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India's Crypto Landscape in 2025: Virtual Digital Assets (VDAs)

Why in News? The Supreme Court's remarks, ongoing offshore trading losses, and the proactive role of Indian VASPs highlight the urgent need for **clear crypto legislation** to address regulatory gaps, curb financial risks, and harness the economic potential of India's vibrant crypto ecosystem.

Relevance : UPSC Pre & Mains

Prelims : VDAs/ VASPs

Mains : GS 3/ Economy/Science & tech

Key Points:

Continued Leadership in Crypto Adoption: India leads global grassroots **crypto adoption** for the second year, per Chainalysis' 2024 'Geography of Crypto' report. Indian retail investors invested **$6.6 billion** in crypto assets, with the **NASSCOM** report projecting over **800,000 jobs** by 2030 and a thriving **web3 developer** community.

Regulatory Challenges and Policy Gaps: The **Supreme Court of India**, in May 2025, criticized the lack of **comprehensive crypto regulation**, noting that banning crypto ignores "ground reality." India's strict **capital controls** and **regulated payment systems** clash with the decentralized nature of), creating regulatory dissonance.

RBI's Stance and Past Restrictions: The **Reserve Bank of India (RBI)** flagged crypto risks since 2013, citing their lack of central bank authorization. A 2018 **RBI circular** barred financial institutions from engaging with VDA entities, but it was overturned by the Supreme Court in 2020.

Taxation as a Stop-Gap: In 2022, India introduced a **1% TDS** on VDA transactions above Rs10,000 and a **30% capital gains tax** without loss offsetting. These measures aimed to curb speculation but have been **ineffective**, with **Rs 1.03 trillion** traded on **non-compliant platforms** from July 2022 to December 2023, leading to **Rs 2,488 crore** in uncollected tax revenue. From December 2023 to October 2024, **Rs2.63 trillion** was traded offshore, with **Rs 60 billion** in uncollected TDS.

Offshore Trading and Enforcement Struggles: Efforts to block non-compliant platforms via **URL blocking** failed, with trade volumes rebounding and web traffic to these platforms rising by

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57%. Users bypassed restrictions using **VPNs**, **mirror platforms**, and other non-compliant exchanges.

Role of VASPs: **Virtual Asset Service Providers (VASPs)** are critical for aligning VDAs with regulations, enhancing **transparency**, and aiding **anti-money laundering** and **counter-terror financing** efforts. Indian VASPs have collaborated with the **Financial Intelligence Unit-India**, earning praise from the **Financial Action Task Force (FATF)**. Post a **$230 million hack** in 2024, Indian exchanges bolstered **cybersecurity**, established **insurance funds**, and developed **industry-wide cybersecurity guidelines**.

Need for Comprehensive Regulation: India's current policy, pushing users to **offshore platforms**, undermines risk mitigation and tax collection. A **balanced, pragmatic regulatory framework** is essential to leverage VASPs for a safer VDA ecosystem, support **economic growth**, and align with **global standards** from bodies like the **IMF**, **FSB**, and **FATF**.

About Virtual Digital Assets (VDAs):

Virtual Digital Assets (VDAs) refer to digital representations of value that can be transferred, traded, or used electronically. They typically rely on blockchain or **distributed ledger technology (DLT)** for verification and operation.

Key Features of VDAs

1. Decentralization:

- Operate without central authority or intermediaries, relying on blockchain or DLT.

2. Cryptographic Security:

- Secured using advanced cryptographic techniques to ensure data integrity and prevent unauthorized access.

3. Types:

- **Cryptocurrencies** (e.g., Bitcoin, Ethereum): Digital currencies used for transactions or investments.
- **Utility Tokens:** Provide access to specific products or services.
- **Stablecoins:** Cryptocurrencies pegged to a stable asset like the USD or gold.
- **Non-Fungible Tokens (NFTs):** Unique digital assets representing ownership of items like art or collectibles.

Advanced Cooling Technologies/Green Data Centres:

Why in News? Microsoft and WSP Global's study in *Nature* highlights how advanced cooling methods like cold plates and immersion cooling can significantly reduce data center emissions (15-21%), energy use (15-20%), and water consumption (31-52%) compared to traditional air cooling

Relevance : UPSC Pre & Mains

Prelims : Green Data Centers:

Mains : GS 1-Geography/Env.

Importance of Cooling:

- Electronics in data centers generate immense heat due to densely packed transistors performing continuous tasks. Cooling is vital to prevent hardware failure, maintain performance, and extend component lifespan.

Industry Emission Targets:

- The ICT industry aims to reduce emissions by **42% by 2030 (from 2015 levels).** Advanced cooling can contribute significantly to achieving these climate goals.

Cooling Techniques:

Cold Plates: Use coolant-filled microchannels to transfer heat directly from components, enhancing efficiency.

Immersion Cooling: Submerges components in a heat-dissipating liquid, offering higher efficiency and lower noise compared to air cooling.

Sustainability Insights:

- Cold plates and immersion cooling lower greenhouse gas emissions, energy use, and water demand, especially when powered by renewable energy.
- A cradle-to-grave life cycle assessment emphasizes systemic thinking to avoid merely shifting the pollution burden.

Challenges:

- Deployment of these technologies is slowed by regulatory hurdles, design complexities, and potential trade-offs in environmental impacts.

Renewable Energy Impact:

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- Pairing advanced cooling with renewable energy sources drastically reduces emissions (**85-90%), energy consumption (6-7%), and water demand (55-85%).**

Future of Green Data Centers:

- Sustainability requires a combined focus on advanced technologies, renewable energy, and systemic solutions rather than isolated innovations.

The study underlines the urgency of upgrading data center cooling systems to balance technological demands with environmental sustainability.

About Green Data Centers:

Green data centers are facilities designed to minimize their environmental impact by leveraging energy-efficient technologies, renewable energy sources, and sustainable practices. They are crucial for the Information and Communications Technology (ICT) industry to meet global climate goals.

Key Features of Green Data Centers:

Energy Efficiency:

- Use advanced cooling methods (e.g., cold plates, immersion cooling) to reduce energy consumption.
- Optimize power usage effectiveness (PUE) with innovative design and operation strategies.

Renewable Energy Integration:

- Powered by solar, wind, or hydropower to cut down on greenhouse gas emissions.
- Battery storage systems ensure consistent energy supply even during grid outages.

Sustainable Cooling Solutions:

- Liquid cooling methods (cold plates and immersion cooling) that are more efficient than traditional air cooling.
- Reduced reliance on water-intensive cooling systems to conserve resources.

Resource Management:

- Reuse of waste heat for district heating or other applications.
- Water conservation through efficient cooling designs and recycling.

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1. **Modular and Compact Designs**:
    - Modular data centers reduce material waste during construction and enable scalability with minimal environmental impact.
2. **Green Building Certifications**:
    - Many green data centers are certified by standards like LEED (Leadership in Energy and Environmental Design) and BREEAM (Building Research Establishment Environmental Assessment Method).

Advantages of Green Data Centers:

1. **Environmental Benefits**:
    - Significant reduction in carbon emissions and water use.
    - Mitigation of heat island effects in urban areas.
2. **Economic Savings**:
    - Lower operational costs through energy efficiency and reduced utility expenses.
    - Potential incentives or subsidies for renewable energy adoption.
3. **Regulatory Compliance**:
    - Align with global sustainability goals and government mandates for reduced carbon footprints.
4. **Enhanced Reputation**:
    - Demonstrates corporate responsibility and appeals to environmentally conscious clients.

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Birch Glacier in the Swiss Alps

Why in News ?

Relevance : Pre & Mains

Prelims: Famous Affected Glaciers

Mains : GS 3 (Env & Ecology)

The interview highlights significant developments in India's telecom and connectivity landscape, which is particularly relevant due to India's imminent milestone of reaching 1 billion internet users by this fiscal year. The context is India's leadership in affordable data markets, rural connectivity through BharatNet, innovation in 5G and 6G technologies, and modernization efforts in the Department of Posts.

Key Points:

1. **India's Internet User Growth**:
    - The Internet market has expanded from 250 million to 974 million subscribers.
    - India is set to reach 1 billion internet users by the end of this fiscal year.
2. **Affordable Telecom Services**:
    - India offers the cheapest data rates globally, with data costs dropping from ₹287/GB to ₹9/GB.
3. **BharatNet Initiative**:
    - **Phase I**: Connected 2.14 lakh gram panchayats using 7 lakh kilometers of fiber optic cables.
    - **Phase II**: Aims to connect an additional 2.64 lakh gram panchayats with robust technological upgrades such as Multiprotocol Label Switching routers and centralized network operations.
    - Represents the largest public-sector rural connectivity investment globally, worth $16.9 billion.
4. **Innovation in Telecom**:
    - Themes like *'Innovate to Transform'* and *'The Future is Now'* drive advancements in domestic telecom.
    - India has transitioned from importing 80% of its mobile phones to exporting ₹1.75 lakh crore worth.
    - The Bharat 6G Alliance targets contributing 10% of global 6G patents.

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5. **Production-Linked Incentive (PLI) Scheme**:
    - Attracted ₹4,000 crore in investment, generated ₹80,000 crore in revenue, and created 25,000 jobs.
    - Introduced a 1% design-led incentive to encourage local design and production.
6. **Satellite Communication and Remote Connectivity**:
    - Long-term focus includes integrating satellite communication with terrestrial networks to enhance remote area connectivity.
7. **Department of Posts Modernization**:
    - Amendments in the Post Office Act, 2023 empower India Post for niche market logistics.
    - Innovations like India Post Payments Bank, digital access codes, and modernization of services contribute to comprehensive service delivery.
    - The department's initiatives align with expanding rural and financial inclusion.
8. **Vodafone Idea Ltd. (VIL)**:
    - The government converted ₹37,000 crore of VIL debt into equity, now holding a 49% stake.
    - Ensuring market competition with three private operators and one state-owned operator.

This article underscores India's advancements in telecom, rural connectivity, and modernization of the postal network, emphasizing the country's growing digital and technological footprint.

The RBI's draft directions on gold loans

Why in News ? The RBI's **draft directions on gold loans** aim to bring uniformity across banks and NBFCs, amidst concerns about rapid growth in the gold loan portfolio and irregular lending practices. With rising gold prices and widening credit gaps, gold loans are increasingly being used as a key liquidity source for individuals, particularly in rural areas.

Relevance- Pre & Mains

Prelims: Loan-to-Value (LTV) Cap

Mains: GS 3 (Economy/NPA)

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Key Points:

Objective of the Draft Directions:

- **Harmonization**: Uniform regulatory framework for banks and NBFCs.
- **Borrower Protection**: Safeguard the interests of small borrowers.
- **Transparency**: Clarify operational and credit processes.

RBI's Concerns:

- **Exponential Growth**:
  - Gold loan portfolios grew by over 50% in FY 2024-25.
  - Banks alone saw 104% growth in their gold loan business.
- **Irregular Practices**: Significant discrepancies in lending standards and practices among entities.

Draft Proposals:

- **Loan-to-Value (LTV) Cap**: Remains at 75%, with accrued interest included for bullet loans, reducing disbursable amounts.
- **Proof of Ownership**: Borrowers must provide ownership proof for pledged gold.
- **Valuation Standards**: Gold collateral must be valued based on 22-carat rates.
- **Loan Renewals**: Allowed only if classified as standard and within LTV limits.
- **Delayed Collateral Return**: Lenders must compensate borrowers Rs5,000/day if delays exceed seven working days post-repayment.

Ministry of Finance Clarification:

- Ensured that regulations will not adversely affect small borrowers.
- Confirmed implementation from January 1, 2026, providing entities time to adapt.

Concerns Raised by Stakeholders:

- Tamil Nadu Chief Minister highlighted potential disruption to rural credit systems.
- Gold loans are a primary credit source for rural and semi-urban households, especially small farmers and informal sector workers.

Implications of the Changes:

- **For Borrowers**:
  - Reduced flexibility due to stricter documentation and processes.

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- Increased costs passed down from higher operational expenses faced by lenders.

- **For NBFCs and Banks**:
  - Compliance burden increases with stricter LTV calculations and monitoring.
  - Smaller NBFCs may face liquidity issues due to reduced reliance on re-pledging.

Way Forward:

- The RBI may consider a **differentiated approach**:
  - **Micro Gold Loans**: Flexible norms for low-value, essential loans.
  - **High-Value Loans**: Stricter norms for structured borrowing.
- **Enhanced Communication**: Engage stakeholders, especially rural borrowers and smaller NBFCs, to address concerns before implementation.

This policy shift is poised to redefine the gold loan landscape in India, balancing the need for growth with responsible lending practices.

Stratospheric Aerosol Injection (SAI)

Why in News? A recent study published in *Earth's Future* journal explores a novel approach to **stratospheric aerosol injection (SAI),** a controversial geoengineering technique aimed at cooling the planet to combat climate change.

Relevance : UPSC Pre & Mains

Prelims : SAI/

Mains : GS 1/ GS 3/ Geograohy/Science & tech/Environment

What is Stratospheric Aerosol Injection (SAI)?

SAI involves injecting reflective aerosols, such as sulphur dioxide, into the stratosphere to reflect sunlight and reduce global temperatures, mimicking the cooling effect of volcanic eruptions like **Mount Pinatubo in 1991.**

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- **Purpose**: Proposed as a temporary measure to mitigate climate change impacts while greenhouse gas emissions are reduced, as global emissions continue to rise due to competing issues like war, poverty, and inflation.

Key points:

- **Cooling Potential**: The study suggests injecting 12 million tonnes of sulphur dioxide annually at 13 km altitude in polar regions during spring and summer could cool the planet by approximately **0.6°C,** similar to the cooling observed after the 1991 Mount Pinatubo eruption.
- **Alternative Approach**: Injecting **7.6 million tonnes** annually at higher altitudes (20 km) in the subtropics could achieve **1°C of cooling**, but this requires specialized aircraft.

Innovative Low-Altitude Strategy Using Existing Aircraft:

- **Lower Altitude Advantage**: In polar and extratropical regions, the stratosphere is lower (around 13 km) compared to the equator (18 km+), allowing existing aircraft like the **Boeing 777F** to be used with modifications, such as insulated tanks for safe aerosol transport.
- **Cost and Time Efficiency**: Using existing aircraft eliminates the need for specially designed high-altitude jets, which require nearly a decade and billions of dollars to develop, making the approach more accessible and faster to implement.
- **Trade-Off**: Low-altitude injections are less effective, requiring three times more aerosols (e.g., 21 million tonnes for 1°C cooling) because particles remain in the stratosphere for months rather than years, increasing the risk of side effects.

Risks and Side Effects of SAI:

- **Environmental Concerns**: Increased aerosol use could lead to acid rain, ozone layer depletion, and altered rainfall patterns, potentially harming ecosystems and agriculture.
- **Regional Disparities**: Cooling is more pronounced in polar regions, leaving tropical areas—where warming is most severe—less protected.
- **Moral Hazard**: SAI may mask warming, leading to complacency in reducing greenhouse gas emissions, which does not address root causes like ocean acidification.

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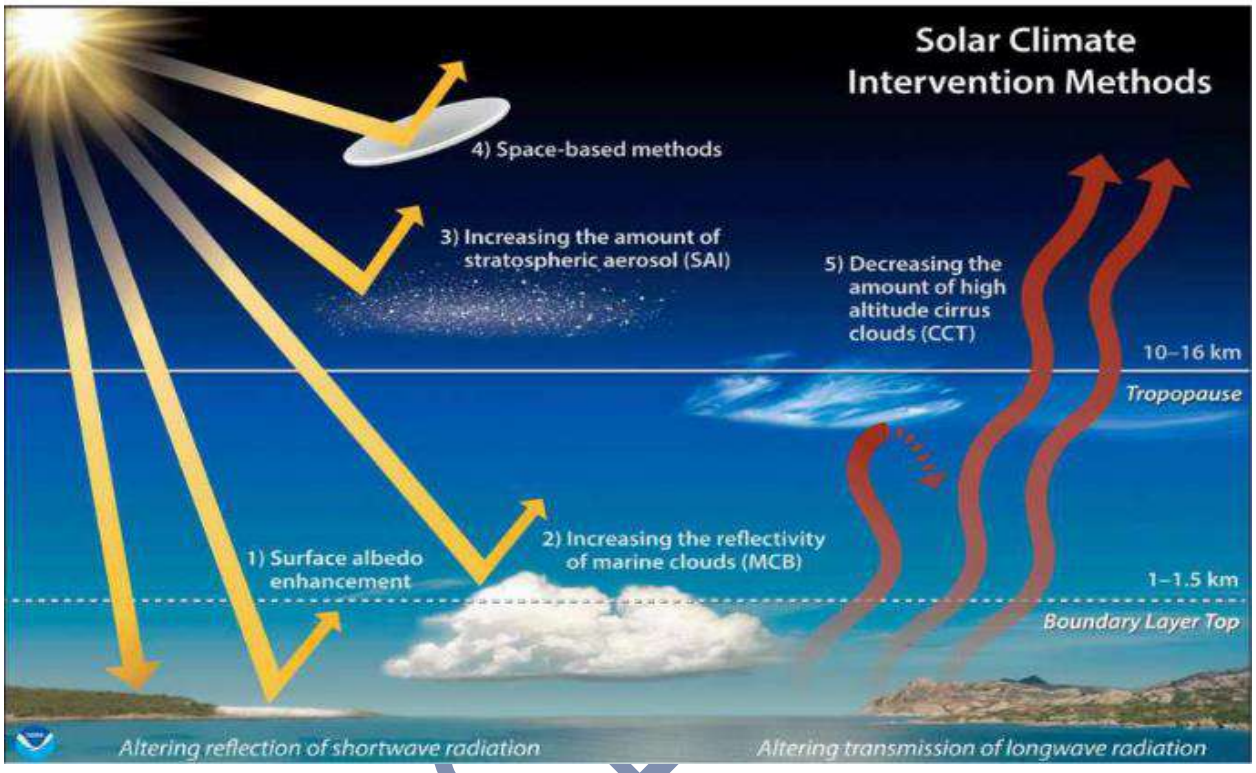
- **Global Impact**: As aerosols affect the entire planet, unilateral deployment by one country could have unintended consequences for others, raising geopolitical tensions.



Controversy and Governance Challenges:

- **Support for Research**: In 2021, recommendations were made to fund solar geoengineering research with transparency, reflecting growing interest in SAI.
- **Opposition**: In 2022, calls for a moratorium on solar geoengineering R&D argued it is "ungovernable" in a fair and democratic manner due to its global impacts and potential for inequity.
- **Public Sentiment**: Social media reveals mixed sentiments, with some advocating SAI as a necessary response to worsening climate conditions, while others label it as risky or conspiratorial, citing health and environmental concerns.

Technical and Ecological Considerations:

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- **Simulation Findings**: The study used models to simulate sulphur dioxide injections at various altitudes, latitudes, and seasons, confirming the cooling potential but highlighting ecological risks.
- **Ecological Impacts**: SAI could disrupt the global hydrological cycle, with some regions experiencing harmful changes in rainfall. It also does not reverse climate change effects like ocean acidification.
- **Long-Term Commitment**: Continuous injections are required to maintain cooling, as aerosols last only a few years in the **stratosphere, unlike carbon dioxide**, which persists for centuries. Sudden cessation could trigger rapid warming (termination shock).

Conclusion:

The study presents a potentially cost-effective and faster approach to SAI by leveraging existing **aircraft for low-altitude injections in polar regions**. While it offers a temporary solution to cool the planet, the increased aerosol use amplifies risks like **acid rain, ozone depletion, and geopolitical conflicts.**

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Advancements in India's Food Safety Regulations

Why in News? World Food Safety Day 2025, observed on June 7, emphasized the role of science in ensuring food safety, with the theme "**Food Safety: Science in Action**."

Relevance : UPSC Pre & Mains

Prelims : PFA Act/MRLs

Mains : GS 3/Food Security

Key Highlights:

- **World Food Safety Day**: Celebrated annually on June 7 to promote science-based, risk-driven food safety measures.
- **India's Food Safety Evolution**:

- Began with the **Prevention of Food Adulteration (PFA) Act, 1954**, which focused on basic adulteration checks.
- Transitioned to the **Food Safety and Standards Act, 2006**, establishing the **Food Safety and Standards Authority of India (FSSAI)**.
- FSSAI aligns with global standards (e.g., Codex Alimentarius) by setting:
  - **Maximum Residue Limits (MRLs)** for pesticides.
  - Safe levels for additives and contaminants.
  - Standards for veterinary drug residues.
- By 2020, India's food safety standards were comparable to those of developed nations.

Challenges:

- **Data Gaps**: Lack of India-specific toxicological data and absence of a **Total Diet Study (TDS)** hinder accurate risk assessment.
- **Risk Communication**: Complex terms like MRLs and Acceptable Daily Intake (ADI) confuse the public.
- **Outdated Regulations**: Example—monosodium glutamate (MSG) still carries a warning label despite global safety consensus.

Way Forward:

- Conduct localized toxicology studies and a comprehensive TDS.
- Simplify risk communication for public understanding.
- Enhance transparency and train risk assessors regularly.
- Engage stakeholders to build trust and update standards periodically.

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Digital Literacy: Shaping India's Future Workforce

Why in News ? Recent insights highlight how rural India is building digital fluency among children through innovative, resource-scarce methods, preparing them for a digital economy.

Relevance : Pre & Mains

Prelims: WEF *Future of Jobs 2025* report

Mains : GS 1/3

Key Highlights:

- **Digital Access in Schools**: Only 51% of Indian schools have functional computers, and 53% have internet access (Ministry of Education report).
- **Innovative Learning**:
    - Students use shared devices and peer-led learning to gain digital skills.
    - Examples include children accessing teachers' voice notes via parents' phones and siblings teaching each other local-language learning apps.
- **Future Workforce Needs**: The World Economic Forum's *Future of Jobs 2025* report states **75% of jobs** will require digital proficiency.
- **Blended Learning**: Combines textbooks, audio, peer interactions, and digital tools, fostering lifelong learning.
- **Broader Digital Literacy**: Encompasses agency, confidence, curiosity, creativity, and problem-solving.
- **Public-Private Partnerships**: Support teacher training, STEM education, and digital labs in rural schools.
- **Local Language Tools**: Enhance comprehension and engagement through mother-tongue digital resources.
- **Scalable Model**: Rural India's curiosity-driven digital learning approach is replicable for broader impact.

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AI Readiness Assessment Framework

Why in News ? UNESCO and the Ministry of Electronics and Information Technology (MeitY) recently held the final stakeholder consultation for the **AI Readiness Assessment Methodology (RAM)**.

Relevance- Pre & Mains

Prelims: AI Readiness Assessment Methodology (RAM).

Mains: GS 3 (Science & tech)

Key Highlights:

- **AI Readiness Assessment Methodology (RAM)**: A UNESCO tool to evaluate a country's preparedness for ethical and responsible AI adoption.
- **Assessment Process**: Conducted by an independent research body with a national team (UNESCO, government, academia, civil society, private sector).
- **Key Areas Evaluated**:
  - Legal and regulatory frameworks.
  - Social and cultural impacts.
  - Economic implications.
  - Scientific and educational readiness.
  - Technological and infrastructural capacity.

