facility

Figure 5: Key technologies licensed by ISRO to the private sector industries for commercial & regular production

In addition to these, ISRO has also led initiatives that enables key technology transfers to the private sector. It is estimated that approximately 349 technologies have been transferred to the industry thus far. Amongst these, about 30.3% have been in the field of chemicals and special materials, 24.6% in the field of communications, 17.2 in the field of sensors and optical instrument, 15.5% in the field of electronics and computer-based systems, and 12.3% in the field of mechanical and electro-mechanical technologies.\(^{24}\) The figure above highlights key technologies that have been licensed to the Indian Industry by ISRO during the FY2019-2020.\(^{25}\)

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\(^{23}\) Available at: https://www.thehindu.com/news/national/isro-opens-doors-to-private-sector/article20603113.ece

\(^{24}\) Available at: https://www.isro.gov.in/capacity-building/technology-transfer

4.2 Indian Space Start-up landscape

The NewSpace era began in the late 00’s and early 2010’s with the advent of Skybox Imaging (now Planet) and Planet Labs (now Planet), both based in the USA and largely funded by the Silicon Valley. From then (2010) to now (2019)\(^\text{26}\), the start-up arena has witnessed a significant boom. It is estimated that USD 27.4B has been invested thus far into the NewSpace economy, globally. The Indian NewSpace start-up scene is no different, there are at least 120 start-ups that have been identified in India, both venturing into the upstream and downstream space segment. Some of the prominent Indian Start-ups are illustrated in the figure below, and the stage they are in currently. It is evident that, amongst these prominent contenders, most are still in the R&D phase (upstream companies) while, the ones operating downstream are already revenue generating.

\(^{26}\) Bryce Space and Technology: Start-up Space, Update on Investment in Commercial Space Ventures

![Figure 6: Status of Indian Start-Ups](image-url)
These start-ups could play a very critical role in expanding the Indian space economy, and at the same time may come extremely handy in meeting the demand of launching 16-18 satellites, as opposed to the current 3-4.\textsuperscript{27} However, for this to happen a lot of support will have to be provisioned by ISRO to these start-ups, such as providing them with incubation centers and access to R&D facilities.

\textsuperscript{27} Available at: https://www.thehindu.com/news/national/isro-opens-doors-to-private-sector/article20603113.ece
Current Governing Policies in the Space Sector in India

The space sector in India and its ecosystem has been characterized for decades by the drive of the Central Government through the Department of Space (DoS) and the central and rather unique role of India Space Research Organization (ISRO) and its related centers.

Over the decades DoS and ISRO have gradually developed through prominent government space programs (in Satcom, EO/Remote sensing, Satnav, Launchers, Science and Exploration): in the upstream its domestic space manufacturing industry at supplier level (~60 to 80% of ISRO funding goes to suppliers), in the midstream a wealth of know-how in launch vehicle and satellite operation within ISRO (sole operator in India) and in the downstream has enabled the rise of services and applications in India (including those provided by private entities such as Satcom VSAT and EO VAS).

India has now reached a point in which the Government see the opportunity to take its space sector to the next level by leveraging ISRO know-how and opening-up its silos, by taking a more commercial oriented approach (at least in some space domains, e.g. via NSIL), and by nurturing the grow of private entities across the whole Indian space value chain (likely, banking on the now more mature domestic market for space-based services).

In line with such vision, existing Indian space policies are to be revamped and a new space legislation is soon to be approved.

Space policy framework (current, under revision)

Currently, India does not have an official national space policy but through the DoS has adopted two dedicated space sector
policies in the past years (which are now both under revision):

- The Satellite communication policy
- The Remote Sensing data policy

_Satellite communication policy and related norms of 2000_ were developed at a time in which user demand for satcom services (both broadcasting and telecommunication) was already established in India and expanding from governmental to non-governmental users, India was party to major inter-governmental satcom operators that were about to be privatized (Intelsat and Inmarsat), India had only one satcom operator (ISRO) providing domestic services with its fleet of INSAT satellites and was at risk of facing competition from foreign private satellite operators that were emerging. In the downstream, the rise of Indian private entities (e.g. VSAT operators) to access ISRO provided satcom capacity was a supported trend. The emergence of Indian private satcom operators was still a far distant goal although already hypothesized.

