

**1. What have been India's recent achievements on the space technology front? Discuss.**

**Approach**

A simple and straightforward question where in the candidate needs to discuss India's recent achievement's in the field of space technology.

**Introduction**

The Indian Space Research Organization (ISRO) is one of the largest and most successful space agencies in the world. Since its inception back in 1969, the Indian space agency has achieved a number of milestones, from successfully launching Chandrayaan-2 to testing a critical technology for human spaceflight.

**Body**

Indian Space Research Organisation (ISRO) has come a long way since its formation from launching small rockets of just 30-70 kg payloads to carrying 4,000 kg payloads to the outer space. In this regard, some of India's recent achievements on space technology front include –

**Launch Vehicles –**

- Polar Satellite Launch Vehicle (PSLV): PSLV upper stage (PS4) restart capability has also been demonstrated which enables PSLV to inject multiple satellites in different orbits in same mission thereby making PSLV more versatile launcher.
- GSLV-Mark III: The first developmental flight was successfully launched, in which a 3136 kg communication satellite (GSAT19) was injected into the Geosynchronous Transfer Orbit. GSAT-19 is the heaviest satellite launched with Indian launch vehicle.
- Technology demonstration: The first experimental mission of ISRO's Scramjet engine towards the realization of an Air Breathing Propulsion System, was successfully conducted. With this test, India became the fourth country to demonstrate the flight-testing of a Scramjet engine.
- Towards developing essential technologies for a fully reusable launch vehicle to enable low cost access to space, ISRO successfully flight tested India's first winged body Reusable Launch Vehicle - Technology Demonstrator (RLV-TD) demonstrating Autonomous navigation, guidance and control & re-entry mission management.

**Communication, Navigation and Earth Observation Satellites –**

- The Indian space agency, scripted history by successfully launching RISAT-2B, a super surveillance satellite, from the Satish Dhawan Space Center. The radar imaging satellite can take high-resolution images even in cloudy conditions.

Further, South Asia Satellite was realized with the objective of providing communication services over South Asian countries.

- Recently, ISRO's PSLV-C43 lifted off with India's Hyper-Spectral Imaging Satellite (HysIS), the country's best high-resolution satellite ever, which can study the earth's surface in visible, near-infrared, and shortwave infrared regions of the electromagnetic spectrum.
- Seven more satellites of the Indian Regional Navigation Satellite System (IRNSS) constellation were successfully launched. The constellation is named as 'NavIC', and was dedicated to the nation by the PM.
- Recently, the Indian Space Research Organisation (ISRO) declared that it has successfully demonstrated free-space Quantum Communication over a distance of 300 metres, for the first time in the country.

### **Space Science Missions –**

- **ASTROSAT:** India's first multi wavelength observatory capable of simultaneously viewing the Universe in the visible, Ultra-Violet and X-ray regions of the electromagnetic spectrum, with its 5 payloads, was successfully launched into its planned orbit.
- **Mars Orbiter Mission (MOM):** India's first inter-planetary mission MOM, far outliving its originally planned life, completed three years in its orbit, in September 2017. The Mars Colour Camera has, so far, produced around 940 images.
- **Chandrayaan 1:** It changed the course of India's space exploration. It was launched in October 2008 and was the first lunar probe under the Chandrayaan program. The mission had a lunar impactor and orbiter. It was launched to collect scientific information about the moon's mineralogy, geology and topography.

### **Human Space Flight –**

- ISRO successfully carried flight test of the indigenous Crew Escape System, a crucial technology for launching astronauts into space. The Crew Escape System is an emergency escape measure that is designed to quickly pull the crew module and the astronauts away from the launch vehicle, to a safe distance, in case of a malfunction in the initial launch stage.
- Further, Isro's Vyommitra will ride to space in the first test flight of the human space mission, Gaganyaan. She is being called a half-humanoid since she will only have a head, two hands and will not have lower limbs. She will simulate human functions before real astronauts take off. She can detect and warn if environmental changes within the cabin get uncomfortable to astronauts and change the air condition.

### **Conclusion**

The spirit of the nation's scientific community and inventor stayed undeterred even as the Covid-19 pandemic continued to create havoc throughout the last year, which is embodiment of the fact that Indian space research and technology field is robust and ready to take the nation to further heights.

**2. What are the key challenges for tapping solar energy in India? What measures have been taken to address those? Examine.**

**Approach**

Candidates are expected to write about the key challenges for tapping the solar energy in India and then suggest some measures to tackle the challenges.

