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## Space Park – The Future of Space Exploration and Human Advancement

Sub-theme: Goal 9 - Industry, Innovation, and Infrastructure

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### Abstract

Space expeditions have undergone a revolution, and the denationalization of the space sector resulted in a comprehensive shift from the “Old Space Sector” towards the “New Space Sector.” Numerous countries have made the most of this change by using it as an opportunity in different fields. The space sector which had historically been a realm of government space agencies, is now within reach of the private sector as well, due to which the space has turned out to be a platform of innovation for a wide range of purposes.

India is not unversed in space; it ranks among the world's top six space-advancing countries. However, India holds a very minimum stake in the global space economy. This paper proposes to boost India's progress in space-associated education, interest, necessary infrastructure, and through improved policies by the government for its citizens and to pose itself as an eager participant in space-based exploration. India is poised to be the largest platform for space production, technology, and research for emerging branches in this field like space habitation, space tourism, space archaeology, bioastronautics, etc. This paper proposes the need for an establishment for private participants, scientists, and space enthusiasts to nurture space advancement.

Sustainable Development Goal Nine seeks to build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation. Abiding by this goal, the space sector is one of the contributors to the growth of the industrial base and innovations. Several policies and articles are referred and case studies concerning international standards are carried out to support these grounds.

### Keywords

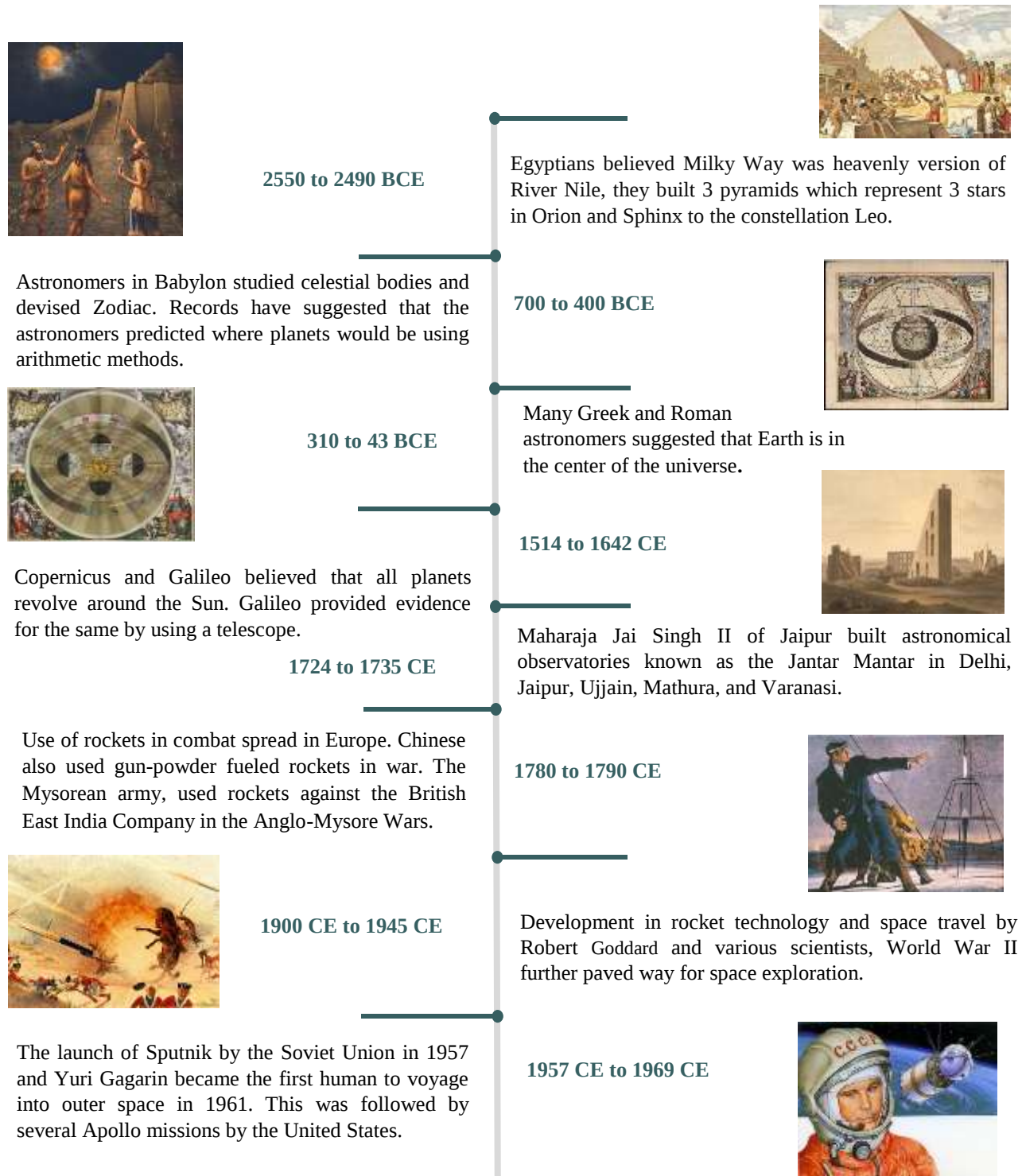
Space; Exploration; India; New Space.

