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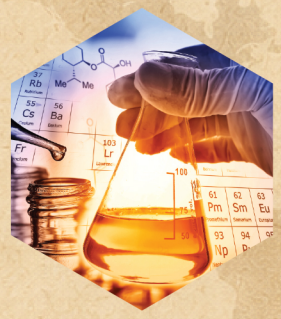

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POLITY AND GOVERNANCE

1.1. PM SURYA GHAR: MUFT BIJLI YOJANA

Context: **Recently**, the Ministry of New and Renewable Energy (MNRE) has proposed a new incentive scheme for States to accelerate the adoption of the "Utility-Led Aggregation (ULA)" model under the PM Surya Ghar: Muft Bijli Yojana.

To achieve the national target of one crore rooftop solar households by March 2027, the government is encouraging State Power Distribution Companies (DISCOMs) to lead the installation process, particularly for households that face financial or infrastructural barriers.

1. **Overview and Objectives**
   - **Launch:** Launched in February 2024 by the Prime Minister.
   - **Nodal Ministry:** Ministry of New and Renewable Energy (MNRE).
   - **Primary Goal:** To provide up to **300 units of free electricity** every month to one crore households across India.
   - **Target Capacity:** Aiming to reach 30 GW of solar capacity through residential rooftop systems.
   - **Financial Outlay:** A total central investment of over **₹75,021 crore**.
2. **Implementation Models**

   The scheme moves beyond individual applications by introducing systemic models to ensure scalability:
   - **Utility-Led Aggregation (ULA) Model:** DISCOMs or designated state agencies act as aggregators. They float bulk tenders to install systems across multiple households, lowering costs through economies of scale.
   - **RESCO (Renewable Energy Service Company) Model:** A third-party developer (RESCO) installs, owns, and operates the solar plant on the consumer's roof. The consumer only pays for the electricity generated, often at a rate lower than the grid tariff.
3. **Central Financial Assistance (CFA) & Subsidy Structure**

   The subsidy is directly credited to the consumer's bank account following installation and inspection.
   - **For 1–2 kW systems:** Up to 60% of the benchmark cost.
   - **For 2–3 kW systems:** 40% of the additional cost for the capacity beyond 2 kW.
   - **Upper Limit:** The total subsidy is capped at a maximum of 3 kW capacity (approx. ₹78,000).
   - **Low-Interest Loans:** Collateral-free, low-interest (around 7%) loan options are available through banks for systems up to 3 kW.
4. **Special Components**
   - **Model Solar Village:** The scheme aims to develop one "Model Solar Village" in every district of India to act as a demonstration hub for solar adoption.
   - **Local Body Incentives:** Urban Local Bodies (ULBs) and Panchayati Raj Institutions (PRIs) are provided financial incentives to promote and facilitate rooftop solar in their respective areas.
   - **National Portal:** A dedicated digital platform handles the end-to-end process from registration to subsidy release, ensuring transparency.

1.2. RIGHT TO VOTE IN INDIA

Context: Recently, the Supreme Court of India, underscored the significance of the right to vote by describing it as a "sentimentally vital" entitlement for citizens. This observation came during a directive to the Election Commission of India (ECI) regarding the large-scale removal of voters from electoral rolls in West Bengal due to "logical discrepancies."

With nearly 34 lakh appeals pending before Appellate Tribunals just ahead of the 2026 Assembly elections, the Court emphasized that ensuring the integrity of electoral rolls is essential for protecting the democratic right of every eligible citizen to participate in the governing process.

1. **The Nature of the Right**

   There is often a debate on whether the right to vote is a Fundamental, Constitutional, or Statutory right. For the UPSC Prelims, the following distinctions are vital:

   - **Constitutional Right:** It is a right granted by the Constitution (Article 326) but is located outside Part III (Fundamental Rights).
   - **Statutory Right:** It is also a statutory right because it is regulated and operationalized by the **Representation of the People Act, 1951**.
   - **Supreme Court's Stance:** In the *Anoop Baranwal case (2023)* and *Kuldip Nayar case (2006)*, the Court maintained it is a statutory right. However, in *PUCL vs. Union of India*, it was observed that voting is a "facet of freedom of expression" under **Article 19(1)(a)**.

2. **Constitutional Provisions**

   - **Article 326:** This article defines **Universal Adult Suffrage**. It states that elections to the Lok Sabha and State Legislative Assemblies shall be on the basis of adult suffrage; every citizen not less than 18 years of age (and not otherwise disqualified) is entitled to be registered as a voter.
   - **61st Constitutional Amendment Act, 1988:** This amendment reduced the voting age from **21 to 18 years**, which became effective in 1989.

3. **Legal Framework**

   The right to vote is governed by two major statutes:

   - **Representation of the People Act (RPA), 1950:** Focuses on the preparation of electoral rolls, qualification of voters, and delimitation of constituencies.
   - **Representation of the People Act (RPA), 1951:** Focuses on the actual conduct of elections and defines the "Right to Vote" under **Section 62**.

4. **Key Disqualifications and Limitations**

   The right to vote is not absolute and can be restricted on grounds of:

   - Non-residence.
   - Unsoundness of mind.
   - Crime or corrupt/illegal practices.
   - **Prisoners' Rights:** Under **Section 62(5)** of the RPA 1951, no person shall vote if they are confined in a prison or in the lawful custody of the police (this does not apply to persons under preventive detention).
   - **NRI Voting:** Non-Resident Indians can vote but currently must be **physically present** in their respective constituencies (Section 20A of RPA 1950).

1.3. CUSTODIAL VIOLENCE AND POLICE ACCOUNTABILITY IN INDIA

Context: **Recently**, a trial court in Madurai, Tamil Nadu, awarded the **death penalty** to nine policemen found guilty of the custodial torture and murder of a trader, P. Jayaraj, and his son, J. Benicks.

