**INCREASING SPENDING IN ISRO**

**BY**

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**INTRODUCTION**

The story of ISRO ranging from the quick transformation from launching sounding rockets to missions like Mars is the culmination of the strong foundation and methodological learning from past failures. ISRO is working in varied and complex technical fields such as earth observation, communication, navigation, disaster management, climate and environment monitoring. In spite of more than 15 units and multiple ground stations across the world the integrated approach of a satellite is made possible by ISRO by keeping the high spirit and sticking to a professional way of working. System of ISRO is laid on such a strong foundation that even small hiccups could not shake it and it overcomes at a must faster pace. Further the spread of the units across India and people employed from across the country having different faiths amply proof that with right atmosphere and environment the organization can touch greater heights. The model which evolved over the year is worth emulating as students from a humble background and normal universities also excelled in the same environment. The model of growth is discussed so as others can benefit from the same and can provide tangible contributions in the country's progress[[1]](#footnote-2). The evolution of ISRO being shaped by visions of Dr Vikram Sarabhai with the motto of serving society with his famous quote,” We must be second to none in the applications of advanced technologies to the real problems of man and society”. Dr Sarabhai envisioned that the resources in space have the potential to address the real problems of man and society[[2]](#footnote-3). The focus of ISRO is to have usage of outer space and harnessing space technology for peaceful use. It was on this background that the foundation of ISRO is laid and reinstates the belief that any work started with noble deeds is bound to taste success. The leaders of ISRO always believe in the potential of their employees and make things happen with the available resources. They not only provided the direction to the organization but equally provide excitement to the employees by striving them to do better. The architect of the ISRO is built by the leaders who are great visionary and within a span of 40 years a mere idea led to the present-day veritable giant[[3]](#footnote-4). The enormous work of creating infrastructure, training and recruiting manpower, creating an environment, planning, execution and tie-up with advanced countries is made possible in a short duration. This approach also calls for calculated risks and support of government machinery with a strong commitment to the cause and dedication to achieve the same. The other factors are to get continual funding and setting achievable goals with intention and plan to achieve it. The other R&D institutes which are established prior to ISRO are either closed or way behind their peers while proving white elephant to the economy. In such a scenario it is essential to explore the ingredients with which ISRO philosophy and its standing among peers have recognized the world over. The fact is that despite following all the procedures and without deviating from the same, the output is exceeded far from expectations[[4]](#footnote-5). The main objectives of ISRO are [1] · Design and development of launch vehicles and related technologies for providing access to space. · Design and development of satellites and related technologies for observation, communication, navigation, meteorology and space science. Indian National Satellite (INSAT) program for meeting telecommunication, television broadcasting and developmental applications. Indian Remote Sensing Satellite (IRS) programme for management of natural resources and monitoring of environment using space-based imagery. Space-based Applications for Societal development. · Research and Development in space science and planetary exploration[[5]](#footnote-6). The story of ISRO is also having its own share of failures which paved the way of learning and overcoming the same in time bound manner. The initial concept of lying foundation of an organization is a hurricane job and even more difficult if the technology is sufficiently advanced and not a single expertise available to take it forward. The integral part of ISRO success is attributed to the greater emphasis to lessons learned in due course of time. These lessons are an integral part of each brainstorming meeting. The initial failures in satellite building where issues related with thermal, power apart from launch vehicles are threadbare discussed, deliberated and further implemented in the next project. The strong foundation on reliability aspects further strengthens the zero-defect mechanism adopted in this direction. ISRO model is worth emulating and inspire many industries across the globe due to its unique ISRO culture. This article will analyze the overall model of ISRO, success scenario and analyze the factors responsible for the same along with the methodologies to replicate in other sectors.