## 1. Introduction

Throughout history, humans have been fascinated by space, which inspired inquisitiveness, study, and the exploration of meaning in them. Science gradually revealed itself to explain the essential workings of space which we today know as ‘Space Science’. Mankind's perspective of space changed considerably during the 16th-century scientific revolution, due to the work of astronomers Copernicus and Galileo, as well as experimental physicist Isaac Newton. The 20<sup>th</sup> century with it brought a new dawn for the entire humanity as space exploration and space travel became a reality due to steps taken by great space pioneers such as the Russian scientist and mathematician Konstantin Tsiolkovsky, the American inventor and physicist Robert Goddard, and the German scientist Hermann Oberth, in addition to other amateur rocket societies around the world.

But the true journey of human space exploration is believed to begin on October 4, 1957, when Sputnik, the first man-made satellite was launched by the Soviet Union. Astronaut Yuri Gagarin on April 12, 1961, became the first individual who encircles the Earth, which denoted the initiation of the genuine voyage of human space exploration supported by gradually complicated voyages to the Low Earth orbit (LEO) excelled by a succession of NASA's Apollo Program, ultimately ensuing in man reaching on the surface of the moon in 1969.

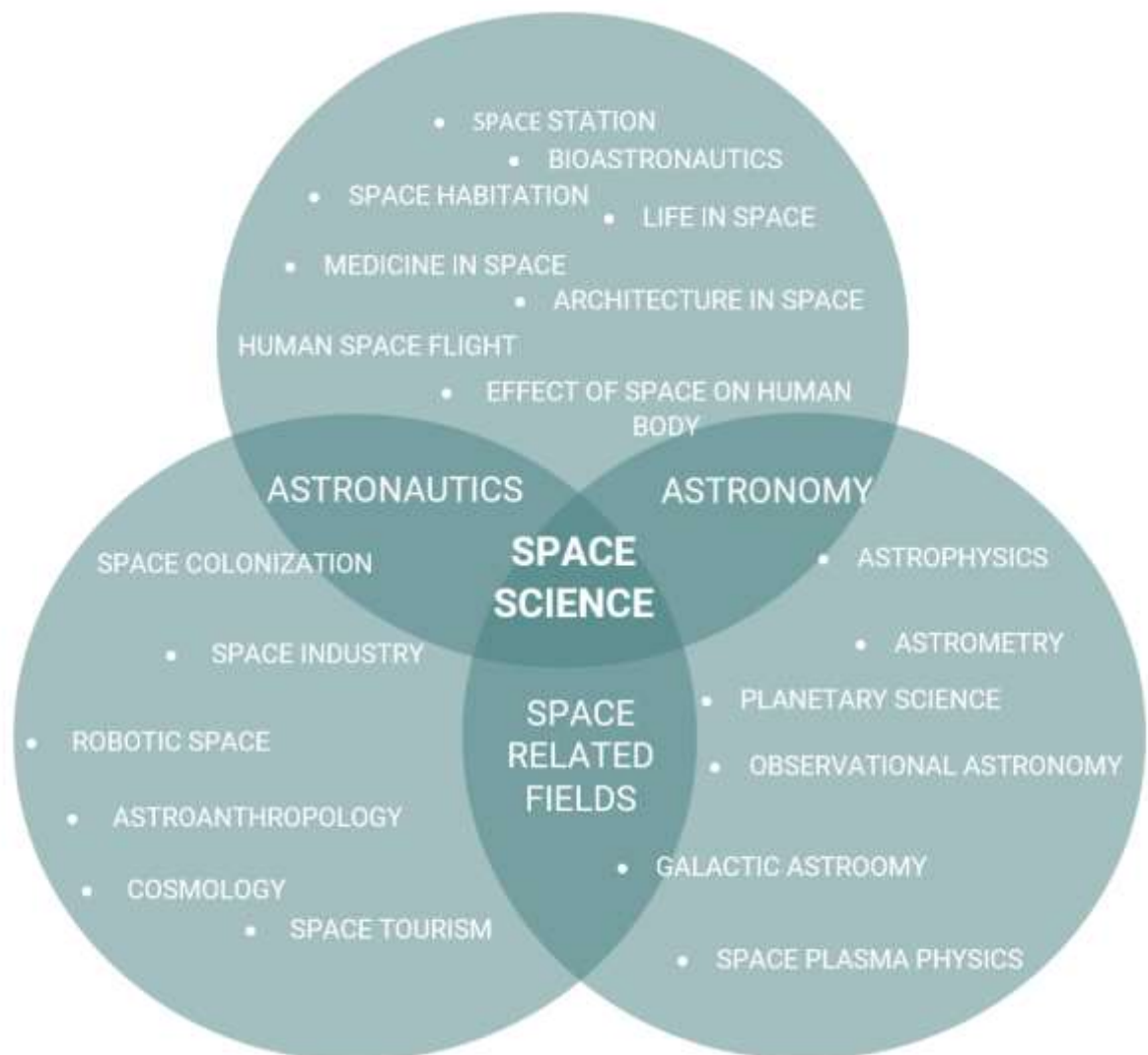
Figure 1: Timeline for foundation years of Space Exploration



Reference: The Smithsonian History of Space Exploration, Created by Author

## Branches of Space Science

Figure 2: Different Branches of Space Science



Reference: Created by Author

## Old Space Sector and New Space Sector of India

- “Old space” or “Traditional space” are space endeavors with the government at the helm and “New Space” are space undertakings piloted by privately owned establishments.
- “Old space” in India is the activity of ISRO (Indian Space Research Organization), India’s principal body for space-related exploration was founded in 1969. ISRO’s undertakings include performing tasks associated with space-based applications, space exploration, and the expansion of related technologies. ISRO has been impeccable in making India a global space power.
- The “New space” sector was established in India with startups who were tech players utilizing their skills and knowledge to form solutions that make India self-sufficient and a global leader.