Purpose:

- Identifies strengths and gaps in AI adoption.
- Guides policy formulation.
- Promotes inclusive, safe, and trustworthy AI systems.

- **Significance for India**:
  - Aligns with the **India AI Mission** to develop indigenous AI frameworks, governance tools, and funding for responsible AI.
  - Translates UNESCO's **Global AI Ethics Recommendations** into India-specific policies.

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RBI's Loan-to-Value (LTV) Ratio

Why in News ? The Reserve Bank of India (RBI) recently raised the Loan-to-Value (LTV) ratio for gold-backed loans up to Rs. 5 lakh to improve credit access for small borrowers.

Relevance- Pre & Mains

Prelims: LTV

Mains: GS 3-ECONOMY

Recent Changes by RBI –

It aims to ease credit accessibility for small borrowers.

- This means that individuals can now get a larger loan amount against the same value of pledged gold.
- Specifically, for loans below **Rs.2.5 lakh, the LTV** has been raised to 85%, and for loans between Rs.2.5 lakh and Rs.5 lakh, it's set at 80%.
- However, all loans above Rs.5 lakh will have an **LTV of 75%,** the central bank specified in its final guidelines for lending against gold and silver collateral.
- RBI decided to raise that to 85% for small loans below **Rs.2.5 lakhs per borrower**, including interest, in the final guidelines on gold loans.
- State-owned lenders have been including both interest and principal while making gold loans under the current **LTV limit of 75%,** but in the case of some non-bank lenders and smaller banks, the LTV was being stretched till 88%.

About LTV:

The **Loan-to-Value (LTV) Ratio** is a financial metric used by lenders to assess the risk of a loan, particularly in mortgage and auto financing. It measures the relationship between the loan amount and the appraised value or purchase price of the asset (e.g., a home or car) being financed, expressed as a percentage.

Formula:

LTV Ratio = (Loan Amount / Appraised Value or Purchase Price) × 100

Key Points:

- **Purpose**: LTV indicates how much of the asset's value is financed through borrowing. A higher LTV suggests higher risk for the lender, as it means the borrower has less equity in the asset.
    - **Example**: If you buy a home valued at $200,000 and take out a $160,000 mortgage, the LTV is (160,000 / 200,000) × 100 = 80%.
    - **Thresholds**:

Low LTV (e.g., ≤80%): Indicates lower risk, often leading to better loan terms (e.g., lower interest rates). For mortgages, an LTV of 80% or less typically avoids private mortgage insurance (PMI).

High LTV (e.g., >80%): Suggests higher risk, potentially requiring PMI or resulting in higher interest rates.

Bharatiya Bhasha Anubhag (BBA)

Why in News? The Union Home Minister and Minister of Cooperation, Shri Amit Shah, launched the **Bharatiya Bhasha Anubhag (Indian Languages Section)** in New Delhi.

Relevance : UPSC Pre & Mains

Prelims : BSA/Official Language

Mains : GS 2

About Bharatiya Bhasha Anubhag (BBA):

A Complete Official Language Department:

- The **establishment of BBA completes the Department of Official Language** by incorporating all Indian languages into a unified framework.
- Aimed at strengthening administrative processes in regional languages, the initiative seeks to maximize the potential of governance by encouraging thought and decision-making in native languages.

Promoting Linguistic Diversity:

- BBA is designed to provide a platform for all Indian languages, ensuring mutual development and enrichment.
- Shri Amit Shah emphasized that Indian languages collectively form the cultural Ganga of India, underscoring their interconnectedness.

Cultural and Technological Integration:

- Indian languages are portrayed as the soul of Indian culture, with the initiative aiming to preserve their richness and sensitivity.
- Technology will be leveraged to promote languages while maintaining their spirit and integrity.

Milestone against English Imposition:

- The BBA symbolizes a step forward in reducing the dominance of English in administration.
- The initiative aspires to elevate the status of Indian languages in every sphere, empowering citizens through linguistic accessibility.

Significance of the Initiative:

- Strengthens linguistic inclusivity and reduces foreign language dependency.
- Enhances cultural preservation and national unity through language.
- Supports the vision of making governance more accessible and relatable to citizens in their native tongues.

About Official Language in the Indian Constitution:

The Indian Constitution lays down provisions related to the **Official Language** in **Part XVII** (Articles 343 to 351). These provisions aim to promote linguistic harmony and ensure effective governance in a linguistically diverse country like India.

Key Provisions Related to the Official Language

Article 343 – Official Language of the Union:

- **Hindi in Devanagari Script** is the official language of the Union.
- The **international form of Indian numerals** is to be used for official purposes.
- **English** was to continue as an associate official language for **15 years** from the commencement of the **Constitution (until 1965).**

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Article 344 – Commission and Committee of Parliament on Official Language:

- A **Commission** was to be appointed by the President after five years from the commencement of the Constitution to recommend measures for the progressive use of Hindi and the restrictions on English.
- A **Committee of Parliament** is constituted to examine these recommendations.

Articles 345 to 347 – Regional Languages:

- States are empowered to adopt any language as their official language (**Article 345).**
- The Constitution recognizes the linguistic diversity of India and allows states to continue the use of English or any other language as needed.
- A special provision (**Article 347**) allows the President to recognize a language spoken by a substantial population of a state as the official language in that state.

Article 348 – Language for Certain Proceedings:

- English is to be used in the Supreme Court, High Courts, and for bills, laws, and other official documents until Parliament provides otherwise.

Article 349 – Restriction on Legislative Power

- Any bill or amendment related to the language of communication between the Union and States or regarding **Article 343 must be approved by the President.**

Article 350 – Facilities for Linguistic Minorities

- Provides for individuals to submit representations for the redress of grievances in any language used in the Union or the State.

Article 351 – Directive for the Development of Hindi

- Promotes the development of Hindi as a medium of expression for India's composite culture.
- It calls for the enrichment of Hindi by assimilating elements from other Indian languages.

Eighth Schedule of the Constitution

The Eighth Schedule lists **22 recognized languages**, which include:

- Hindi, Bengali, Telugu, Marathi, Tamil, Urdu, Gujarati, Kannada, Malayalam, Oriya, Punjabi, Assamese, Maithili, and others.

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Dhanushkodi Greater Flamingo Sanctuary

Why in News? The sinking of the Liberian-flagged container ship **MSC ELSA 3** off the Kochi coast on May 25, 2025, has triggered an environmental crisis along the coasts of Kerala and Tamil Nadu, with plastic pellets (nurdles) washing ashore. The spill has now reached the ecologically sensitive **Dhanushkodi and Rameswaram regions**, raising concerns about marine pollution and its impact on biodiversity.

Relevance : UPSC Pre & Mains

Prelims : MSC ELSA 3/Dhanushkodi Greater Flamingo Sanctuary

Mains : GS 3/Environment & Ecology

Key Points :

The spill is a significant environmental concern due to the widespread dispersal of nurdles, which are primary microplastics used in manufacturing. These pellets, resembling fish eggs, pose a severe threat to marine life, coastal ecosystems, and potentially human health through the food chain. The incident has sparked urgency for cleanup efforts and stricter maritime regulations, especially as it affects the newly declared **Dhanushkodi Greater Flamingo Sanctuary** and the **Gulf of Mannar Biosphere Reserve**.

- **Incident Overview**: The **MSC ELSA 3,** carrying 640 containers, sank 38 nautical miles off Kochi, Kerala, on May 25, 2025, due to a mechanical failure in its ballast tank. The ship carried 13 containers with hazardous materials, 12 with **calcium carbide, 367 tonnes of furnace oil, and 84 tonnes of diesel.**
- **Nurdle Spill Spread**: Over 20 bags, with estimates up to 80 bags (each weighing 25 kg), containing plastic pellets were found along a 12-km stretch of Dhanushkodi, Arichalmunai, and near **Kothandaramaswamy temple in Rameswaram** on June 9, 2025. Approximately 858 bags (22 tonnes) have been recovered overall.
- **Ecological Impact**: Nurdles, **primarily low-density polyethylene (LDPE**) and **high-density polyethylene (HDPE**), are mistaken for food by marine animals, causing blockages, starvation, and death. They absorb toxins, entering the food chain and

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threatening the **Gulf of Mannar's coral reefs**, seagrass beds, and 128 bird species, including flamingos.

- **Affected Areas**: The spill, initially reported in Thiruvananthapuram and Kanniyakumari, has spread to **36 of 42 coastal villages in Kanniyakumari** and now Dhanushkodi, carried by southwest-to-northeast ocean currents.
- **Cleanup Efforts**: Ramanathapuram District Collector Simranjeet Singh Kahlon reported **15–30 bags identified**, with special teams deployed for cleanup.
- The Kerala government declared the shipwreck a state disaster, and the **Mediterranean Shipping Company (MSC)** has appointed T&T Salvage for recovery and pollution control.
- **Environmental Risks**: The spill threatens the **Malabar Upwelling Region**, a critical fish-breeding ground. The 2021 X-Press Pearl disaster in Sri Lanka, which released 1,680 tonnes of nurdles, serves as a precedent, causing mass marine deaths and fishery losses.

About Dhanushkodi Greater Flamingo Sanctuary:

The **Dhanushkodi Greater Flamingo Sanctuary**, established on June 5, 2025, in Ramanathapuram district, Tamil Nadu, spans **524.78 hectares** at the southern tip of Rameswaram Island within the **Gulf of Mannar Biosp.**

India's First E-Waste Eco Park

Why in News ? Environment Minister **Manjinder Singh Sirsa** recently announced the establishment of **India's first electronic waste (e-waste) eco park** in **Holambi Kalan**, North Delhi. The project aims to revolutionize e-waste management in India by integrating green technology and promoting a circular economy.

Relevance : Pre & Mains

Prelims: E Waste Eco Park / DBFOT

Mains : GS 3

Key Points :

- To be developed in **Holambi Kalan**, North Delhi.
- Spanning **11.4 acres**.

Execution Model:

- Implemented under a **Design, Build, Finance, Operate, and Transfer (DBFOT)** model.
- Operates on a **Public-Private Partnership (PPP)** basis with a **15-year concession period**.

Global Collaboration:

- **Delhi State Industrial and Infrastructure Development Corporation** to issue a **global tender** for sourcing the **best green technology partners**.

Processing Capacity:

- Designed to process up to **51,000 tonnes of e-waste annually**.
- Covers **all 106 categories of waste** listed under the **E-Waste Management Rules, 2022**.

About E-Waste Recycling Park:

Purpose:

- Comprehensive management of **electronic waste** to reduce environmental hazards.
- Promote a **circular economy** by minimizing waste and maximizing resource reuse.

Features:

- Advanced **green technology** for sustainable waste processing.
- Job creation and inclusion **of informal sector** workers into the formal waste management system.

Significance:

- One of **four such facilities planned** across India.
- Symbol of Delhi's transition towards **sustainable waste management practices**.

About DBFOT Model :

The **DBFOT model** is a form of **Public-Private Partnership (PPP)** used for large-scale infrastructure projects. Under this model, a private entity is entrusted with the responsibility

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of designing, building, financing, operating, and eventually transferring the project to the government or a designated authority after a specific concession period.

Key Features of the DBFOT Model:

Design and Build:

- The private partner is responsible for the **design** and **construction** of the infrastructure project, ensuring it meets the required standards and specifications.

Finance:

- The private entity funds the project, either through equity, loans, or a combination of financial resources, reducing the immediate financial burden on the government.

Operate:

- Once operational, the private entity manages and operates the project for the agreed concession period to generate revenue.

Transfer:

- At the end of the concession period, the project is transferred back to the government or the concerned authority in a pre-defined condition.

Revenue Generation:

- The private entity recovers its investment and earns profits through **user charges**, **fees**, or other agreed mechanisms during the concession period.

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Solid State Drive (SSD):

Why in News? The Solid State Drive SSD was recently in News.

Relevance : UPSC Pre & Mains

Prelims : SSD/HDD/Floppy disk

Mains : GS 3 (Technology)

Solid State Drive (SSD):

- **Technology**: Uses NAND flash memory (semiconductor-based) to store data, with no moving parts. Data is stored in memory cells, accessed electronically via a controller.
- **Performance**: Extremely fast read/write speeds (up to 500–7000 MB/s depending on interface, e.g., SATA or NVMe PCIe). Low latency, ideal for quick boot times and application loading.
- **Capacity**: Ranges from 128 GB to 4 TB+ for consumers, with enterprise models up to 100 TB (e.g., Nimbus ExaDrive). More expensive per GB than HDDs.

Hard Disk Drive (HDD):

- **Technology**: Uses spinning magnetic platters and a mechanical read/write head to store and access data. Data is stored in tracks and sectors on the platters.
- **Performance**: Slower than SSDs, with read/write speeds typically 80–200 MB/s. Higher latency due to mechanical movement. Speed depends on RPM (e.g., 5400–15,000).
- **Capacity**: High, ranging from 500 GB to 20 TB+. Cheaper per GB, making it cost-effective for large storage needs.

Floppy Disk

- **Technology**: A thin, flexible magnetic disk encased in a plastic shell (e.g., 3.5-inch). Data is read/written via a magnetic head in a floppy disk drive (FDD).
- **Performance**: Extremely slow read/write speeds and high latency due to mechanical nature and low data density. Access is sequential, not random.
- **Capacity**: Very low, typically 720 KB or 1.44 MB for 3.5-inch disks. Earlier 8-inch and 5.25-inch versions stored even less (e.g., 160–360 KB).

Other Storage Devices:

USB Flash Drive (Thumb Drive):

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Technology: Uses NAND flash memory, similar to SSDs, but in a compact, portable form.

Performance: Slower than SSDs (10–300 MB/s depending on USB version, e.g., 2.0 vs. 3.2).

Capacity: 4 GB to 2 TB.

Feature	SSD	HDD	Floppy Disk	Others (e.g., USB, Tape, Optical)
Technology	NAND flash, no moving parts	Magnetic platters, mechanical	Magnetic disk, mechanical	Varies (flash, magnetic, optical)
Speed	Very fast (500–7000 MB/s)	Moderate (80–200 MB/s)	Very slow	Slow to moderate
Capacity	128 GB–100 TB	500 GB–20 TB+	720 KB–1.44 MB	4 GB–45 TB (tape)
Durability	High, shock-resistant	Low, prone to mechanical failure	Very low, fragile	Varies (high for tape, low for optical)
Power Consumption	Low	High	Moderate (obsolete)	Low to moderate

Financial Stability and Development Council (FSDC)

Why in News? The Financial Stability and Development Council (FSDC), chaired by Union Finance Minister Nirmala Sitharaman, convened its 29th meeting in Mumbai recently to address critical issues impacting India's financial sector.

Relevance : UPSC Pre & Mains

Prelims : FSDC

Mains : GS 3/Economy

Key Points from the FSDC Meeting:

Cybersecurity Enhancement: The FSDC deliberated on a financial sector-specific cybersecurity strategy to bolster cyber resilience, driven by an analysis of existing regulations and FSAP 2024-25 recommendations. This responds to rising cybersecurity threats, such as **ransomware attacks on critical infrastructure.**

Unclaimed Assets Reduction: Finance Minister Sitharaman urged regulators to expedite refunds of **unclaimed assets, estimated at over Rs 78,000 crore**, including dormant bank deposits, dividends, shares, and insurance funds. Special district-level camps were proposed to facilitate seamless refunds to rightful owners.

Streamlined KYC Norms: The council emphasized prescribing uniform KYC norms across the financial sector, including simplified and digitized processes for Non-Resident Indians **(NRIs), Persons of Indian Origin (PIOs)**, and **Overseas Citizens of India (OCIs)** in the securities market, to enhance user experience and curb illegal lending.

Macro-Financial Stability: The FSDC reviewed global and domestic macro-financial developments, stressing **vigilance against systemic risks** and the need for inter-regulatory coordination to ensure financial stability.

Financial Inclusion and Regulatory Reforms: Discussions included boosting investments, expanding factoring services, strengthening the account aggregator ecosystem, and implementing past budget announcements to promote financial inclusion.

About the Financial Stability and Development Council (FSDC):

The **FSDC, established in December 2010, is India's apex** forum for coordinating financial sector policies to ensure stability, development, and inter-regulatory coherence. Chaired by the Union Finance Minister, it addresses systemic risks, promotes financial inclusion, and enhances regulatory coordination.

Key Functions:

- **Financial Stability**: Monitors macro-financial developments to mitigate systemic risks and strengthen resilience.
- **Inter-Regulatory Coordination**: Facilitates collaboration among regulators like RBI, SEBI, IRDAI, and PFRDA to streamline policies.
- **Financial Sector Development**: Promotes reforms to enhance investment, inclusion, and literacy.
- **Crisis Management**: Institutionalizes mechanisms to address financial crises and ensure economic security.

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Composition:

Chairperson: Union Finance Minister (currently Nirmala Sitharaman)

Members: RBI Governor, SEBI Chairperson, IRDAI Chairman, PFRDA Chairman, Chief Economic Adviser, and senior finance ministry officials.

Sub-Committee: **Chaired by the RBI Governor**, it handles technical discussions and implements FSDC decisions.

United Nations Population Fund (UNFPA) Report 2025

Why in News ? The **United Nations Population Fund (UNFPA)** released its report titled **"State of the World Population 2025: The Real Fertility Crisis"**, highlighting India's demographic trends, fertility rate, and population growth projections.

Relevance : Pre & Mains

Prelims: UNFPA/About Report

Mains : GS 1/GS 2

About the UNFPA Report

Population Statistics:

- **India's Current Population**: Estimated at **146.39 crore** (April 2025).
- **China's Current Population**: Pegged at **141.61 crore**, confirming India as the world's most populous nation.
- **Future Projections**: India's population is expected to peak at **170 crore** before declining in the next 40 years.

Total Fertility Rate (TFR):

- **India's TFR**: Declined to **1.9**, below the **replacement level of 2.1**.
- **Replacement Level TFR**: The fertility rate required to replace the previous generation's population.

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Youth and Working Age Population:

- **Youth (0-24 years)**: Constitutes **26%** of the population.
- **Working-age Population (15-64 years)**: Accounts for **68%**.
- **Elderly Population (65+ years)**: Currently at **7%**, expected to rise with increasing life expectancy.

Life Expectancy:

- Projected at **71 years** by 2025, with an average of **70 years for men** and **74 years for women**.

Real Fertility Crisis:

- The report emphasizes the **"real fertility crisis"**, focusing on the inability of individuals to achieve their fertility goals due to lack of **reproductive agency**.
- **Reproductive Agency**: Defined as the ability to make free and informed choices about contraception, family planning, and reproductive health.

2. **About the United Nations Population Fund (UNFPA)**
3. **Establishment and Headquarters**
4. **Established**: 1969 (originally as the United Nations Fund for Population Activities, later renamed UNFPA in 1987).
5. **Headquarters**: New York City, USA.
6. **Headquarters**: New York City, USA.

Members: UNFPA operates under the umbrella of the United Nations and collaborates with its **193.**

Key Focus Areas:

UNFPA works to promote:

1. **Reproductive Health**: Ensuring access to family planning, maternal health services, and safe childbirth.
2. **Gender Equality**: Advocating for the empowerment of women and girls.
3. **Population and Development**: Addressing the links between population dynamics and sustainable development.
4. **Youth Empowerment**: Supporting the health and rights of adolescents.
5. **Humanitarian Assistance**: Providing reproductive health support in emergencies and crises.

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Reports Published by UNFPA:

1. **State of World Population Report** (Annual):
2. **Demographic and Health Surveys**:
3. **World Population Prospects**:
4. **Model-Based Estimates and Projections of Family Planning Indicators**:
5. **Global Report on Gender Equality**:

One Earth ! One Health

Why in News? This year's Yoga Day activities will revolve around 10 unique signature events to mark the 11 th edition of the global event.

Relevance : UPSC Pre & Mains

Prelims : Key terms related to Yoga Day

Mains : GS 1/3 Health /Enviroment

Key Highlights of IDY 2025 Activities:

Signature Events:

- **Yoga Sangam**: A synchronized yoga demonstration at 1,00,000 locations globally.
- **Yoga Bandhan**: A global exchange program coupled with knowledge-sharing sessions.

Yoga Parks:

- Aiming for long-term community engagement, Jadhav has introduced yoga parks in Maharashtra, including his constituency Akola. These parks serve as permanent hubs for yoga practice and education.

Special Programs by the Ayush Ministry:

- **Yoga Samavesh**: Yoga programs tailored for Divyangjan (differently-abled individuals), senior citizens, children, and marginalized groups.

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- **Yoga Prabhav**: A decadal assessment of yoga's impact on public health.
- **Yoga Connect**: A global online yoga summit for collaboration among yoga experts, policymakers, and health specialists.

Innovative Initiatives for 2025:

- **Harit Yoga**: Combines yoga with sustainability activities like tree planting and clean-up drives.
- **Yoga Maha Kumbh**: A week-long yoga festival at 10 prominent locations across India.
- **Samyoga**: Translating yoga practices into contemporary medicine.
- **Yoga Unplugged**: Designed to attract young people to yoga.

Countdown to IDY 2025:

- Jadhav inaugurated the 25-day countdown in Puducherry on May 27, 2025, marked by mass demonstrations of the **Common Yoga Protocol (CYP).**

Jadhav's Vision and Role in Promoting Yoga:

Yoga as a Way of Life:

- Jadhav emphasized that yoga is more than an exercise; it's a practice for mental and physical well-being.
- He introduced yoga into the daily curriculum of schools managed by his family to reflect the importance of integrating yoga into daily life.

Global Outreach and PM Modi's Role:

- Acknowledged PM Modi's efforts in making yoga a global phenomenon.
- Highlighted the United Nations' declaration of June 21 as the International Day of Yoga as a significant milestone.

Jadhav's Contribution to Yoga's Promotion:

- Organized various yoga sessions and initiatives in his constituency and Maharashtra.
- Advocated for the inclusion of yoga in education, workplaces, and even defense sectors.

Political and Personal Background:

Political Career:

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- Began in 1986 with Shiv Sena and won his first election in 1995 from the Mehkar constituency in Maharashtra.
- Elected to the Lok Sabha in 2009 from Buldhana and retained the seat for four consecutive terms.
- Currently aligned with the Eknath Shinde faction of Shiv Sena.

Developmental Initiatives:

- Focused on education for girls, farmer welfare policies, and community health.
- Organized events like health camps, career guidance sessions, and agricultural exhibitions.

Collaboration and Acknowledgments:

- Jadhav praised Andhra Pradesh CM N. Chandrababu Naidu for supporting IDY 2025.
- He expressed gratitude to Union Health Minister JP Nadda and BJP President Eknath Shinde for providing opportunities to promote yoga.

One Earth, One Health: Yoga Day 2025

Theme Explanation

The theme "**One Earth, One Health" for Yoga Day 2025** emphasizes the interconnectedness of human health and environmental well-being. It reflects the idea that the health of the planet and humanity are interdependent, advocating a holistic approach to wellness through yoga.