**ISRO CULTURE**

The Department of Space and ISRO are directly under the watchful eyes of PM and policies are charted out by the Space Commission. The main lead **centers** are VSSC, LPSC, SHAR, ISAC, SAC, NRSC and fully supported by small **centers** such as IPRC, LEOS, IISU, DECU, IIRS, MCF and ISTRAC. Various other **centres** working on applications, educational activities, indigenization aspects such as PRL, NARL, NE-SAC, SCL, IIST. The various hierarchical position in ISRO starts with: Section Head, Division Head, Group Head, Group Director, Project Director, Deputy Director, Associate Director, and Director[[6]](#footnote-7). The first and foremost requirement of any organization is the choice of the manpower and the recruitment policy which is based in ISRO on the various traits such as · Scientific knowledge · Research aptitude · Logical thinking · Updated knowledge. The unique part in ISRO is having a healthy working culture where all are treated at par. The opinions of each one is deliberated and mindset of superiority is not followed paving way for the juniors to feel part of the system. The main aim is to have the consistency of purpose and all people strive to achieve the same. The main strengths of the ISRO culture are: · Highly motivated manpower · High Integrity · Loyalty · Foresightedness · Team spirit · Decisiveness. Further providing world-class infrastructure, achieving perfection in each domain, respecting and recognization each individual is some of the attributes which is a unique part of ISRO culture. ISRO Model India is at present recognized as a role model in applications of space technology for socio-economic development. As per Indian tradition ISRO successfully moulded its Chintana Shakti into Kriya Shakti. As the workforce is always in high spirit and motivated so any new challenge is taken happily. The saying of Buddha “You are what you think” is totally applicable in this scenario. The success of organizations such as ISRO, BARC rely heavily on this model where academic interactions are deep-rooted in the system. But the model is not duplicated by other industries resulting in the quality and rendering them way behind the peers in the market. Innovations and new development are minuscule compared to such models followed by the developed nations due to a lack of synergy between them. The other amazing aspect is that in spite of following all the rules and regulations the output is amazingly high compared to many other industries. The following reasons are the core of its success: Dissemination of knowledge and sharing attitude, Openness resulting in the free flow of ideas and accepting criticism in right spirit, Teamwork and disciplined workforce, Technical liberty, Importance on quality and reliability aspects, Optimum usage of available resources, Strong and mature leadership. The pillars of ISRO stand on the above where technical discussions and points are taken seriously. Transfer of knowledge to the young engineers and grooming those results in innovation and growth. This results in the making and launching of multiple satellites having multidisciplinary in nature within a limited timeframe. The work of ISRO ranges from building satellites for communication and remote sensing, space transportation system and various applications[[7]](#footnote-8). The main aspect of ISRO is to take up the projects in mission mode and to deliver on time. The motto of harnessing space technology for national development while pursuing space science research and planetary exploration is still guiding mantra for envisioned programmes[[8]](#footnote-9). Focussing on progress achieved, generating time bound actions and identifying the task is the habitual process. Programme management and systems group, project director, programme management board, programme executive board and programme management council is the chain taken for the new project supported by PDRs and CDRs. The promotion of the scientific manpower is carried out on various parameters with the board consisting of domain experts and academicians. The main parameters are · Subject related skill · New skills acquired · Targets achieved · Quality of work · Application development · Vision · Understanding and personal traits Technology Development is vital for the organization to keep abreast with the global Space Market. Technology Development Programmes and Respond Programme are the unique programmes run by ISRO to keep updating of the latest in the field and having close coordination with the academia of the country. Office of Innovations Management (OIM) is another flagship programme which is having main objectives as below: · Catalogue all the innovations carried out at different ISRO Centres. · Tangible parameters for identifying innovations. · Approach towards fostering further spurt in Innovations in ISRO both cultural and institutional. ·Approach/Encouragements for making larger cross-section engineers/scientists to participate in this renewed endeavours of Innovations. · Tangible goals of achieving further Innovations, spin-offs and related Technology Transfers ISRO is facilitating investment, fostering innovation, enhancing skill development, protecting IPR and building the best manufacturing infrastructure. Yes we can and Yes we will the present motto reflects the farsightedness of the present-day leaders of ISRO besides having a personal rapport with the employees. Loading with more projects results in healthy competition among various groups led to the speeding up of activities which resulted in the motivation of manpower by directly associating them with the missions[[9]](#footnote-10). This could be made possible by envisioning various projects and around 80 Projects were envisaged during 2017-22 time frame[[10]](#footnote-11). High communication satellite, Cartosat series, Rendezvous and Docking, Resources finding series, Oceans monitoring, advanced geo-imaging satellite, second generation navigation satellites are some challenges in mission mode[[11]](#footnote-12).