Figure 3: The ISRO, 1963-2019 (and plans till 2028)

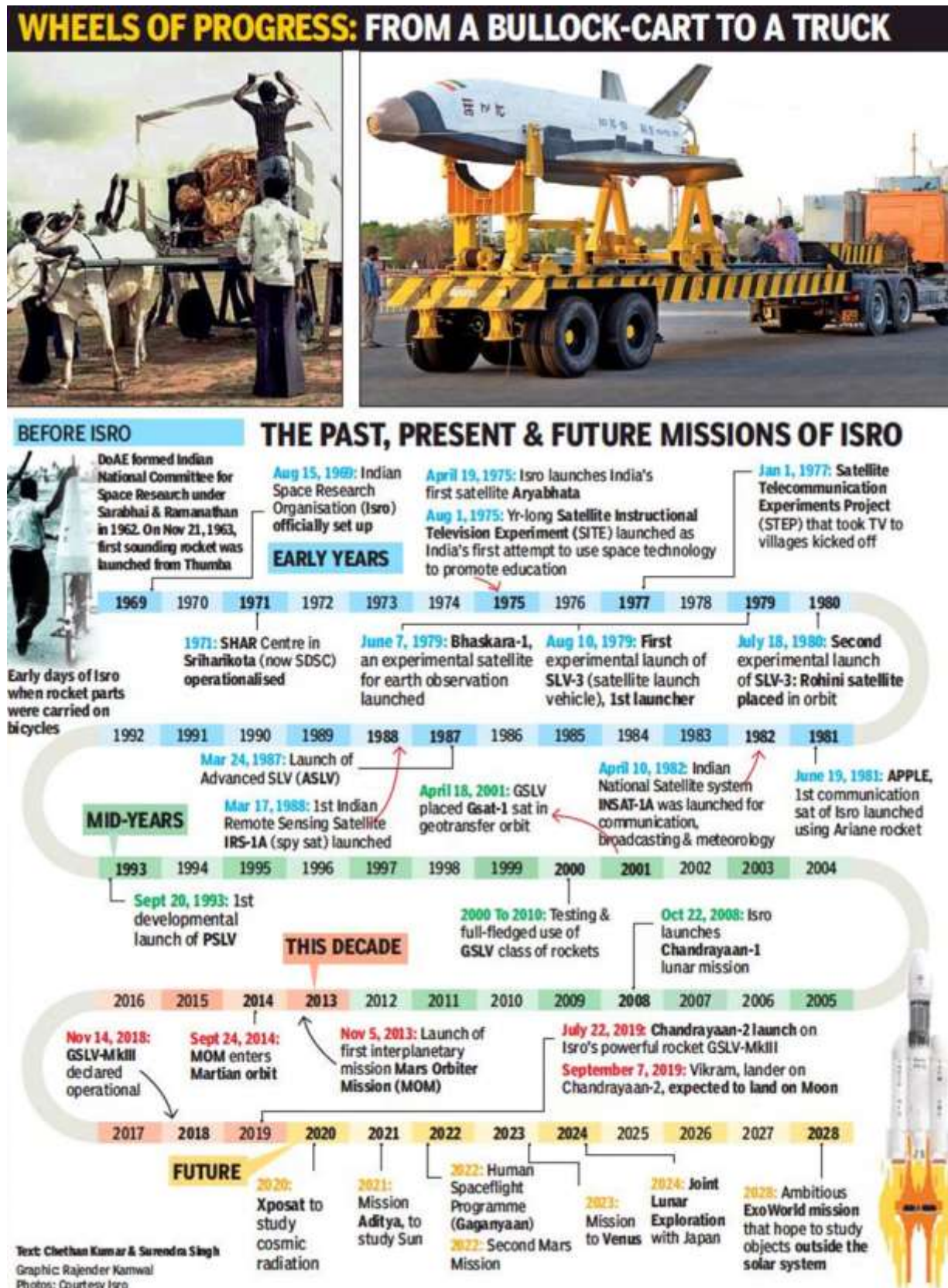
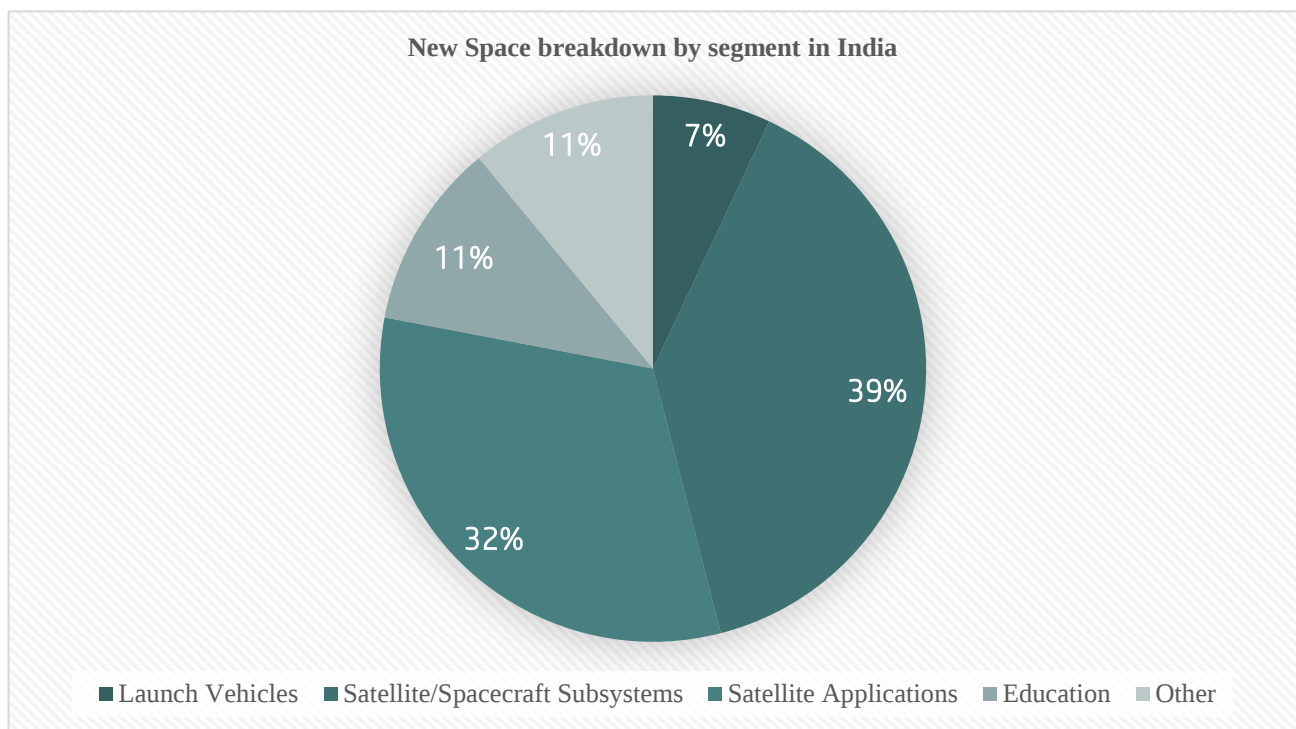