Significance of the Theme

Holistic Health

- Yoga integrates physical, mental, and spiritual well-being, making it a powerful tool for achieving personal health and planetary harmony.

Global Unity

- Promotes the idea that nations and individuals must work collectively to address health and environmental challenges.

Sustainability and Wellness

- Encourages eco-friendly practices like **Harit Yoga**, combining yoga with tree planting and clean-up drives to promote sustainability.

Axion -4 Mission/Liquid Oxygen (Lox)

Why in News? The Axiom Space Ax-4 mission, set to carry Indian astronaut Group Captain Shubhanshu Shukla and three others to the International Space Station (ISS), has been delayed due to a liquid oxygen (LOx) leak in SpaceX's Falcon 9 rocket.

Relevance : UPSC Pre & Mains

Prelims : Lox/ISS/

Mains : GS 3/ Scince & Tech/ Space technology

India's Milestone: Shubhanshu Shukla's mission marks India's first human spaceflight in 41 years, making him the second Indian in space after **Rakesh Sharma in 1984.**

Global Collaboration: The mission involves Axiom Space, NASA, ISRO, and the European Space Agency, with astronauts from India, Poland, and Hungary, each marking their nation's first ISS visit.

Technical Issue: The LOx leak highlights the rigorous safety checks required for space missions, drawing attention to SpaceX's pre-launch protocols.

Research Focus: The crew will conduct 60 experiments, including seven from ISRO, on microgravity, food studies, and technology.

About Liquid Oxygen (LOx):

- LOx is oxygen cooled to **-183°C (-297°F),** used as an oxidizer in rocket engines.
- In **Falcon 9**, LOx pairs with RP-1 (refined kerosene) to fuel Merlin engines for combustion in space.

- **Role in Propulsion**:
  - **Oxidizer**: Enables fuel combustion in space's vacuum, producing thrust.
  - **Efficiency**: High reactivity ensures powerful propulsion.
- **Leak Risks**:
  - **Safety**: LOx leaks can cause fires or explosions if they contact fuel or materials.
  - **Mission Impact**: The leak in the propulsion bay requires repairs and tests, delaying the launch.
  - **Repair Process**: Initial purge attempts failed, possibly requiring the rocket's removal from the pad, extending the delay.

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About Falcon 9 :

- It is a reusable, two-stage rocket designed and built by **SpaceX for launching** payloads into orbit and beyond.
- **Design and Purpose**: Falcon 9 is a medium-lift launch vehicle capable of delivering satellites, cargo, and crew to **low Earth orbit (LEO), geostationary transfer orbit (GTO)**, and other destinations. It's a cornerstone of **SpaceX's mission** to reduce spaceflight costs through reusability.

High Seas Treaty

Why in News ? India is unlikely to ratify the **Biodiversity Beyond National Jurisdiction (BBNJ)** agreement, also known as the **High Seas Treaty**, at the ongoing **United Nations Ocean Conference** in Nice, France.

Relevance : Pre & Mains

Prelims: **High Seas Treaty/BBNJ**

Mains : GS 2

Key Points:

Pending Ratification:

- **India signed the treaty** in September 2024.
- Ratification requires amendments to the Biological Diversity Act, expected to be addressed after the Monsoon Session of Parliament.
- **49 countries have ratified the treaty as of June 10, 2025**; the treaty will enter into force once 60 countries complete the process.

Contentious Issues:

- Equitable sharing of economic benefits from marine resources on the high seas remains unresolved.

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- The high seas, beyond national jurisdiction, are home to unique marine life with potential economic value.

India's Marine Initiatives:

- Progress on **Samudrayaan Mission**, aiming for a trial dive to depths of 6,000 meters by 2026.
- Nationwide ban on single-use plastics.
- More than $80 billion invested in the Blue Economy.
- Launch of the **SAHAV Digital Ocean Data Portal** to enhance marine conservation efforts.
- Call for a legally binding **Global Plastics Treaty**.

About the High Seas Treaty (BBNJ Agreement):

- The High Seas Treaty was adopted in March 2023 under the United Nations Convention on the Law of the Sea (UNCLOS).
- Focus: Protecting marine biodiversity in areas beyond national jurisdiction.

Key Features:

- **Marine Protected Areas:** Establishment of protected zones to conserve and manage ocean biodiversity.
- **Equitable Benefit Sharing:** Framework for sharing economic benefits from marine genetic resources.
- **Environmental Impact Assessments (EIAs):** Guidelines to evaluate the impact of human activities on high seas ecosystems.
- **Capacity Building and Technology Transfer:** Assisting developing nations in accessing marine resources and technology.

Significance:

- Covers nearly **50% of the Earth's surface** – areas beyond national jurisdiction (the high seas).
- Ensures sustainable use of marine biodiversity.
- Promotes global cooperation in marine conservation and equitable sharing of resources.

Challenges:

- Lack of consensus on benefit-sharing mechanisms.
- Technical difficulties in accessing deep-sea resources.
- Political and economic concerns over equitable participation

Uttar Pradesh Invokes ESMA, 1966

Why in News ?. The Uttar Pradesh government invoked the Uttar Pradesh Essential Services Maintenance Act (ESMA), 1966, on June 11, 2025, to prohibit strikes in the electricity department for six months, addressing ongoing unrest in the sector amid a heatwave crisis.

Relevance : Pre & Mains

Prelims: **ESMA 1966**

Mains : GS 3 – Energy /UP Paper 6

Key Points:

ESMA Invocation:

- Notification issued under Section 3(1) of ESMA, 1966, banning strikes in the electricity department for six months, starting June 11, 2025.

Objective:

- Ensures uninterrupted power supply during north India's heatwave, preventing disruptions in essential electricity services.

Context of Unrest:

- Follows protests against proposed privatization, demands for contractual workers' regularization, and opposition to the Electricity (Amendment) Bill 2022, with demonstrations in Lucknow as recent as April 2025.

Legal Provisions:

- ESMA allows police to arrest violators without a warrant. Penalties include up to one year imprisonment, a fine up to Rs 1,000, or both.

Public Interest:

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- Aimed at safeguarding vital electricity services during extreme weather conditions.

Broader Context:

- Previous ESMA invocations in February and December 2024 banned strikes across all state departments, showing a trend of curbing labor unrest.

About ESMA-1966:

The **Uttar Pradesh Essential Services Maintenance Act (ESMA), 1966**, is a state legislation in Uttar Pradesh, India, designed to ensure the uninterrupted delivery of essential public services by prohibiting strikes and other forms of labor disruptions in critical sectors. Below is a concise overview based on available information:

Key Features of the Uttar Pradesh ESMA, 1966

Purpose:

- To maintain the continuity of essential services vital to public welfare, such as **electricity, water supply, public transport, and other state-managed services**, especially during emergencies or crises.

Scope:

- Applies to services deemed "essential" by the state government, including electricity departments, public health, sanitation, and government-run institutions like hospitals or transport services.

Prohibition of Strikes:

- Under **Section 3(1)**, the government can issue a notification to ban strikes in specified essential services for a period (typically six months, as seen in the **June 11, 2025**, notification for the electricity department).
- Strikes, work stoppages, or any acts disrupting these services are prohibited during the specified period.

Penalties for Violation:

- Violators, including employees participating in or instigating strikes, can be arrested without a warrant by the police.
- Punishment includes imprisonment for up to **one year**, a fine of up to **Rs 1,000**, or both.

Step by Step (SPArc)

Why in News? The step-and-shoot Spot-Scanning Proton Arc Therapy (SPArc) was successfully used for the first time to treat a patient with adenoid cystic carcinoma, a rare type of cancer. The treatment, performed at Corewell Health William Beaumont University Hospital, demonstrates significant advances in radiation therapy for anatomically complex tumors while sparing nearby critical tissues.

Relevance : UPSC Pre & Mains

Prelims : SFO/IMPT/SPArc

Mains : GS 1/3 Health /Scince Tech.

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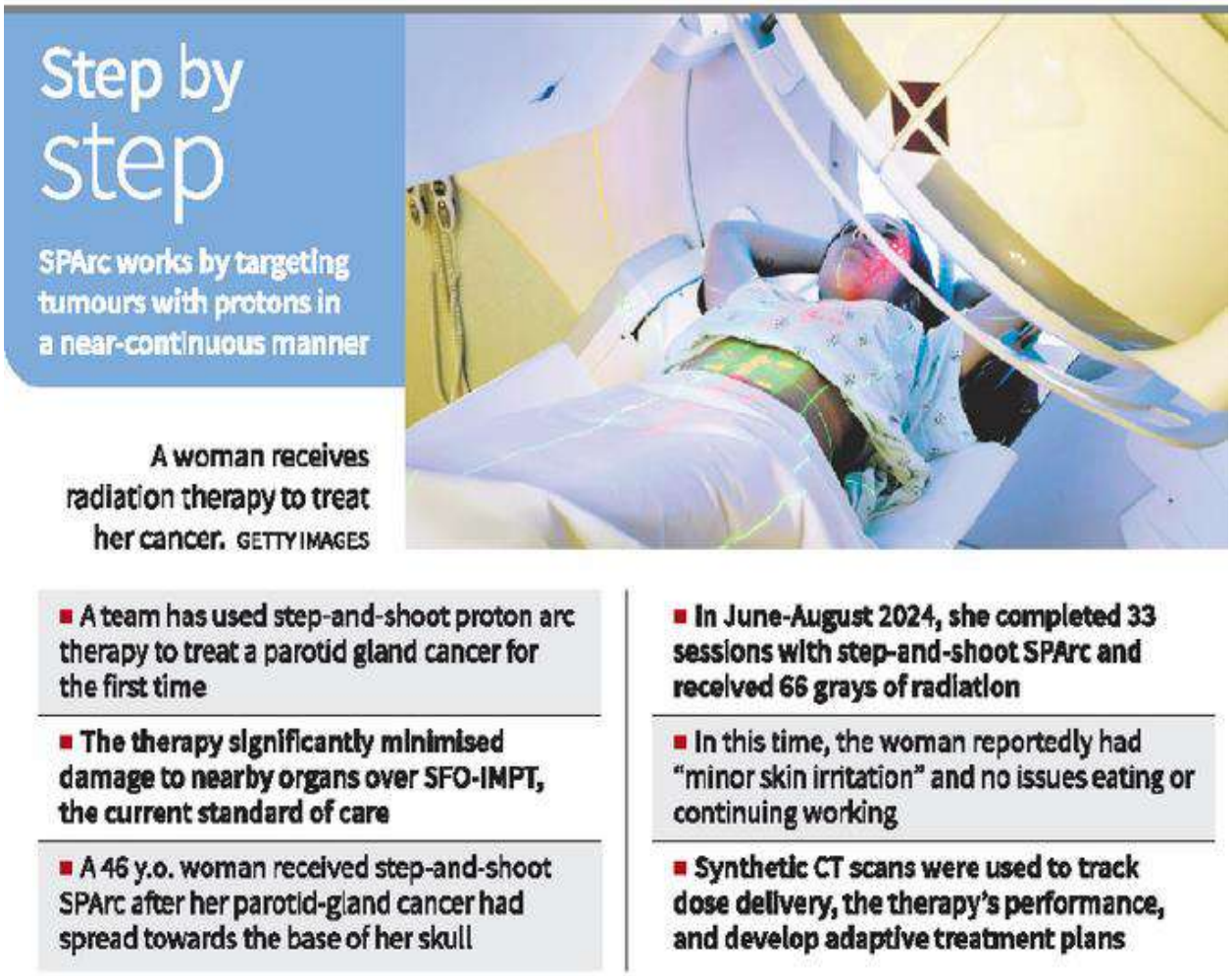

- The team compared the results of three techniques: **SFO-IMPT** (the current standard of care), **step-and-shoot SPArc**, and fully dynamic SPArc (simulated with computers).
- The SPArc methods reduced radiation delivered to the **brainstem (by 10%),** optical **chiasm (56%),** oral cavity (72%), and **spinal canal (90%) over SFO-IMPT.**

SFO-IMPT (Standard of Care):

- **Definition**: Intensity-Modulated Proton Therapy using static fields.
- **Function**: Delivers proton beams from fixed angles to target tumors.
- **Characteristics**: Precise, but less flexible compared to dynamic methods; standard in current clinical practice.

Step-and-Shoot SPArc:

- **Definition**: Spot-Scanning Proton Arc therapy with pre-programmed steps.

- **Function**: Delivers proton beams in discrete, planned steps, rotating around the patient.
- **Benefits**: Enhances tissue sparing by optimizing beam angles, reducing damage to healthy tissues.

Fully Dynamic SPArc (Simulated):

- **Definition**: Advanced Spot-Scanning Proton Arc therapy with continuous adjustments.
- **Function**: Dynamically adjusts energy and delivery points during treatment for superior precision.
- **Status**: Not yet clinically implemented; remains in simulation phase for research and development.

Flue Gas Desulphurisation (FGD)

Why in News? a committee of experts, chaired by Principal Scientific Advisor (PSA) Ajay Sood, has recently recommended that India do away with a decade-long policy of mandating Flue Gas Desulphurisation (FGD) units in all coal-fired thermal power plants (TPPs).

Relevance : UPSC Pre & Mains

Prelims : FGD/TPPs

Mains : GS 3/ Environment

Flue Gas Desulphurisation (FGD) units have come under scrutiny after a committee of experts, chaired by Principal Scientific Advisor (PSA) Ajay Sood, recommended rolling back the mandate for installing FGDs in all coal-fired **Thermal Power Plants (TPPs)**.

What is a FGD Unit?

- **Flue gas** is a byproduct of fossil fuel combustion, containing pollutants like **Sulphur Dioxide (SO2)**, **Carbon Dioxide (CO2)**, and particulate matter.
- **FGD units** target SO2 emissions by neutralizing them with a basic compound.
- **Common FGD Types:**

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1. **Dry Sorbent Injection**: Uses powdered limestone to react with SO2, forming compounds removed by filters.
2. **Wet Limestone Treatment**: Involves limestone slurry; produces **gypsum** as a byproduct, widely used in industries.
3. **Sea Water Treatment**: Absorbs SO2 in sea water, commonly used in coastal plants.

Why are SO2 Emissions Harmful?

- **Greenhouse Gas**: SO2 contributes to global warming.
- **Health Impacts**: Causes **respiratory problems** and contributes to the formation of **particulate matter (PM2.5)**.
- **Air Quality Impact**: **15% of India's PM2.5** is linked to coal-based SO2 emissions.

FGD Unit Status in India:

- **Policy**: In 2015, the Environment Ministry mandated FGDs in 537 TPPs.
- **Compliance**: Only **39 plants** installed FGDs by April 2025.
- **Delays**: Deadlines extended multiple times, with the latest extension to **2027-2029**.
- **Cost**: Approx. **Rs 1.2 crore/MW**; total expected expense for India is **Rs 97,000 crore**.

Why Are FGDs Contentious?

- **High Costs**: Increases electricity tariffs by **Rs 0.72 per kWh**, primarily due to fixed costs.
- **Health vs. Economics**: Skipping FGDs may undermine India's **clean air targets** and **public health commitments**.
- **Impact on Air Quality**: Depends on proximity to towns; for example, PM2.5 contributions in cities like Delhi are complex but stationary sources like TPPs are easier to target.

Are There Alternatives to FGDs?

- **No Alternative**: Experts assert that FGDs are the only effective solution for removing SO2 from coal emissions.
- **Urgency**: Delays in compliance risk public health and environmental goals.

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Digital Flight Data Recorder (DFDR)

Why in News ? Representatives from global agencies like the NTSB, FAA, and U.K.'s CAA are aiding India's AAIB in investigating the June 12, 2025, Air India Boeing 787 crash in Ahmedabad, which claimed 241 lives. The victims included 181 Indians, 53 Britons, seven Portuguese, and one Canadian.

Relevance : Pre & Mains

Prelims: **DFDR/ICAO**

Mains : GS 3

Key Points:

- The AAIB retrieved the **digital flight data recorder** (**DFDR**) from the crash site at B.J. Medical College hostel campus. The next steps involve extracting data from the DFDR (up to 25 hours) and **cockpit voice recorder** (**CVR**, about two hours), followed by analysis of flight parameters like speed and angle of attack, which could take four to five days.
- The investigation follows **International Civil Aviation Organization (ICAO**) standards under **Annex 13 of the Chicago Convention**, mandating a preliminary report within 30 days and encouraging a final public report within 12 months. India, as the state of occurrence, controls all information releases, as confirmed by the NTSB.

About the International Civil Aviation Organization (ICAO)

- The International Civil Aviation Organization (ICAO) is a United Nations specialized agency established in **1944 under the Chicago Convention** to promote safe, secure, and sustainable international civil aviation.
- **Headquartered in Montreal, Canada, ICAO** sets global standards and recommended practices (SARPs) for aviation safety, security, efficiency, and environmental protection.
- It coordinates with **193 member states** to ensure uniform regulations, including accident investigation protocols outlined in Annex 13, which mandates that the state where an accident occurs leads the investigation and controls information release.

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- ICAO does not enforce regulations but provides a framework to enhance global aviation safety and interoperability.

About Digital Flight Data Recorder (DFDR)

The **Digital Flight Data Recorder (DFDR)**, commonly part of an aircraft's "black box" alongside the **Cockpit Voice Recorder (CVR**), is a critical device that records a wide range of flight parameters to aid in accident and incident investigations. Typically housed in a crash-survivable unit, the DFDR is designed to withstand extreme conditions such as high-impact crashes, fires, and submersion.

Key Features and Functions:

- **Data Recording**: The DFDR captures detailed flight information, including parameters like altitude, airspeed, heading, angle of attack, engine performance, control inputs, and system statuses. Modern DFDRs can record hundreds of parameters, often sampling data multiple times per second.
- **Storage Capacity**: It continuously records data on a loop, typically retaining 25 hours of flight data, overwriting older information as new data is collected.
- **Crash-Survivable Design**: Built to endure extreme temperatures (up to 1,100°C for 60 minutes), high-impact forces (up to 3,400 Gs), and water pressure at significant depths (up to 20,000 feet underwater for 30 days). It is equipped with an Underwater Locator Beacon (ULB) to aid recovery.
- **Data Extraction**: Extracting or "**milking" data from a DFDR** involves downloading raw data, which can take up to 25 hours due to the volume and complexity. This data is then analyzed to reconstruct flight events, often requiring specialized software and expertise.

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'Anti-Smog Guns' and 'Super Sprayers.'

Why in News? The Delhi government has taken a significant step in addressing the contentious issue of pollution by announcing the inclusion of new technology-based machines. The government has launched advanced machines such as **'Anti-Smog Guns' and 'Super Sprayers.'**

Relevance : UPSC Pre & Mains

Prelims : SFO/IMPT/SPArc

Mains : GS 3 Scince Tech./Environment

Water Sprinkler Machine:

Explanation:

Sprays water on roads and open areas to settle dust particles. This prevents dust from becoming airborne and contributing to air pollution.

- **Example:**

  In **Gurugram**, water sprinklers are used during the construction of highways to prevent dust pollution caused by construction debris.

Anti-Smog Machine (Integrated System):

Explanation:

Anti-smog machines use water mist to capture and settle harmful particulate matter in the air, reducing smog levels.

- **Example:**

  In **Delhi**, anti-smog guns were deployed near construction sites and traffic-dense areas like ITO during winter to combat smog caused by vehicle emissions and stubble burning.

Electric Mechanical Road Sweeping Machine:

Explanation:

Cleans roads by using brushes and suction mechanisms powered by electricity to collect small dust particles and waste.

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- **Example:**

  In **Mumbai**, these machines clean arterial roads like the Western Express Highway to reduce dust and improve road cleanliness.

Hydraulic Mechanical Road Sweeping Machine:

Explanation:

Uses hydraulic systems for stronger suction and better cleaning, particularly effective for heavy or industrial waste.

- **Example:**

  In **Chandigarh**, hydraulic sweeping machines clean roads near industrial areas to remove oil spills, dust, and solid waste.

Water Sprayer Machine:

Explanation:

Sprays water at moderate pressure to settle dust on roads and construction sites.

- **Example:**

  In **Jaipur**, these machines are used on roadsides near markets to control the dust generated by vehicular and pedestrian movement.

Water Jetting Machine:

- **Explanation:**

  Uses high-pressure water jets to remove dirt, grime, and tough stains from roads, sidewalks, and public spaces.

- **Example:**

  In **Bengaluru**, water jetting machines clean pavements in areas like MG Road to remove tough stains and ensure hygiene near public spaces.

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Crisis in the Marine Ecosystem/ Marine Protected Areas (MPAs)

Why in News? The ocean is a vital component of Earth, serving as a hub of biodiversity and playing a crucial role in regulating the global climate. It is **home to fish, coral reefs**, marine

plants, and various other organisms. However, human activities have led to a severe crisis in the marine ecosystem. **Pollution, overfishing, climate change, and the reckless exploitation of marine resources** are the primary causes.

Relevance : UPSC Pre & Mains

Prelims : MPAs/All important treaty/conventions etc

Mains : GS 3/ Environment

Causes:

Pollution:

- **Plastic waste in** the ocean is a major issue, with approximately **8 million tons of plastic dumped into the ocean annually.**
- Oil spills are highly destructive to marine life. For example, the **2010 Deepwater Horizon oil spill in the Gulf of Mexico** killed millions of marine organisms.
- Industrial and chemical waste dumped into the ocean makes the water toxic.

Climate Change:

- Rising ocean temperatures due to global warming are causing **coral bleaching**, leading to the death of coral reefs.
- **Ocean acidification** is adversely affecting shellfish and other marine species.
- Melting glaciers are raising sea levels, which damages coastal ecosystems.

Overfishing:

- **Excessive fishing has pushed many species to the brink of extinction.**
- This disrupts the food chain, impacting the entire ecosystem.

Habitat Destruction:

- Unplanned coastal development, such as port construction and tourism, is destroying **mangrove forests and coral reefs.**
- Mangroves serve as breeding grounds for marine life, and their destruction significantly affects marine biodiversity.

Impacts:

Impact on Biodiversity:

- **The population of marine species is declining rapidly.** For example, several shark species are now endangered.

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- Coral reefs, which support **25% of marine life**, are being destroyed at an alarming rate.

Impact on Human Life:

- Communities dependent on fishing for their livelihood are at risk. **Around 3 billion people worldwide rely on seafood for their protein needs.**
- Rising sea levels and the loss of mangroves and coral reefs have increased the frequency of floods and storms in coastal areas, as these natural barriers can no longer provide protection.

Economic Impact:

- Marine tourism and the fishing industry are suffering significant losses.
- According to the World Bank, the degradation of marine ecosystems causes a **global economic loss of $200 billion annually.**

Solutions:

Pollution Control:

- Reduce plastic usage and launch campaigns for ocean cleanup.
- Enforce strict regulations to prevent the dumping of industrial waste into the ocean.

Sustainable Fishing:

- Set quotas for fishing and crack down on illegal fishing activities.
- Establish **Marine Protected Areas (MPAs)** to conserve marine biodiversity.

Tackling Climate Change:

- Promote renewable energy to reduce carbon emissions.
- Use scientific techniques for **coral restoration** to revive damaged reefs.