**SOCIAL MEDIA: OUTREACH**

Media campaigns on important events, campaign through social media, organization of exhibition, educational activities like lectures, interactive sessions with students, quiz programmes, publications, videos, documentaries are the programmes run by ISRO to spread awareness about its programmes and to catch up with the young minds. Success in a single mission paves way for achieving more. This leads to recognization of organisation which further instils confidence and enthusiasm. Also due to the involvement in projects the person is not involved in unproductive activities and takes national pride by contributing to various endeavours. Mars mission created a lot of interest amongst the young generation which is evident by the response on the ISRO Facebook account. This creates awareness amongst the masses and also paves way for new ideas and suggestions for charting out the programmes in the future.

**FUTURE ASPECTS**

The increased number of spacecrafts per year, identifying and expanding the industryparticipation in the areas of developing satellite subsystems, ground systems and integration and testing of the satellite/sub-systems will give necessary impetus. Despite ISRO wings spread across the country still the potential of it is to move one notch higher by having all the centers contributing to the pace and momentum of the lead centers. The major part of the components and devices are still imported which needs immediate attention. ASIC, sensors and other devices needs to be indigenized so as to bring self-reliance and saving foreign exchange. Fabs to take up such activity should be encouraged in the private sectors and public-private partnerships to be encouraged. Further solar cells, thermal control materials, specialized alloy, optical materials, test and measurement equipment are other materials that need indigenization. This can also result in multiple spin-offs which can be tapped for societal benefits and due to varied domain, it needs technical expertise to be created. At present the major workforce has reaped the benefit of the forefathers and the next step is to realize the systems with the adoption of the latest technology. This needs another revolution to take it at another level which can only possible by adopting ISRO culture[[12]](#footnote-13).

**SUMMARIZATION OF ISRO**

ISRO’s main strength lies in converting failures in rich learning experiences and eventually continually strive for trumps. The core strength lies in developing holistic leadership skills to young people resulted in considerable job satisfaction and feeling part of the family from day one[[13]](#footnote-14). The main attributes can be summarized as · Democratic culture: work ethics developed due to this trait · Transparency: design reviews, various assessments, open discussions · Careful planning: result-oriented approach · Building leadership: bringing out extraordinary from ordinary and involving juniors · Smooth transition. The capability of ISRO in the satellite building area rivaled that of the most advanced countries of the world. The present mantra given by the Chairman ISRO is "Look at what we need to complete, Look at what we need to work on in the near future and Look a little farther into future" amply proof that goals are well defined. This article dwelt upon the reasons, formation and mechanisms, working culture, model and various methodologies adopted in due course by ISRO to achieve the present stature in the country.

**SOME MAJOR ISSUES REGARDING INCREASE IN SPENDING:**

The Indian space industry is in need of some serious revolutions as it is lagging behind in the global space industry with its share in it being very minimal[[14]](#footnote-15). Today, the value of the global space industry is estimated to be $350 billion and is likely to exceed $550 billion by 2025.