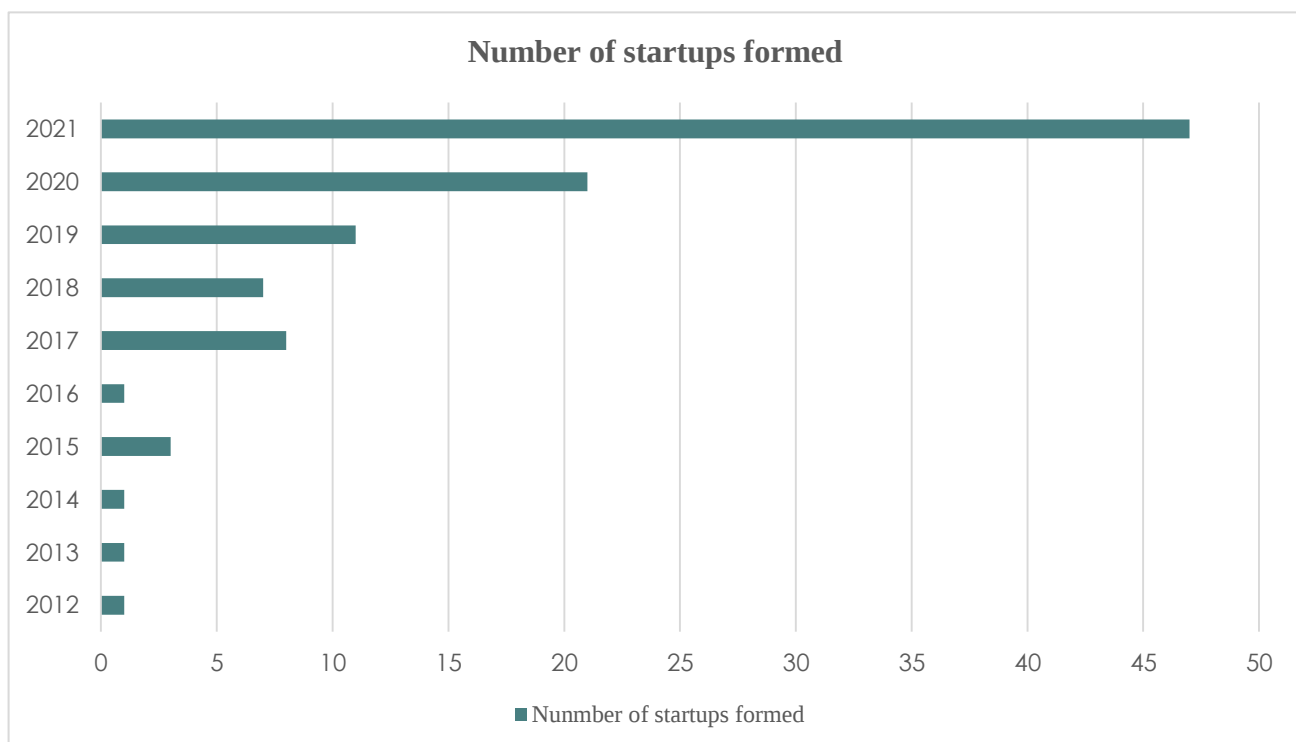
Figure 4: India's New Space breakdown by segment.