The incident, which occurred in June 2020 at the Sattankulam police station, involved brutal physical assault during the COVID-19 lockdown. The judge categorized the act as a "social evil" and a "case of the fence eating the crop," emphasizing that law enforcement officers who are meant to protect the public had instead committed a heinous crime.

This verdict has reignited the national debate on police accountability and the urgent need for anti-torture legislation in India.

1. **Defining Custodial Violence**

   Custodial violence refers to the infliction of physical or mental suffering on individuals while they are in custody of the police or judicial authorities. It includes:

   - **Physical Torture:** Beating, third-degree methods, and sexual assault.
   - **Psychological Torture:** Threats, humiliation, and sleep deprivation.
   - **Custodial Death:** Fatalities occurring in police lockups or prisons.

2. **Constitutional Safeguards**

   The Indian Constitution provides several protections to prevent the abuse of power by the state:

   - **Article 20(3):** Provides the right against **self-incrimination**, ensuring no person is compelled to be a witness against themselves.
   - **Article 21:** Guarantees the **Right to Life and Personal Liberty**, which the Supreme Court has interpreted to include the right to be free from torture and cruel treatment.
   - **Article 22:** Provides protection against arrest and detention, including the right to be informed of the grounds of arrest and the right to consult a legal practitioner.

3. **Legal Provisions**

   - **Indian Penal Code (IPC) / Bharatiya Nyaya Sanhita (BNS):** Sections 330 and 331 of the IPC (now relevant sections in BNS) penalize the use of hurt or grievous hurt to extort confessions.
   - **Code of Criminal Procedure (CrPC) / Bharatiya Nagarik Suraksha Sanhita (BNSS):** Section 176(1A) of the CrPC mandates a **judicial inquiry** (by a Magistrate) in cases of death, disappearance, or rape in custody.
   - **Indian Evidence Act:** Section 25 states that a confession made to a police officer cannot be proved against an accused.

4. **Landmark Judicial Guidelines: D.K. Basu vs. State of West Bengal (1997)**

   The Supreme Court laid down 11 mandatory requirements for arrest and detention to prevent custodial torture:

   - **Identification:** Police personnel must wear clear, visible name tags with designations.
   - **Arrest Memo:** A memo must be prepared at the time of arrest, attested by at least one witness (family member or local respectable person).
   - **Right to Inform:** The arrestee has the right to have a friend or relative informed of the arrest as soon as possible.
   - **Medical Examination:** The arrestee should be examined at the time of arrest and every 48 hours during detention by a trained doctor.
   - **Legal Access:** The arrestee may be permitted to meet their lawyer during interrogation (though not throughout).

5. **International Standards**
    - **United Nations Convention Against Torture (UNCAT):** India signed this convention in 1997 but has **not yet ratified** it. Ratification would require India to enact a specific standalone law criminalizing torture.

1.4. CONSTITUTION (ONE HUNDRED AND THIRTY-FIRST AMENDMENT) BILL, 2026

Context: **Recently**, the Union Government introduced the **Constitution (One Hundred and Thirty-First Amendment) Bill, 2026** in the Lok Sabha. The Bill aims to overhaul the electoral map of India by expanding the strength of the Lower House to **850 members** and enabling the immediate rollout of 33% reservation for women by decoupling it from the requirement of a post-2026 Census.

Key Provisions of the 131st Amendment Bill, 2026

1. **Expansion of Lok Sabha Strength**

    The Bill proposes a significant increase in the membership of the Lok Sabha to accommodate India's growing population.

    - **Total Seats:** Increased from 543 to **850**.
    - **State Representation:** Maximum seats for States capped at **815**.
    - **UT Representation:** Maximum seats for Union Territories capped at **35**.
    - **Rationale:** To improve the representative-to-population ratio, which has remained stagnant based on the 1971 Census data.

2. **Amendment to Article 81 and 82 (Removing the Freeze)**
    - **Article 82:** Currently, this article mandates that delimitation can only happen after the first Census conducted after the year 2026. The 131st Amendment seeks to **delete this proviso**.
    - **Data Baseline:** It allows the government to use the **2011 Census** (or any "last preceding published census" as determined by Parliament) to redraw constituencies immediately, rather than waiting for the final results of the 2027 Census.

3. **Accelerated Women's Reservation (Article 334A)**
    - The **106th Amendment Act (2023)** had stipulated that women's reservation would only take effect after a census and subsequent delimitation.
    - The 131st Amendment modifies **Article 334A** to allow the 1/3rd reservation to be implemented for the **2029 General Elections** by linking it to the expedited delimitation process proposed in this Bill.

4. **Role of the Delimitation Commission 2026**
    - The Bill is accompanied by a new **Delimitation Bill, 2026**.
    - The Commission will be chaired by a **retired or serving Supreme Court Judge**.
    - It will include the Chief Election Commissioner and respective State Election Commissioners.
    - **Judicial Immunity:** As per standard practice, the orders of the Delimitation Commission, once published in the Gazette, cannot be called into question in any court of law.

5. **Federal Challenges and Concerns**
    - **North-South Divide:** Southern states (like Tamil Nadu and Kerala) fear a loss of political weight because they successfully implemented population control, whereas Northern states (like Uttar Pradesh and Bihar) will see a massive surge in seats due to higher population growth.

- **Constitutional Default:** By removing the 1971 freeze, the Bill reverts to the default of **Article 81(2)(a)**, which requires seats to be proportional to population, potentially penalizing states with better demographic management.