India’s share is estimated as just 2% of the global market[[15]](#footnote-16). Globally, 17,000 small satellites are expected to be launched between now and 2030. Today, Indian Space Research Organization (ISRO) annual budget has crossed ₹10,000 crore, growing steadily from ₹6,000 crore[[16]](#footnote-17) . However, demand for space-based services in India is far greater than what ISRO can supply. So, private sector investment is critical. There is a need for national legislation to ensure overall growth of the space sector[[17]](#footnote-18). Satellite communication – With INSAT and GSAT as backbone, it addresses the national needs for telecommunication, broadcasting and broadband infrastructure, disaster management services, etc. Earth observation – By the usage of space-based imagery, weather forecasting, disaster management and national resource mapping and planning are possible. It is done using Geographical Information Systems (GIS) applications Indian Remote Sensing (IRS), RISAT, Cartosat and Resourcesat series. Satellite-aided navigation – The GPS-aided GEO augmented navigation (GAGAN) has civil aviation applications and is used for air traffic management over Indian airspace[[18]](#footnote-19). Indian Regional Navigation Satellite System (IRNSS) or Navigation with Indian Constellation (NavIC) provides accurate positioning service for civilian and military use[[19]](#footnote-20). The Chandrayaan and the Mangalyaan missions, with a manned space mission, Gaganyaan planned for its first test flight in 2021[[20]](#footnote-21). None of this would have been possible without mastering the launch-vehicle technologies which includeSatellite Launch Vehicle (SLV**)** andAugmented Satellite Launch Vehicle (ASLV), Polar Satellite Launch Vehicle (PSLV) has an enviable record. Geosynchronous Satellite Launch Vehicle (GSLV) which is still developing[[21]](#footnote-22). Over the years, ISRO built a strong association with the industry, particularly with Public Sector Undertakings (PSUs) but most of the private sector players are Tier-2/Tier-3 vendors[[22]](#footnote-23).

**WHAT ‘NEW SPACE’ START-UPS ARE UP TO?**

New Space entrepreneurship has emerged in India who are not enamoured of the traditional vendor/supplier model. They see value in exploring end-to-end services in the Business-to-Business and Business-to-Consumer segments. Developments in Artificial Intelligence (AI) and big data analytics have led to their emergence. They see a role as a data-app builder between the data seller (ISRO/Antrix) and the end user by taking advantage of the talent pool, innovation competence and technology know-how[[23]](#footnote-24). They are yet to take off in the absence of regulatory clarity.

**WHAT CHANGES SHOULD BE MADE IN THE INDIAN SPACE**

**1. Traditional Space in India**

In order to understand the business ecosystem and the aspirations ofthe Indian space industry for expansion, it is important to acknowledge thestrengths and weaknesses of traditional business models in the space sector Today, India has a large Small-Medium-Enterprises (SMEs) base that caters within the traditional space agency-driven model. The phenomenon of encouraging the development of India’s private sector in the space domain began in the 1970s when the Indian Space Research Organisation (ISRO) started handholding entrepreneurs in technology transfer initiatives with the safety net of buybacks to ensure business survivability.

 2. Fast forward four decades, today there are new initiatives being taken to encourage the complete development of end-to-end systems in both launch vehicles and satellites by the private industry. What traditional space approach tries to do is to increasingly offload work that is considered to be routine to the industry as an initiative in capacity building to achieve volumes that might not be possible without a significant increase in the infrastructure and manpower within a space agency. This is no doubt a significant step in helping the Indian industry to further mature and be able to perform Assembly, Integration and Testing (AIT) of both rockets and satellites[[24]](#footnote-25). However, the current measures are more top-down in nature, and mostly based on capacity building via the development of industry in upstream. This step will elevate vendors in the space programme to the next level, working alongside the space agency to be able to deliver back complete end-to-end systems. However, this current form of capacity building where a partnership is envisioned to perform AIT-related aspects (in both launch vehicles and satellites) is an extremely elementary one since the know-how transferred in this process is mostly at the system level of integration and does not entail capacity building to design, develop and complete end-to-end systems independently. Although this is definitely a jump up for the industry in acquiring the know-how on AIT aspects, the roadmap for the traditional vendors to get to a level of being able to design, develop and manufacture end-to-end launch vehicles or satellites is not on the horizon until the current initiatives attain fruition and begin to show signs of sustainability. Therefore, this track is more a top-down model that enables the industry over long gestation periods to systematically develop capacity and primarily feeds on taxpayer funding to execute projects. This model of industry engagement is not exclusive to India. Most traditional space business models work on this framework where the industry is funded largely by the government to deliver end-to-end systems. However, what is different between advanced space-faring nations and India in terms of current models is the level of capacity built up in the private industry. As a country, India is one of the most successful nations to have developed the capacity to deliver payloads to space or to develop satellites for services or to interplanetary missions. However, there is a stark gap in the capacity built up in the private industry where the industry is mostly involved as tier-based vendors and presently there is no single industry vendor who has the capacity to deliver end-to-end systems. This creates bottleneck effects in the possible expansion of industry to the global supply chain, especially from an export perspective. However, the traditional space approach has a strong edge of having room for building upon proven and reliable technology and handholding from the space agency. Policy makers should look to draw a long-term roadmap in creating an environment of multiple industry players or industry consortiums having the ability to deliver end-to-end systems so that there is room for competition in the national ecosystem. The current outlook for the traditional space approach in India is positive with the initiatives of stepping of industry participation in launch vehicles and satellites. From a market perspective, the present outlook makes it certain that traditional space suppliers will be limited to upstream capacity building and will not be able to participate in completely commercial frameworks in the downstream. The traditional space industry ecosystem will definitely benefit from long-term perspective planning by policymakers. Building a long-term perspective plan where the industry is enabled to participate in a complete commercial model where end-to-end systems shall be delivered can help in not only meeting the growing requirements in volumes nationally but also in integrating the Indian industry base globally[[25]](#footnote-26).