Reference: Chethan Kumar, August 16, 2019: The Times of India



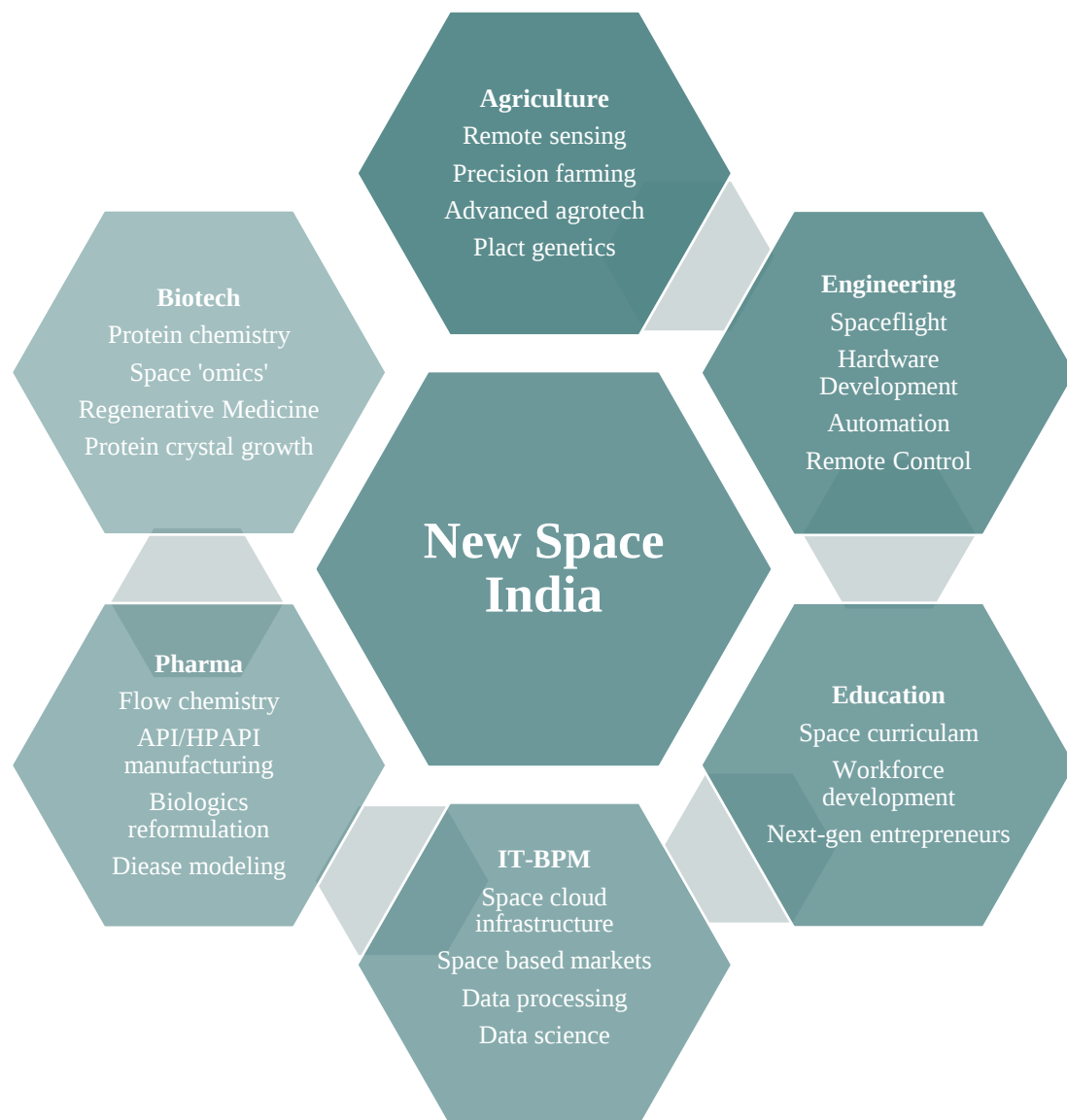
Reference: ESPI Report 77- New Space in Asia, Created by Author

Figure 5: Number of Space start-ups formed in India per year from 2012



Reference: ISRO, Economic Survey, Created by Author

Figure 6: Opportunities in New Space Sector for numerous Indian activities



Reference: India's Launch into New Space: Leveraging the Constellation of Information Technology, Pharma, and Biotech | New Space (liebertpub.com) Created by Author.