Awareness and Education:

- Raise awareness about the importance of marine ecosystems.
- Involve local communities in conservation efforts.

About Marine Protected Areas (MPAs) :

They are designated regions of the ocean where human activities are regulated to conserve marine ecosystems, biodiversity, and resources. They aim to protect habitats, species, and ecological processes while often supporting sustainable **fisheries and cultural values.**

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Key Points:

- **Purpose**: Safeguard marine biodiversity, restore ecosystems, and support fisheries by preserving critical habitats like coral reefs, mangroves, and seagrass beds.
- **Global Coverage**: As of recent data, MPAs cover about **8.2% of the global ocean**, with a target of **30% by 2030** under the Global Biodiversity Framework.
- **Types**:
  - **No-take MPAs**: Prohibit all extractive activities (e.g., fishing, mining).
  - **Multiple-use MPAs**: Allow regulated activities like sustainable fishing or tourism.
  - **Marine Reserves**: Highly protected areas, often fully no-take.

Convention on Supplementary Compensation (CSC)

Why in News ? A French private company and the **Nuclear Power Corporation of India (NPCIL)** are addressing challenges related to the construction of six nuclear power reactors in **Jaitapur, Maharashtra.**

Relevance : Pre & Mains

Prelims: **NPCIL/CLNDA/CSC**

Mains : GS 3

Understanding Nuclear Liability Legislation:

- Nuclear liability laws ensure compensation for victims of nuclear damage caused by incidents or disasters. The international framework for nuclear liability was strengthened post the 1986 Chernobyl disaster and includes several treaties.
- The **Convention on Supplementary Compensation (CSC), adopted in 1997**, aims to establish a minimum national compensation amount. **India signed the CSC and ratified it in 2016.**
- To align with international standards, India enacted the **Civil Liability for Nuclear Damage Act (CLNDA) in 2010.**

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- The **Vienna Convention on Civil Liability for Nuclear Damage** sets minimum standards to provide financial protection for damages from peaceful nuclear energy uses.

Key Features of CLNDA 2010:

- **Prompt Compensation**: Facilitates a swift compensation process for victims of nuclear incidents.
- **Absolute and No-Fault Liability**: Holds the operator liable for damages regardless of fault.
- **Right of Recourse**: Allows the operator to seek recourse if the incident results from a supplier's or their employee's actions.
- **Supplier Liability**: Introduces liability for suppliers for defective equipment, materials, or substandard services.
- **Compensation Amount**: Sets a minimum compensation of **Rs 1,500 crore**, covered by insurance or financial security.
- **Excess Compensation**: Provides Rs 2,100 to Rs 2,300 crore for damages exceeding Rs 1,500 crore.
- **Nuclear Reactors in India**: India operates 22 nuclear reactors, all managed by the state-owned **Nuclear Power Corporation of India Limited (NPCIL)**.

Current Challenges;

- **Unique Supplier Liability**: CLNDA is distinctive in holding suppliers accountable for damages, creating concerns.
- **Insurance Ambiguity**: Uncertainty over the amount of insurance required for damage claims worries suppliers.
- **Criminal Liability**: The provision for pursuing criminal liability deters many companies from building reactors in India.
- **Undefined Nuclear Damages**: The lack of a clear definition of nuclear damages creates confusion.
- **Operator vs. Supplier Fault**: Suppliers can be held liable even for damages caused by operator errors during equipment repairs.

Key Information:

About the Nuclear Power Corporation of India Limited (NPCIL):

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- A Public Sector Enterprise under the Department of Atomic Energy (DAE).
- Responsible for the design, construction, commissioning, and operation of nuclear power reactors.
- Holds equity in BHAVINI, another DAE public sector unit implementing the Fast Breeder Reactors program.
- Operates 22 commercial nuclear reactors with a total installed capacity of 6,780 MW.

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About the Convention on Supplementary Compensation for Nuclear Damage (CSC) :

It is an international treaty adopted on September 12, 1997, under the International Atomic Energy Agency (IAEA

). It aims to establish a global framework for compensating victims of nuclear incidents, enhancing the existing nuclear liability regimes post the 1986 Chernobyl disaster. Below are its key aspects:

Key Features of the CSC

- **Global Compensation Regime**: Establishes a minimum national compensation amount and provides additional funding through an international pool for significant nuclear incidents.
- **Liability Framework**: Ensures that operators of nuclear facilities are primarily liable, with a minimum liability of 300 million **Special Drawing Rights (SDRs, approximately $400** million USD as of 2023).
- **Supplementary Fund**: If damages exceed the operator's liability, contributions from contracting parties fund additional compensation, proportional to their nuclear capacity.
- **No-Fault Liability**: Operators are liable regardless of fault, ensuring swift victim compensation.
- **Jurisdiction**: Legal proceedings are handled in the country where the nuclear incident occurs, streamlining claims.
- **Broad Coverage**: Applies to nuclear damage, including loss of life, property damage, environmental harm, and economic loss, subject to national laws.

India and the CSC

- **Signatory and Ratification**: India signed the CSC in 2010 and ratified it in 2016.

- **Alignment with CLNDA**: India's Civil Liability for Nuclear Damage Act (CLNDA) 2010 aligns with CSC principles but introduces unique provisions, like supplier liability, causing some friction with international suppliers.

INS Arnala/ First Indigenous Anti-Submarine Warfare Shallow Water Craft

Why in News? The commissioning of **INS Arnala** on June 18, 2025, in Visakhapatnam is a landmark event for the Indian Navy, boosting its coastal defense capabilities and advancing the **Aatmanirbhar Bharat** initiative. As the first of **16 indigenously built Anti-Submarine Warfare Shallow Water Craft (ASW-SWC)**, INS Arnala strengthens India's ability to counter submarine threats in shallow waters, reinforcing its maritime security in the Indian Ocean Region

Relevance : UPSC Pre & Mains

Prelims : INS Arnala/ASW-SWC

Mains : GS 3 Scince Tech./Defence

Key Points

- **Commissioning Ceremony**: Held on June 18, 2025, at Naval Dockyard, Visakhapatnam, presided over by **Chief of Defence Staff General Anil Chauhan**, and hosted by **Vice-Admiral Rajesh Pendharkar**, Flag Officer Commanding-in-Chief, Eastern Naval Command.
- **Indigenous Build**: Constructed by **Garden Reach Shipbuilders and Engineers (GRSE), Kolkata**, with **L&T Shipbuilders**, featuring over **80% indigenous content**, supporting India's self-reliance in defense.
- **Strategic Role**: Designed for **anti-submarine warfare** in coastal waters, INS Arnala enhances the Navy's ability to detect and neutralize submarines, replacing older Abhay-class corvettes.

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- **Fleet Expansion**: First of **16 ASW-SWC vessels** under a Rs 12,622 crore contract, with **GRSE and Cochin Shipyard Limited** building eight ships each, to be completed by 2028.
- **Maritime Heritage**: Named after **Arnala Fort** off Vasai, Maharashtra, symbolizing India's maritime legacy, with a crest featuring an auger shell for resilience and precision.

Important Features of INS Arnala:

- **Dimensions and Propulsion**:
  - **Length**: 77 meters
  - **Displacement**: Over 1,490 tonnes
  - **Propulsion**: Largest Indian naval warship with a **diesel engine-waterjet combination**, ensuring high speed and maneuverability in shallow waters.
  - **Speed**: Up to **25 knots**
- **Endurance**: **1,800 nautical miles** (~3,300 km)
- **Advanced Technology**:
  - Equipped with **Hull-Mounted Sonar (Abhay)**, **Low-Frequency Variable Depth Sonar (LFVDS)**, and **Underwater Acoustic Communication Systems (UWACS)**.
  - Supports **subsurface surveillance**, **search and rescue**, **low-intensity maritime operations**, and **mine-laying**.
- **Weaponry**: Includes **torpedoes**, **rockets**, and **mines** for effective anti-submarine operations.
- **Operational Purpose**: Optimized for **sub-hunting in coastal waters**, freeing larger naval ships for offensive roles.

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The Financial Action Task Force (FATF)

Why in News?. India has been advocating for Pakistan's re-inclusion on the FATF's "grey list" due to its alleged support for terrorism, including the Pahalgam attack, which Indian authorities attribute to Pakistan-trained terrorists. India is preparing a dossier for the Asia

Pacific Group (APG) meeting on August 25, 2025, and the FATF plenary on October 20, 2025, to argue for increased scrutiny of Pakistan.

Relevance : UPSC Pre & Mains

Prelims : FATF

Mains : GS 3/ Economy

About FATF:

- The **Financial Action Task Force (FATF)** is an intergovernmental organization established in **1989 by the G7 Summit** in Paris to combat money laundering and terrorist financing.
- Over time, its mandate has expanded to address other threats to the international financial system, such as proliferation financing.

Headquarters: Paris, France.

Purpose:

- To set international standards and promote the effective implementation of legal, regulatory, and operational measures for combating money laundering, terrorist financing, and other related threats.
- To safeguard the integrity of the global financial system.

Membership:

- **39 Members**: Includes 37 member jurisdictions and 2 regional organizations (European Commission and Gulf Cooperation Council).
- Observers: Various international and regional organizations like the IMF, World Bank, and UN.
- **India** became an FATF member in 2010.

FATF Black List:

The Black List, officially **"High-Risk Jurisdictions Subject to a Call for Action,"** flags countries with severe AML/CFT deficiencies and little commitment to improvement. These pose significant risks, prompting calls for enhanced due diligence and potential countermeasures like sanctions.

Current Countries (as of June 2025)

- Democratic People's Republic of Korea (DPRK)

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- Iran
- Myanmar

Implications

- **Economic Sanctions**: Restrictions like asset freezes or trade embargoes deter investment.
- **Reputational Damage**: Signals non-cooperation, harming global trade.
- **Countermeasures**: FATF urges members to apply protective measures against money laundering, terrorist financing, and proliferation financing risks.

Compliance Requirements

Financial institutions must implement **enhanced due diligence (EDD)**, including rigorous customer screening and transaction monitoring, for blacklisted countries.

The Grey List, or **"Jurisdictions Under Increased Monitoring,"** includes countries with AML/CFT deficiencies but committed to addressing them within set timelines. They undergo active FATF monitoring.

Current Countries (as of February 2025):

Algeria • Angola • Bulgaria • Burkina Faso • Cameroon • Côte d'Ivoire • Democratic Republic of Congo • Haiti • Kenya • Lao PDR • Lebanon • Mali • Monaco • Mozambique • Namibia • Nigeria • South Africa • South Sudan • Syria • Tanzania • Venezuela • Vietnam • Yemen

Recent Changes:

- **Removed**: Philippines, Mali, Tanzania, Croatia (after resolving deficiencies).
- **Added**: Nepal, Lao PDR (due to identified AML/CFT gaps).

Implications:

- **Economic Impact**: Reduced investment, higher transaction costs, and challenges accessing international loans.
- **Increased Monitoring**: Regular progress reports and assessments required.
- **Reputational Risk**: Signals elevated risk, prompting financial institutions to apply EDD.

Compliance Requirements:

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Businesses use a **risk-based approach (RBA)** for grey-listed countries, often applying EDD as required by regional regulations. Robust customer due diligence (CDD) and transaction monitoring are essential.

About Asia Pacific Group (APG):

- The Asia Pacific Group on Money Laundering (APG) is an inter-governmental organization established in **1997 in Bangkok, Thailand**, to combat money laundering, terrorist financing, and proliferation financing in the **Asia-Pacific region**.
- It consists of 42 member jurisdictions and several observer jurisdictions and international organizations, including the **Financial Action Task Force (FATF),** International Monetary Fund, World Bank, and others.
- The APG is headquartered in Sydney, Australia, with Australia as the permanent co-chair and a rotating co-chair currently **held by Canada (2022-2024).**

FATF White List (Unofficial):

The informal White List includes countries compliant with FATF standards, identified through mutual evaluations. These jurisdictions have effective AML/CFT systems and are not on the Black or Grey Lists.

Examples of Countries:

United States • Canada • United Kingdom • Australia • Japan • Germany

Other Lists and Context:

- **OECD Tax Haven List**: Focuses on tax transparency, separate from FATF but related. No countries are currently listed as uncooperative tax havens.
- **EU and UK High-Risk Lists**: Often align with the **Grey List, requiring EDD** for listed jurisdictions.
- **FATF Monitoring**: **Mutual Evaluation Reports (MERs**) assess compliance, influencing list placements based on adherence to standards like customer due diligence and suspicious transaction reporting.

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Oryza Sativa/ACT1 Gene

Why in News ? Researchers subjected the rice plant, **Oryza sativa**, to low temperatures to test its adaptability. The study focused on the number and quality of seeds produced as indicators of adaptation. The landmark finding revealed that rice plants exposed to cold temperatures developed **epigenetic changes** in a gene called **ACT1**, enabling them to adapt better and pass this ability across **five generations.**

Relevance : Pre & Mains

Prelims: ACT1/

Mains : GS 3

About ACT1 Gene:

The **ACT1 gene** is integral to the growth, development, and adaptability of rice plants, particularly in response to environmental stresses. It gained prominence in a recent landmark study that demonstrated its role in enabling rice plants to tolerate cold temperatures through epigenetic regulation.

Function of ACT1 in Plants

Growth and Development:

- **ACT1** codes for a protein involved in cellular activities essential for the plant's structural integrity and function.
- It is highly expressed during normal growth conditions, contributing to the plant's development.

Stress Response:

- Under environmental stresses like cold temperatures, the regulation of ACT1 plays a pivotal role in determining the plant's survival and adaptability.
- In normal rice, cold stress triggers the silencing of ACT1, impairing growth and survival.

Role in Cold Adaptation:

The recent study revealed how the ACT1 gene supports cold tolerance in rice:

Epigenetic Regulation:

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- In cold-adapted rice, the methylation (a chemical modification) near ACT1 is altered.
- This prevents the gene from being silenced, ensuring continued production of the ACT1 protein.

Protein Function:

- The ACT1 protein supports cellular functions that are crucial for growth and development under cold stress, allowing the plant to survive and thrive in lower temperatures.

Heritability of Adaptation:

- The epigenetic changes associated with ACT1 were passed on to subsequent generations, allowing cold-adapted traits to persist without altering the DNA sequence itself.

Significance of ACT1 in Agricultural Science:

Climate Resilience:

- Understanding and leveraging the role of ACT1 can aid in developing rice varieties that are more resilient to extreme climates.

Sustainable Agriculture:

- Crops with enhanced ACT1 activity can ensure better yields in regions prone to temperature fluctuations.

Biotechnological Applications:

- Genetic and epigenetic interventions targeting ACT1 could be utilized to improve plant adaptability to other environmental stresses.

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SIPRI 2025 Report: Nuclear Modernization and Global Risks

Why in news? The Stockholm International Peace Research Institute (SIPRI) in its 2025 Yearbook reports that nearly all nine nuclear-armed states—the United States, Russia, the **United Kingdom, France, China, India, Pakistan, North Korea, and Israel**—continued intensive nuclear modernization programs in 2024.

Key Findings:

- **Global Nuclear Inventory**: As of January 2025, the global nuclear warhead inventory is estimated at **12,241, with 9,614 in military stockpiles** for potential use. Approximately 3,912 warheads are deployed with missiles and aircraft, and around 2,100 are on high operational alert, primarily held by **Russia and the USA, with China** possibly maintaining some warheads on alert during peacetime.
- **India's Nuclear Arsenal**: India slightly expanded its nuclear stockpile from 172 warheads in January 2024 to 180 in January 2025.
- **Pakistan's Developments**: Pakistan's nuclear arsenal remained stable at 170 warheads in January 2025. However, it continued to develop new delivery systems and accumulate fissile material, suggesting potential arsenal expansion over the next decade. Pakistan's doctrine emphasizes short-range tactical nuclear weapons, which SIPRI notes could lower the threshold for nuclear use, increasing regional instability.

Other Nuclear Powers:

United States: Holds 5,177 warheads (1,770 deployed, 1,930 stored), down from 5,328 in 2024. Its modernization program faces funding and planning challenges but continues to progress.

Russia: Possesses **5,459 warheads** (1,718 deployed, 2,591 stored), reduced from 5,580 in 2024. It is modernizing its arsenal, with potential increases in deployed warheads post-New START expiry.

China: Expanded its arsenal to **600 warheads (24 deployed, 576 stored)** from 500 in 2024, the fastest growth among nuclear powers. It completed around 350 new ICBM silos by January 2025.

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Other States: The **UK, France, Israel, and North Korea** are also modernizing their arsenals, with North Korea estimated to have assembled around 50 warheads and Israel upgrading its plutonium production capabilities.

Regional and Global Implications:

- The SIPRI report warns that the modernization and expansion of nuclear arsenals, particularly in **South Asia, heighten the risk of escalation. India's adoption** of canisterized missiles and a potential shift toward mating warheads with launchers during peacetime could reduce response times, increasing the chance of miscalculation.
- Pakistan's focus on tactical nuclear weapons further destabilizes the region, as their battlefield use could trigger rapid escalation.
- The brief India-Pakistan conflict in early 2025 underscores the fragility of nuclear deterrence in the region, exacerbated by disinformation and strikes on sensitive military sites. Globally, the report notes that the **post-Cold War** trend of reducing nuclear stockpiles is likely to reverse as dismantlement slows and new deployments accelerate.

About New START Treaty:

The **New START Treaty** (Strategic Arms Reduction Treaty) is a nuclear arms control agreement between the **United States** and **Russia**, aimed at reducing and limiting the number of strategic nuclear weapons held by both nations. Signed on **April 8, 2010**, in Prague, Czech Republic, the treaty entered into force on **February 5, 2011**, and was set to last for ten years, with the option for a five-year extension.

Key Features of the New START Treaty:

Limits on Strategic Nuclear Weapons:

- Each country is allowed a maximum of **1,550 deployed nuclear warheads**.
- The number of deployed intercontinental ballistic missiles (ICBMs), **submarine-launched ballistic missiles (SLBMs)**, and heavy bombers equipped for nuclear weapons is capped at **700**.
- A further limit of **800** is placed on deployed and non-deployed launchers.

Reduction in Global Nuclear Risks:

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- It builds on previous treaties like START I (1991) and **SORT** (Moscow Treaty, 2002), furthering efforts to reduce nuclear stockpiles.

PM Modi at G 7

Why in News? Prime Minister Shri Narendra Modi recently participated in the Outreach Session of the G7 Summit in Kananaskis , Canada.

Relevance : UPSC Pre & Mains

Prelims : G 7

Mains : GS 2/ 3 IR / Scince Tech./Defence

Key Points of Prime Minister's Address:

Energy Security and Sustainable Development:

- Emphasized the principles of availability, accessibility, affordability, and acceptability in energy security.
- Highlighted India's achievements:
  - Electricity connections in almost all homes.
  - One of the lowest per-unit electricity costs globally.
  - Achieving Paris Commitments ahead of time.
  - Renewable energy contributing to **50% of installed capacity, targeting 500 GW** by 2030.
- Focus on **Green Hydrogen, Nuclear Energy, Ethanol Blending**, and clean energy initiatives like:
  - International Solar Alliance (ISA).
  - Coalition for Disaster Resilient Infrastructure (CDRI).
  - Global Biofuels Alliance.
  - Mission LiFE (Lifestyle for Environment).

Global South and Energy Transition:

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- Urged collective action for energy transition with the spirit of "**not I, but us.**"
- Addressed the disproportionate impact of global tensions on the Global South.
- Advocated bringing Global South concerns to the world stage.

Terrorism and Global Accountability:

- Condemned the recent terrorist attack in Pahalgam as an attack on humanity.
- Called for unity against terrorism, holding supporters accountable.
- Criticized double standards in addressing terrorism and questioned global commitment to tackling the issue.

Technology, AI, and Energy:

- Emphasized the synergy between technology, AI, and renewable energy to meet growing energy demands.
- Focused on:
    - **Solar Energy, Small Modular Reactors,** smart grids, and green energy corridors.
    - Development of AI-powered solutions like weather prediction apps and '**BHASHINI**' for language inclusivity.
    - Democratisation of technology through Digital Public Infrastructure.

Human-Centric Approach to AI:

- Advocated for AI tools that enhance human dignity and empowerment.
- Highlighted India's diverse and rich data as a foundation for inclusive AI development.
- Stressed the need for global governance of **AI to balance innovation** with accountability.

Suggestions on AI Governance:

- Develop international governance for AI to address concerns while promoting innovation.
- Strengthen supply chain resilience for critical minerals and technologies.
- Mandate watermarking of AI-generated content to combat deep fakes.

8. Cooperation Over Competition

- Called for cooperation in technology rather than competition.
- Promoted the principle of "Sabka Saath, Sabka Vikas, Sabka Vishwas, aur Sabka Prayas" (**Together for Everyone's Progress).**
- Announced the **AI Impact Summit** to be held in India next year.

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Group of Seven (G7):

The **Group of Seven (G7)** is an intergovernmental organization of the world's major advanced economies. It serves as a platform for addressing global economic issues and fostering international cooperation on pressing challenges such as climate change, security, and development.

- Represents **~40% of global GDP** and major industrialized economies.

Members:

The G7 consists of the following countries:

1. **United States/United Kingdom/Germany**
2. **France**
3. **Japan**
4. **Canada**
5. **Italy**

Additionally, the **European Union (EU)** participates in G7 meetings as a non-enumerated member.

Key Features

- **Foundation**: Established in **1975 as the G6, Canada joined in 1976, forming the G7.**
- **Purpose**: Originally aimed at discussing economic policies and crises; now addresses broader global challenges.
- **Annual Summits**: Leaders of member countries meet annually to discuss global issues and develop collective responses.
- **Rotating Presidency**: Each year, a member country assumes the presidency, hosting the summit and setting its agenda.

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Sixteenth Finance Commission (SFC)

Why in News? The Sixteenth Finance Commission (SFC), set to recommend financial devolution formulas effective from April 1, 2026, is under scrutiny due to States' demands for an increased share in the divisible pool of central taxes. **With 22 out of 28 States** advocating for

their share to rise from **41% to 50%,** concerns about the Centre's increasing reliance on non-shareable cesses and surcharges have sparked debates on cooperative federalism and fiscal balance

Relevance : UPSC Pre & Mains

Prelims : SFC

Mains : GS 3/ Economy

Key Points

States' Demand for Increased Share:

- **Current Share**: States receive **41% of the divisible pool** of tax collections.
- **Demand**: Many States, including those governed by the BJP, are asking for an increase to 50%.
- **Rationale**:
    - Centre's rising non-shareable revenue through cesses and surcharges (12.8% in **2015-20 to 18.5% in 2020-24**).
    - Declining effective share of States in the Centre's gross tax revenue (from **35%** pre-pandemic to **31% post-pandemic**).
    - Limited avenues for States to raise revenue due to the Goods and Services Tax (GST).

Issues with Horizontal Devolution Formula

- **Weightage**: Current formula prioritizes population and income distance.
- **Impact**:
    - Economically progressive States (e.g., Southern States) feel penalized for better governance and performance.
    - Calls for a more balanced approach that considers performance and specific State needs.