**2. New Space in India**

New Space is a worldwide phenomenon of entrepreneurs developing products, and service enterprises focusing on space and is using private funding in their initial developments. While there is no internationally accepted technical definition of ‘New Space’, principally, the ethos of the movement has been to challenge the traditional ways of space exploration that are widely considered as too expensive, time-consuming, and lacking in room for inventive risk-taking[[26]](#footnote-27). Companies that fit in the bracket of New Space include the likes of Space X, One Web, and Planet Labs, which are primarily funded by private capital to build products and services that challenge the cost to either access to space itself or access to services based out of assets in space. New Space has gone on to attract successful global entrepreneurs to either kick-off ventures of their own or to support start-ups. Examples of such global entrepreneurs include the likes of Richard Branson kicking off Virgin Galactic, Jeff Bezos starting up Blue Origin, and Larry Page backing Planetary Resources. One can argue that New Space kicked off where traditional space enterprises were stifling with the cost for creating more assets in space in areas such as developing cheaper rockets with greater launch cadence and developing satellite constellations that can enable greater and faster coverage to now many of them diversifying into space tourism and mining of space resources[[27]](#footnote-28).

**MILESTONES ACHIEVED BY ISRO**

The Indian Space Research Organisation is the apex space exploration agency owned by the Government of India. Aryabhatta, the first Indian satellite was entirely built in India in 1975[[28]](#footnote-29). ISRO has discovered three species of bacteria in the earth’s upper stratosphere in 2009. These species of bacteria are highly resistant to the ultraviolet rays[[29]](#footnote-30). ISRO placed two satellites in the earth’s orbit using the PSLV-C21 in the year 2012. One of the exceptional achievements of ISRO is sending the Mars Orbiter Mission in its first attempt using the PSLV-XL. India reached Mars successfully in 2014 and became the fourth country to reach Mars after the United States, Europe and Russia. In 2014, ISRO launched a crew capsule, GLSV MK3, capable of taking humans to space[[30]](#footnote-31). In 2017, the Indian Space Research Organisation, using the PS:V-C37, launched 104 satellites using a single rocket from Sriharikota in Andhra Pradesh[[31]](#footnote-32). Geosynchronous Satellite Launch Vehicle Mark - II launched by ISRO in 2017 made use of Cryogenic Upper Stage has helped in providing one of the biggest networks of communication in South Asia. India is amongst the top five countries to own a navigation system, NAVIC. By its various missions and launches, ISRO has been able to set up many records[[32]](#footnote-33).