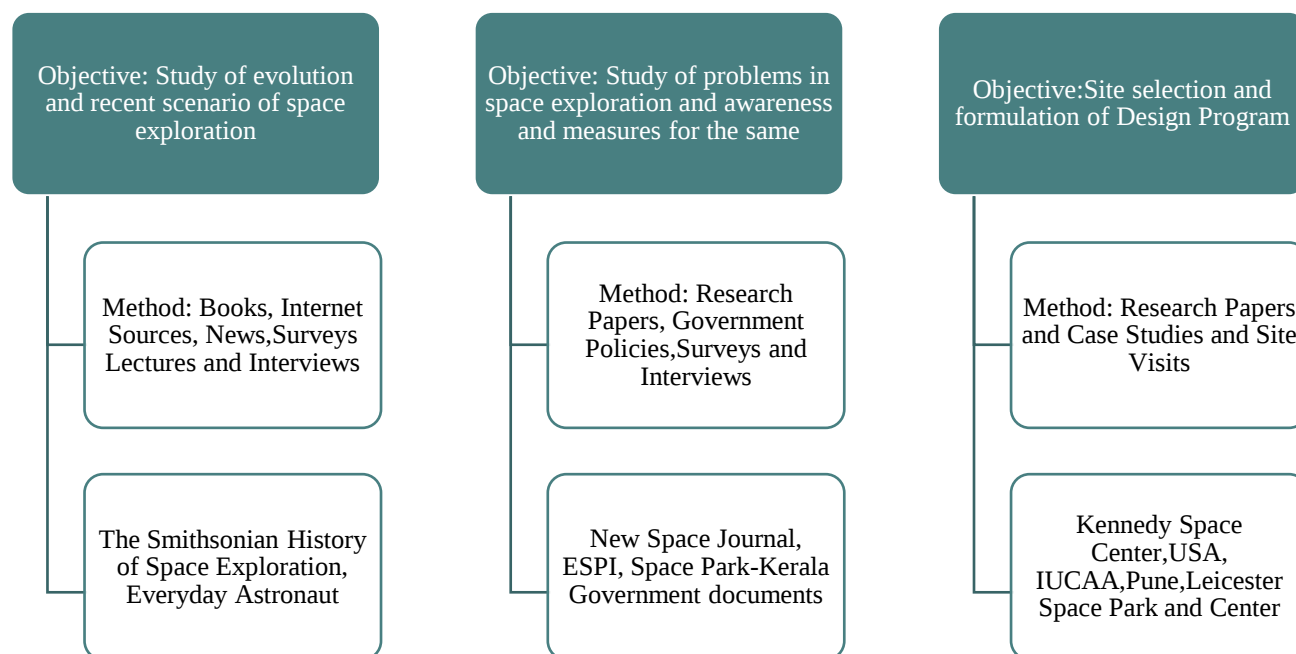
## 2. Methodology

The study has major three forms of analysis.

- The first part tries to map down the history of space exploration and the current scenario of 'New Space,' which attempts to understand how it started and evolved through the ages in the Indian context for which books, news, lectures, and internet resources were the primary sources of information and interviews were secondary.
- The second part focuses on its awareness, problems, and measures to promote space exploration for which government policies and research papers were the primary sources of information along with interviews being secondary. It also tries to understand how architecture can be a medium for space exploration which is researched using case studies.
- The third and final part emphasizes on site locations and design program, for which site selection criteria were set with help of case studies and requirements, then research was carried out for potential locations in "Space

Clusters” of India which have resources to sustain and develop a design program of “Space Park” that represents the interest of the whole nation.

Figure 7: Methodology for conducting the study



Reference: Created by Author

## 2.1 Policies and bodies for the development of the space sector

- "Draft- Spacecom Policy-2020" was issued by the Department of Space which aspires to meet the nation's increasing need for space-based communication requirements.
- In June 2020, the Indian Government announced the formation of IN-SPACE, an independent body, under the Department of Space for enabling and synchronizing space activities with the use of ISRO amenities by Non-Government-Private-Entities (NGPE).

## 2.2 Basic Analysis of Survey

A survey was carried out of Indian citizens to know their awareness, interest, and knowledge regarding space exploration and advancement. It was found that besides some famous agencies, very few are aware of other government and private space agencies and their endeavors.

Figure 8: Government Space Agencies people know around the world.

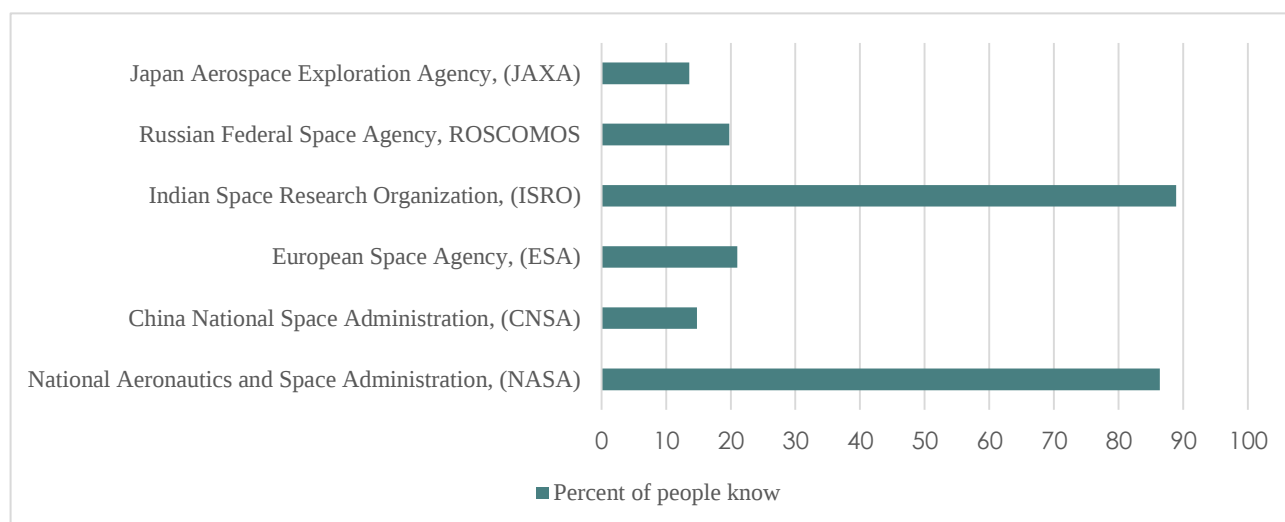


Figure 9: Private Space Agencies people know around the world.