The Satcom policy and its related norms established key principles and some procedural guidelines, which are briefly summarized below (examples):

- Satcom capacity from Indian (INSAT) satellites (of ISRO) should be leased on a commercial basis to non-governmental/commercial users and on a non-commercial basis to Indian governmental users
- Satcom capacity (existing and planned) from Indian (INSAT) satellites (of ISRO) should be allocated first based on the demand of Indian governmental agencies (e.g. DoT, DD, MoD) and then a certain percentage should be earmarked for non-governmental users that have been authorized (under Indian broadcast/telecom law) to provide broadcasting and/or telecommunication services in India
- Private satcom operators of Indian satellites (i.e. using an Indian ITU frequency/orbital slot) need to have (main conditions): i) a registered company in India, ii) foreign direct investments in the company not exceeding 74%, iii) the satellite control center in India, iv) a Space Operation authorization from DoS - soon IN-SPACe following the Space Activities bill - v) a Space Station license for orbit spectrum frequency/orbital slot from the Min of Communication/CAISS in line with ITU Radio Regulation, and vi) eventually also an Operating license for the services to be provided by the system/network for broadcasting or telecommunication in India as per India broadcast/telecom law
- As part of the Indian Space Station license process for orbit spectrum/frequency in case of conflicting requests, Indian governmental satellites have priority over
non-governmental ones, and in case of conflict between two or more non-governmental entities preference is given to those using satellites manufactured in India and/or launched from India.

- Usage of foreign satellites for broadcasting/telecom services in India may be allowed only in special cases (e.g. International intergovernmental system operated by Indian Party but temporally registered in other Country, International private systems with substantial Indian participation equity) and in any case license applications using Indian satellites will receive preferential treatment.

**India Remote Sensing data policy (RSDP) of 2011** was developed at a time in which the user demand for remote sensing data generated by Indian and foreign satellites was growing in India driven by governmental users, remote sensing (RS) satellite sensor technology had made significant progress in terms of resolution (in India and worldwide), Indian national security concerns were paramount for very-high resolution satellites (1m resolution), and India had only one local RS satellite operator - incl of VHR satellites - (ISRO) that was facing the competition of foreign commercial satellites on the Indian domestic market.

The RSDP established several important governing principles, which are briefly summarized here (examples):

- Data generated by Indian RS satellites are considered as public good, thus it emphasized from the outset the institutional rather than commercial approach to data exploitation.
- Centralized and exclusive role of ISRO/NRSC as the authority to acquire and distribute RS satellite data on the Indian domestic market – for data generated by all Indian and foreign satellites.
- Centralized and exclusive role of ISRO/NRSC to maintain the national RS data archive for all satellite remote sensing data.
- Exclusive role of Antrix to commercialize data generated by Indian RS satellites to the global market (i.e. outside of India), including to enter into agreements with foreign local data re-sellers.
- Distribution of >1m resolution RS satellite data on the Indian domestic market without any screening and clearance procedure. Although the Government reserves the right to impose control and restrictions over data tasking and distribution by Indian RS satellites for national security reasons.
- Distribution of <1m resolution RS satellite data on the Indian domestic market subject to a screening and clearance procedure, which accounts for type of
user, sensitive areas, Governmental agency backing, and clearance by the inter-agency High Resolution Image Clearance Committee (HRC).

The DoS has also developed other policies over the years. However, these are not space sector policies but rather internal policies or guidelines, which were developed to support the need and functioning of ISRO and/or its centers (e.g. on technology transfer, industry participation, safety, human resources) and are not addressed here.

**Space Activities Bill (draft, under approval)**

Under international space law (i.e. UN Outer Space Treaty and related Conventions), India is hold internationally responsible for space activities carried out by governmental entities (e.g. ISRO) as well as by non-governmental entities (e.g. private satellite operators, universities).

In an ecosystem in which space operation activities are conducted by Governmental entities only and moreover in a centralized manner via ISRO and its related centers, the development of domestic space legislation can (and it was) viewed in the past as unnecessary. However, such ecosystem is changing in India.

The game changer is the diversification of governmental entities carrying out space operation activities (e.g. in the near future not only ISRO, but also New Space India Ltd will own and operate space objects) and – most of all - the rise of Indian private sector satellite operators (e.g. Satellize - first Indian private sector satellite was launched in 2018).

The rise of private sector satellite operators is seen by the Indian government as the opportunity to enter into a new era, in which India space industry can further grow and diversity not only as a result of Governmental programs and supply development initiatives but also by demand driven private sector space-based services initiatives.

As a result, it becomes important for India to provide legal certainty and a regulatory level playing field so that:

- On the one hand, private sector investors can be comfortable to invest, private entities know their responsibilities and can plan accordingly, and commercial space activities can flourish in coming years, and
- On the other hand, the State can still maintain the due authorization and supervision of launch and space operation in view of its obligations under
international space law as well as its general duty to preserving Indian national security, foreign policy interests, and public safety.