**Introduction**

Debate of global warming and climate change is compelling the world to move from fossil based energy towards clean and green energy. India lying in tropical belt has an advantage of receiving peak solar radiation for 300 days. With its pollution free nature, virtually inexhaustible supply and global distribution, solar energy is very attractive energy resource.

**Body**

Solar energy in India:

- India's current installed solar power capacity, according to Central electricity authority, is 26025.97 MW which is 34% of total renewable energy sources. India's Intended Nationally Determined Contributions (INDC's) commitment include 100 GW of solar power out of 175 GW renewable energy by 2022.

Challenges for tapping solar energy:

- India's solar capacity is largely based on imported items. We are heavily dependent on China for PV cells, modules, and other associated products. The low-priced Chinese imports do not let Indian manufacturing to flourish. The dumping of low-cost equipment is a threat to the profitability of local manufacturers.
- Per capita land availability is a scarce resource in India. Dedication of land area for exclusive installation of solar cells have to compete with other necessities that require land. It is a space-intensive method of energy production. The more energy production you require, the more space you will need.
- The initial installation costs are very high as of now so they are not affordable to a large section of the population. The battery requirements, inverter, wiring, and installation takes up a large amount of cost.
- Solar energy storage is expensive and the storage technology is still evolving and the current storage scenario is costly.

- There is also an issue of toxic materials and hazardous products used during the PVs production that can indirectly affect the environment though in smaller amounts.
- Though India had added the DCR in its bid to improve the local manufacturing ecosystem, the WTO litigation and unsuccessful attempt to protect it is making the flowering of local manufacturing more difficult.
- Though the skilling of the workforce is included in the policy support measure for the solar sector, the skilling requirement for the sector is very high and India is not keeping up the pace.
- The COVID-19 has affected all the sectors of the economy which includes solar energy sectors too. The ongoing solar projects have been halted and the developers are concerned about the cost escalations due to domestic lockdown and production cuts in China.
- The impact of COVID-19 on the supply chain has also been a cause for the rising demand for cancellation of Power purchase agreements apart from the fact that there are no new takers for new Power supply agreements and auctions.

Measure to tackle the challenges:

- The solar-wind hybrid energy model is an emerging model that works on deficiencies of both the sectors and provides a more reliable source of power generation. Such innovative models can provide more cost-effective investment opportunities.
- The architecture more suitable for most of India would be a highly distributed, individual rooftop power generation systems, all connected via a local grid.
- There is a need to improve investment in the solar supply chain within India. As the conventional finance mechanisms are reeling under pressure, measures like green bonds, solar bonds, UNFCCC finance mechanisms can be tried.
- There should be fair tariff policies so that investments are not rendered profitless. The optimisation of the price-profit duo is of critical importance for India with a huge population in lower middle income.
- The R&D and skilling of the manpower aspect must be given the most thrust to. If we are to have a robust domestic manufacturing, local R&D and skills are most important.
- What India needs today is a dedicated solar manufacturing strategy that addresses all the aspects of solar manufacturing ranging from land, tariff, import to skilling, and behavioural aspects.

### **Conclusion**

Growth of solar sector though halted due to pandemic, the pandemic itself is a critical opportunity for India to plan its own green deal on the lines of the European Union. Solar energy sector is a solution to most of our pressing issues such as equitable and sustainable development, social sector, employment generation, etc. Also it forms an important component of the quest for Atmanirbhar Bharat.

### **3. What are the parameters to measure innovation? What has been India's recent performance in innovation? Discuss.**

**Approach-** Candidate is expected to define what is innovation and why it is necessary. With the help innovation index and its parameters, future of India's innovation can be stated.

#### **Introduction**

Innovation is the process of creating value by applying novel solutions to meaningful problems. Innovation is a process. It's not the result itself per se, but the path to get there. We know it's possible to innovate unsuccessfully—there's plenty of evidence that innovations often fail. What's key is that seeking to create value by applying a novel solution to a meaningful problem.

#### **Body**

What are the innovation metrics?