Challenges in Increasing Vertical Devolution:

- **Centre's Stance**:
    - Rising expenditures on defense and capital projects make the Centre reluctant to reduce its share.
    - A sudden 9% jump to 50% could disrupt fiscal stability.

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- **Need for Compromise**: A modest increase in devolution may balance States' demands and fiscal prudence.

Recommendations for the Finance Commission:

- **Capping Cesses and Surcharges**: Introduce a fixed percentage cap on non-shareable cesses and surcharges.
- **Inclusion in Divisible Pool**: Surplus collections from cesses and surcharges should be included in the divisible pool.
- **Revising Horizontal Devolution Formula**: Balance States' needs, area, and performance in the distribution formula.
- **Strengthening Cooperative Federalism**: Foster trust between the Centre and States through a more equitable fiscal compact.

About the Sixteenth Finance Commission (SFC):

Purpose and Role

- Established under **Article 280** of the Indian Constitution.
- Recommends the distribution of tax revenues between the **Centre and the States** (vertical devolution).
- Determines the allocation among States (horizontal devolution).

Tenure and Implementation:

- Recommendations are valid for five years.
- The SFC's recommendations will take effect from April 1, 2026, succeeding the **Fifteenth Finance Commission's period (2021–26).**

Key Mandates

- **Vertical Devolution**: Decide the percentage of tax revenues shared with States.
- **Horizontal Devolution**: Frame a formula for distributing the States' share based on parameters like population, income distance, and area.
- **Special Grants**: Recommend grants for specific purposes or addressing fiscal imbalances.

Global Observance of World Day against Desertification and Drought

Why in News ? India recently participated in the global observance of the World Day to Combat Desertification and Drought, reinforcing its dedication to sustainable land management and climate resilience.

Relevance : Pre & Mains

Prelims: NAAPC/UNCCD

Mains : GS 1- Geo/ GS 3 –Environment

Established: By the United Nations General Assembly in 1994, observed annually on June 17.

Purpose: Raises awareness about the critical need for sustainable land management and collective action to combat desertification.

Theme for 2025: "Restore the Land. Unlock the Opportunities."

Understanding Desertification:

- **Definition by UNCCD**: Desertification refers to "land degradation in arid, semi-arid, and dry sub-humid areas caused by factors such as climatic variations and human activities."
- **Global Impact**: Land degradation accelerates, costing the global economy $878 billion yearly, with **Africa and Asia**, particularly the **Sahel, Middle East, and Central Asia**, being the most affected regions.
- **India's Scenario**: Per ISRO's 2021 Desertification and Land Degradation Atlas, 29.7% of India's total geographical area is experiencing desertification or land degradation.
- **UNCCD's Role**: The United Nations Convention to Combat Desertification promotes policies for sustainable land use and climate resilience.

Causes of Desertification:

- **Environmental Factors**: Drought, erratic rainfall, wind and water erosion, and climate change.
- **Human Activities**: Overgrazing, deforestation, unsustainable agriculture, urbanization, industrialization, excessive groundwater extraction, poor irrigation practices, soil salinization, mining, and infrastructure development.

Consequences of Desertification:

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- **Environmental**: Reduced soil fertility, biodiversity loss, diminished groundwater recharge, intensified climate change due to lower carbon sequestration, and increased dust storms and sand encroachment.
- **Economic**: Decreased agricultural productivity, loss of livelihoods for farmers and pastoralists, heightened rural poverty, food insecurity, migration pressures, and significant costs for restoration and irrigation infrastructure.
- **Social**: Forced migration, resource-based conflicts, and erosion of traditional and indigenous land management knowledge.
- **Geopolitical**: Fuels transboundary tensions over water, land, and food security, especially in vulnerable regions like the Sahel and Indo-Gangetic plains.

India's Initiatives:

- **National Action Plan on Climate Change (NAPCC)**: Includes the National Mission on Sustainable Agriculture and Green India Mission to tackle land degradation.
- **Afforestation Efforts**: The National Afforestation Programme, Green India Mission, Forest Fire Protection & Management Scheme, and Compensatory Afforestation Fund Management and Planning Authority (CAMPA) promote forest conservation and expansion.
- **Desert Development Programme (DDP)**: Focuses on arid zones through integrated watershed management.
- **Coastal Ecosystem Conservation**: Annual Management Action Plans under the National Coastal Mission protect mangroves and coral reefs in coastal states and Union Territories.

Global Commitments

- **UNCCD**: India, a member since 1996, hosted the 14th Conference of Parties (COP-14) in New Delhi in 2019.
- **Bonn Challenge**: India committed to restoring 13 million hectares of degraded land by 2020 and an additional 8 million hectares by 2030.
- **2030 Agenda (SDG 15.3)**: India aims to achieve Land Degradation Neutrality.

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Indus Valley Script

Why in News? The Archaeological Survey of India (ASI) is organizing an **international conference** to discuss the decipherment of the **Indus Valley script**, marking a significant step towards advancing research on the Harappan civilization.

Relevance : UPSC Pre & Mains

Prelims : Indus Valley script/ASI

Mains : GS 1/ Art & Culture

Key Points:

Event Details:

- Organized by the **Archaeological Survey of India (ASI).**
- Scheduled from **August 20 to 22** at the **Pt. Deendayal Upadhyay Institute of Archaeology**, Greater Noida.

Focus of the Conference:

- The theme is **"Decipherment of the Indus Script: Current Status and the Way Forward."**
- Aimed at bringing together national and international experts working on Harappan civilization and culture.

About Indus Valley script:

The **Indus Valley script**, used by the **Harappan civilization** (2600–1900 BCE), is one of the most fascinating and enigmatic writing systems in the world. Despite extensive research, the script remains undeciphered.

Key Features

Nature of the Script:

- Composed of **over 400–600 pictorial symbols** (glyphs).
- It is often engraved on **seals, pottery, tablets, and other artifacts**.
- The symbols are pictorial in nature, resembling humans, animals, plants, and geometric shapes.

Mediums of Usage:

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- Found on **steatite seals, terracotta tablets, copper plates, pottery, and amulets**.
- The inscriptions are typically brief, with an average length of 5 characters.

Direction of Writing:

- Primarily written from **right to left**, as deduced from the spacing of symbols.
- Some inscriptions have a **boustrophedon pattern** (alternate lines written in opposite directions).

Function:

- Likely used for **administrative and commercial purposes**.
- Possibly denoted **ownership, trade transactions**, or held religious significance.

Geographical Spread:

- Symbols have been discovered across major **Harappan sites** such as **Mohenjo-Daro, Harappa, Lothal, Dholavira, and Kalibangan**.
- Arti bearing the script have also been found in regions linked to the **Mesopotamian trade network**.

Challenges in Decipherment

No Bilingual Texts:

- Unlike the Rosetta Stone for Egyptian hieroglyphs, no bilingual inscription exists to compare the Indus script with a known language.

Short Inscriptions:

- Most inscriptions are too brief (average 5 characters) for meaningful linguistic analysis.

Unknown Language Family:

- The linguistic lineage of the script is uncertain, and theories suggest connections to **Dravidian, Indo-Aryan**, or even unrelated language families.

Symbol Complexity:

- The script may be **logo-syllabic**, combining symbols for words (logograms) and syllables, further complicating decipherment.

Theories on the Script

Dravidian Hypothesis:

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- Suggests that the script represents an early form of the **Dravidian languages**, particularly Proto-Tamil.

Indo-Aryan Hypothesis:

- Argues that the symbols are linked to **early Indo-European languages**.

Non-Linguistic Hypothesis:

- Some scholars propose that the symbols are **non-linguistic**, serving as religious or clan markers rather than a writing system.

Mathematical Patterns:

- Recent computational studies suggest the script might follow the structure of a **formal language**.

Green India Mission (GIM) Revised Roadmap:

Why in News? The Centre released a revised roadmap for the **National Mission for Green India (Green India Mission or GIM)** on June 17, 2025. The updated plan focuses on region-specific restoration efforts to combat climate change and land degradation.

Relevance : UPSC Pre & Mains

Prelims : GIM/other related initiatives

Mains : GS 3/ Environment.

Key Highlights:

Objective and Achievements

- **Launched**: 2014 under the National Action Plan on Climate Change (NAPCC).
- **Core Objectives**:
  - Combat climate change by increasing forest and green cover.
  - Restore degraded ecosystems.
  - Improve livelihoods for forest-dependent communities.
- **Target**:

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- Increase forest/tree cover on 5 million hectares.
- Improve forest quality on an additional 5 million hectares.

- **Achievements** (2015-2021):
  - Tree plantation and afforestation activities across **11.22 million hectares**.
  - **Funding (2019-2024)**:
    - **Allocated**: Rs 624.71 crore
    - **Utilized**: Rs575.55 crore (across 18 states).

Revised Roadmap

Focus Areas:

- Ecological restoration in **Aravalli ranges, Western Ghats, Himalayas, and mangrove ecosystems**.
- Area-specific restoration practices aligned with ecological needs.

Key Projects:

Aravalli Green Wall Project:

- Target: Combat degradation and desertification in the Aravallis.
- Coverage: 8 lakh hectares across 29 districts in 4 states.
- Key Activities: Forest area restoration, grasslands and water systems rejuvenation, native species plantations.
- Estimated Cost: ₹16,053 crore.
- Aim: Buffer zone creation of 5 km around the mountain range to mitigate dust pollution and sandstorms.

Western Ghats Restoration:

- Activities: Afforestation, groundwater recharge, eco-restoration of abandoned mining sites.

Land Degradation and Desertification Combat Strategy:

- **Current Status**:
  - 97.85 million hectares (1/3rd of India's geographical area) degraded (2018-19, ISRO Atlas).
- **National Goals (2030)**:
  - Create a **carbon sink of 2.5-3 billion tonnes** via forest and tree cover.

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- **Role of Natural Carbon Sinks**:
    - Forests, restored grasslands, wetlands, and mountain ecosystems to act as barriers and sponges for climate impact.

Significance:

1. Strengthens India's climate commitments under the **Paris Agreement** and UN Framework Convention on Climate Change (UNFCCC).
2. Addresses critical issues like dust pollution, desertification, and ecological degradation.
3. Provides livelihood support to forest-dependent communities.
4. Enhances resilience against the adverse impacts of climate change.

Heavy Water Reactors (HWR)

Why in News ? Israel has recently launched **airstrikes** on Iran's **Arak heavy water reactor**, highlighting concerns about the potential production of **plutonium** for atomic weapons.

Relevance : Pre & Mains

Prelims: **HWR/IAEA**

Mains : GS II- / GS 3 –Environment

- The strikes targeted several Iranian nuclear sites, including the **Natanz enrichment facility**, **centrifuge workshops near Tehran**, and **laboratories in Isfahan**.
- The **International Atomic Energy Agency (IAEA)** reiterated that nuclear facilities should not be military targets.

About Iran's Heavy Water Reactor:

Arak Reactor

Location:

- Situated 250 km southwest of Tehran.

Purpose:

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- Can produce **plutonium**, a key material for nuclear bombs, raising international concerns.

Current Status:

- Not operational; lacks uranium fuel.
- No nuclear material release occurred during the recent strike.

Historical Background

- Iran secretly sought a nuclear weapon program after the **1980s Iran-Iraq war**.
- Initial attempts to purchase a heavy water reactor from four nations failed, prompting Iran to construct its own facility.
- Similar heavy water reactors exist in **India, Pakistan, and Israel**.

Significance in Nuclear Deals:

- Became a contentious issue after the **2018 U.S. withdrawal** from the **Joint Comprehensive Plan of Action (JCPOA)** (Iran nuclear deal).
- In 2019, Iran's nuclear official Ali Akbar Salehi claimed Iran secretly bought **extra parts** for the reactor despite JCPOA restrictions.

IAEA Concerns

- Iran imposed restrictions on IAEA inspections, leading to the loss of "continuity of knowledge" about Iran's **heavy water production**.

Why Heavy Water Reactors are Important?

Function:

- Unlike light water reactors, heavy water reactors use deuterium oxide (heavy water) to slow down neutrons, enabling the use of natural uranium.
- Capable of producing **weapons-grade plutonium** as a by-product.

Global Context:

- Heavy water reactors are pivotal in nuclear energy and weaponization strategies.

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Light Water Reactors (LWRs) vs. Heavy Water Reactors (HWRs):

Light Water Reactors (LWRs)

- LWRs use **ordinary water (H_2O)** as both a coolant and a moderator in the nuclear fission process.

Key Features

- **Coolant/Moderator**: Ordinary water.
- **Fuel**: Requires **enriched uranium** (typically 3-5% U-235).
- **Operation**: Water slows down neutrons to sustain the fission process.

Advantages

Widely Used: Most common type of reactor globally, including in the U.S., Europe, and Japan.

Fuel Availability: Uses enriched uranium, widely available through established supply chains.

Safety: Inherent safety mechanisms due to water acting as a coolant and neutron absorber.

Disadvantages:

High Fuel Cost: Requires uranium enrichment.

Waste Management: Produces spent nuclear fuel that requires long-term storage.

Not Optimal for Weaponization: Does not efficiently produce weapons-grade plutonium.

Heavy Water Reactors (HWRs):

- HWRs use **heavy water (D_2O)**, which contains deuterium, as a coolant and moderator.

Key Features:

- **Coolant/Moderator**: Heavy water.
- **Fuel**: Can use **natural uranium** (0.7% U-235), eliminating the need for enrichment.
- **Operation**: Heavy water is more effective at slowing down neutrons, sustaining fission with natural uranium.

Advantages:

1. **No Enrichment Required**: Reduces fuel preparation costs.
2. **Efficient Neutron Economy**: Can sustain chain reactions with natural uranium.
3. **Versatile**: Can be used for both civilian and military purposes (e.g., plutonium production).

Disadvantages:

1. **Cost of Heavy Water**: Production and maintenance of heavy water are expensive.
2. **Proliferation Risk**: Can produce **weapons-grade plutonium** as a by-product.
3. **Complex Design**: Requires advanced infrastructure for operation.

Global Usage

- **Light Water Reactors**:
  - Examples: Pressurized Water Reactors (PWRs), Boiling Water Reactors (BWRs).
  - Used in countries like the U.S., Japan, and South Korea.
- **Heavy Water Reactors**:
  - Example: **CANDU reactors** (Canadian Deuterium Uranium reactors).
  - Prominent in **India**, **Canada**, and **Pakistan** due to reliance on natural uranium.

World Investment Report 2025 : UNCTAD

Why in News? The **World Investment Report 2025**, released by **UN Trade and Development (UNCTAD)** on **June 19, 2025**, highlights a **11% decline in global foreign direct investment (FDI)** in 2024, marking the **second consecutive year** of decline.

The report's release comes ahead of the **4th International Conference on Financing for Development (FfD4)**.

Relevance : UPSC Pre & Mains

Prelims : UNCTAD

Mains : GS 2/ 3

Key Highlights:

Global FDI Trends:

- **Global FDI** rose by **4%** in 2024 to **$1.5 trillion**, but this increase was driven by **volatile financial conduit flows** through European economies acting as investment transfer points.

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- The **11% decline** in productive FDI reflects a broader slowdown, exacerbated by **geopolitical tensions**, **trade fragmentation**, and **intensifying industrial policy competition**.
- Multinational companies are prioritizing **short-term risk management** over long-term strategies, particularly in sectors tied to **national security**, **supply chain reconfiguration**, and **shifting trade policies**.

Regional Disparities

- **Developed Economies**: FDI dropped by **22%**, with Europe experiencing a sharp **58% plunge**. North America, however, saw a **23% increase**, led by the **United States**.
- **Developing Economies**:
  - **Africa**: FDI surged by **75%**, largely due to a single large project in **Egypt**. Excluding this, inflows still grew by **12%**, supported by **investment facilitation** and **regulatory reforms**.
  - **Asia**: Remained the **top FDI recipient** globally, despite a **3% decline**. **Southeast Asia** saw a **10% rise** to **$225 billion**, the second-highest level on record.
  - **Latin America and the Caribbean**: Total flows fell by **12%**, though **greenfield project announcements** increased in **Argentina**, **Brazil**, and **Mexico**.
  - **Middle East**: Maintained strong inflows due to **economic diversification** in the Gulf region.
- **Structurally Vulnerable Economies**:
  - **Least developed countries**: FDI rose by **9%**.
  - **Small island developing states**: FDI increased by **14%**.
  - **Landlocked developing countries**: FDI fell by **10%**.
  - Investment in these groups remains **highly concentrated** in a few countries.

Sectoral Insights

- **Digital Economy**: FDI grew by **14%**, driven by **information and communication technology manufacturing**, **digital services**, and **semiconductors**. However, **80% of new digital projects** were concentrated in just **10 countries**, leaving many developing economies excluded due to gaps in **infrastructure**, **regulations**, and **skills**.

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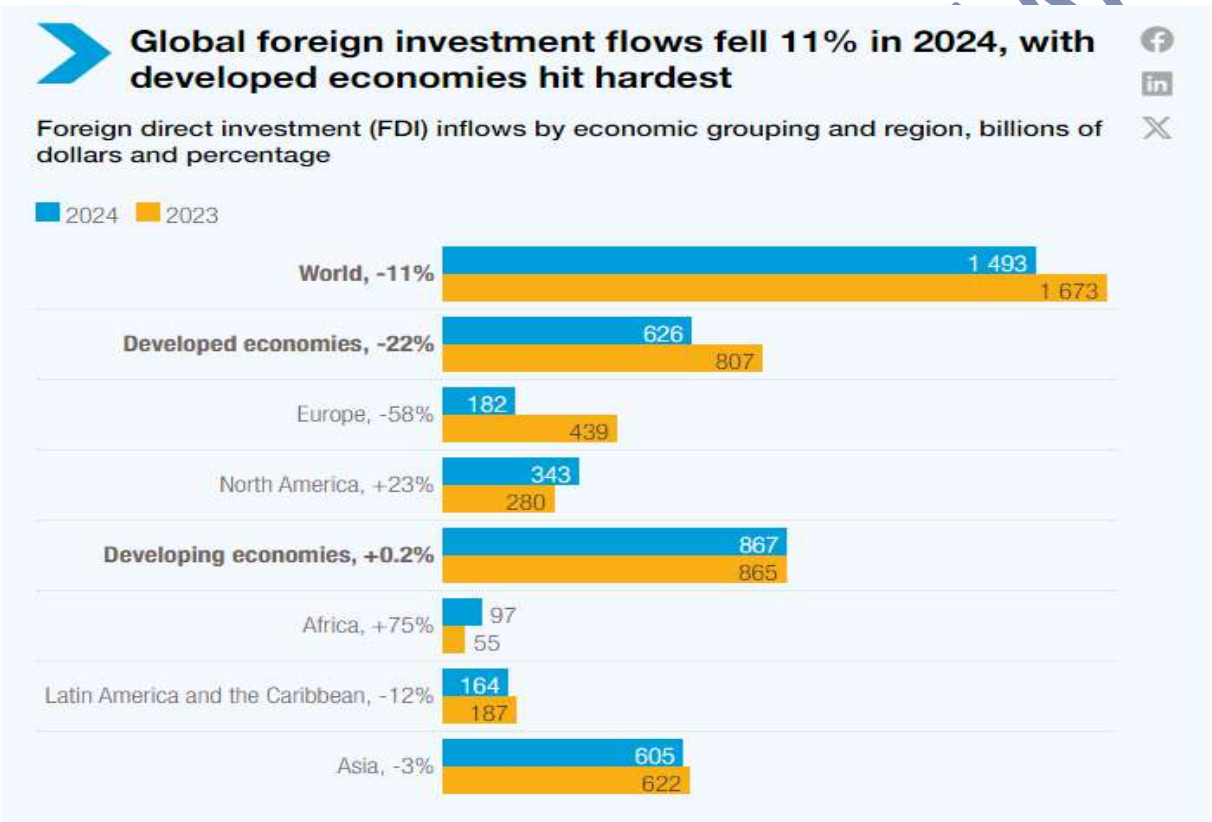
- Key sectors like **infrastructure**, **energy**, **technology**, and **job-creating industries** are seeing **stagnating or bypassing capital**, particularly in developing economies.

Challenges and Gaps

- The report warns that current FDI levels are insufficient to meet global needs, with a **$4 trillion annual financing gap** for sustainable development in developing countries.
- **Geopolitical tensions**, **financial risks**, and **uncertainty** are eroding **long-term investor confidence**, redrawing global investment maps.



Proposed Solutions:

UNCTAD calls for **smarter capital** and **coordinated reforms** to align investments with **sustainable development goals**. A **multilateral agenda** focuses on seven priority areas:

1. **Improving data and AI governance** for sound digital development strategies.
2. **Developing policy toolkits** tailored to digital investment needs in developing countries.
3. **Advancing global rules** for digital trade and investment through multilateral dialogue.
4. **Strengthening digital infrastructure** via global partnerships and blended finance.
5. **Building innovation ecosystems** through university-industry collaboration.

6. **Enhancing digital skills** with targeted education, training, and entrepreneurship.
7. **Promoting responsible digital investment** by managing risks and advancing sustainability standards.

About UNCTAD

- **United Nations Trade and Development (UNCTAD)**, established in **1964**, is a permanent intergovernmental body of the United Nations headquartered in **Geneva, Switzerland**.
- It aims to promote **inclusive and sustainable development** through trade, investment, finance, and technology, particularly for **developing countries**.
- UNCTAD supports these nations in integrating into the **global economy** while addressing challenges like poverty, inequality, and economic instability.

Structure:

- **Membership**: 195 member states.
- **Governance**: Overseen by the **Trade and Development Board**, with quadrennial conferences setting priorities.
- **Leadership**: Currently led by Secretary-General **Rebeca Grynspan** (as of 2025).

Reports released by UNCTAD:

- World Investment Report
- Trade and Development Report
- Digital Economy Report
- Economic Development in Africa Report
- Commodities and Development Report
- Least Developed Countries Report
- Technology and Innovation Report
- Review of Maritime Transport
- Global Trade Updates
- Investment Trends Monitor
- Handbooks and Manuals

Global Drought Outlook Report: Latest Insights and Implications

Why in News? The **Organisation for Economic Co-operation and Development (OECD)** recently released its **Global Drought Outlook: Trends, Impacts and Policies to Adapt to a Drier World**.

Relevance : UPSC Pre & Mains

Prelims : OECD

Mains : GS 2/3/ Environment.

Overview of the Report:

The **Global Drought Outlook Report** is a roadmap for navigating how droughts are reshaping economies, ecosystems, and societies. It examines the link between climate change, human activities, and worsening droughts, offering strategies for adaptation in a warming world. By analyzing current trends and future projections, the report highlights the urgent need for **proactive drought management policies** to address an increasingly drier future.

Key Findings:

Rising Frequency and Severity of Droughts:

- **40% of the world's land area** is now facing more frequent and severe droughts due to climate change and human activities like deforestation, urban expansion, and unsustainable agriculture.
- Since the **1980s**, **37% of global land** has experienced significant soil moisture loss, worsening water scarcity in affected regions.
- **Water levels in rivers and aquifers** are declining globally, with many groundwater tables showing **consistent reductions** in recent decades.