1.5. 131ST CONSTITUTIONAL AMENDMENT BILL, 2026

Context: **Recently**, the Lok Sabha was adjourned sine die following the defeat of the **Constitution (131st Amendment) Bill, 2026**, which failed to secure the mandatory two-thirds "Special Majority" required under Article 368. This legislative proposal sought to increase the strength of the Lok Sabha to **850 members** and decouple the implementation of **women's reservation** from the post-2026 census requirements.

1. Constitutional Source and Power

- The power to amend the Constitution is enshrined in **Article 368** of **Part XX**.
- It grants Parliament the "constituent power" to add, vary, or repeal any provision.
- However, as per the **Kesavananda Bharati Case (1973)**, this power is not absolute and cannot be used to alter the **"Basic Structure"** of the Constitution.

2. Procedure for Amendment

The procedure for a Constitutional Amendment Bill (CAB) is distinct from ordinary bills in the following ways:

- **Initiation:** A CAB can only be initiated in **either House of Parliament** (Lok Sabha or Rajya Sabha) and not in State Legislatures.
- **Introduction:** It can be introduced by either a **Minister** or a **Private Member**.
- **Prior Permission:** Unlike Money Bills, a CAB **does not require** the prior recommendation of the President for its introduction.
- **Passage:** The Bill must be passed in each House by a **Special Majority** (a majority of the total membership of that House AND a majority of not less than two-thirds of the members present and voting).
- **No Joint Sitting:** There is **no provision for a joint sitting** of the two Houses in case of a deadlock over a CAB. Each House must pass it separately.
- **State Ratification:** If the Bill seeks to amend the **federal features** of the Constitution (e.g., election of the President, Seventh Schedule, representation of states in Parliament), it must also be ratified by the legislatures of **half of the states** by a **simple majority**.
- **Presidential Assent:** Once passed by both Houses (and ratified by states if necessary), the President **must give assent** to the Bill. The **24th Amendment Act of 1971** made it obligatory for the President to give his assent; he can neither withhold assent nor return the Bill for reconsideration.

3. Types of Amendments

The Constitution provides for three categories of amendments, though Article 368 specifically deals with the latter two:

Type of Amendment	Requirement	Examples
Simple Majority	Majority of members present and voting. (Not deemed as amendment under Art 368).	Admission of new states; Abolition/ Creation of Legislative Councils; Quorum in Parliament.

Special Majority (Art 368)	Total Membership (>50%) + 2/3rd Present & Voting.	Fundamental Rights; Directive Principles of State Policy (DPSP).
Special Majority + State Ratification	Special Majority + Consent of 1/2 of State Legislatures.	Distribution of legislative powers; Supreme Court & High Courts; Goods and Services Tax Council (Art 279A).

1.6. PNGRB: REGULATING INDIA'S GAS SECTOR

Context: **Recently**, the Petroleum and Natural Gas Regulatory Board (PNGRB) has moved toward the final stages of awarding bids for four major LPG pipelines spanning approximately 2,500 km, an initiative aimed at eliminating road-based bulk LPG transportation by 2030.

Furthermore, the board has been in the news for implementing the **Unified Tariff Regime (effective January 2026)**, which operationalizes the "One Nation, One Grid, One Tariff" model to make natural gas more affordable for distant consumers and industrial hubs across India.

PNGRB

Petroleum and Natural Gas Regulatory Board

1. **Origin and Legal Status**

   The PNGRB is a **statutory body** established under the **Petroleum and Natural Gas Regulatory Board Act, 2006**. It operates under the aegis of the Ministry of Petroleum and Natural Gas (MoPNG).

2. **Composition of the Board**

   - The Board consists of a **Chairperson**, a **Member (Legal)**, and three other members.
   - All members are appointed by the Central Government based on the recommendations of a Search Committee.

3. **Regulatory Mandate and Scope**

   The PNGRB's jurisdiction is primarily focused on the **downstream and midstream** sectors.

   - **What it Regulates:** Refining, processing, storage, transportation, distribution, marketing, and sale of petroleum, petroleum products, and natural gas.
   - **What it DOES NOT Regulate:** The **production (upstream)** of crude oil and natural gas is outside the purview of the PNGRB.
   - **Key Responsibilities:** Registering entities to market notified petroleum products and operate LNG terminals.
     - Authorizing the laying of pipelines (Common Carriers) and City Gas Distribution (CGD) networks.
     - Ensuring competitive markets and preventing restrictive trade practices.
     - Setting technical standards and safety specifications for the sector.

4. **Quasi-Judicial Powers and Appeal Mechanism**

   The PNGRB functions as a **quasi-judicial body** with powers equivalent to a **Civil Court** for the purpose of adjudicating disputes.

   - **Dispute Resolution:** It can decide on matters between entities or between an entity and any other person regarding the transport or marketing of gas.
   - **Appeals:** Any person aggrieved by an order or decision of the Board can file an appeal with the **Appellate Tribunal for Electricity (APTEL)**, established under the Electricity Act, 2003.

5. **Recent Policy Initiatives (2025–2026)**
   - **Unified Tariff Regime:** PNGRB replaced the multiple-layered tariff system with a unified structure. This ensures that customers located far from gas sources do not pay prohibitively high transportation costs.
   - **Compressed Bio-Gas (CBG) Integration:** Mandatory blending obligations for CBG in CNG and PNG segments commenced from **FY 2025-26** to support the SATAT initiative.
   - **LPG Interoperability:** The Board is facilitating digital and physical infrastructure to allow consumers more flexibility in choosing LPG service providers.