- **Capabilities-** Capabilities refer to the abilities, practical skills, unique insights and know-how of the people. In addition, it also covers the tacit knowledge, and other information capital, as well as financial capital needed to create innovation.
- **Structures-** By structures, we refer to the organizational structure, processes, resources and infrastructure of the organization that enable the effective use of the aforementioned capabilities. Structure metrics should support resource allocation, efficient innovation management and idea-to-launch process, as well as speed of testing of new ideas.
- **Culture-** Culture enables the organization to acquire the capabilities related to people. Although it might be relatively difficult to effectively measure direct impacts on culture, the right type of culture may have a tremendous effect on the innovativeness of an organization. An innovative company culture supports the process and need for always getting better, learning and experimenting at a fast speed, as well as balancing between freedom and responsibility.
- **Leadership & Strategy metrics-** Strategy is ultimately about making a deliberate choice between a number of feasible options to have the best chance of "winning". It is the high-level plan for the organization to achieve its goals and long-term success, whereas leadership is needed on the way there.

Innovation index and India's performance

- **Global Innovation Index-**It provides detailed metrics about the innovation performance of 131 countries and economies around the world. Its 80 indicators explore a broad vision of innovation, including political environment, education, infrastructure and business sophistication. It is published annually by Cornell University, INSEAD and the WIPO.

- Global Innovation Index 2020 was released by the World Intellectual Property Organisation (WIPO). India is at the 48th position in the list of top 50 innovative countries. India occupied the 52nd position in 2019 rankings.
- Switzerland, Sweden, the USA, the UK and Netherlands are the top five countries. With a group of Asian economies advancing up the rankings, the index indicates that "a gradual eastward shift in the locus of innovation" is underway.
- In Asian economies, China, India, the Philippines and Vietnam have made the most progress on the index in recent years, with all four now among the top 50.
- India is one of the leading innovation achievers in the central and southern Asian region, as it has shown a consistent improvement in its innovation ranking for the last 5 years. China, which is the only middle-income economy among the top 30, now holds the 14th position.

#### India innovation index

- Developed by NITI (National Institution for Transforming India) Aayog with the Institute for Competitiveness.
- The index has been developed on the lines of the Global Innovation Index (GII), to ameliorate the innovation ecosystem of Indian states and Union Territories (UTs) and to design policies to drive innovation across regions.
- The index goes beyond traditional approaches by considering the best parameters in measuring innovation such as patents per million of population, publication in scientific journals, percentage of GDP spending on research. It also adds parameters that are specific to the Indian economy (eg. Demographic dividend), to give it a more holistic coverage.
- India Innovation Index Report 2020 was released by NITI Aayog in which Karnataka retained its top position in the major States category.
- The Index is calculated as the average of the scores of its two dimensions – Enablers and Performance. The Enablers are the factors that underpin innovative capacities, grouped in five pillars: (1) Human Capital, (2) Investment, (3) Knowledge Workers, (4) Business Environment, and (5) Safety and Legal Environment. The Performance dimension captures benefits that a nation derives from the inputs, divided in two pillars: (6) Knowledge Output and (7) Knowledge Diffusion.

#### **Conclusion**

India has a unique opportunity among its myriad challenges to become the innovation leader in the world. Cluster-based innovation should be leveraged upon as the focal point of competitiveness. The index is a great beginning to improve the environment of innovation in the country as it focuses on both the input and output components of the idea.

**4. what is the economic and geostrategic significance of central Asia for India? Discuss the recent efforts to increase the outreach to central Asia..**

**Approach**

Since question asking you to discuss so it necessitates a debate where reasoning is backed up with evidence to make a case for and against an argument and finally arriving at a conclusion. In simple terms an examiner expects one to discuss various perspectives and present a logical argument.

**Introduction**

The prospects of India-Central Asian relations is not a new one. Several facets of cultures, civilizations, and intellectual histories of the two regions suggest that they evolved not in isolation, but through reciprocal cultural enrichment. In modern times, however, the importance of Central Asia to India is not merely civilizational and historical, but also geostrategic and economic.

**Body**

**Economic and geostrategic significance of central Asia for India:**

- The geo-strategic location of the Central Asian Republics (CAR) has made this region extremely fundamental which has attracted the attention of various countries, including India.
- New energy sources from Central Asia will play an important role in the Indian energy strategy in the coming years. Peace and stability in CARs and Afghanistan seem to be the most significant factor for India's security.
- Central Asia is significant for India as it is well versed with energy resources as it has an abundance of oil and gas deposits. It contains vast hydrocarbon fields both on-shore and off-shore in the Caspian Sea which homes around 4 percent of the world's natural gas reserves and approximately 3 percent of oil reserves.
- Central Asia, located in the heart of Eurasia, forms a part of India's extended neighborhood. Its geographical proximity, strategic location, and historical linkages make it an important partner for India.

