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THE HINDU

'Despite reputation, India's per-unit space launch cost highest'

Prelims: General Studies Paper 1

Current events of national and international importance

Mains: General Studies 3

Achievements of Indians in science & technology; indigenization of technology and developing new technology.

Why in Focus?

- A peer-reviewed study published in Economics Letters finds that **India has the highest cost per kilogram for placing payloads into Low Earth Orbit (LEO)** among major spacefaring nations, challenging India's image as a low-cost space-launch provider.

Low Earth Orbit (LEO) is an orbit around Earth at an altitude of roughly 160–2,000 km, commonly used by satellites and crewed spacecraft.

Key Highlights

- In 2025, **India's estimated launch cost was \$13,302/kg, compared with Europe (\$9,897), Russia (\$6,682), China (\$5,809), Japan (\$5,287) and the U.S. (\$3,225);** the global average was \$3,868/kg.
- The study attributes **India's high cost mainly to smaller rockets and low launch frequency,** which prevents fixed launch costs from being spread over larger payloads.

- Since 2010, the U.S. and Europe have **reduced space-launch costs** as their number of launches increased.
- India recorded only **5 launches in 2025, highlighting the gap between its ambitions and actual launch frequency.**
- Since opening the space sector to private players in 2020, **India has registered around 400 space startups with IN-SPACe.**
- Skyroot Aerospace became the first Indian private company to launch an orbital rocket (Vikram-1),** making India the third country after the U.S. and China with private orbital launch capability.

Implications

- High launch costs reduce India's global competitiveness** in the commercial space market.
- Low launch frequency limits economies of scale and learning-by-doing,** keeping costs high.
- Dependence on foreign launchers can **create strategic and geopolitical vulnerabilities.**
- SpaceX's dominance accounting for around 75% of global payload launched to orbit in 2025 **could give the U.S. significant leverage over countries dependent on its launch services.**

Way Forward

- Increase launch frequency** to achieve economies of scale and experience-based cost reduction.



- **Strengthen private participation through IN-SPACE** and support indigenous launch-service providers.

Indian National Space Promotion and Authorisation Centre: An autonomous single-window agency under the Department of Space that facilitates and regulates the participation of private companies and startups in India's space sector.

- **Invest in heavier, reusable and cost-efficient launch vehicles** to compete in the global market.
- **Develop a robust domestic ecosystem for launch services**, satellite manufacturing and space infrastructure.
- **Promote international partnerships while reducing excessive dependence** on any single foreign launch provider.

Mains Question

"India's space programme is renowned for cost-effective missions, yet its commercial launch costs remain relatively high. Examine the reasons for this paradox and suggest measures to make India's space-launch industry globally competitive." (250 Words)

Why has the Centre opposed creamy layer for SC/STs?

Prelims: General Paper 1

Current events of national and international importance.

Mains: General studies 2

Welfare schemes for vulnerable sections of the population by the Centre and States and the performance of these schemes.

Why in Focus?

- The debate over applying the **"creamy layer" principle to Scheduled Castes (SCs) and Scheduled Tribes (STs)** has returned to the Supreme Court.
- The issue gained importance after the **2024 Davinder Singh judgment**, which allowed States to **sub-categorise SC/ST communities** within the existing reservation quota.

Key Highlights

- The **2024 Davinder Singh judgment** recognised that SC and ST communities are not equally placed. Some communities remain more backward and may not receive a fair share of reservation benefits.
- The Court therefore allowed **sub-categorisation** within SC/ST reservations. This means dividing the existing quota among different communities so that **more disadvantaged groups can get a greater share of the benefits**.
- Justice **B.R. Gavai** also suggested considering a **"creamy layer" principle** for SCs and STs, similar to the principle applicable to **OBCs (Other Backward Classes)**.
- **Creamy layer** means excluding relatively advanced individuals within a reserved category from reservation benefits. **Sub-categorisation**, on the other hand, distributes the existing quota among different groups within the same reserved category.
- The **Union government has opposed extending the creamy layer principle to SCs and STs**. It argues that SC/ST reservation addresses **historical caste-based discrimination** and cannot be determined only on the basis of income or economic advancement.
- The government has stated that any change in reservation policy should be based on a **detailed empirical study and socio-economic data**. It also maintains that such a policy decision should be taken by **Parliament**.
- The larger issue is how to ensure that reservation benefits reach the **most disadvantaged communities** while protecting the constitutional objective of **social justice and substantive equality**.