**WHY ARE EXISTING MECHANISMS INSUFFICIENT?**

In rhetoric, all the space faring powers endorse the need to keep outer space safe, secure and sustainable; in the real world, however, the gaps are yawning. There are rapidly advancing military space programmes, including anti-satellite (ASAT) capabilities which are inherently destabilising, and increasing space debris as well as a proliferation of small satellites including mini, micro and nano satellites which lead to congestion in outer space. Each of these needs to be addressed in a priority manner if there is to be uninterrupted and secure access to outer space for the future generations. There is a body of treaties and regulations in place that regulate activities in outer space. These include the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (1967), Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (1967), Convention on International Liability for Damage Caused by Space Objects (1972), Convention on Registration of Objects Launched into Outer Space (1974), and Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1979). These conventions have proven to be insufficient for a variety of reasons. While there are many challenges facing the outer space domain, the most significant is the state of the outer space regime. The lack of consensus among major space faring powers in identifying challenges to ideating possible solutions has become the biggest stumbling block in developing an effective outer space regime. The Outer Space Treaty (OST) is the oldest and most comprehensive mechanism regulating outer space activities. While it prohibits states from placing weapons of mass destruction (WMD) in outer space, it leaves out a bigger challenge of conventional weapons in outer space. Another concern is that the OST was formulated in the 1960s and thus far removed from today’s realities and challenges. Similarly, the Prevention of Arms Race in Outer Space (PAROS) is an important proposal for tackling the challenge of an arms race in outer space. Despite the fact that there has been a resolution on PAROS passed in the UN General Assembly as far back as in 1981, a meaningful session on the treaty has yet to be held by the Conference on Disarmament (CD) in Geneva. This also reflects the larger problem faced within some of the UN institutions dealing with security and arms control. CD has been locked in a stalemate for more than two decades, with parties failing to arrive at a consensus even on the agenda. Transparency and Confidence Building Measures (TCBMs) have gained traction in the last couple of decades owing to the state of the regime. However, the lack of consensus among major powers has contributed to the slow development of space norms, and their disagreement on both current challenges and the way forward has made the formulation of legal regimes extremely challenging. Meanwhile, TCBMs suffice as intermediary measures between acknowledging the need for a mechanism and framing legal measures. They are typically voluntary, non-legal measures that would enable better understanding, potentially reducing wariness, competition and rivalry. They also provide a solid base for establishing greater confidence between nations and help in mitigating inter-state political difficulties, which may be the biggest hurdles in developing an effective regime. TCBMs can also contribute to greater interactions and dialogue processes among states that could gradually lead to openness, transparency and information-sharing. Outer space TCBMs have begun to be acknowledged as critical components of the entire process for the sheer magnitude of challenges that potentially put access to outer space at risk. Some of the prominent TCBMs in the recent years include the Group of Governmental Experts (GGE) and the International Code of Conduct (ICoC). These have their own share of advantages and disadvantages but considering the challenges, there is a need for all space faring powers to join hands in devising certain common standards of responsible behaviour that would avoid the pitfalls of an arms race and additional debris-generation activities. GGE is a multilateral initiative under the United Nations and the effort is to develop consensus among the fifteen member countries. They have succeeded in doing so as some level of consensus within the GGE has been achieved. While this is positive, the GGE has come under criticism for its limited representation. The five permanent members of the UN Security Council are permanent members of the GGE, and the remaining 10 are selected on other criteria including geographical representation. India was not part of the last GGE on outer space because it was established at the same time as the GGE on cyberspace. As a non-UNSC member, India had to choose between the two; it chose to join the GGE on cyberspace. Critics also point to GGE's recommendations not being binding and rather merely recommendatory. These recommendations, though, can gain some traction and possibly be carried forward if they are introduced as resolutions in the UN General Assembly, sponsored by the member countries[[33]](#footnote-34).