1.7. DELIMITATION REFORM IN INDIA 2026

Context: **Recently**, the Union Government convened a special session of Parliament to introduce a landmark suite of legislations: the **Constitution (131st Amendment) Bill, 2026**, the **Delimitation Bill, 2026**, and the **Union Territories Laws (Amendment) Bill, 2026**. This move follows the mandate of the **Nari Shakti Vandan Adhiniyam (106th Amendment)**, which tied the implementation of 33% women's reservation to the completion of a fresh delimitation exercise. In light of the delayed 2021 Census, these bills propose to utilize the **2011 Census** data to increase the Lok Sabha strength to **850 seats**, aiming to resolve the long-standing freeze on parliamentary seats while ensuring electoral parity across the nation.

1. **Definition and Objective**
   - **Definition:** Delimitation is the act of redrawing boundaries of Lok Sabha and State Assembly seats to reflect changes in population.
   - **Primary Objective:** To provide equal representation to equal segments of the population, ensuring "One Vote, One Value."
2. **Constitutional Framework**
   - **Article 81:** Specifies the composition of the Lok Sabha. It mandates that the ratio between the number of seats allotted to each State and the population of the State is, so far as practicable, the same for all States.
   - **Article 82:** The Parliament enacts a **Delimitation Act** after every Census. Once the Act is in force, the President appoints a Delimitation Commission.
   - **Article 170:** Similar to Article 82, but applies to the readjustment of constituencies for **State Legislative Assemblies**.
   - **Article 327:** Empowers Parliament to make provisions with respect to all matters relating to elections, including delimitation.
   - **Article 329(a):** Bars the judiciary from interfering in the delimitation of constituencies.
3. **The Delimitation Commission (The Boundary Commission)**
   - **Nature:** A high-power body whose orders have the force of law.
   - **Composition:**
   - **Chairman:** A serving or retired Judge of the **Supreme Court**.
   - **Ex-officio:** The Chief Election Commissioner (or an EC nominated by them) and the State Election Commissioner of the concerned State.

- **Associate Members:** 10 members (5 Lok Sabha MPs and 5 State MLAs) are appointed for each state. **Note:** They have no right to vote or sign the final report.
- **Finality of Orders:** Orders are laid before the Lok Sabha/Assembly. However, these houses **cannot** make any modifications to the orders.

4. **The History of the "Freeze"**
   - **1952, 1963, 1973, 2002:** The years Delimitation Commissions were constituted.
   - **42nd Amendment (1976):** Froze the allocation of seats based on the 1971 Census until the 2001 Census to ensure states' family planning efforts didn't reduce their political clout.
   - **84th Amendment (2001):** Extended the freeze on the **number of seats** until the first census after **2026** (originally intended to be the 2031 census). However, it allowed the redrawing of **internal boundaries** within states based on the 1991 (later 2001) census.
   - **87th Amendment (2003):** Provided for delimitation on the basis of the **2001 Census** without changing the total number of seats.
5. **Current 2026 Proposal & The Federal Crisis**
   - **The 850-Seat Plan:** The 2026 Bills propose increasing seats to **850** to ensure that no state loses its current number of seats, even as northern states gain more due to higher population growth.
   - **The Population Paradox:** Southern states (Kerala, Tamil Nadu, etc.) argue that delimitation based purely on population penalizes them for succeeding in national population control goals.
   - **New Criteria:** Experts and the NITI Aayog have suggested that the new Commission may consider "additional markers" alongside population, such as economic contribution or social indicators, to maintain federal balance.

1.8. ONLINE GAMING RULES 2026

Context:

Recently, the Ministry of Electronics and Information Technology (MeitY) notified the **Promotion and Regulation of Online Gaming Rules, 2026**, which are set to come into effect from May 1, 2026. These rules act as subordinate legislation to operationalize the **Promotion and Regulation of Online Gaming Act, 2025**.

The notification marks a significant shift toward a "light-touch" regulatory framework that mandates registration for e-sports while keeping casual social games largely optional, alongside a strict ban on real-money gambling platforms.

1. **The Legal Framework: PROG Act, 2025**
   - **Objective:** To provide a uniform national framework for the growth of e-sports and social games while prohibiting harmful "online money games."
   - **Scope:** Applies to all online gaming services offered within India or operated from abroad but accessible to Indian users.
   - **Prohibition:** It imposes a **complete ban** on online money games, including those based on "games of skill," "games of chance," or a hybrid of both, if they involve financial stakes or rewards that can be monetized outside the game.
2. **The Online Gaming Authority of India (OGAI)**
   - **Status:** Established as an **attached office** under MeitY.

- **Composition:** A multi-sectoral body chaired by the **Additional Secretary, MeitY**. It includes ex-officio members from the Ministries of Home Affairs, Finance, Information & Broadcasting, Youth Affairs and Sports, and Legal Affairs.
- **Powers:** * Functions as a quasi-judicial body with powers of a **civil court** to summon individuals and conduct inquiries.
  - Issues **Digital Certificates of Registration** (valid for up to 10 years).
  - Empowered to direct banks and payment gateways to block financial transactions linked to prohibited games.

3. Classification and Registration Rules

The 2026 Rules introduce a three-tier trigger for "determination" (classification) of games:

- **Mandatory Registration:** Strictly required for all **e-sports** titles and any specific categories of games notified by the Centre due to risks of addiction or financial loss.
- **Voluntary/Optional Registration:** Most online social games (casual/educational) do not require mandatory registration unless the publisher seeks regulatory clarity.
- **Determination Process:** Once an application is filed, the OGAI must deliver a decision within **90 days**.

4. Age Classification and Standards

- **BIS Standard (IS 19690:2026):** The Bureau of Indian Standards has introduced six age bands: **U/A 0+, 3+, 7+, 13+, 16+, and A (Adults Only)**.
- **Content Regulation:** The rules allow the government to notify mandatory age classifications if deemed necessary to address gaming addiction or psychological risks.

