JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

The Future of Space Tourism: Assessing ISRO's Role with Current Technology

[1]Ashwini Panicker, [2]Apeksha Pandey, [3]Sneha Gokarnkar

[1]Student at Sheth L.U.J. and Sir M.V. College of Arts, Science, and Commerce, [2]Student at Sheth L.U.J. and Sir M.V. College of Arts, Science, and Commerce, [3]Asst. Professor at Sheth L.U.J. and Sir M.V. College of Arts, Science, and Commerce

Abstract: Space tourism is becoming a serious industry as technology advances and more private companies enter the market. ISRO has made significant advances in space exploration with low-cost rockets like as PSLV and GSLV. This study investigates how ISRO may affect the future of space tourism by examining its technological capabilities, challenges, and opportunities. Using a survey and chi-square analysis, the study assesses public interest in space travel and whether commercial space tourism is feasible in India. According to the findings, space tourism will expand in the coming decades as technology advances and costs fall. However, there are major difficulties to address, such as making it affordable, safe, and sustainable. The paper concludes by stating that if ISRO invests in reusable launch technologies and collaborates with other countries, India might become a major global space tourism market player.

IndexTerms - Space Tourism, ISRO, Gaganyaan, PSLV, GSLV, RLV, Space Exploration, LEO, Chi-Square Analysis.

I. INTRODUCTION

However, ISRO has goals beyond Gaganyaan. To create reusable launch vehicles and advanced space infrastructure, the agency is collaborating closely with private businesses. India is well-positioned to compete in the global space tourism sector because to affordable launch systems like the Geosynchronous Satellite Launch Vehicle (GSLV) and the Polar Satellite Launch Vehicle (PSLV). These developments strengthen India's standing as a pioneer in reasonably priced space technology while also facilitating access to space flight.

The dream of common people visiting space could soon come true as ISRO keeps coming up with new ideas and working with commercial companies. India is positioned to play a significant role in the future of space travel with its emphasis on cost, efficiency, and technological strength.

The Gaganyaan mission, which aims to put Indian astronauts into low Earth orbit (LEO), is a major milestone in India's space exploration history. Beyond demonstrating ISRO's capability in human spaceflight, the landmark mission marks India's entry into a select club of nations that have carried out crewed space missions. Gaganyaan is paving the way for future space exploration — and maybe space tourism — with spacecraft re-entry tech and astronaut training.

But ISRO is not just focused on Gaganyaan. The agency is partnering closely with private enterprise to develop reusable launch systems and sophisticated space infrastructure. Affordable launch systems such as the Geosynchronous Satellite Launch Vehicle (GSLV) and the Polar Satellite Launch Vehicle (PSLV) have positioned India to compete globally in the space tourism sector. These developments bolster India's position not only as a leader in affordable space technology but also increasing access to space flight.

ISRO keeps innovating and collaborating with commercial companies, and it may not be long before the dream of regular people visiting space becomes a reality. With its launch cost exceptions, efficient power and robust science, India is set to play a major role in the future of way space travel.

1.1 Literature Review

Gupta and his team (2007) noted that ISRO had been able to make necessary technological advancements for the launch of its next two space vehicles. The study argued that ISRO had obtained the necessary capabilities for the Polar Satellite Launch Vehicle (PSLV) and the Geosynchronous Satellite Launch Vehicle (GSLV). Furthermore, the research report stated that the institution presented proficiency in the launch of a group of satellites, which again demonstrated India's increasing ability in the area of space technology and exploration.

Pandey (2013) has put forth the view that besides being the aircraft development powerhouse, India has shown great promise in developing low-cost flying vehicles for commercial use. This particular study focussed on the improvements the country is witnessing in the aerospace area, particularly the capacity of the country to produce cost-effective flying vehicles. Notwithstanding these achievements, the research also pointed out that India was not in a position to engage itself in space tourism at that time. So the conclusions seem to propose that even though the country is doing well in the field of aviation innovation, it has to go for the next level by embracing

opportunities beyond space.

According to Sivan and Pandian (2018), the Indian Space Research Organization (ISRO) was working efficiently on the Reusable Launch Vehicle (RLV) technologies. The report pointed out one of the key stages of this work, namely that in 2016, ISRO had even carried out a technology demonstrator flight, which turned out to be a big success. This step made it possible to save a lot of money and fly more efficiently insofar as the equipment could be reused, which in turn would significantly lower the cost, and thereby caused an increase in the sustainability of space missions.

In 2010, Sundararajan stated that the Indian Space Research Organization (ISRO) had made outstanding performance with the success of both the Polar Satellite Launch Vehicle (PSLV) and the Geosynchronous Satellite Launch Vehicle (GSLV) systems. He also mentions ISRO's plans for the future, one of which includes the development of heavy-lift launchers to make possible further space missions. Moreover, the study seems to be very confident that the Organization', S project of launching a human spacecraft will happen very soon, which will definitely be a greater and landmark step toward the country's space program. India will then join the most advanced countries in the sphere of space exploration.