Implications

- Some relatively advanced communities within the SC/ST categories may receive a larger share of reservation benefits, while **more disadvantaged communities may remain under-represented**.
- Economic advancement does not necessarily remove **caste-based discrimination, social stigma and exclusion**. Therefore, using income alone to identify a creamy layer among SC/STs may not adequately address the problem.



- The absence of comprehensive and updated **socio-economic and representation data** makes it difficult to identify which communities are being left behind.
- Any change must carefully consider the **constitutional protection given to SCs and STs under Articles 341 and 342**, particularly regarding their identification and inclusion in the constitutional lists.
- Different States may have different patterns of backwardness among SC/ST communities. This can make the design of a **uniform national policy** challenging.
- Changes in reservation policy can create **social and political tensions**, making it important to balance **social justice, equality of opportunity and constitutional safeguards**.

Way Forward

- Conduct a **comprehensive empirical study** on the social, educational and economic conditions of different SC/ST communities.
- Use **objective and transparent criteria** for sub-categorisation so that the **most disadvantaged groups receive adequate representation**.
- Avoid relying only on income to determine backwardness, as **historical and continuing caste discrimination** must also be considered.
- Ensure wider consultation among the **Centre, States, Parliament, judiciary, constitutional bodies and affected communities**.
- Strengthen monitoring of reservation outcomes to ensure that the policy achieves its broader objective of **substantive equality and inclusive social justice**.

Mains Question

“The debate over sub-categorisation and the creamy layer principle within SC/ST reservations reflects the challenge of achieving substantive equality.” Discuss in the context of the 2024 Davinder Singh judgment. (15 marks, 250 words)

What does Anthropic stand to gain and risk with its IPO?

Prelims: General Studies Paper 1

Current events of national and international importance

Mains: General Studies 3

Awareness in the fields of IT, Space, Computers, robotics, nano-technology, bio-technology and issues relating to intellectual property rights.

Why in Focus?

- According to a Financial Times report, **Anthropic is reportedly considering an Initial Public Offering (IPO) valued at around \$2 trillion by September**, highlighting the growing commercial value and intense competition in the generative AI industry.

Anthropic: A U.S. Artificial Intelligence (AI) company that develops AI models and products such as Claude.

Initial Public Offering: The process by which a private company offers its shares to the public for the first time and becomes publicly traded.

Key Highlights

- Anthropic’s Claude **has gained strong popularity among software engineers, particularly for advanced coding tasks using AI agents**.
- Anthropic **competes with OpenAI’s ChatGPT and Codex, coding-focused tools such as Cursor**, and a rapidly growing open-source AI ecosystem.
- **Chinese AI companies are gaining ground, with Alibaba’s Qwen offering competitive performance** with relatively low hardware requirements.
- **Large Language Models (LLMs) are AI systems trained on vast datasets to understand and generate human-like text**; increasingly capable open-source LLMs could challenge proprietary models such as Claude.
- **Open-source AI lets users run AI models locally**, reducing reliance on paid AI subscriptions and usage fees.
- **Company size alone does not guarantee AI dominance; the rapid improvement of Google’s Gemini demonstrates how competitors can catch up** despite entering the market later.
- **Continual learning** is where an AI model uses real-world experience and feedback to



improve future performance could create a powerful advantage for widely used AI systems.

- **Greater adoption can generate more user feedback and useful training data**, creating a positive feedback loop.

Implications

- **Open-source and Chinese models could reduce Anthropic's market share** and pricing power.
- **High computing and token costs** may pressure profitability.
- **Dependence on user feedback** for continual learning raises data and privacy concerns.
- Rapid AI advances can quickly erode Anthropic's market advantage.