5. Enforcement and Penalties

- **Blocking Power:** Section 69A of the IT Act is leveraged to block illegal betting/gambling sites.
- **Penalties:** Offering prohibited money games can lead to **3 years imprisonment** and a fine of up to **₹1 crore**.
- **Grievance Redressal:** A two-tier system where users first approach the service provider and then appeal to the OGAI within 30 days.

1.9. ANTI-DEFECTION LAW IN INDIA

Context: **Recently**, the Anti-Defection Law has regained national prominence following the resignation of several high-profile legislators from the Aam Aadmi Party (AAP) in Delhi and Punjab to join the Bharatiya Janata Party (BJP). These political shifts, have triggered fresh legal debates regarding the potential disqualification of Rajya Sabha members and State MLAs under the **Tenth Schedule**.

Furthermore, the Supreme Court has recently intensified its scrutiny of the "time-bound" disposal of disqualification petitions, emphasizing that Speakers cannot indefinitely delay decisions to favor a particular political faction.

1. Introduction and Constitutional Basis

The Anti-Defection Law was introduced to curb the "Aya Ram, Gaya Ram" culture of frequent floor-crossing which destabilized governments.

- **52nd Amendment Act, 1985:** This amendment inserted the **Tenth Schedule** into the Constitution.
- **Articles Affected:** It amended Articles 102(2) and 191(2), which deal with the disqualification of Members of Parliament and State Legislatures, respectively.

2. Grounds for Disqualification

The law specifies three categories of members who can be disqualified:

1. **Members of Political Parties:**
   a. If they **voluntarily give up** the membership of their political party. (Note: Resignation is not mandatory; "conduct" can also imply giving up membership).
   b. If they vote or abstain from voting in the House **contrary to the direction (whip)** issued by the party without prior permission, and the act is not condoned by the party within **15 days**.
2. **Independent Members:**
   a. If an independent candidate joins **any** political party after the election.
3. **Nominated Members:**
   a. If they join a political party **after the expiry of six months** from the date they take their seat. (They can join a party within the first six months without penalty).

3. Key Exceptions

Legislators are protected from disqualification in the following scenarios:

- **Merger (2/3rd Rule):** If at least **two-thirds** of the members of a party's legislative wing agree to a merger with another party.
- **Presiding Officers:** If a member is elected as the Speaker or Chairman, they may resign from their party and rejoin it after they demit office without being disqualified.

4. The 91st Amendment Act, 2003

This amendment significantly strengthened the law by:

- **Removing the "Split" Provision:** Earlier, a "split" by one-third of the members protected them from disqualification; this was abolished to prevent frequent breaks in parties.
- **Limiting the Cabinet Size:** The total number of ministers, including the PM/CM, cannot exceed **15%** of the total strength of the Lok Sabha/Legislative Assembly (State minimum is 12).
- **De-barring from Office:** Any member disqualified for defection is also disqualified from being appointed as a **Minister** or holding any **remunerative political post** until the end of their term or until they are re-elected.

5. The Deciding Authority and Judicial Review

- **The Presiding Officer:** The Speaker or Chairman of the House has the final authority to decide on disqualification.
- **Kihoto Hollohan Case (1992):** The Supreme Court ruled that while the Speaker decides, the decision is subject to **Judicial Review**. The Speaker acts as a "Tribunal" in such cases.
- **Timeline:** While the law does not specify a timeline, the SC in the **Keisham Meghachandra Singh Case (2020)** suggested that disqualification petitions should ideally be decided within **three months**.

1.10. THE MAHANADI RIVER CRISIS

Context: The Mahanadi Water Disputes Tribunal (MWDT) has issued a final ultimatum to the states of Odisha and Chhattisgarh to present a mutual water-sharing settlement by May 2. Failing this, the tribunal has stated it will proceed to deliver a judgment on the merits of the case.

1. The Mahanadi River System

- **Nomenclature:** Derived from Sanskrit words "Maha" (great) and "Nadi" (river).

- **Characteristics:** A major east-flowing peninsular river recognized for its high silt load, historical flood cycles, and immense agricultural importance.
- **Origin:** Nagri Sihawa Hills near Pharsiya village, Dhamtari district, Chhattisgarh (altitude: ~442m).
- **Length & Outflow:** Travels approximately 900 km (560 miles), emptying into the Bay of Bengal via distributaries near Paradip, Odisha.
- **Catchment Area:** Spans roughly 1.32 lakh sq. km.
- **Basin States:** Primary flow through Chhattisgarh (upper and middle basin) and Odisha (lower basin and delta), with minor catchments in Jharkhand, Maharashtra, and Madhya Pradesh.
- **Left Bank Tributaries:** Seonath (Shivnath), Hasdeo, Mand, and Ib.
- **Right Bank Tributaries:** Ong, Tel, and Jonk

2. Key feature

- **Hirakud Dam:** Situated in Odisha, it is the world's longest earthen dam, functioning for flood control, irrigation, and hydropower generation.
- **Satkosia Gorge:** An ecologically sensitive and scenic geographical formation cutting through the Eastern Ghats.
- **Delta Region:** One of India's largest delta systems, shared with the Brahmani River, acting as a crucial base for agriculture, fisheries, and port operations.
- **Biodiversity:** The ecosystem sustains over 130 avian species, diverse fish populations, and key tiger reserve zones.

The Mahanadi River Water Dispute

The conflict between Odisha and Chhattisgarh centers on the equitable sharing of the Mahanadi River's water resources.

Odisha's Grievances

- Reports a severe reduction in river flow entering its territory, resulting in harm to its population and environment.
- Attributes this decline to Chhattisgarh's construction of upstream dams and barrages, alongside its increased water consumption.
- Cites severe downstream impacts on state irrigation, drinking water supply, and coastal ecology.