**Recent efforts to increase the outreach to central Asia :**

- A new impetus to India's connectivity project with Central Asia was added when India-Iran-Uzbekistan signed an agreement for the use of the strategically important chabahar port located in Iran.
- There is the Ashgabat agreement which India is part of and similarly, the North-South Corridor project along with the maritime connectivity project through the proposed "Chennai-Vladivostok" route (though it will connect Siberia through indo Pacific corridor).

- It can also be further connected to Kazakhstan because of land connectivity options as India is initiating major projects in recent years to give a strong boost to its 'Look North Policy'.
- The trilateral cooperation between New Delhi, Teheran, and Tashkent will have a geopolitical ramification on three counts. These are : a) It will facilitate India's growing connectivity with Central Asian countries which in turn will contribute to the fruition of trade and economic cooperation; b) over a couple of years other Central Asian countries may also join this endeavor. As has been reported, these Central Asian countries are also showing their keenness to become part of this Chabahar multilateral initiative for use of the port; c) studies suggest that Central Asian countries are also interested to reap maximum benefits (both geopolitically and geo-economically) from the emerging Indo-Pacific strategic corridor and are interested to use the Chabahar port as an entrepot.

### **Conclusion**

Today Central Asia is the region that is considered a critical area in the foreign policy of the West, South, and East Asian countries. As India cements its position as one of the fastest-growing major economies of the world, its increased engagement with the Central Asian region can lead to mutually beneficial gains — both in economic and strategic terms.

### **5. The Development Finance Institution holds the potential to give the much needed stimulus to the infrastructure sector. Comment.**

#### **Approach:**

Students are expected to follow the directive properly and highlight the potential of development finance institution for infrastructure sector by providing detailed explanation to the points.

#### **Introduction:**

Development finance institutions are specialized institutions set up primarily to provide development/ Project finance especially in developing countries. These DFIs are usually majority-owned by national governments. The source of capital of these banks is national or international development funds. This ensures their creditworthiness and their ability to provide project finance in a very competitive rate.

#### **Body:**



In India, the first DFI was operationalised in 1948 with the setting up of the Industrial Finance Corporation (IFCI). Subsequently, the Industrial Credit and Investment Corporation of India (ICICI) was set up with the backing of the World Bank. The Industrial Development Bank of India (IDBI) came into existence in 1964 to promote long-term financing for infrastructure projects and industry.

**Need of Development finance Institutions in India-**

- According to the estimates of a recent report – India will require a whopping Rs 50 trillion (US\$ 777.73 billion) in infrastructure by 2022 for sustainable development in the country. It is also showcasing a myriad of opportunities for foreign investors to invest in the country's infrastructure development.
- A DFI differs from a commercial bank in that its mandate balances positive development outcomes with profit maximization, often prioritizing the former over the latter. It typically provides necessary financing for activities that are in the realm of public good, but are not lucrative from a financial risk-return perspective, such as environmental projects, long gestation greenfield infrastructure projects and even supporting innovative startups.
- Theoretically, the establishment of a DFI could be justified by the dual existence of massive infrastructure needs and availability of bankable projects.
- The establishment of such an institution is considered as a positive step as banks do not have the long-term funds to finance such projects.
- Banks cannot afford to lend for such projects because that would shrink their lending capacity as the funds get locked up in such projects for that time period.
- Health of banks has been a cause of concern for policy makers because of rising NPAs and the impact of COVID-19 pandemic has made the establishment of specialised infrastructure financing institutions important.
- Successful completion of infrastructure projects is capital intensive and requires a massive capital inflow. The most crucial strategy to stimulate growth in the sector is an effective deployment of capital resources by the government.
- Any sector that needs a strong push needs to identify the roadblocks and come up with a solution for its progress. In the infrastructure industry, one of the biggest hurdles is incomplete projects. These are usually left for too long in the last stage of development and the completion of them would make way for new projects as well as provide support for them. This case is evident especially with physical infra projects such as roadways and railways. Focus on physical infrastructure projects will make the movement of resources easier and also provide aid to logistics.

**Conclusion:**

India needs DFI's to boost economic growth which would increase capital flows and energize capital markets. To improve long term finances, provide credit enhancement for infrastructure and housing projects. As India does not have a development bank, DFI would fulfil the need for us to have an institutional mechanism.