Escalating Economic Costs:

- The **economic toll of droughts** is rising rapidly, with the cost of an average drought event in **2025 estimated to be at least double** that of 2000.
- By **2035**, drought-related **economic losses are projected to increase by at least 35%**, impacting sectors such as agriculture, tourism, food production, river transport, and hydropower.

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- Globally, **agriculture is the hardest hit**, with crop yields potentially declining by **up to 22%** in the driest years.

Human and Societal Impacts:

- Despite accounting for only **6% of natural disasters**, droughts cause **34% of disaster-related deaths**, according to the **World Meteorological Organization (WMO)**.
- Droughts exacerbate **poverty, inequality, and displacement**, particularly in vulnerable regions like **Sub-Saharan Africa**, where they drive migration and worsen social challenges.

Climate Change as a Major Driver:

- In a **4°C global warming scenario**, droughts could become **up to seven times more frequent and intense** compared to a world without climate change.
- Climate change has already made extreme droughts more likely, for example, increasing the probability of the **2022 European drought** by **up to 20 times** and the ongoing **North American drought** by **42%**.

Policy Recommendations for Resilience:

The **OECD** stresses that adaptation and proactive measures can significantly reduce drought impacts. Key **policy solutions** include:

- **Efficient Water Management**: Upgrading irrigation systems and reducing water withdrawals (which account for **70% of global water use** through irrigation) can ease pressure on water resources.
- **Soil and Ecosystem Restoration**: Restoring degraded soils and ecosystems can boost drought resilience and improve long-term agricultural productivity.
- **Agricultural Adaptation**: Promoting **drought-tolerant crops** and reorienting farming practices can minimize crop yield losses.
- **Urban Redesign**: Cities should adopt **water-sensitive designs** to better manage scarce resources during droughts.
- **Investment in Resilience**: Every **$1 invested in drought prevention** can yield **up to tenfold economic returns**, reducing immediate impacts and supporting sustainable development.

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- **Integrated Drought Management Plans**: Governments should develop **clear strategies** to prioritize measures, coordinate responses, and define responsibilities across public and private sectors.

About OECD:

- The **Organisation for Economic Co-operation and Development (OECD)** is an international body founded in **1961** to promote economic progress and world trade.
- Headquartered in **Paris, France**, it comprises **38 member countries**, primarily high-income economies with a strong commitment to democracy and market-based systems.
- **Mission**: The OECD aims to foster economic growth, improve living standards, and promote sustainable development globally. It works with member countries and over **100 non-member economies** to tackle issues like poverty, inequality, and environmental impacts of growth.
- **Structure**: The OECD is governed by the **OECD Council**, supported by the **Secretariat** and various committees focusing on areas like education, environment, and public governance. It is funded by member contributions based on the size of their economies.
- **Global Reach**: OECD members account for **62.2% of global GDP**, **three-quarters of world trade**, and **18% of the world's population**. The organization also engages with emerging economies like India, a key partner but **not a member**.

History: The OECD succeeded the **Organisation for European Economic Co-operation (OEEC)**, established in **1948** to manage Marshall Plan aid for post-World War II European reconstruction. It evolved into the **OECD in 1961** with the inclusion of the **U.S. and Canada.**

B-2 Spirit stealth bombers

Why in News? On June 21, 2025, the U.S. launched **Operation Midnight Hammer**, targeting Iran's nuclear facilities at Fordow, Natanz, and Isfahan using **B-2 Spirit stealth bombers** armed with **GBU-57 Massive Ordnance Penetrator bombs**. Former President Donald Trump hailed it as a "spectacular military success," claiming Iran's nuclear capabilities were "obliterated." The 40-hour B-2 mission, noted by former Indian Air Force officer Ajay Ahlawat, has sparked global concerns over potential escalation.

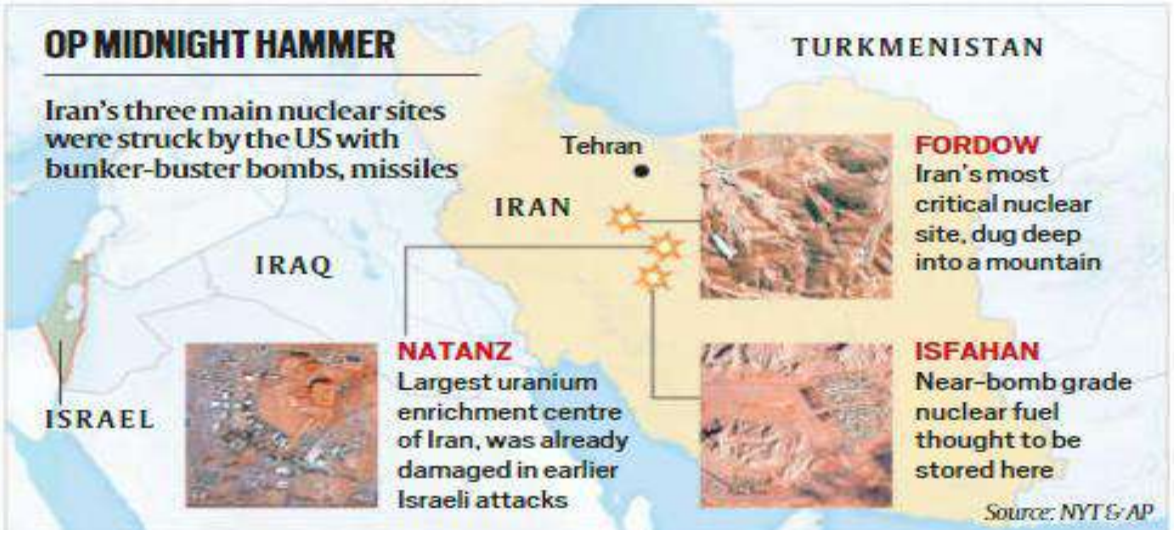
Relevance : UPSC Pre & Mains

Prelims : B 2 bomberes/ GBU-57

Mains : GS 3 Technology

Key Points:

- **Operation Midnight Hammer**:
  - Began June 21, 2025, at 00:01 ET, led by U.S. Central and European Commands.
  - Involved **125+ aircraft**, including **seven B-2s**, fighters, and refueling tankers.
  - Used deception tactics to bypass Iranian defenses.
- **B-2 Spirit Stealth Bombers**:
  - Flew from **Whiteman Air Force Base, Missouri**, for a **37–40-hour** round-trip.
  - Each B-2, costing **$2.1–2.2 billion**, carried two **30,000-pound GBU-57s**.
  - Stealth design minimizes radar detection, akin to a small bird.
- **GBU-57 Massive Ordnance Penetrator**:
  - **14 MOPs** dropped, with **6–12** on Fordow.
  - Each **$20 million** bomb penetrates **60 feet of concrete** or **200 feet of earth**.
- **Targeted Sites**:
  - **Fordow**: Fortified uranium enrichment site, hit by multiple MOPs, showing craters.
  - **Natanz**: Underground enrichment facility, struck by two MOPs.
  - **Isfahan**: Nuclear research site, targeted with **30 Tomahawk missiles**.



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B-2 Spirit Stealth Bomber: An Overview

The **B-2 Spirit** is an advanced stealth bomber developed by the United States for long-range, strategic bombing missions. Manufactured by **Northrop Grumman**, the B-2 is considered one of the most advanced and iconic military aircraft in the world, capable of delivering both conventional and nuclear payloads.

Key Features

Stealth Capabilities

- Uses advanced stealth technology to evade radar detection.
- Features a unique "flying wing" design to minimize its radar cross-section.
- Coated with radar-absorbent material for enhanced invisibility to enemy sensors.

Payload Capacity

Can carry up to **40,000 pounds** of bombs, including:

- Conventional bombs.
- Precision-guided munitions.
- Nuclear weapons.

Range and Endurance

- Unrefueled range of approximately **6,900 miles** (11,100 km).
- With aerial refueling, it can conduct missions globally, making it a vital strategic asset.

Design and Technology

- Features **fly-by-wire** controls for superior maneuverability.
- Equipped with state-of-the-art avionics and navigation systems.
- Minimal heat signature to reduce detectability by infrared sensors.

Critical Tiger Habitat (CTH)

Why in News? A recent plan to rationalize the boundary of Sariska Tiger Reserve's Critical Tiger Habitat (CTH) offers a potential lifeline to over 50 marble and dolomite mines closed last year due to a Supreme Court order.

Relevance : UPSC Pre & Mains

Prelims : CTH/ SC-NBWL

Mains : GS 3/ Environment.

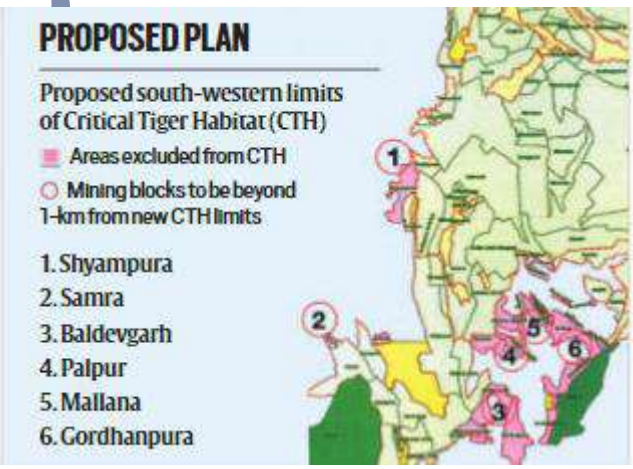
Key Points:

Revised Boundaries:

- The Rajasthan government has proposed to redefine the boundaries of the **Critical Tiger Habitat (CTH**) in the Sariska Tiger Reserve.
- Approximately 48.39 square kilometers of land, referred to as "**peripheral degraded areas,**" are being considered for exclusion from the CTH.
- The move aims to exclude areas with ongoing mining activities from CTH designation.

Proposed Plan:

- The proposal suggests specific areas like Shyampura, Samra, Baldeogarh, **Palpur, Mallana, and Gordhanpura** be excluded from the CTH.
- Mining blocks and other areas within a one-kilometer radius of the CTH are also being considered for exclusion.



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Double-Engine Push:

- The state government's initiative will be discussed by the Standing Committee of the **National Board of Wildlife (SC-NBWL**).
- The SC-NBWL meeting was initially scheduled for June 11 but has been deferred to June 26 to incorporate suggestions.
- Rajasthan has added 881.89 square kilometers of land to the Sariska CTH since 2008, but the status of certain areas is pending legal scrutiny.

Benefits:

- The reclassification of these areas will facilitate mining and other human activities without violating wildlife protection laws.
- It is expected to improve relations between local communities and tiger reserve management by resolving land-use conflicts.

Field Impacts:

- Sariska has over 100 marble, dolomite, and other mines, with **54 active and 46** inactive due to legal or permitting issues.
- The changes will benefit these industries while maintaining the protected core area for tiger conservation.

On the Ground:

- Sariska Tiger Reserve spans approximately 777.63 square kilometers.
- The proposed plan will focus on protecting the core habitat while allowing sustainable use of less critical areas.

About Critical Tiger Habitat (CTH):

Critical Tiger Habitat (CTH) refers to areas within tiger reserves that are legally notified under the **Wildlife Protection Act, 1972**, for the exclusive purpose of tiger conservation. These areas are specifically demarcated to provide the best possible environment for tiger populations to thrive.

Key Features of Critical Tiger Habitat:

Legal Framework:

- CTHs are notified under **Section 38V of the Wildlife Protection Act, 1972**.
- They are established as inviolate areas, meaning human activities like mining, logging, and human settlements are prohibited to ensure tiger survival.

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Purpose:

- To conserve tigers and their prey species by protecting their habitats.
- To maintain ecological balance and ensure biodiversity.

Identification Process:

- Scientific studies are conducted to identify critical areas for tigers based on population density, prey base, and habitat quality.
- Recommendations are made by the **National Tiger Conservation Authority (NTCA)**.
- The final notification is issued by the respective state government.

Human Settlements:

- If there are **human settlements within the CTH**, the government may relocate these communities under a voluntary resettlement scheme.
- Rehabilitation programs offer alternate lands, monetary compensation, and other facilities for affected families.

Core and Buffer Zones:

Core Zone: Comprises the CTH; strictly protected with no human disturbances.

Buffer Zone: Surrounds the core and allows limited human activity to reduce pressure on the core area.

Monitoring:

- **The NTCA and State Forest Departments** are responsible for monitoring and managing CTHs.
- Periodic reports assess tiger population trends and habitat conditions.

Examples of CTH in India:

Sariska Tiger Reserve (Rajasthan):

- A well-known tiger reserve where reclassification of CTH boundaries has been recently proposed to exclude mining areas.

Corbett Tiger Reserve (Uttarakhand):

- Known for its dense tiger population and rich biodiversity.

Sundarbans Tiger Reserve (West Bengal):

- A unique mangrove ecosystem providing habitat for the **Royal Bengal Tiger**.

Estimates Committees

Why in News? The **Lok Sabha Speaker has recently** inaugurated the **National Conference of Estimates Committees** in **Mumbai** to commemorate **75 years** of the committee's existence, highlighting its enduring role in ensuring **transparent and accountable**

Relevance : UPSC Pre & Mains

Prelims : Estimates Committees/other parliamentary committees

Mains : GS 2

About Estimates Committee :

The **Estimates Committee** is one of the three key **financial committees** of the Indian Parliament, alongside the **Public Accounts Committee (PAC)** and the **Committee on Public Undertakings (CoPU)**. Constituted under the **Rules of Procedure and Conduct of Business in Lok Sabha**, it is the **largest parliamentary committee**, comprising **30 members** exclusively from the **Lok Sabha**. Its primary objective is to examine **budget estimates** presented in Parliament, suggest **economies** in public expenditure, and propose **alternative policies** to enhance administrative efficiency.

Historical Background:

- **Origin**: The concept of the Estimates Committee traces back to the **British Era** in the **1920s**, when it was established to review government expenditure. However, the first Estimates Committee of **Independent India** was set up in **1950**, post the adoption of the **Constitution of India**.
- **Fiscal governance**.
- **Evolution**: Since its inception, the committee has published **1118 reports** (as of 2018), including **624 original reports** and **494 action-taken reports**, reflecting its extensive oversight over government spending.

Composition:

- **Membership**: The Estimates Committee consists of **30 members**, all elected annually from the **Lok Sabha** through **proportional representation** using a **single transferable vote** system. This ensures representation from all **political parties**.

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- **Eligibility**: **Ministers** are not eligible to be members. If a member is appointed as a minister during their term, they cease to be a committee member from the date of appointment.
- **Chairperson**: The **Lok Sabha Speaker** appoints the **chairperson**, who is invariably from the **ruling party** or coalition. For instance, **Sanjay Jaiswal** was appointed chairperson for the **2024-25 term**.
- **Tenure**: The committee's term is **one year**, with members eligible for re-election.

Functions:

As outlined in **Rule 310** of the Rules of Procedure and Conduct of Business in Lok Sabha, the Estimates Committee performs the following key functions:

1. **Scrutiny of Expenditure**: Examines **budget estimates** to identify potential **economies**, improvements in **organization**, **efficiency**, or **administrative reforms** consistent with the policy underlying the estimates.
2. **Policy Suggestions**: Proposes **alternative policies** to enhance **efficiency** and **economy** in administration.
3. **Financial Oversight**: Assesses whether funds are allocated within the **limits of the policy** implied in the estimates.
4. **Presentation Improvements**: Recommends formats for presenting **budget estimates** to Parliament for greater clarity and transparency.
5. **Selective Review**: Chooses specific **ministries**, **departments**, or **statutory bodies** for detailed scrutiny each year, as it cannot review all budgets annually.

The committee is often referred to as the **Continuous Economy Committee** due to its ongoing efforts to promote fiscal prudence.

Limitations:

Despite its critical role, the Estimates Committee operates within certain constraints:

- **Post-Voting Review**: The committee can only examine **budget estimates** after they are **voted** by Parliament, not before.
- **No Policy Scrutiny**: It lacks authority to question the **policies** underlying the estimates, limiting its scope to implementation aspects.

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- **Advisory Role**: Recommendations are **advisory** and **non-binding** on Parliament or the government.
- **Selective Examination**: Cannot review **all budgets** annually; it examines departmental budgets over multiple years.
- **Exclusion**: Does not oversee **public undertakings**, which fall under the **Committee on Public Undertakings (CoPU)**.

Significance:

The Estimates Committee is a cornerstone of **parliamentary oversight**, offering several benefits:

- **Accountability**: Holds the **government** accountable by scrutinizing expenditure and ensuring funds are used efficiently.
- **Efficiency**: Promotes **economies** in public spending, reducing wasteful expenditure.
- **Non-Partisan Approach**: Fosters a **cooperative** environment among MPs, encouraging consensus-building.
- **Stakeholder Engagement**: Consults **experts**, **civil society**, and the **public** to gather diverse perspectives.
- **Time Management**: Reduces the **workload** of Parliament by conducting detailed scrutiny outside the main sessions.
- **Policy Impact**: Its recommendations, such as those on **GDP estimation** or **Ganga rejuvenation**, influence administrative reforms and policy implementation.

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U.S. Military Bases in West Asia

Why in News ? After the US carried out airstrikes on Iran's nuclear facilities, Tehran has issued warnings of potential retaliation targeting US military bases in West Asia, escalating regional tensions.

Relevance : UPSC Pre & Mains

Prelims : Military Bases

Mains : **GS** 2/GS 3 Security

Overview:

The U.S. operates an extensive network of **military bases** and **facilities** in West Asia, with approximately **40,000 to 50,000 troops** stationed across at least **19 sites** as of mid-2025. These bases, both **permanent** and **temporary**, support operations under the **U.S. Central Command (CENTCOM)**, covering a region from **Egypt** to **Kazakhstan**. The presence has grown since **October 2023**, driven by escalating tensions with **Iran** and its proxies, including **Hamas**, **Hezbollah**, and the **Houthis**, as well as support for **Israel** during its conflict in **Gaza**. The bases facilitate **counterterrorism**, **air and missile defense**, **intelligence gathering**, and **naval operations** in strategic waterways like the **Persian Gulf** and **Red Sea**.

Key U.S. Military Bases in West Asia

Bahrain: Naval Support Activity (NSA) Bahrain:

- **Location**: Manama, Bahrain
- **Significance**: Hosts the **U.S. Navy's Fifth Fleet** and **U.S. Naval Forces Central Command (NAVCENT)**, overseeing operations in the **Persian Gulf**, **Red Sea**, **Arabian Sea**, and **Indian Ocean**. The base, established in **1948** on a former British naval facility, supports **9,000 personnel**, including military and civilian staff. Its **deep-water port** accommodates large vessels like **aircraft carriers** and houses **anti-mine vessels** and **logistical support ships**.

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- **Strategic Role**: Ensures **maritime security**, protects **oil shipping routes**, and counters **Iranian naval threats**. The base is critical for **regional deterrence** and has been targeted in Iranian rhetoric following U.S. airstrikes on Iran's nuclear facilities in **2025**.
- **Example**: In **2024**, NSA Bahrain coordinated naval operations to counter **Houthi attacks** on commercial shipping in the **Red Sea**, showcasing its role in maintaining **freedom of navigation**.

Qatar: Al Udeid Air Base

- **Location**: West of Doha, Qatar
- **Significance**: The **largest U.S. military base** in West Asia, established in **1996**, hosting approximately **10,000 troops** and **100 aircraft**, including **drones** and **combat aircraft**. It serves as the **forward headquarters** for **CENTCOM** and supports the **379th Air Expeditionary Wing**.
- **Strategic Role**: Central to operations in **Iraq**, **Syria**, and **Afghanistan**, it supports **logistics**, **command**, and **air operations** across the region. The base is pivotal for **counterterrorism missions** and **regional air superiority**.
- **Example**: In **January 2020**, a **U.S. drone strike** launched from Al Udeid killed **Qassem Soleimani**, Iran's Quds Force leader, highlighting its role in **high-profile operations**.

Kuwait: Camp Arifjan

- **Location**: 55 km southeast of Kuwait City, Kuwait
- **Significance**: A major **U.S. Army base** established in **1999**, hosting approximately **13,500 troops**. It serves as a **logistics**, **supply**, and **command hub** for **CENTCOM operations**.
- **Strategic Role**: Supports **troop deployments** to **Iraq** and **Syria**, facilitates **logistical operations**, and enhances **regional deterrence**. The base has been a key hub since the **1991 Gulf War**.
- **Example**: During **Operation Desert Shield** in **1990**, Camp Arifjan's predecessor facilities supported the deployment of **694,550 U.S. troops** to liberate Kuwait from Iraqi occupation.

United Arab Emirates: Al Dhafra Air Base

- **Location**: Abu Dhabi, UAE

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- **Significance**: Hosts approximately **3,500 troops** and advanced aircraft like **F-22 Raptor stealth fighters**, **drones**, and **AWACS** surveillance planes. It supports the **332nd Air Expeditionary Wing**.
- **Strategic Role**: Focuses on **reconnaissance**, **intelligence gathering**, and **combat air operations**. It bolsters **air and missile defense** with systems like **Patriot** and **THAAD**.
- **Example**: In **2025**, Al Dhafra supported **U.S. air operations** against **ISIS remnants** in Syria, showcasing its role in maintaining **regional security**.

Iraq: Al Asad and Al Harir Air Bases

- **Location**: Al Asad in Al-Anbar Governorate; Al Harir in Erbil, Iraq
- **Significance**: Host approximately **2,500 troops** as part of the **international coalition** against **ISIS**. Al Asad supports **air operations**, while Al Harir advises **Kurdish** and **Iraqi forces**.
- **Strategic Role**: Key nodes in the **NATO mission** to combat **ISIS** and stabilize Iraq. Both bases have faced **Iranian missile strikes**, notably in **2020** after Soleimani's killing.
- **Example**: In **January 2020**, Iran launched **ballistic missiles** at Al Asad in retaliation for Soleimani's death, causing **traumatic brain injuries** to U.S. troops but no fatalities.

Syria: Al-Tanf and Other Facilities

- **Location**: Al-Tanf and 12 smaller facilities across Syria
- **Significance**: Host approximately **900 to 2,000 troops**, primarily **Special Operations Forces**, training **Free Syrian Army rebels** and conducting **counterterrorism operations**.
- **Strategic Role**: Supports **anti-ISIS operations** and monitors **Iranian-backed militias**. Al-Tanf is a critical **forward operating site** near the **Iraq-Syria-Jordan border**.
- **Example**: In **October 2019**, U.S. forces at Al-Tanf facilitated **drone operations** to target **ISIS leadership**, including Abu Bakr al-Baghdadi.

Jordan: Multiple Facilities

- **Location**: Various sites, including near Amman
- **Significance**: Host approximately **2,936 troops**, supporting **air operations** and **training** with Jordanian forces.
- **Strategic Role**: Enhances **regional stability**, supports **counterterrorism**, and provides **logistical support** for operations in **Iraq** and **Syria**.