Chhattisgarh's Defense

- Asserts its right to utilize the river water to meet state requirements based on its geographical share.
- Constitutes 52.9% of the river's total basin catchment area.
- Encompasses nearly 90% of the river's catchment area situated upstream of the Hirakud Dam.

Tribunal Intervention

- In 2018, following a petition filed by Odisha, the Supreme Court directed the Central Government to intervene.
- The Mahanadi Water Disputes Tribunal (MWDT) was formally constituted on March 12, 2018.
- The MWDT was established under the provisions of the Inter-State River Water Disputes Act, 1956.

Inter-State Water Disputes in India

- **Nature of Conflicts:** Disputes arise between neighboring states over the sharing of inter-state river waters, directly impacting basic water needs, agriculture, and public livelihoods.
- **Constitutional Authority:** Article 262 of the Constitution empowers Parliament to legislate the adjudication of any dispute or complaint regarding the use, distribution, or control of inter-state river or river valley waters.
- **Statutory Mechanism:** To formally settle these conflicts, Parliament enacted the Inter-State River Water Disputes Act, 1956, pursuant to the powers granted under Article 262.

1.11. GOVERNMENT GRANTS DEEMED UNIVERSITY STATUS TO NCERT

Context: The Ministry of Education has issued a formal notification declaring the **National Council for Educational Research and Training (NCERT)** as an institution **deemed to be a university**. This status follows recommendations from an expert panel approved by the **University Grants Commission (UGC)** in January.

1. **Key Provisions and Implications**
   - **Expanded Role**: The new status transitions NCERT from a nodal school curriculum body into a **higher education and research institution**.
   - **Degree-Granting Authority**: NCERT and its **six regional institutes** are now empowered to offer academic courses, design their own programmes, and **grant degrees** (undergraduate, postgraduate, and doctoral).
   - **Research Focus**: The mandate specifically directs the body to begin **doctoral programmes** and expand into "innovative academic areas".
   - **Global Reach**: The notification allows for the establishment of **off-campus or offshore campuses**, provided they comply with UGC norms and guidelines.
2. **Mandatory Compliance and Conditions**
   - **UGC Norms**: All academic courses must conform to the standards prescribed by the **UGC** and other relevant statutory bodies.
   - **Non-Commercial Nature**: NCERT is strictly prohibited from engaging in any activities that are **"commercial" or "profit-making"** in nature.
   - **Accreditation**: The institution must secure accreditation from the **National Assessment and Accreditation Council (NAAC)** and obtain programme ratings from the **National Board of Accreditation**.
   - **NEP 2020 Alignment**: All future expansions and academic endeavours must align with the **National Education Policy (NEP) 2020**.
3. **About NCERT:**

   NCERT (1961) is an autonomous body under the Government of India that advises Centre and States on improving school education quality.

   Key Functions:
   - Conducts and promotes research in school education
   - Develops textbooks, learning materials, and digital content
   - Organises teacher training (pre-service & in-service)
   - Promotes innovative teaching methods and practices
   - Collaborates with states, universities, NGOs, and international organisations
   - Acts as a nodal agency for Universalisation of Elementary Education
   - Supports bilateral and international educational exchange programmes

1.12. CENTRAL ARMED POLICE FORCES BILL, 2026

Context: Recently, the **Central Armed Police Force (General Administration) Bill, 2026** was passed in the **Lok Sabha** via a **voice vote**. The Bill seeks to restructure the administrative and promotional hierarchy within the CAPFs.

Key Features of the CAPF Bill

1. **Reservation of Senior Posts for IPS Officers**

   The most critical and controversial provision of the Bill involves the "deputation" of Indian Police Service (IPS) officers into senior CAPF ranks:

   - **Inspector-General (IG):** 50% of total posts to be filled by IPS officers.
   - **Additional Director-General (ADG):** At least 67% of posts to be filled by IPS officers.
   - **Special DG & Director-General (DG):** 100% of these top-tier ranks are reserved for IPS officers on deputation.

2. **Scope of Application:** The Act covers the five major CAPFs—CRPF, BSF, CISF, ITBP, and SSB—and authorizes the Central Government to include additional forces through notification.
3. **Rule-Making Power:** It grants the Central Government authority to formulate rules regarding recruitment, deputation, and service conditions, with such rules having overriding effect over existing laws and judicial decisions.
4. **Nodal Administrative Authority:** The Bill grants the Ministry of Home Affairs (MHA) expanded powers to move officers between different CAPFs for administrative exigencies, though the distinct identity of each force (e.g., the border-guarding role of the BSF vs. the internal security role of the CRPF) is to be maintained.

Important Supreme Court Judgements

In May 2025, the Supreme Court issued a specific directive to address career stagnation:

- **Phasing Out Deputation:** The Court ordered the government to **"progressively reduce"** IPS deputation in CAPFs up to the rank of IG over a period of two years.
- **Cadre Review:** It mandated a comprehensive cadre review within six months to ensure more promotion avenues for homegrown cadre officers.

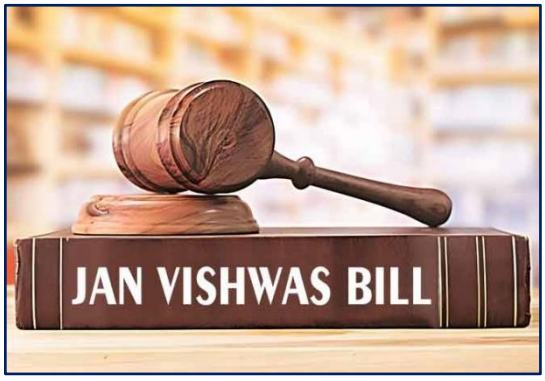
About CAPF

- The Central Armed Police Forces (CAPF) are seven security units under India's Ministry of Home Affairs (MHA), responsible for internal security, border patrol, and counter-insurgency, with over 10 lakh personnel. Key forces include CRPF, BSF, CISF, ITBP, SSB, NSG, and Assam Rifles.