Sundararajan (2020) has presented the news that Indian Space Research Organization (ISRO) declared to the public the Gaganyaan Mission, whose objective is to send humans into space. The article drew attention to ISRO's aspirations regarding human spaceflight to Low Earth Orbit (LEO) by 2022, which are fundamental for India's successful space exploration strategy. This mission was exceptional work in securing India as a significant actor in crewed space missions, and also in catching the country's growing talent in sophisticated space technologies.

1.2 Objectives of the Study

➢ The biggest developments in space tourism; ISRO's efforts and scope in the future.

➢ To analyze the potential rise of space tourism in the next few decades and what impact it would have on society and the economy.

➢ Analyse the space tourism industry, challenges and opportunities, and recommendations for sustainable development.

Hypothesis H0: Space tourism will not be booming in the coming decades.

Hypothesis H1: Space tourism will be booming in the coming decades.

1.3 Scope

The present study explores the concept of space tourism as a future thing, particularly with its emphasis on ISRO's activities and progress. The main areas of concern are the technological, economic, and social changes, bringing with them the advantages and challenges of sustainable growth. This study is based on the existing developments and the future of the industry, indicating India's contributions to it..

II. RESEARCH METHODOLOGY

2.1 Data Collection

This study uses primary data acquired through a questionnaire taken by people from across the world. The data is examined using the chi-square test.

2.2 Data Analysis and Interpretation

AGE GROUP	NO.OF PEOPLE	PERCENTAGE
Under 18	4	4%
18-29	85	85%
30-49	4	4%
50-59	4	4%
60 and above	3	3%

Table 1. Age group of Respondents.

Out of 100 responses, above are the divisions according to the age groups of respondents, where the maximum number of respondents were in the age group of 18-29 years and the lowest number of them were the ones 60 and older.

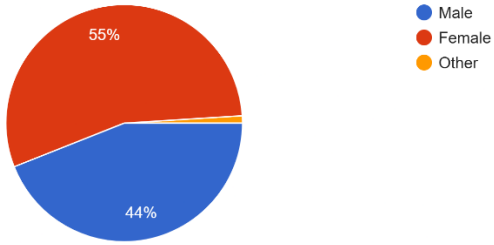

Figure 1. Gender classification of the respondents.

The graphic is a pie chart that depicts gender distribution. It displays 55% female (red), 44% male (blue), and a minor number of other (orange). A legend on the right shows the colors for each category.

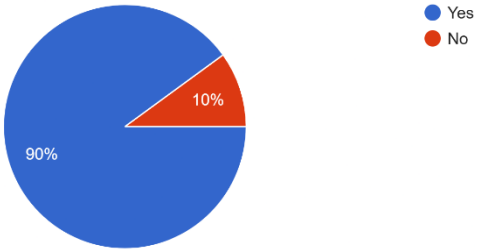

Figure 2. Familiar with ISRO

The graphic depicts a pie chart with a Yes/No distribution. 90% (blue) means "yes," whereas 10% (red) means "no." A legend on the right shows the associated hues.

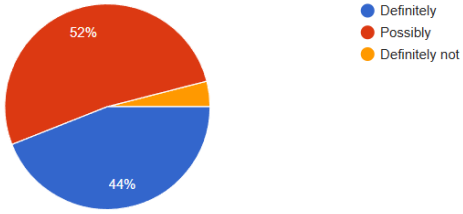

Figure 3. People's interest in going to space.

The image depicts a pie chart of response distribution. 44% (blue) is "Definitely," 52% (red) is "Possibly," and a small amount (orange) is "Definitely Not." The corresponding colors are indicated by a legend to the right.

II. RESULTS AND DISCUSSION

3.1 Chi-square test

The chi-square test is used to determine the relationship between Artificial Intelligence and jobs and its influence on individuals in diverse industries in accordance with a given hypothesis..

Formula:

Chi-square (χ 2) Test in r x c Contingency Table = $\sum i \sum j ((Oij - Eij)^2 / Eij)$

Where: O =Observed values, E = Expected values

Table 2. Observed Values

Female	19	1	35	55
18-29	16	0	30	46
No	11	0	23	34
Yes	5	0	7	12
30-39	1	0	1	2
No	1	0	0	1
Yes	0	0	1	1
50-59	0	1	2	3
No	0	1	2	3
60 and above	1	0	1	2
No	0	0	1	1
Yes	1	0	0	1
Under 18	1	0	1	2
No	1	0	1	2

Male	25	3	16	44
18-29	22	3	14	39
No	12	3	9	24
Yes	10	0	5	15
30-39	1	0	1	2
No	1	0	0	1
Yes	0	0	1	1
50-59	1	0	0	1
No	1	0	0	1
60 and above	0	0	1	1
Yes	0	0	1	1
Under 18	1	0	0	1
No	1	0	0	1
Other	0	0	1	1
Under 18	0	0	1	1
Yes	0	0	1	1
Grand Total	44	4	52	100