The Space Activities Bill of India is currently in draft form (after consultation with local stakeholders and industry, which started in late 2017) and is at an advanced stage in the decision-making process and it is expected to be approved soon by the Cabinet of Ministries and the Parliament.

The Space Activities Bill has been conceived to be the 1st tier of domestic space legislation in India, to be applicable to Indian governmental as well non-governmental entities, and to include basic provisions for example in matters such as:

- Space authorization and licensing of space activities (launch and satellite/space objects operation)
- Space objects registration (at national level)
- Liability exposure of authorized operators/entities
- Third party liability space insurance (for damages on Earth/airspace and in outer space)
- Penalties in the event of infringements

The Space Activities Bill also anticipates that more detailed rules are to be adopted in second tier legislation in order to implement the basic provisions of the Bill and provide more clarity for example in matter such as:

- Authorization procedure for applicants (e.g. application process, evaluation criteria, time limits)
- Liability and TPL insurance of operators (e.g. liability ceiling if any, required insurance coverage)
- Space objects registration (e.g. establishment of national register, and required information)

Accident and incident investigation (e.g. authority, duty of bookkeeping and collaboration). Formation of IN-SPACe

The government intends to open up the space sector, also in line with India’s mission to become self-reliant in all industries. Private industries and start-ups have been involved in the space sector, but the new reforms will help them become a player in the entire space value chain by undertaking end-to-end space activities. The government plans to involve the private players in R&D activities and also
become part of inter-planetary missions through ‘Announcement of Opportunities’. ISRO will identify new technology areas for the industry and technology spin-offs will be given for mass production.

Within the overall Indian strategy of facilitating the rise of private sector entities (with the objective to nurture the progressive growth of such entities up to being able to conduct end-to-end space activities), the proposed establishment of the Indian National Space Promotion and Authorization Centre (IN-SPACe) has a pivotal role.

IN-SPACe is expected to be the nodal agency of the DoS to act as:

- The regulatory space authority in India to ensure compliance with Indian space policies and the Space Activities Bill. It will have an autonomous and binding decision power on space authorization applications from both governmental (e.g. ISRO, NSIL) and non-governmental entities (e.g. private satellite operators, universities)

- The coordination launch agency to maintain the Indian integrated space launch manifest, which will account for launch demand from governmental entities (e.g. ISRO, NSIL) and non-governmental entities (e.g. private satellite operators, universities) as well as their readiness

- The promotion agency that will hold-hand of private sector entities for example to – set-up their facilities within DoS premises (space park), access and use ISRO facilities (e.g. R&D lab, test facilities), access ISRO expertise/know-how (ISRO capacity building function), so that private sector entities can grow their competence in building launch vehicles, satellites and other spacecraft as well in operating them and providing space-based services.

IN-SPACe will be overseen by a board headed by a Chairman, of the level of Secretary to Govt. of India. It will consist members from industry, academia and DOS. The operations will be administered by creating functional directorates and the organization will have its own cadre of management staff to drive the secretariat, administration and the directorates.
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IN-SPACe organization is under definition, and the organogram below should be viewed as preliminary:

**Figure 8: Architecture of IN-SPACe**

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**Figure 7: IN-SPACe Structure**
It has been anticipated that:

- **IN-SPACe Board** will include representatives of the DoS and Indian Gov, as well as industry and academia to ensure representation of all type of stakeholders.

- It will have four main directorates which will have expertise in space policy, space legislation as well as in safety, security and technical/engineering in order to ensure that IN-SPACe will function as an independent entity when assessing authorization applications.

- It may take around 3 to 6 months (from inception) for IN-SPACe to become operational.

Private industry players will have to apply to IN-SPACe and it will be taken up for assessment by the different directorates for the viability, technical maturity, adherence to legal and regulatory requirements and other parameters. The application and approval process can be depicted as below:

**Figure 9: Application Process to IN-SPACe**

### Recommendations to move forward on policy/regulatory front

India has begun a journey into a new era in which India space industry should further grow and diversity not only as a result of Indian Governmental programs and supply development initiatives but also as a result of demand driven private sector space-based service initiatives.

From a governance perspective, the formation of IN-SPACe is a major step in such direction. And, IN-SPACe has the opportunity to become India center of excellence and national engine for the development of future space policies and legislation.
Equally important, is for India to clearly define the new role & responsibilities of its space governmental entities (e.g. ISRO and NSIL). Whilst it looks like ISRO will have the opportunity to focus its programmatic efforts in the least commercial oriented domains (i.e. space science and human-spaceflight/exploration), it will be critical to define the role of NSIL that is foreseen to act as launch vehicle operator and also as a satellite operator likely in those space domains that are – by market nature - the most commercial oriented (i.e. Satcom, EO/remote sensing and Satnav). Therefore, the role of NSIL and its programmatic remits must be well crafted in order to avoid that this governmental operator (or any other) will end-up to be in competition with emerging Indian private sector satellite operators.