Force	Full Form	Primary Border / Role
BSF	Border Security Force	**Pakistan** and **Bangladesh** borders.
ITBP	Indo-Tibetan Border Police	**China** (Line of Actual Control - LAC).
SSB	Sashastra Seema Bal	**Nepal** and **Bhutan** borders.
Assam Rifles	—	**Myanmar** border (Sentinels of the North-East).
CRPF	Central Reserve Police Force	**Internal Security** (Naxalism, Riot control, Elections).

CISF	Central Industrial Security Force	**Industrial Security** (Airports, Metro, Space & Nuclear installs).
NSG	National Security Guard	**Counter-terrorism** and Anti-hijacking (The "Black Cats").

1.13. JAN VISHWAS BILL, 2026



Context: **Recently**, the Lok Sabha passed the **Jan Vishwas (Amendment of Provisions) Bill, 2026**, a successor to the 2023 Act, aiming to decriminalize over **700 provisions** across **79 Central Acts**. By replacing minor criminal punishments with civil penalties, the Bill seeks to reduce judicial burden and foster trust-based governance.

Union Minister Piyush Goyal noted that the reform shifts from colonial-era "punishment-centric" laws to a "justice-oriented" framework, specifically benefiting MSMEs and entrepreneurs by enhancing the ease of doing business.

1. **Scope and Objective**
   - **Total Amendments:** The Bill proposes to amend **784 provisions** spanning across **79 Central Acts** administered by **23 different Ministries**.
   - **Primary Goal:** It aims to bolster the **"Ease of Doing Business"** and **"Ease of Living"** by decriminalizing minor, technical, and procedural defaults that do not involve any threat to national security or public interest.
   - **Decriminalization Stats:** Out of the proposed changes, **717 provisions** are specifically being decriminalized, while **67 provisions** are being amended to simplify daily living for citizens.
2. **Key Features of the Reform**
   - **Replacement of Imprisonment:** For several minor offences under laws like the **Motor Vehicles Act (1988)** and the **Electricity Act (2003)**, the Bill replaces jail terms with monetary penalties.
   - **Adjudication Mechanism:** To reduce the load on the judiciary, the Government will appoint **Adjudicating Officers** to determine penalties through administrative inquiries rather than court trials.
   - **Appellate Authority:** A structured grievance redressal system is introduced where individuals can appeal to the decisions of Adjudicating Officers to a higher administrative authority.
   - **Graduated Penalties:** The Bill introduces the concept of **warnings** or **improvement notices** for first-time offenders in specific categories, moving to monetary fines only for repeat violations.
   - **Periodic Revision:** To ensure the penalties remain effective in deterrents, the Bill mandates a **10% increase** in the minimum amount of fines and penalties every **three years**.
3. **Major Acts Targeted**

   The Bill covers a wide array of sectors, including but not limited to:
   - **Environment & Forests:** Indian Forest Act (1927), Environment (Protection) Act (1986).
   - **Media & Tech:** Information Technology Act (2000), Press and Registration of Books Act.
   - **Trade & Industry:** Patents Act (1970), Copyright Act (1957), Trade Marks Act (1999).
   - **Consumer Protection:** Legal Metrology Act (2009), Food Safety and Standards Act (2006).

1.14. GOVERNOR'S CLEMENCY POWERS UNDER ARTICLE 161

Context: **Recently**, a Full Bench of the **Madras High Court** ruled that the Governor of a State is strictly bound by the "aid and advice" of the State Council of Ministers while exercising powers under **Article 161** of the Constitution.

The Court clarified that the Governor, regardless of personal opinion, cannot exercise independent discretion or take a different view from the Cabinet regarding the remission and premature release of convicts.

1. Scope of Article 161

Article 161 of the Indian Constitution empowers the **Governor of a State** to grant:

- **Pardon:** Completely absolves the convict from the sentence and the conviction.
- **Reprieve:** A temporary stay on the execution of a sentence.
- **Respite:** Awarding a lesser sentence in place of one originally awarded due to special facts (e.g., pregnancy or physical disability).
- **Remission:** Reducing the period of the sentence without changing its character (e.g., reducing two years of rigorous imprisonment to one year).
- **Commutation:** Substituting one form of punishment for a lighter form (e.g., rigorous imprisonment to simple imprisonment).

2. Limitations on Article 161

- **Jurisdiction:** The power extends only to matters to which the **executive power of the State** extends (offences against State laws).
- **Death Penalty:** Unlike the President, the Governor **cannot pardon** a death sentence. However, the Governor **can** suspend, remit, or commute a death sentence.
- **Court Martial:** The Governor has no power to grant clemency in cases of punishment by a Military Court (Court Martial).

Recent Madras High Court Judgement (April 2026)

The Full Bench of the Madras High Court addressed whether the Governor has any "discretionary" power to reject a Cabinet recommendation for premature release.

Key Highlights of the Ruling:

- **Binding Nature of Advice:** The court held that the Governor is constitutionally obligated to follow the State Cabinet's recommendation. The phrase "aid and advice" under Article 163 is mandatory for the exercise of powers under Article 161.
- **No Independent Discretion:** The Bench ruled that under no circumstances can the Governor take a view different from the Council of Ministers in matters of remission.
- **Reliance on Precedents:** The High Court relied heavily on the Supreme Court's landmark judgements in **Maru Ram v. Union of India (1980)** and **AG Perarivalan v. State of Tamil Nadu (2022)**, which established that the executive power of the Governor is actually the power exercised by the State Government.