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- **Example**: In **2024**, Jordan-based U.S. forces coordinated with **Israeli forces** to counter **Iranian-backed threats**, strengthening bilateral defense ties.

Saudi Arabia: Prince Sultan Air Base

- **Location**: Near Riyadh, Saudi Arabia
- **Significance**: Hosts approximately **2,700 troops** and supports **air and missile defense** systems like **Patriot** and **THAAD**.
- **Strategic Role**: Bolsters **defense against Iranian missile threats** and supports **air operations** in the region.
- **Example**: In **2025**, the base deployed **THAAD systems** to counter potential **Iranian ballistic missile attacks** following U.S. airstrikes on Iran's nuclear sites.

Strategic Context and Challenges

- **Geopolitical Tensions**: The U.S. presence is a response to threats from **Iran** and its proxies, including **Hamas**, **Hezbollah**, and the **Houthis**. Recent **U.S. airstrikes** on Iran's nuclear facilities in **2025** have heightened tensions, with Iran threatening retaliation against U.S. bases.
- **Regional Dynamics**: Bases are often hosted by **authoritarian regimes** (e.g., **Bahrain**, **Qatar**, **Saudi Arabia**), raising concerns about **human rights** and **anti-democratic governance**. These alliances, justified during the **Cold War** to counter the **Soviet Union**, persist despite criticism.
- **Security Risks**: Bases face risks from **Iranian ballistic missiles** and **proxy attacks**. Posts on **X** suggest Iran could target bases in **Bahrain**, **Qatar**, and **Kuwait** with **hypersonic** and **ballistic missiles** in a potential conflict.
- **Local Opposition**: Some host countries face domestic opposition to U.S. bases, viewing them as tools of **Western influence** or threats to **sovereignty**. For example, **Iraq** and **Syria** host bases without full governmental consent, fueling local resentment.

Historical Context

- **Origins**: The U.S. established its first significant presence in **1958** during the **Lebanon Crisis**, deploying **15,000 troops**. The **1991 Gulf War** expanded the footprint, with bases like **Camp Arifjan** supporting **Operation Desert Shield**.

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- **Post-9/11 Expansion**: The **2001 invasion of Afghanistan** and **2003 Iraq War** led to new bases, such as **Al Udeid** and **Al Asad**, to support **counterterrorism** and **regional operations**.
- **Withdrawal and Realignment**: The U.S. withdrew from **Afghanistan** in **August 2021**, leaving behind **$80 billion** in equipment, but maintained bases in **West Asia** to counter **Iran** and **ISIS**.

Significance of U.S. Bases:

- **Power Projection**: Bases enable the U.S. to **project power**, conduct **expeditionary warfare**, and support **allies** like **Israel** and **GCC countries**.
- **Economic Impact**: Host nations benefit economically, e.g., **Bahrain** and **Qatar** gain from **U.S. spending** and **military aid**, but this often supports **authoritarian regimes**.
- **Deterrence**: Bases deter **Iranian aggression** and secure **strategic waterways** like the **Strait of Hormuz**, critical for **global oil trade**.
- **Global Reach**: With **750 bases** worldwide, West Asia's bases are part of a broader U.S. strategy to maintain **global hegemony**, though they face competition from **China** and **Russia**.

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Food Processing: A Force for Grassroots Transformation

Why in News? Recently an article highlighted the significance of food proceesing at gross root level.

Relevance : UPSC Pre & Mains

Prelims : PLIS/GVA

Mains : GS 3 /Economy/Food Processing

A Quiet Revolution in Madhubani, Bihar

In the **NITHEMAKHANA belts of Madhubani**, Bihar, a remarkable transformation is underway. Entrepreneur **Gyanish Kumar Mishra** has elevated the traditional crop, **foxnut**

(makhana), into a nationally recognized brand of flavored snacks. Supported by the **Production Linked Incentive Scheme (PLIS)**, his enterprise under the **PMFME Scheme** now exports to the **United States and Canada**.

This success mirrors India's broader vision of leveraging **local strengths for global opportunities** in the food processing sector.

From Fragmentation to Integration:

In **2014**, India's food processing sector suffered from fragmentation, rampant **post-harvest losses**, and unrealized value. The **gross value addition (GVA)** of the sector stood at **Rs 1.34 lakh crore**. Today, following sustained efforts, this figure has surged to **Rs 2.24 lakh crore**.

Key Government Initiatives Driving Growth:

Pradhan Mantri Kisan SAMPADA Yojana:

- **1,604 projects sanctioned**, creating over **250 lakh metric tonnes** of processing capacity.
- More than **Rs 22,000 crore** in private investments.
- Direct benefits to **53 lakh farmers** and **7.6 lakh jobs** created.

PMFME Scheme:

- Launched under **Atmanirbhar Bharat Abhiyan** with an outlay of **Rs10,000 crore**.
- Empowered **1,42,000 micro and small enterprises**, aiding **3.3 lakh SHG members**.
- Over **1 lakh individuals trained** and **75 incubation centers** approved.

Production Linked Incentive Scheme (PLIS):

- Committed investments of **Rs 8,900 crore**.
- Over **3.3 lakh jobs** created and **67 lakh metric tonnes** of processing capacity added.

Infrastructure and Innovation:

The **Union Budget 2024–25** emphasized infrastructure with the following initiatives:

- **50 multi-product infrastructure units** to reduce **post-harvest losses**.
- **100 NABARD-accredited food testing laboratories** for quality assurance.
- Launch of the **National Mission on Edible Oils** to reduce import dependency by **50%**.

Promoting Education and Entrepreneurship:

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- Institutions like **NIFTEM-Kundli** and **NIFTEM-Thanjavur**, under the Ministry, are shaping the next generation of **food technologists and entrepreneurs**. Over **5,000 startups** are innovating in **AI-enabled traceability**, **functional foods**, and **sustainable packaging**.

Showcasing India's Strength: World Food India

- The flagship **World Food India** event highlights India's leadership in the global food economy. It serves as a platform for **investment**, **innovation**, and **collaboration**, attracting global stakeholders to India's **agri-food ecosystem**.

Transforming Rural India:

- In **Chhattisgarh**, tribal kitchens supported by the PMFME scheme are turning **Mahua flowers** into value-added products like chocolates, energy bars, and tea, creating international markets while preserving **indigenous knowledge**.

Vision for the Future:

The government remains committed to ensuring that products bearing the **India name** reflect stories of **collective prosperity** and **national pride**. The goal is clear: every global shelf should carry a product that represents India's transformative journey in food processing

ECI: Electoral integrity & Transparency

Why in News? The recent by-elections in five Assembly constituencies have drawn attention due to significant political outcomes and proactive steps taken by the Election Commission of India (ECI) to ensure transparency and integrity in the electoral process.

Relevance : UPSC Pre & Mains

Prelims : ECI/MCC/ *SVEEP*

Mains : GS 2

Proactive Steps by the ECI:

The ECI introduced several measures to enhance electoral integrity and accessibility:

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- **Mobile Deposit Facility:** Voters could deposit mobile phones at polling stations for convenience.
- **Upgraded Voter Turnout Sharing:** Faster updates of polling trends provided real-time insights.
- **Webcasting:** Deployed at 100% of polling stations to ensure transparency.

Challenges and Recommendations:

- **Heavy Polling in Sensitive Booths:** Concerns about disputes during the final hours of voting need to be addressed.
- **Transparency in Booth Activities:** Enhanced video recording and monitoring are essential to build trust in the process.

About Election Commission of India (ECI):

The Election Commission of India (ECI) is an independent constitutional authority responsible for administering and supervising elections in India to ensure they are conducted fairly and transparently.

Constitutional Basis:

- **Established:** January 25, 1950.
- **Article 324:** Empowers the ECI to supervise, direct, and control elections for the Parliament, State Legislatures, the Office of the President, and Vice-President of India.

Structure of the ECI:

- **Chief Election Commissioner (CEC):** Heads the commission.
- **Election Commissioners (ECs):** Two other commissioners assist the CEC.
- **Tenure and Appointment:** Appointed by the President of India, the CEC and ECs have a tenure of 6 years or until they reach the **age of 65**, whichever is earlier.
- **Independence:**
    - Their salary and service conditions are similar to a Supreme Court judge.
    - Removal of the CEC requires a process akin to the impeachment of a Supreme Court judge, ensuring independence.

Functions and Responsibilities:

Conduct of Elections:

- Prepares and updates electoral rolls.

- Supervises the nomination process for candidates.
- Monitors campaign funding and expenditure.

Voter Awareness and Participation:

- Organizes initiatives like *Systematic Voters' Education and Electoral Participation (SVEEP)* to encourage voting.

Ensuring Free and Fair Elections:

- Implements the **Model Code of Conduct (MCC)** during elections.
- Addresses complaints and malpractices during elections.

Technology Integration:

- Use of Electronic Voting Machines (EVMs) and Voter Verifiable Paper Audit Trails (VVPATs).
- Deployment of webcasting and real-time monitoring for enhanced transparency.

Redressal of Electoral Disputes:

- Resolves disputes related to the conduct of elections and political parties' registrations.

Conclusion:

The by-election results reflect complex regional dynamics and significant challenges for major political parties ahead of state elections. The ECI's initiatives demonstrate a commitment to upholding electoral integrity, but sustained efforts are needed to address lingering concerns and reinforce public confidence in the democratic process.

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State of the Climate in Asia 2024 : WMO

Why in News? The **World Meteorological Organization (WMO)** has released its **State of the Climate in Asia 2024** report, highlighting the alarming rate of warming in Asia and its wide-ranging impacts on ecosystems, economies, and societies.

Relevance : UPSC Pre & Mains

Prelims : WMO/About Report

Mains : GS 2/ 3

Key Points:

Warming Trends:

- **Asia warming twice as fast** as the global average (1991–2024 vs. 1961–1990).
- 2024: **Warmest or second warmest year on record**, depending on the dataset.
- **1.04°C above** the 1991–2020 average.
- **Prolonged heatwaves**: East Asia (April–November); Myanmar recorded a national high of **48.2°C**.

Ocean Warming and Marine Heatwaves:

- **Sea Surface Temperature (SST)**: Increased at **0.24°C per decade**, double the global average (0.13°C).
- **Marine heatwaves (2024)**: Worst on record, impacting **15 million square kilometers** (~10% of Earth's ocean surface).
- Regions most affected: **Northern Indian Ocean**, **Yellow and East China Seas**, and the **northern Arabian Sea**.

Cryosphere Impact:

- **Glaciers in retreat**: 23 out of 24 glaciers in **High-Mountain Asia** showed mass loss.
- **Urumqi Glacier No. 1**: Recorded the most negative mass balance since 1959.
- Risks: **Glacial lake outburst floods (GLOFs)**, landslides, and water insecurity.

Extreme Weather Events:

Floods:

Central Asia: Worst in 70 years; 118,000 people evacuated.

Nepal: Record rainfall led to **246 deaths**, damages of **12.85 billion Nepalese rupees (US $94 million)**.

Kerala, India: Landslides caused **350+ deaths**.

Tropical Cyclone Yagi: Affected **Viet Nam, Philippines, Thailand, Myanmar, and China**.

Drought: In **China**, impacted **4.8 million people**, damaged **335,200 hectares** of crops, and caused direct losses of **2.89 billion Chinese yuan (US $400 million)**.

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Sea-Level Rise:

- Rates exceeded the global average in **Pacific and Indian Oceans**.
- Risks: Increased vulnerability of **low-lying coastal areas** to flooding and erosion.

Socio-Economic Impacts:

- Severe damage to **livelihoods**, **agriculture**, and **infrastructure**.
- Early warning systems in countries like **Nepal** mitigated casualties and provided life-saving support to **130,000 people**.

Policy Implications:

- The report provides **policy-relevant insights** for **climate adaptation and mitigation** strategies in Asia.
- Highlights the role of **National Meteorological and Hydrological Services** in improving early warnings and building resilience.

World Meteorological Organization (WMO):

- The **World Meteorological Organization (WMO)** is a specialized agency of the **United Nations** dedicated to promoting international collaboration on the state and behavior of the Earth's atmosphere, its interaction with the oceans, and the resulting impacts on climate and water resources.
- Headquarters: **Geneva, Switzerland**
- Established: **23 March 1950**, succeeding the International Meteorological Organization (IMO).

Objectives:

Weather Monitoring: Improve the understanding and prediction of weather, climate, and water cycles.

Climate Services: Provide reliable data for addressing climate variability and change.

Disaster Risk Reduction: Support the development of early warning systems to reduce the impact of natural hazards like floods, droughts, and cyclones.

Data Sharing: Facilitate global exchange of weather, climate, and hydrological information.

Key Functions:

- Standardization of **meteorological observations** across countries.

- Coordination of **research programs** in meteorology, climatology, hydrology, and related fields.
- Assisting countries in capacity building for improved weather and climate services.
- Issuing regular **reports and bulletins**, such as the **State of the Global Climate**, to provide data-driven insights into climate trends.

Emergency Provisions in India: Historical Background

Why in News? Union Home Minister **Amit Shah** chaired the **25th Central Zonal Council meeting** in Varanasi recently, urging the Chief Ministers of **Uttarakhand**, **Uttar Pradesh**, **Chhattisgarh**, and **Madhya Pradesh** to enhance **gram panchayat revenue** and strengthen the **Panchayati Raj system**. The meeting addressed critical regional and national issues, fostering **federal unity** and **development**.

Relevance : UPSC Pre & Mains

Prelims : Key provisions

Mains : GS 2

The emergency provisions in the Indian Constitution, enshrined in **Part XVIII (Articles 352 to 360)**, are a critical mechanism designed to address extraordinary situations that threaten the nation's security, stability, or financial integrity.

Colonial Legacy and Pre-Independence Context

- The emergency provisions in the Indian Constitution were significantly influenced by the **Government of India Act, 1935**, enacted by the British colonial government. This act provided a framework for governance in British India, including mechanisms for the central authority to intervene in provincial affairs during crises.

Influence of the Weimar Constitution

- Another significant influence was the **Weimar Constitution of Germany (1919–1933)**, particularly its provisions for suspending fundamental rights during emergencies. The

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Weimar Constitution's Article 48 allowed the President to take extraordinary measures, including suspending civil liberties, to restore order during crises.

- The Indian Constitution borrowed the concept of suspending fundamental rights during emergencies, particularly under **Articles 358 and 359**, which allow for the suspension of certain rights (except those under **Articles 20 and 21**) during a national emergency.
- Dr. B.R. Ambedkar, a key architect of the Constitution, emphasized the unique nature of India's federal structure, which could transition to a unitary system during emergencies. He described this flexibility as a "novel feature" of the Constitution, enabling the central government to respond decisively to threats while maintaining democratic governance.

Constitutional Framework and Types of Emergencies:

The Indian Constitution provides for three types of emergencies under Part XVIII:

National Emergency (Article 352): Declared due to war, external aggression, or armed rebellion (originally "internal disturbance" until amended by the **44th Amendment Act of 1978). I**t allows the President to proclaim an emergency across the entire country or specific regions, suspending certain fundamental rights and centralizing power.

State Emergency or President's Rule (Article 356): Imposed when there is a failure of constitutional machinery in a state, based on the Governor's report or other sources. The central government assumes control of the state's administration, and the state legislature's powers may be exercised by Parliament.

Financial Emergency (Article 360): Declared when the financial stability or credit of India or any part thereof is threatened. This allows the central government to issue directions to states for financial propriety and reduce salaries of public officials, including judges.

Historical Instances of Emergency in India:

First National Emergency (1962–1968):

- The first national emergency was declared on **October 26, 1962**, during the **Sino-Indian War**, when Chinese aggression in the **North-East Frontier Agency** (now Arunachal Pradesh) posed a threat to India's territorial integrity. Proclaimed under Article 352 on

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the grounds of "**external aggression**," this emergency lasted until **January 10, 1968**, as the government sought to consolidate national security and mobilize resources.

- During this period, the six fundamental rights under **Article 19** (freedom of speech, assembly, movement, etc.) were automatically suspended, as per **Article 358**, and the central government exercised enhanced powers over the states. This emergency was relatively uncontroversial, as it was seen as a necessary response to a clear external threat.

Second National Emergency (1971–1977):

- The second national emergency was declared on **December 3, 1971**, during the **Indo-Pakistan War**, which led to the creation of Bangladesh. Proclaimed on the grounds of "external aggression," this emergency overlapped with the **1962** emergency, which was still in effect.
- It remained in force until **March 21, 1977**, and was justified by the need to address the war's impact on national security. Like the 1962 emergency, it involved the suspension of **Article 19 rights and centralized governance**.

Third National Emergency (1975–1977):

- The third and most controversial national emergency was declared on **June 25, 1975**, by Prime Minister **Indira Gandhi**, under the presidency of **Fakhruddin Ali Ahmed**, on the grounds of "internal disturbance."
- This proclamation followed a political crisis triggered by the **Allahabad High Court's ruling** on June 12, 1975, which declared **Indira Gandhi's 1971** election from **Rae Bareli** invalid due to electoral malpractices and barred her from holding public office for six years.
- The **1975–1977** emergency, often referred to as "**the Emergency**," is considered a dark chapter in Indian democracy. Fundamental rights, including the right to life and personal **liberty under Article 21**, were suspended through presidential orders under **Article 359**. The government curtailed civil liberties, censored the press, and detained political opponents without trial, leading to widespread allegations of authoritarianism.
- The **ADM Jabalpur v. Shivakant Shukla (1976)** case became a notorious landmark, where the Supreme Court, by a majority, upheld the suspension of habeas corpus, effectively

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denying citizens the right to challenge unlawful detentions. **Justice H.R. Khannarosa** challenged this view, arguing that the right to life could not be suspended.

President's Rule (Article 356):

- President's Rule has been imposed **over 130 times** since 1950, often in cases of political instability or failure of constitutional machinery in states.
- The first instance occurred in **Punjab in 1951**. Notable cases include the dissolution of state assemblies in **Tamil Nadu (1976 and 1991)** and numerous other states. The frequent use of Article 356 has been controversial, with critics arguing it has been misused for political purposes. The **S.R. Bommai v. Union of India (1994)** case was a landmark judgment, where the Supreme Court laid down guidelines to curb arbitrary imposition of **President's Rule**, emphasizing that it should be a last resort and subject to judicial review.

Financial Emergency:

- A **Financial Emergency** under **Article 360** has never been imposed in India to date. This provision remains a theoretical tool to address severe financial crises, with safeguards requiring parliamentary approval within two months.

Constitutional Amendments and Safeguards:

- The misuse of emergency powers during **1975–1977** led to significant reforms through the **44th Amendment Act of 1978**, enacted under the Janata Party government to prevent future abuses. Key changes included:
- Replacing **"internal disturbance" with "armed rebellion" in Article 352** to narrow the grounds for declaring a national emergency.
- Requiring a written request from the **Cabinet for the President** to proclaim a national emergency, ensuring collective decision-making.
- Mandating parliamentary approval within **one month (reduced from two months**) for a national emergency proclamation, with re-approval every six months.
- Making national emergency proclamations subject to judicial review, as affirmed in the **Minerva Mills v. Union of India (1980)** case, which ruled that the President's satisfaction could be challenged if based on mala fide or extraneous grounds.

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- Ensuring that Article 19 rights are not suspended during an emergency declared on the grounds of armed rebellion.

Criticism

- **Potential for Misuse**: The 1975 emergency highlighted the risk of emergency powers being used to suppress dissent and consolidate political power.
- **Erosion of Federalism**: Centralization during emergencies undermines the federal structure, reducing state autonomy.
- **Civil Liberties**: Suspension of fundamental rights, as seen in 1975, raises concerns about authoritarianism and human rights violations.

Landmark Judicial Interventions:

- **Makhan Singh v. State of Punjab (1964)**: Upheld the legality of detentions during a national emergency under Article 359, emphasizing the suspension of enforcement of certain rights.
- **S.R. Bommai v. Union of India (1994)**: Established guidelines for Article 356, limiting its use to cases of genuine constitutional breakdown and affirming judicial review.
- **Minerva Mills v. Union of India (1980)**: Reaffirmed judicial review of national emergency proclamations, ensuring accountability.

Conclusion

The emergency provisions in the Indian Constitution reflect a balance between the need for strong central authority during crises and the preservation of democratic principles. Rooted in the colonial legacy of the **Government of India Act, 1935,** and inspired by the Weimar Constitution, these **provisions** were designed to address extraordinary threats to India's sovereignty, unity, and stability. While they have been effective in managing crises like the **1962 and 1971 wars, the 1975** emergency exposed their potential for misuse, leading to significant constitutional reforms.

25th Central Zonal Council meeting

Why in News? Union Home Minister **Amit Shah** chaired the **25th Central Zonal Council meeting** in Varanasi recently, urging the Chief Ministers of **Uttarakhand**, **Uttar Pradesh**,

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Chhattisgarh, and **Madhya Pradesh** to enhance **gram panchayat revenue** and strengthen the **Panchayati Raj system**. The meeting addressed critical regional and national issues, fostering **federal unity** and **development**.

Relevance : UPSC Pre & Mains

Prelims : Zonal council

Mains : GS 2

Key Points

- **Revenue Enhancement for Panchayats**: Amit Shah emphasized increasing **gram panchayat revenue** to make the **three-tier Panchayati Raj system** more effective, as stated by the **Ministry of Home Affairs (MHA)**.

Issues Discussed: A total of **19 issues** were deliberated, including:

- Implementation of **fast track special courts** for speedy resolution of **rape cases** involving **women and children**.
- Provision of **brick and mortar banking facilities** in every village.
- Execution of the **Emergency Response Support System**.

Social Development Goals: Shah urged States to focus on:

- Eradicating **child malnutrition**.
- Reducing **school dropout ratio** to **zero**.
- Strengthening the **cooperative sector**.

- **Increased Zonal Council Meetings**: Shah highlighted a **twofold rise** in meetings:
  - **2004–2014**: Only **11 Zonal Council meetings** and **14 Standing Committee meetings**.
  - **2014–2025**: **28 Zonal Council meetings** and **33 Standing Committee meetings**.

State-Specific Requests:

- **Uttarakhand CM Dhami** requested enhanced support from the **Border Roads Organisation** to improve **road**, **communication**, and **security infrastructure** in **border areas**.

- **Federal Unity**: CMs Adityanath and Sai noted that the council strengthens **federal unity**, **national integrity**, and **regional development**.

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About Zonal Councils:

The Zonal Councils are statutory bodies established under the **States Reorganization Act, 1956** to promote cooperative federalism in India.

Composition of Zonal Councils

There are **five Zonal Councils** in India, each comprising specific states grouped geographically:

1. **Northern Zonal Council**
    - Members: Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, National Capital Territory of Delhi, and Union Territory of Chandigarh.
2. **Central Zonal Council**
    - Members: Chhattisgarh, Uttarakhand, Uttar Pradesh, and Madhya Pradesh.
3. **Eastern Zonal Council**
    - Members: Bihar, Jharkhand, Odisha, and West Bengal.
4. **Western Zonal Council**
    - Members: Goa, Gujarat, Maharashtra, and Rajasthan.
5. **Southern Zonal Council**
    - Members: Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Telangana, and Union Territories of Andaman & Nicobar Islands, Lakshadweep, and Puducherry.