From a policy framework perspective, the on-going revision of the existing policies (i.e. Satcom and Remote Sensing data) and the formulation of new ones (e.g. Satnav) will need to shift from focusing on protecting Indian governmental operators from foreign competitors to shaping market conditions (in which Indian governmental space entities will need to retreat) to stimulate the rise of Indian private sector players.

Experience in other Space countries suggests that striking the right balance can be challenging and India may be set to endure a transition period of mixed governmental and non-governmental operators at least in some areas (e.g. upper-end of EO/remote sensing market), before policies can completely shift (e.g. aggregating governmental user demand for services to boost private sector satellite operators’ investments).

The content and benefits of different space policies can vary significantly depending on objectives, addressed subject (e.g. EO/remote sensing data), industry landscape, and domestic market characteristics. Developing sound space policies is no trivial task. High-level principles may be identified early in the process but as the work progresses more tricky provisions tend to arise and striking the right balance becomes challenging and avoiding unwanted outcomes a must. For example, avoiding to generating:

- Unfair governmental competition (e.g. governmental entities occupying a spot in the marketplace/value chain, which de facto precludes private entities to play or to offer commercial services)
- Undesired market barriers (e.g. which are counter-productive to the growth of private sector players, or force them to go abroad to circumvent the barrier)
- Ineffective provisions (e.g. rise of private sector players calls for legally binding legislation, for example in matter of EO/remote sensing data security)
From a space legislation perspective, the upcoming Space Activities Bill (under approval) and lower tier space legislation (expected) will need to reflect the Government vision of acting as an enabler for the rise of private sector entities in India by providing legal certainty, an industry friendly space legislation and level playfield.

Experience in other Space countries suggests that although the first tier of space legislation (the Bill in India) is very important in setting the basic provisions (which need to last for years) the main challenge and “secret” to get it right rests in the lower tiers legislation (e.g. some call it regulations, others decrees, others procedures).

These lower tier documents are the ones that determine what is ultimately required from applicants that seek a space authorization or will have to comply with post-authorization obligations.

The overarching benefit of a sound space legislation framework at domestic level is to facilitate the rise of private sector operators of launch vehicles and/or spacecrafts. The challenge in the development of such framework is to strike the right balance, avoid pitfalls and risks, which can lead to generating, for example:

- Regulatory entry barriers (e.g. for start-up and nano-micro satellites operators)
- Undesirable industry risk exposures (e.g. unlimited third-party liability for space operation, undefined Government prior approval process for satellite in-orbit transfer)
- Unnecessary cost of compliance (e.g. space operation authorization fees, un-sync process/duplications with ITU/national orbital spectrum licensing)
- Delays due to red tape situations (e.g. unclear authorization requirements, lengthy assessment process with no time limits for the regulatory authority).

In general, it is highly recommended to clarify the key objectives from the outset with main local stakeholders, benchmark relevant best practices around the world, identify local specificities, account for global market dimensions, and consult with experts and local stakeholders, including academia and industry across the space value chain.
Opportunities in the Indian Space Sector

6.1 Opportunities in the satellite manufacturing and Launch segment

It is fair to say that India is well positioned in the launch segment, however it has the smallest space segment in terms of market share. This is largely due to the success of PSLV and GSLV launchers that NSIL operates, and the fact that a lot of revenue for these launchers also comes from rideshares.

In addition to that, from a private sector perspective too, India seems to stand in a strong position to capture the upcoming market potential of 10,000 small satellites by 2026. However, this is dependent on whether or not start-ups such as Skyroot Aerospace, Bellatrix Aerospace, and Agnikul succeed in developing their micro launcher in time to capture a share of this potential.

However, when it comes to manufacturing satellites, the Indian space ecosystem could face some challenges, as ISRO/Antrix does not receive a lot of satellite manufacturing contract from international satellite operators or even governments. In addition to this, there is another such challenge, and by far the most important challenge to curb, that is the lack of local demand for procuring and launching satellites. A prime contributor to this is the absence of satellite operators in India. As of now, there are no prominent private sector satellite operators in any of the major space verticals, may it be satellite communication (Satcom), Earth Observation (EO), or Navigation.