Way Forward

- **Invest in efficient, lower-cost AI models** to reduce token and computing costs.
- **Strengthen continual learning through safe and high-quality real-world feedback.**
- **Improve AI agents for complex coding** and enterprise tasks.
- **Balance proprietary AI with open innovation** and interoperability.

Proprietary AI: AI systems owned and controlled by a company, where the model, code or training data is not publicly available.

- **Strengthen data privacy, safety and responsible AI governance** while scaling AI deployment.

Mains Question

“The future of Artificial Intelligence competition may be determined not merely by model size but by continual learning, efficiency and user adoption. Discuss the factors that could determine leadership in the global AI industry.” (250 Words)

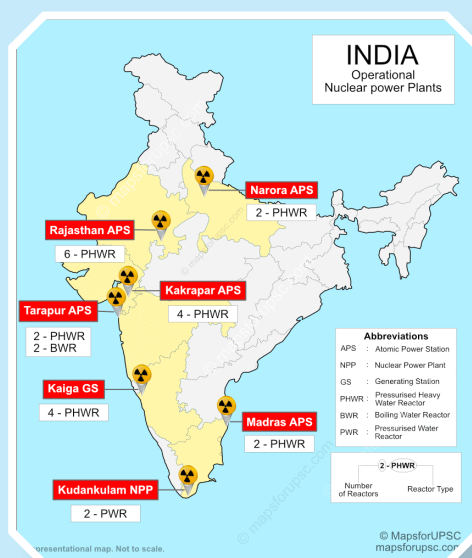
KEYWORDS

Green India Mission (GIM)

- The **Green India Mission (GIM)** was launched in 2014 as one of the eight missions under the National Action Plan on Climate Change (NAPCC).
- Its revised roadmap focuses on increasing forest and tree cover and restoring degraded ecosystems, particularly in the Aravallis, Western Ghats, Himalayas and mangroves.
- The mission has an estimated outlay of **₹12,190 crore for 2021–2030** and adopts a **bottom-up**, decentralised approach involving local forest management institutions.
- It aims to improve ecosystem services, biodiversity and forest-based livelihoods while creating an additional carbon sink of 2.5- 3 billion tonnes of CO₂ equivalent by 2030.
- Key priorities include ecosystem restoration, micro-ecosystem approaches, livelihood enhancement, non-timber forest produce value chains and a “lab-to-field” approach to strengthen forest management.

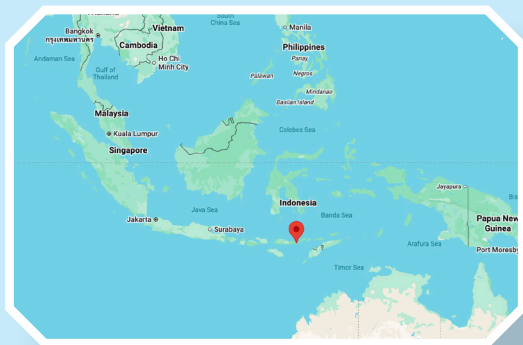
Places in News

Kudankulam Nuclear Power Plant (KKNPP)



- Kudankulam Nuclear Power Plant (KKNPP) is **India's largest nuclear power facility, located in Tamil Nadu, with six planned reactors of 1,000 MW each.**
- It is **being developed through cooperation between India's Nuclear Power Corporation of India Limited (NPCIL) and Russia's Atomstroyexport/Rosatom, using VVER-1000 pressurised water reactors.**
- **Units 1 and 2 are operational, while Units 3–6 are under construction, taking the planned total capacity to 6,000 MW.**
- The **reactors incorporate advanced safety features such as double containment, high-pressure resistance and post-Fukushima safety upgrades.**
- The **project has faced local opposition over nuclear safety, environmental risks and evacuation concerns, particularly following the 2011 Fukushima disaster.**

Maumere



- Maumere recently made headlines after a **devastating 7.7-magnitude earthquake** struck off its coast, killing at least **40 people**, injuring dozens, and causing widespread collapse of buildings.
- It is the **largest town and a vital port city** located on the **northern coastline of Flores Island, part of East Nusa Tenggara province in Indonesia.**
- The region is highly vulnerable to **earthquakes and tsunamis** because it lies within the **Pacific "Ring of Fire,"** an

area characterized by intense tectonic activity.