**INDIA AND GLOBAL GOVERNANCE**

India has remained an active player in the global governance of outer space. India supported multilateral institutions including the UN Office of Outer Space Affairs (OOSA) and the UN Committee on the Peaceful Uses of Outer Space (COPUOS). Given the significant benefits to the social and economic development agenda, international collaboration was pursued right from the beginning with countries like the United States, France and Russia. Pursuing this agenda of peaceful cooperation, UN OOSA organised three global Conferences on the Exploration and Peaceful Uses of Outer Space – the UNISPACE conferences of 1968, 1982 and 1999 – bringing together both states and multilateral organisations. The conferences, held in Vienna, provided a unique opportunity to further economic, social and scientific benefits of space research to all mankind. India utilised these platforms both for gaining know-how and expertise from other advanced space players and for sharing its own knowledge and skill-sets to other countries especially in the developing world. For example, in furthering the objectives of UNISPACE-2 conference, India initiated a training programme to share space technology applications to technical personnel from other developing countries[[34]](#footnote-35).7 Marking the 50th anniversary of the first UNISPACE conference held in 1968, OOSA is organising UNISPACE+50 in 2018.8 Despite the growing requirements on India’s space programme, New Delhi has not been particularly active in either UNISPACE or COPUOS. However, UNISPACE+50 offers India a unique opportunity to share its expertise to advance international cooperation and promote its foreign policy objectives[[35]](#footnote-36). Though outer space was not immune to the Cold War competition between the US and the USSR, there was a clear acknowledgment even between them of the common challenges to space sustainability[[36]](#footnote-37). This gave way to cooperation in the development of certain regimes, one of the first of which was the Outer Space Treaty (1967). The two countries had an inherent interest in controlling the spread of space technology and thus they managed to come together in writing certain rules of the road. But such treaty-making efforts have become more difficult in the last couple of decades. From a security and arms control perspective, India has for long articulated the need for legally binding, verifiable measures governing outer space. Traditionally, at the CD, India had championed this cause while partnering with the Group of 21 countries (the non-aligned group of countries) articulating the need for a treaty-like mechanism banning the placement of weapons in outer space. Also, India has not been comfortable with political instruments that are merely political commitments and do not have binding effect on states. Questions such as punitive measures if states break their political commitments have remained a puzzle for India. Further, there is no certainty that a code or other TCBMs will bring about responsible behaviour on the part of states, though not being part of them or violating the commitments after signing on to them makes them more like a pariah state. For close to a decade now, India’s approach has become more pragmatic as it moved away from the moralistic and sovereignty-driven arguments it had adopted for the first several decades. As a corollary, India’s own approach to TCBMs has evolved over the past few years[[37]](#footnote-38). From an earlier paradigm that viewed TCBMs as good supplementary measures to legal regimes, New Delhi has begun to approach TCBMs with a more pragmatic sense to acknowledge that one might need to start with the least controversial and minimally acceptable set of measures such as Group of Governmental Experts (GGE) and International Code of Conduct for Outer Space Activities (ICoC). More importantly, these measures could provide the basis for greater understanding among states, which is a prerequisite to tackling political differences. Once the political issues are addressed and there is a greater sense of confidence among the states, one could make progress towards developing more binding agreements. Thus, while one may see some Indian insistence on legal measures, there is a greater sense of pragmatism to understand and acknowledge that it has to possibly start from a normative exercise and gradually move to legally binding measures. As India’s rise picks up pace, its approach to collective governance of global commons has also begun to change. India has shed its past apprehensions for a more pro-active approach wherein it looks to play the role of an active party shaping the debate along with other major space-faring powers[[38]](#footnote-39). India began to undertake this gradual shift in the face of more direct threats in the form of growing missiles and anti-satellite weapons in its own neighborhood. The logic is quite clear – India has made significant investments in the outer space domain and thus, there is a material stake in the kind of rules that are being written. Also, India’s desire to be part of the global governance mechanism as a solution provider and norm-shaper has driven India in this direction. The national security-driven approach, as against the moralistic drive, is far more sustainable both within the country as well as in the global governance circles. And after several decades of lack of substantial activity on the global governance front, there is a sudden rush to institute new norms and regulations governing outer space activities. India’s interests are also driven by the fact that it is one of the earliest space powers. Taking on the role of a norm-shaper has become an important character of this new approach. India also understands and appreciates the geopolitical value of its efforts in this normative exercise[[39]](#footnote-40). Given the current state of play in the outer space domain, India should make efforts to develop all measures – treaties, TCBMs, norms of responsible behaviour, and code of conduct. Efforts must also be made to strengthen the existing instruments such as the OST, the UN-COPUOS, Conference on Disarmament and the GGE. Nevertheless, the major global space powers, including India, will have to recognise and address the political difficulties that have contributed to the crisis[[40]](#footnote-41).

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