28 Available at: https://www.edisongroup.com/investment-themes/test-page/#:忱:text=Frost%26%20Sullivan%20predicts%20that%20nearly%20a%20hundred%20satellites%20or%20more.
6.2 Opportunities in the satellite services segments

The satellite services segment mainly comprises of revenues generated from the satcom market (television, radio, broadcast, fixed and mobility services) and the remote sensing market (data, Information products, Value-Added-Services (VAS), bigdata). However, it is essential to note that the remote sensing market merely represents 1.6% of the of the total satellite services segment and according to some estimates it is poised to grow 30% over the next decade.

Nevertheless, India is quite strongly positioned to grab the opportunities that the remote sensing market is expected to represent, as there are a lot of start-ups that are already generating downstream revenues by providing data analytics as a service, and are poised to offer bigdata solutions in the near future.

Technologies like hyperspectral imaging and synthetic aperture radar (SAR) can be deployed on small satellites, and this can open up new markets, which hitherto were not using satellite imaging. The companies traditionally involved in the earth imaging business are now moving to data analysis using the huge amount of data generated by the satellites.

The role of earth observation in the areas of environmental protection, disaster management and Defence is increasing with the improvement in existing technologies and development of newer ones. These technological developments, coupled with advanced big data analytics and improved ML algorithms, are providing better insights into multiple sectors of the economy, which are being leveraged for commercial use.

However, In order to foster commercial applications based on remote sensing, there is a need to engineer mechanisms that act as a bridge between the data producer (ISRO), the data seller (NRSC), the data application builder and the end user.
On the other hand, the satcom market by far offers a much larger piece of this pie. It incorporates the mobility markets such as land-mobile, aero-satcom, and maritime-satcom. This market is also likely to grow dramatically over the coming years. For instance,

- In the maritime market, between 2017 and 2018, over 7,700 vessels adopted broadband connectivity, as such nearly doubling the installation rates from 2016 to 2017.
- Aeronautical connectivity market is seeing many airliners opting to take-up In-Flight-Connectivity (IFC) services. This is evidenced by the current backlog of approximately 3000 aircraft (wide-body and narrow-body) that are to be outfitted between 2019 and 2020.
- It is hypothesized that 1/3rd of the capacity revenues for backhaul in the upcoming decade will be derived from 5G. Additionally, 5G Cellular Backhaul and Hybrid Networks are expected to generate approximately $ 1B in revenue by 2028.
- It is hypothesised that satellite based IoT market could reach US$5.9B by 2025.

Additionally, with regards to the IFC market, TRAI recently announced that aircraft will now be able to offer IFC services to its passengers. In addition, 5G will also play a critical role in India, given the fact that India is slowly moving towards a more connected, digital society. The combination of these two major upcoming opportunities will open up several growth and development avenues for the Indian space ecosystem. However, lack of private sector operators will be a challenge to overcome.

**IMPACT OF THE COVID19 PANDEMIC**

The impact of COVID19 pandemic may not be as drastic in the remote sensing market. This is largely due to the fact that, there is an ample abundance of data from satellites currently in orbit. However, there may be a slight impact on Indian organisations that heavily rely on data from small sat operators for greater revisit rates, as such operators possess satellites that have a shorted life span (2-3 years), and they launch several (10s to 100s) of these at once. Therefore, if there is a massive launch bottleneck, and some of these satellites perish, such operators may not be able to refill their capacity in time, and as such impact the analytical models of downstream remote sensing analytics providers.

On the other hand, the impact of COVID19 on the satcom community in India could be drastic especially from a ground equipment (TV dishes, VSATs, maritime antennas etc…) installations and procurement point of view. However, estimates from NSR have suggested that the impact of COVID19 on satcom markets would in best case scenarios be 2 years, and worst-case scenario be 3.
The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government and civil society, through advisory and consultative processes.

For 125 years, CII has been working on shaping India’s development journey and, this year, more than ever before, it will continue to proactively transform Indian industry’s engagement in national development.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, with about 9100 members from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 300,000 enterprises from 288 national and regional sectoral industry bodies.

CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes. Partnerships with civil society organizations carry forward corporate initiatives for integrated and inclusive development across diverse domains including affirmative action, livelihoods, diversity management, skill development, empowerment of women, and sustainable development, to name a few.

With the Theme for 2020-21 as Building India for a New World: Lives, Livelihood, Growth, CII will work with Government and industry to bring back growth to the economy and mitigate the enormous human cost of the pandemic by protecting jobs and livelihoods.

With 68 offices, including 9 Centres of Excellence, in India, and 9 overseas offices in Australia, China, Egypt, Germany, Indonesia, Singapore, UAE, UK, and USA, as well as institutional partnerships with 394 counterpart organizations in 133 countries, CII serves as a reference point for Indian industry and the international business community.