Objectives and Functions:

1. **Promoting Inter-State Cooperation**
   Address disputes and ensure smooth coordination between states and Union Territories.
2. **Facilitating Economic and Social Planning**
   Discuss matters related to infrastructure, economic development, and social justice.
3. **Resolving Border Disputes**
   Facilitate amicable solutions to boundary disputes and issues among member states.
4. **Addressing Security Concerns**
   Discuss internal security challenges and work towards coordinated measures.
5. **Enhancing Policy Coordination**
   Ensure uniform implementation of central schemes and policies across states.
6. **Promoting Cultural Integration**
   Encourage cultural exchange and understanding between states.

Organizational Structure:

- **Chairman**: The Union Home Minister is the ex-officio chairman of all the Zonal Councils.
- **Vice Chairman**: Each state's chief minister serves as the vice-chairman on a rotational basis for one year.
- **Members**: Chief Ministers and two other ministers from each state, along with administrators of Union Territories.

Sustainable Development Report (SDR): 2025

Why in News? India has achieved a historic milestone by entering the **top 100** in the **Sustainable Development Goals (SDG) Index**, ranking **99th out of 167 nations** in the **2025 Sustainable Development Report (SDR)** released by the **UN Sustainable Development Solutions Network**

Relevance : UPSC Pre & Mains

Prelims : SDG/SDR

Mains : GS 2/GS 3

Key Points:

- **India's Ranking and Score**: India secured the **99th position** with a score of **67** on the **2025 SDG Index**, a significant leap from **109th in 2024**, **112th in 2023**, **121st in 2022**, and **120th in 2021**.
- **Regional Comparison**:
    - **China**: Ranked **49th** with a score of **74.4**.
    - **United States**: Ranked **44th** with **75.2**.
    - **Neighbours**:

Bhutan: **74th** (70.5).

Nepal: **85th** (68.6).

Bangladesh: **114th** (63.9).

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Pakistan: **140th** (57).

- **Maritime neighbours**: **Maldives** (53rd) and **Sri Lanka** (93rd).
- **SDG Index Overview**: The index measures progress toward the **17 SDGs**, adopted in **2015**, with a score of **100** indicating full achievement. India's score of **67** reflects steady progress but highlights gaps.
- **Global SDG Progress**: Only **17% of SDG targets** are on track for **2030**, hindered by **conflicts**, **structural vulnerabilities**, and **limited fiscal space**.
- **European Dominance**: **Finland**, **Sweden**, and **Denmark** hold the top three ranks, with **19 of the top 20 countries** in Europe, though they face challenges in **climate change** and **biodiversity** due to unsustainable consumption.

Challenges Noted: Globally, five areas show regression since **2015**:

- **Obesity rates** (SDG 2).
- **Press freedom** (SDG 16).
- **Sustainable nitrogen management** (SDG 2).
- **Biodiversity loss** (SDG 15).
- **Corruption Perceptions Index** (SDG 16).

Relevance to India: India's progress aligns with national priorities like **inclusive growth** and **sustainable development**, but challenges remain in areas like **climate action** and **biodiversity**.

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Chimeric Antigen Receptor (CAR) T-cell therapy

Why in News? In recent years, **Chimeric Antigen Receptor (CAR) T-cell therapy** has emerged as a groundbreaking treatment for patients suffering from aggressive blood cancers resistant to conventional therapies.

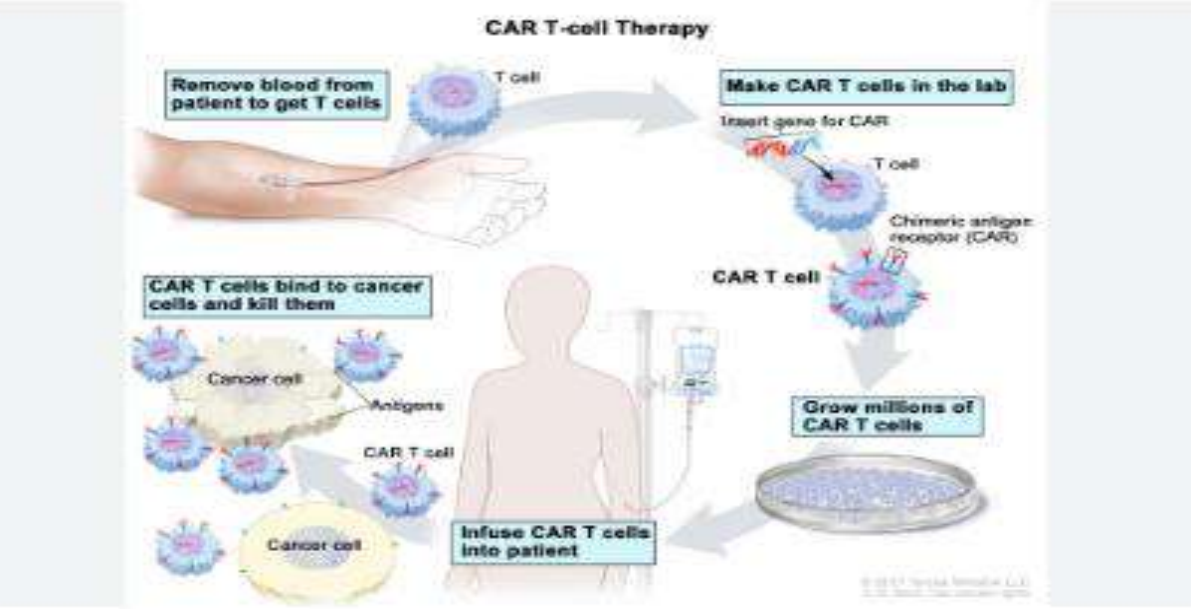
Relevance : UPSC Pre & Mains

Prelims : Chimeric Antigen Receptor (CAR) T-cell therapy

Mains : GS 3/Technology

What is CAR T-Cell Therapy?

Chimeric Antigen Receptor (CAR) T-cell therapy is an advanced immunotherapy that genetically engineers a patient's T-cells (a type of immune cell) to target and destroy cancer cells or, in some cases, address autoimmune diseases. It has transformed treatment for certain blood cancers and is being explored for other conditions.



How it Works?

1. **T-Cell Collection**: T-cells are extracted from the patient's blood via apheresis.
2. **Genetic Modification**: In a lab, T-cells are engineered to express a CAR, a synthetic receptor designed to recognize specific proteins (antigens) on cancer cells or other targets.
3. **Expansion**: Modified T-cells are multiplied to create a large population.
4. **Infusion**: The CAR T-cells are infused back into the patient, where they seek out and attack cells with the target antigen.
5. **Immune Activation**: CAR T-cells multiply in the body, enhancing the immune response against the disease.

Applications:

- **Blood Cancers**: CAR T-cell therapy is FDA-approved for:
  - **Acute Lymphoblastic Leukemia (ALL)**: Particularly in children and young adults.
  - **Diffuse Large B-Cell Lymphoma (DLBCL)** and other non-Hodgkin lymphomas.
  - **Multiple Myeloma**: Targeting BCMA (B-cell maturation antigen).
  - **Chronic Lymphocytic Leukemia (CLL)**: In some refractory cases.

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Facts for Prelims

DeFi (Decentralized Finance)

DeFi is a subset of Web3 that uses blockchain and smart contracts to recreate financial services (e.g., lending, borrowing, trading) without traditional intermediaries like banks.

Key Features:

- **Permissionless**: Anyone with an internet connection and a crypto wallet can participate.
- **Transparency**: Transactions are recorded on public blockchains, ensuring auditability.
- **Smart Contracts**: Automated, self-executing agreements that power DeFi protocols.
- **Accessibility**: Global access to financial services, especially for the unbanked.

Core DeFi Applications:

- **Lending/Borrowing**: Platforms like Aave and Compound let users lend crypto to earn interest or borrow against collateral.
- **Decentralized Exchanges (DEXs)**: Uniswap and SushiSwap enable peer-to-peer trading without centralized exchanges.
- **Stablecoins**: Cryptocurrencies like USDC or DAI, pegged to stable assets (e.g., USD), for low-volatility transactions.
- **Yield Farming**: Users provide liquidity to DeFi protocols and earn rewards in tokens.
- **Insurance**: Protocols like Nexus Mutual offer decentralized insurance for smart contract failures.

Web3 :

- It refers to a decentralized, **blockchain-based internet** where users control their data, identities, and transactions, unlike the centralized **Web2 dominated by tech giants.**

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Wagner Group/ Africa Corps

Why in news ? Moscow's announcement to enhance its military ties in Africa comes amid reports that the Wagner Group, a controversial Russian paramilitary organization, has reportedly exited Mali. The group's operations in Mali have been handed over to the Africa Corps, directly overseen by Russia's Defense Ministry.

About Wagner Group:

The Wagner Group is a private military company (PMC) with close ties to the Russian government, known for its controversial operations in conflict zones worldwide. Its activities, often described as shadowy and opaque, have raised global concerns over human rights violations and geopolitical manipulation.

Formation and Background

- **Founded**: 2014, reportedly by Dmitry Utkin, a former Russian military officer and GRU (Russian military intelligence) operative.
- **Naming**: Named after Utkin's call sign, "Wagner," which is believed to be a tribute to the German composer Richard Wagner.
- **Leadership**: Until recently, Yevgeny Prigozhin, a Russian oligarch close to President Vladimir Putin, was heavily linked to Wagner. Prigozhin played a key role in financing and expanding the group.

Areas of Operation:

The Wagner Group has operated in several regions, often serving as a tool for advancing Russia's strategic interests:

Ukraine:

- Involved in the annexation of Crimea (2014) and ongoing conflicts in Eastern Ukraine.
- Played a key role in the Russia-Ukraine war until Prigozhin's rebellion in 2023.

Syria:

- Supported President Bashar al-Assad's regime during the Syrian Civil War.
- Provided ground support for Russia's military operations and secured oil and gas assets.

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Africa:

- Operated in countries like Mali, Sudan, Libya, and the Central African Republic.

About Africa Corps:

- The **Africa Corps** is a relatively new entity reportedly under the direct supervision of the Russian Ministry of Defense. It is seen as part of Moscow's strategy to maintain and expand its military and geopolitical influence across Africa, particularly following changes in the operations of the Wagner Group.

Key Details:

Formation and Leadership:

- Formed as a state-controlled alternative to the Wagner Group after the latter's internal crisis and the demise of its leader, Yevgeny Prigozhin.
- Managed directly by Russia's Defense Ministry, ensuring tighter government oversight and integration with official military operations.

INCOIS

The **Indian National Centre for Ocean Information Services (INCOIS)** is an autonomous organization under the **Ministry of Earth Sciences (MoES)**, Government of India, established in **1999** and headquartered in **Hyderabad, Telangana**.

It operates as a unit of the **Earth System Science Organization (ESSO)** and is mandated to provide ocean information and advisory services to society, industry, government, and the scientific community through sustained ocean observations and systematic research.

Background and Establishment

- **Origin**: INCOIS evolved from the **Potential Fishing Zone (PFZ) Mission** initiated in the 1990s by the Ministry of Earth Sciences (then Department of Ocean Development). Initially managed by the National Remote Sensing Centre (NRSC) in Hyderabad, the project was separated in **1998 to form INCOIS** as an independent entity under the leadership of **Dr. A. Narendra Nath**, its founding director.

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- **Objective**: To provide accurate and timely ocean data, forecasts, and advisories to support coastal communities, industries, and disaster management, while advancing oceanographic research.

Khaan Quest 2025:

Why in News? The Indian Army contingent arrived in Ulaanbaatar, Mongolia, on June 11, 2025, to participate in **Khaan Quest 2025**, a multinational military exercise scheduled from June 14 to June 28, 2025. Originating in 2003 as a bilateral U.S.-Mongolia initiative, it evolved in 2006 into a **UN-mandated peacekeeping exercise**.

- **Objective**: To enhance peacekeeping capabilities, interoperability, and best practices among participating nations. Activities include tactical drills like checkpoint establishment, cordon-and-search operations, patrolling, IED neutralization, and combat casualty management.
- **Indian Contingent**: A 40-member team, predominantly from the Kumaon Regiment, including a woman officer and two female soldiers, reflecting India's commitment to gender inclusivity.
- **Significance**: Strengthens global peacekeeping efforts, fosters regional security, and enhances India's defence ties with Mongolia.
- **History**: The 22nd edition of Khaan Quest follows the 2024 exercise held in Mongolia (July 27–August 9).

What is Khaan Quest?

- A multinational peacekeeping exercise held annually in Mongolia since 2003, originally launched as a bilateral training event with the **U.S. Armed Forces.**
- It transitioned into a full-fledged international exercise in 2006, co-sponsored by the Mongolian Armed Forces and the **U.S. Indo-Pacific Command** .

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Arambai Tenggol (AT)

Why in News? Arambai Tenggol (AT), a radical Meitei group in Manipur, has been in the spotlight due to its alleged involvement in violent incidents, looting of weapons, and communal tensions in the state.

The recent arrest of its self-styled 'army chief,' Asem Kanan Singh, has drawn attention to the group's activities and its role in the ongoing ethnic strife in the region.

About Arambai Tenggol:

Origins and Name:

- Named after ***Arambai***, a poisoned dart-like weapon historically used by Manipuri kings' troops against Burmese invaders.
- Also refers to ***Tenggol***, a cavalry platoon symbolizing military strength and tradition.

Formation and Agenda:

- Established as a radical Meitei group aiming to "defend and protect Manipur and India."
- Accused of targeting the **Kuki-Zo community, perceived as "illegal settlers**" from Myanmar.

Criminal Allegations:

- Linked to arms smuggling cases, including one from 2020.
- Alleged involvement in instigating violence and looting of weapons during ethnic clashes.

Recent Events:

- On June 7, 2025, Asem Kanan Singh, the group's leader, was arrested by security personnel in Imphal.

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- Following his arrest, the group imposed a 10-day shutdown across the Imphal Valley, lifted after assurances that Singh's arrest was related to criminal cases, not his AT affiliation.

Ethnic Context:

- The group's activities are part of the larger ethnic conflict in Manipur, involving the Meitei and Kuki-Zo communities.

True Promise 3 & Rising Lion Operations

Operation True Promise 3:

- Operation True Promise 3 was a major Iranian retaliatory strike on Israel, launched on June 13, 2025, by the **Islamic Revolutionary Guard Corps (IRGC).**
- It involved over 150 ballistic missiles and 100+ drones targeting Israeli military bases, airfields, intelligence centers, and civilian areas.
- The attack injured 63 Israelis, killed 24 civilians, and caused significant damage in Tel Aviv, Jerusalem, and Haifa. Israel's defenses intercepted 80–90% of missiles, but some hit targets like The **Kirya military headquarters**.

Objectives:

- Retaliate for Israel's Operation Rising Lion, which killed senior IRGC commanders and struck Iranian nuclear sites.
- Deter future Israeli attacks by showcasing Iran's missile and drone capabilities.
- Target military and industrial sites linked to Israel's actions against Palestinian and regional resistance groups.

Why the Name "True Promise 3"?

- "True Promise" symbolizes Iran's pledge to decisively respond to aggression, rooted in its ideological opposition to Israel, called the "**Zionist regime**."
- The "3" marks it as the third direct attack on Israel, **following Operation True Promise (April 2024) and True Promise II (October 2024).**

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- The name invokes divine justice, launched with the code "**Ya Ali ibn Abi Talib**" on **Eid al-Ghadir**, a key Shia holiday.

Operation Rising Lion:

- **Operation Rising Lion, launched by Israel** on June 13, 2025, targeted Iran's nuclear facilities, missile sites, air defenses, and senior military leaders.
- Over 200 IDF jets, including F-35s, and Mossad covert operations hit 100+ sites, killing IRGC chief Hossein Salami, Armed Forces Chief Mohammad Bagheri, and six nuclear scientists.

Objectives:

- Delay Iran's nuclear program, seen as an existential threat.
- Weaken Iran's ballistic missile and air defense capabilities.
- Preemptively neutralize Iran's ability to retaliate or support proxies like Hezbollah.
- Signal military dominance to deter Iran and its allies.

Why the Name "Rising Lion"?

- Derived from Numbers 23:24, "The people shall rise up as a great lion," symbolizing Israel's strength and resolve.
- Possibly references the pre-**1979 Iranian Lion and Sun emblem**, implying dominance over Iran.
- Reflects Israel's narrative of a **bold strike to ensure survival.**

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Strategic Offensive Reductions Treaty (SORT)

About SORT:

- The **Strategic Offensive Reductions Treaty (SORT)**, commonly known as the **Moscow Treaty**, was a nuclear arms reduction agreement signed between the **United States** and **Russia** on **May 24, 2002**.

It was intended to reduce the number of deployed strategic nuclear warheads in both countries. The treaty was signed by U.S. President **George W. Bush** and Russian President **Vladimir Putin** during a summit in Moscow.

Key Features of SORT (Moscow Treaty):

Warhead Limits:

- Each country agreed to reduce its **operationally deployed strategic nuclear warheads** to a range of **1,700 to 2,200** by **December 31, 2012**.

Lack of Verification Measures:

- Unlike previous treaties, SORT did not include detailed mechanisms for verification, monitoring, or transparency. Instead, it relied on the verification framework established under the **START I Treaty (1991)**.

Flexibility:

- The treaty allowed each country to determine its own methods and timelines for achieving the reductions, as long as the final numbers were met by the deadline.

Duration:

- SORT was set to remain in force until **December 31, 2012**, but it could be terminated earlier by mutual agreement or withdrawal by either party with three months' notice.
- In practice, SORT was superseded by the **New START Treaty** in 2010, which incorporated and expanded upon SORT's objectives.

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Operation Sindhu

India's most recent operation to rescue its citizens is **Operation Sindhu**, launched to evacuate Indian nationals from Iran amid the escalating Iran-Israel conflict in June 2025.

First Evacuation Flight: On June 19, 2025, a special IndiGo flight carrying 110 Indian nationals, primarily students from Jammu & Kashmir, landed in New Delhi from Yerevan, Armenia. These students were evacuated from northern Iran via road to Armenia due to the conflict.

Other Recent Rescue Operations:

- Operation Sindhu follows India's history of successful missions like **Operation Ganga** (Ukraine, 2022) and **Operation Kaveri** (Sudan, 2023), showcasing its expertise in crisis evacuations.

Bharatiya Antariksh Hackathon 2025:

The **Indian Space Research Organisation (ISRO)** announced the **Bharatiya Antariksh Hackathon 2025**, aimed at fostering innovation in the space sector.

Key Highlights

Launch and Announcement:

- Launched by **ISRO Chairman V. Narayanan** on **Wednesday, June 19, 2025**.
- ISRO partnered with **Hack2skill** as its innovation partner.

Objective:

- To encourage innovation and problem-solving in India's growing space sector.
- Engage students and researchers in addressing space-related challenges.

Eligibility:

- Open to **undergraduate students**, **postgraduate students**, and **PhD scholars** across India.

Challenges:

- Features a total of **14 challenges** designed to test creativity and technical skills.
- Participants can register and access the challenges via **Hack2skill's website**.

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Significance:

- Promotes collaboration between ISRO and academic institutions.
- Supports skill development in cutting-edge technologies related to space exploration and applications.
- Aligns with India's vision to expand its space technology capabilities.

Sharavathi Lion-Tailed Macaque Wildlife Sanctuary:

Why in News ? The Sharavathi Lion-Tailed Macaque Wildlife Sanctuary in Sagar taluk, Karnataka, has become the center of tensions following the arrest and subsequent bail of farmers accused of entering the sanctuary with country-made weapons. The situation has raised concerns about human-wildlife conflicts in the region.

About Sharavathi Lion-Tailed Macaque Wildlife Sanctuary:

Location and Geography:

- Situated in the **Sharavathi River Valley**, Sagar taluk, Shivamogga District, Karnataka.
- Part of the **Western Ghats**, a UNESCO World Heritage Site.
- Covers an area of approximately **431.23 sq. km**, with the **Linganamakki reservoir** spanning 124 sq. km.
- Formed by merging the **Sharavathi Valley Wildlife Sanctuary**, **Aghanashini Lion-Tailed Macaque Conservation Reserve**, and adjacent reserve forests.
- Shares its southwestern boundary with the **Mookambika Wildlife Sanctuary**.
- Terrain varies from **94 m to 1,102 m in altitude**, making it highly undulating.

Vegetation:

The sanctuary comprises diverse forest types:

- **Tropical Evergreen and Semi-Evergreen Forests**.
- **Moist Deciduous Forests**.
- Grasslands and savannas.

Flora:

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The sanctuary boasts a rich variety of plant species, including:

- **Dhoopa**, **Gulmavu**, **Surahonne**, **Mavu**, and **Nandi**.

Fauna:

- The sanctuary serves as a critical habitat for various wildlife species, particularly the **endangered lion-tailed macaque (Macaca silenus)**, endemic to the Western Ghats.

Other notable fauna include:

- **Mammals**: Tiger, leopard, wild dog, jackal, sloth bear, spotted deer, sambar, barking deer, mouse deer, wild pig.
- **Primates**: Common langur, bonnet macaque.
- **Rodents**: Malabar giant squirrel.

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'Muruga Bhaktargal Conference'-2025

Why in News ? The **'Muruga Bhaktargal Conference'** held in Madurai, Tamil Nadu, organized by Hindu Munnani and attended by BJP leaders, has sparked controversy. The issue arose due to an audiovisual presentation at the event that depicted Dravidian stalwarts such as **Periyar E.V. Ramasamy**, **C.N. Annadurai**, and **M. Karunanidhi** negatively, labeling them as symbols of "adharma" and referring to them as "atheist foxes." The event is seen as part of the ongoing cultural and political debates in Tamil Nadu.

About Muruga Bhaktargal:

The **Muruga Bhaktargal** are devotees of **Lord Muruga**, a revered deity in Tamil Hindu traditions.

Significance of Lord Muruga:

- Known as the **God of War** and **Victory**, Lord Muruga is deeply associated with Tamil culture and spirituality.
- He is also referred to as **Kartikeya**, **Subramanya**, or **Skanda** in other Indian traditions.
- His worship is central to the Tamil Shaivite tradition and often celebrated through festivals like **Thaipusam** and **Panguni Uthiram**.

Purpose of the Conference:

- To mobilize devotees of Lord Muruga and highlight Hindu cultural and religious values.
- To assert the role of Hindu Munnani in "protecting dharma" and counter narratives perceived as anti-Hindu or atheistic.

Controversy:

The conference presentation:

Glorified Hindu Munnani as protectors of dharma.

Criticized Dravidian Leaders: Dravidian icons were portrayed negatively, reflecting the ongoing ideological clashes between Dravidian rationalist movements and Hindutva ideologies.

Background of Hindu Munnani:

- **Hindu Munnani** is a Tamil Nadu-based Hindu nationalist organization established in 1980.
- Its stated aim is to protect Hindu values and counter activities perceived as threats to the religion and culture.
- The group has often been involved in cultural and political confrontations, especially against Dravidian parties advocating rationalism and atheism.

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