- Beyond its seismic vulnerability, Maumere serves as a **major commercial and transport gateway for eastern Indonesia**, connecting remote villages and towns across Flores through the **mountainous Trans-Flores Highway.**

Mocha port

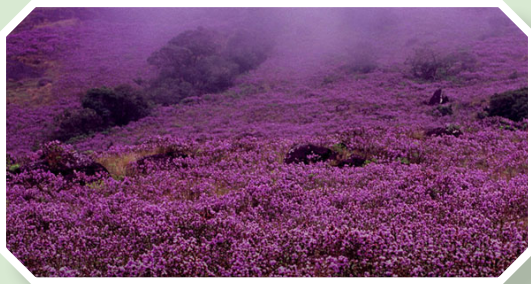
- **Mocha, also spelled Al-Mukha, is a strategic and ancient port city located on the southwestern coast of Yemen along the Red Sea, positioned close to the vital Bab al-Mandab Strait.**
- From the **15th to the 19th centuries**, it operated as a major global maritime hub connecting the **Arabian Peninsula with the Horn of Africa, the Indian Ocean, and European commercial markets.**
- The city is historically renowned for its role in the **early global coffee trade**, exporting high-quality *Coffea arabica* beans grown in the **Yemeni highlands**, which contributed to the global use of the term **"mocha."**
- Although it eventually lost economic dominance to ports such as **Aden** due to shifting trade routes, its **strategic location near the Bab al-Mandab Strait** makes it an important and contested geopolitical asset amid the **ongoing Yemeni civil war.**





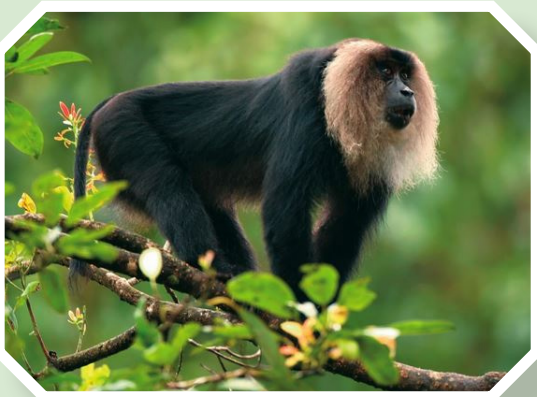
Species In News

Neelakurinji (*Strobilanthes kunthiana*)



- **Neelakurinji (*Strobilanthes kunthiana*)** is a rare flowering shrub endemic to the high-altitude Shola grasslands of southern India.
- It is famous for its mass flowering once every 12 years, after which the plant reproduces and dies.
- Its purplish-blue flowers transform mountain landscapes and give the Nilgiri Mountains ("Blue Mountains") their name.
- It supports biodiversity by attracting pollinators and serves as an indicator of ecosystem health, while also supporting species such as the Nilgiri Tahr.
- Neelakurinji is classified as "Vulnerable" on the IUCN Red List due to habitat loss, invasive species, climate change and other threats.

Lion-tailed Macaque (*Macaca silenus*)



- Strictly endemic to the tropical rainforests of the Western Ghats, occurring only in Karnataka, Kerala, and Tamil Nadu, and primarily arboreal,

diurnal, and frugivorous, requiring dense, contiguous upper-canopy evergreen forests.

- Distinguished by its glossy black coat, silver-white facial mane, and tufted tail tip, it plays a crucial role as a seed disperser in forest ecosystems.
- It was the flagship species of the historic Save Silent Valley Movement, highlighting the ecological importance of preserving its rainforest habitat.
- Protected under Schedule I of the Wildlife (Protection) Act, 1972, it is categorized as Endangered on the IUCN Red List and listed under CITES Appendix I.