Expected value = (Row Total * Column Total) / Grand Total

Table 3. Expected Values

Female	24.2	2.2	28.6
18-29	20.24	0	23.92
No	14.96	0	17.68
Yes	5.28	0	6.24
30-39	0.88	0	1.04
No	0.44	0	0
Yes	0	0	0.52
50-59	0	0.12	1.56
No	0	0.12	1.56
60 and above	0.88	0	1.04
No	0	0	0.52
Yes	0.44	0	0
Under 18	0.88	0	1.04
No	0.88	0	1.04
Male	19.36	1.76	22.88
18-29	17.16	1.56	20.28
No	10.56	0.96	12.48
Yes	6.6	0	7.8
30-39	0.88	0	1.04
No	0.44	0	0
Yes	0	0	0.52
50-59	0.44	0	0
No	0.44	0	0
60 and above	0	0	0.52
Yes	0	0	0.52
Under 18	0.44	0	0
No	0.44	0	0
Other	0	0	0.52
Under 18	0	0	0.52
Yes	0	0	0.52

Table 4. Calculating ((*Oij*− *E*ij) ^2 / *E*ij)

To calculate χ 2, add the values of ((*Oij*− *E*ij) ^2 / *E*ij) to get 49.78642297.

To test the hypothesis at the 0.05 level of significance, deduct the p-value generated by the formula:

p-value = CHISQ.DIST.RT(χ 2, Degree of Freedom)

Where Degree of Freedom = (Total number of Rows -1) * (Total number of Columns - 1)

Degree of Freedom = 58

Therefore,

p-value = CHISQ.DIST.RT(49.78642297, 58)

p-value = 0.770107

III. FINDINGS

The calculated p-value which is greater than the acceptance level of significance at 0.05 makes it evident that Space Tourism will be booming in the next decades as a consequence of the rejection of H0 hence in acceptance of the H1 at a 0.05 level of significance.

IV. CONCLUSION

After exploring this analysis, space tourism is anticipated to boom post the current period, carried by the victory of technology, the growing role of the private sector, and additional programs like ISRO's upcoming space programs. As the cost of space travel goes down, and its availability logic becomes more optimistic, the space tourism industry will move from being an elite indulgence to a more mainstream one.

Nevertheless, problems such as high costs, safety issues, and the eco-effect must be worked out for the growth to be sustainable. The establishment of international partnerships, the creation of a regulatory framework, and further research are the significant steps that need to be taken in order to make the space tourism industry a real and long-term sector. By gaining more focus on the use of reusable launch vehicles and financially viable space missions, ISRO is expected to launch India into the leadership of aerospace tourism.

V. SUGGESTIONS

1. Cost Reduction Strategies

- Put money into reusable launch vehicles (RLVs) to cut down space travel costs.
- Create budget-friendly suborbital flights for quick space trips.
- Push for teamwork between public and private sectors to fund and make space tourism a business.

2. Making Safety Better

- Put in place cutting-edge life-support systems and plans for emergencies.
- Set up thorough training before flights for space tourists.
- Boost protection from radiation and make spacecraft tougher for long trips.

3. Space Travel That Lasts

- Study and build green propulsion systems to lessen harm to the environment.
- Start programs to balance out carbon to offset emissions from rocket launches.

4. Growing Infrastructure

- Build hotels in space and research stations in orbit for long stays.
- Create spaceports and training centers to keep up with rising demand.

5. Stronger Regulations and Policies

- Create international space laws to guide liability, safety, and travel.
- Make sure space tourism takes into account ethical issues like using resources and caring for the environment.

6. Public Awareness and Training

- Boost educational programs to spark interest in space tourism.
- Start simulated space experiences to get potential tourists ready.

These steps will help ISRO and global space agencies speed up the creation of space tourism that's safe, cheap, and long-lasting for people in the future.

REFERENCES

[1] Pandey, M. (2013). The Possibility of Space Tourism in India: Issues and Concerns. *IOSR-JBM*, *11*(4), 32-39. https://doi.org/10.9790/487X-1143239

[2] V. Sundararajan (2010). Economic and Performance Analysis of Indian Space Transportation Systems. https://doi.org/10.2514/6.2010-8708

[3] V. Sundararajan (2020). Gaganyaan Mission: Socio-technical Systems (STS) Design and Strategic Perspectives of India's Human Spaceflight Program. AIAA Scitech 2021 Forum. https://doi.org/10.2514/6.2021-0306

[4] K. Sivan, S. Pandian (2018). An Overview of Reusable Launch Vehicle Technology Demonstrator.10.18520/cs/v114/i01/38-47

[5] S. Gupta, B. N. Suresh, K. Sivan(2007). Evolution of Indian launch vehicle technologies. https://www.jstor.org/stable/24102066