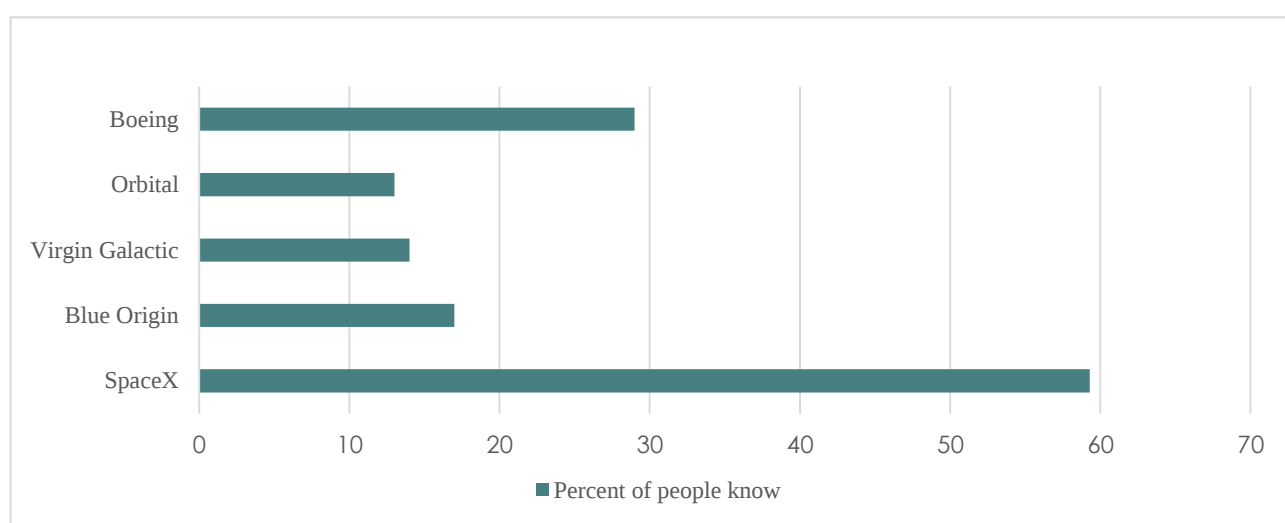
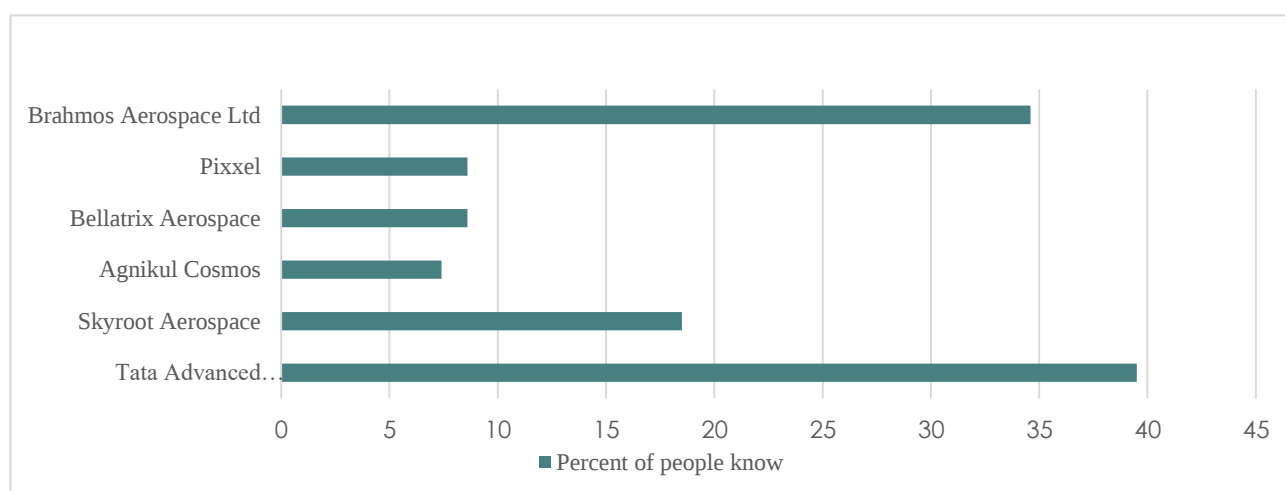


Figure 10: Indian Private Space companies people know about.

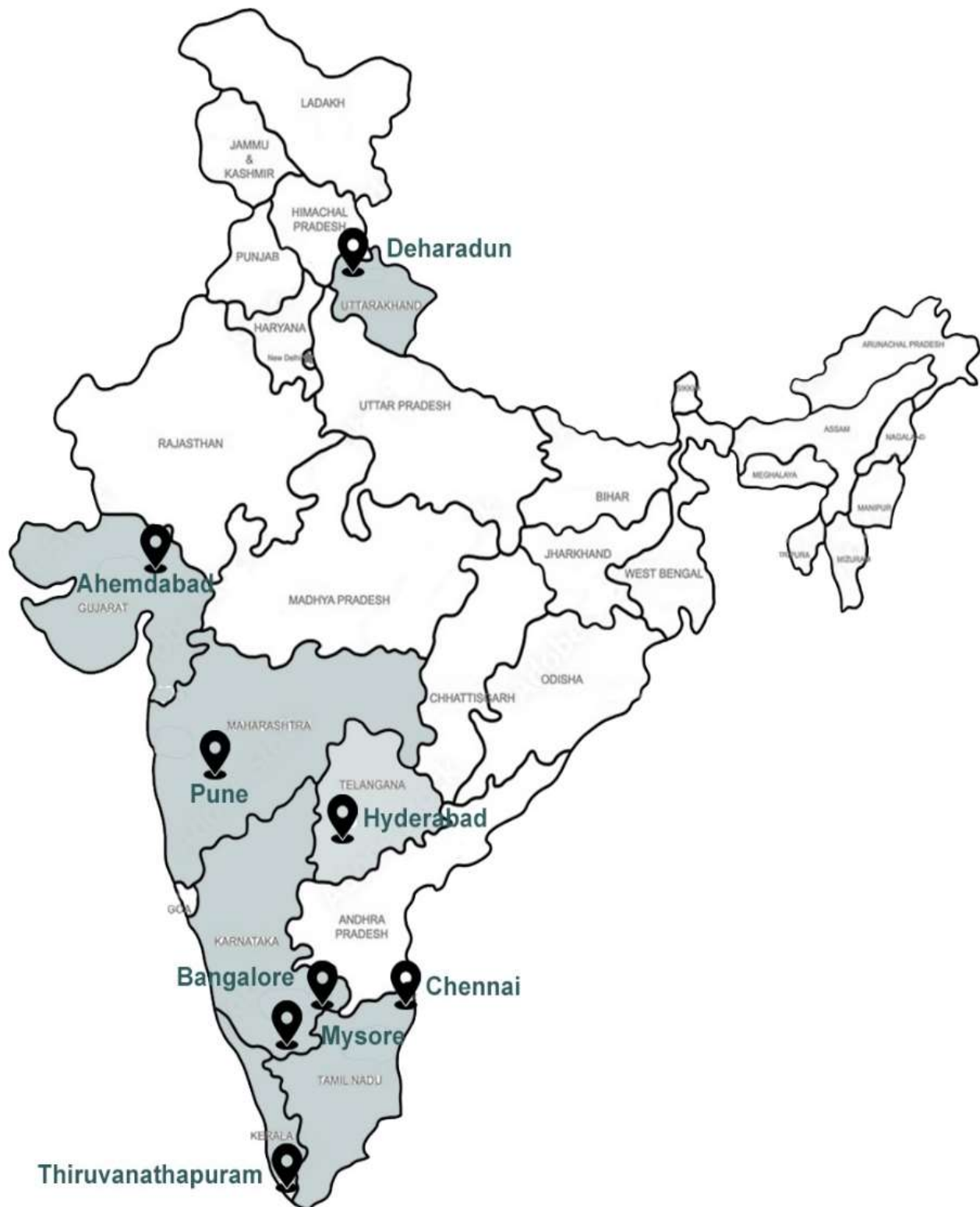


Reference: Created by Author

## 2.3 Space Clusters

In the early years of India's conquest for space, space clusters formed in areas that already had more than one ISRO establishment. As the space program advanced, activity in and about the major centers of space endeavor engaged in a critical role. The following map shows the major space clusters developed in India over the years.

Figure 11: Major Space Clusters in India



Reference: Created by Author

Table 1: Parameters to study space clusters for the development of space parks. This table analyzes three major space clusters in India of Thiruvananthapuram, Hyderabad, and Bangalore.

| NO | PARAMETERS TO STUDY                                                                                                                  | THIRUVANANTHAPURAM                                                                                                                                                                                  | HYDERABAD                                                                                          | BANGALORE                                                   |
|----|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| 1  | Existence of one or more ISRO units.                                                                                                 | Thumba Equatorial Rocket Launching Station(TERLS), Vikram Sarabhai Space Centre(VSSC)                                                                                                               | National Remote Sensing Centre (NRSC)                                                              | Headquarter of ISRO                                         |
| 2  | Scientific organization — nationalized laboratories and other research establishments.                                               | Liquid Propulsion Systems Centre(LPSC),ISRO inertial systems units(IISU)                                                                                                                            | Dr. APJ Abdul Kalam Missile Complex                                                                | U R Rao Satellite Centre (URSC)                             |
| 3  | Strong academic groundwork —universities, engineering colleges, and training organizations.                                          | Cochin University of Science and Technology, Indian Institute of Space Science and Technology, and Indian Institute of Management, Kerala University of Digital Sciences, Innovation and Technology | Tata Institute of Fundamental Research, and Indian Institute of Technology, Hyderabad              | Raman Research Institute, Indian Institute of Astrophysics, |
| 4  | A group of public sector endeavors and defense manufacturing entities.                                                               | BrahMos Aerospace                                                                                                                                                                                   | Defense Electronics Research Laboratory(DRDL), Defense Research and Development Organisation(DRDO) | National Aerospace Laboratories                             |
| 5  | Industrial setup —private fabricating industries, technology parks, testing and manufacturing facilities, and industry correlations. | Existence of Technoparks and Technocity                                                                                                                                                             | Bharat Dynamics Limited, Nuclear Fuel Complex, Electronics Corporation of India Limited            | Hindustan Aeronautics Limited                               |
| 6  | Basic infrastructure—road and railway network, presence of international or national airports.                                       | The International Airport of Thiruvanthapuram, the International airport of Cochin, and the NH-66 Highway are located near the Space-related facilities.                                            | Hyderabad Airport, National Highway 163, etc                                                       | Bangalore Airport, National Highway 48                      |

Reference: Created by Author

### 3. Conclusion

Though there is rapid expansion in the Indian Space sector as a result of growing curiosity among its citizens, influence from other countries, and diverse initiatives taken by the government, there is still a lack of awareness among the general public in India. Space research has proven helpful in numerous areas that affect our day-to-day life like disaster management, security, coastal studies, telecommunication, etc. along with playing a key role in infrastructure mapping and monitoring, climate change, where the most dependable technology is satellite-based. Thus, all of us must recognize the effect of space technologies on our lives and support the same. Sustainable Development Goal Nine seeks to build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation. Abiding by this aim, the space sector has thus proved to be one of the important contributors to the growth of the industrial base and innovations.

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