Comparative Analysis: President vs. Governor

Feature	President (Article 72)	Governor (Article 161)
Law under which offence is committed	Offences against Union Laws.	Offences against State Laws.
Death Sentence	Can grant **Pardon**, commute, or remit.	**Cannot Pardon**; can only commute, remit, or suspend.
Court Martial	Can grant clemency for Military Courts.	No power regarding Court Martial.
Binding Advice	Bound by Union Cabinet advice.	Bound by State Cabinet advice.

***

2.1. RED SEA, BAB AL-MANDEB & HORMUZ STRAITS

Context: **Recently**, the Red Sea region has faced a critical escalation as Iran's central military command (Khatam al-Anbiya) warned it would "completely block" the **Bab al-Mandeb Strait** and the **Strait of Hormuz** if the United States continues its naval blockade of Iranian ports.

1. **The Red Sea**

   The Red Sea is a narrow seawater inlet of the **Indian Ocean**, lying between Africa and the Arabian Peninsula.

   - **Bordering Countries (Littoral States):**
     - **Eastern Shore:** Saudi Arabia, Yemen.
     - **Western Shore:** Egypt, Sudan, Eritrea, Djibouti.
     - **Northern Extremity:** Bordered by the **Sinai Peninsula**, the Gulf of Aqaba, and the Gulf of Suez (connecting to the Mediterranean via the Suez Canal).
   - **Physical Characteristics:** It is one of the **hottest and saltiest** bodies of water in the world due to high evaporation rates and low freshwater inflow from rivers.
   - **Geological Origin:** It occupies part of the **Great Rift Valley** and was formed by the divergence of the Arabian and African tectonic plates.

2. **The Bab al-Mandeb Strait**

   Known as the **"Gate of Tears"** (Bab al-Mandeb), it is a strategic chokepoint between the Horn of Africa and the Middle East.

   - **Connection:** It connects the **Red Sea** (Northwest) to the **Gulf of Aden** and the Arabian Sea (Southeast).
   - **Bordering Nations:** It separates **Yemen** on the Arabian Peninsula from **Djibouti and Eritrea** in Africa.
   - **Key Feature:** The strait is divided into two channels by **Perim Island** (Mayyun Island), which belongs to Yemen. The western channel is wider and deeper, facilitating the movement of large oil tankers.

Strategic and Economic Importance

I. Global Trade Chokepoint

The Red Sea-Suez Canal-Bab al-Mandeb corridor is the shortest maritime route between **Europe and Asia**. If this passage is blocked, ships must travel an additional 6,000 nautical miles around Africa, increasing transit time by **14 to 20 days**.

II. Energy Security

It is a critical transit point for crude oil and Liquefied Natural Gas (LNG) from the Persian Gulf to European and American markets. Any disruption here causes an immediate spike in global **Brent crude prices**.

III. Importance for India

- **Exports:** Over 50% of India's exports to Europe and the US East Coast pass through this route.
- **Energy:** While India gets much of its oil from Russia and the Gulf via the Strait of Hormuz, the Red Sea remains vital for refined petroleum exports.
- **Security:** The Indian Navy often conducts "Anti-Piracy" and "Maritime Security Operations" (like **Operation Sankalp**) in this region to protect Indian-flagged vessels.

2.2. STRAIT OF HORMUZ CRISIS

Context: **Recently**, the Strait of Hormuz has re-emerged as a major global concern due to escalating tensions between the United States and Iran since February 2026.

The situation intensified following **military strikes, naval blockades, and threats to close the strait**, raising serious fears of disruption in global oil and gas supplies.

The region has witnessed **missile and drone attacks on vessels, mining threats, and restrictions on shipping**, significantly impacting global energy markets and trade flows.

1. **What is a Maritime Chokepoint?**
   - A **maritime chokepoint** is a **narrow water passage** that connects major seas or oceans.
   - It serves as an **alternative or shorter route for shipping**.
   - Disruption in chokepoints can:
     - Delay shipping
     - Increase transport costs
     - Disrupt global trade and energy flows
2. **Why is the Strait of Hormuz Critical?**
   - Located between **Persian Gulf and Gulf of Oman**.
   - Acts as the **only sea passage** for oil exports from major producers like:
     - Saudi Arabia
     - Iran
     - Iraq
     - UAE
     - Kuwait
   - **Width:** ~21 nautical miles (38 km) at narrowest point.
3. **Energy Significance**
   - Around **21 million barrels/day of oil** pass through → **~1/5th of global oil consumption**.
   - Also major route for **Liquefied Natural Gas (LNG)**, especially from **Qatar**.

   Key Importers:
   - India
   - China
   - Japan

- South Korea

4. **Other Key Global Chokepoints**

I. **Strait of Malacca**
   - Connects **Indian Ocean & South China Sea**
   - Major route for trade between **Asia and Europe**

II. **Bab el-Mandeb Strait**
   - Connects **Red Sea to Gulf of Aden**
   - Important for access to **Suez Canal**

III. **Suez Canal**
   - Artificial waterway in **Egypt**
   - Connects **Mediterranean Sea & Red Sea**
   - Shortens Europe–Asia trade route

IV. **Panama Canal**
   - Connects **Atlantic & Pacific Oceans**
   - Avoids long journey around South America

5. **International Law (UNCLOS)**

- Governed by **United Nations Convention on the Law of the Sea (UNCLOS)**

Key Principle: Transit Passage

- Applies to **international straits** like Hormuz
- Allows:
   - Continuous and **uninterrupted navigation**
   - Applies to **all ships and aircraft**

Limitations: Countries along the strait can regulate shipping for safety and environmental reasons, but they **cannot stop ships from passing** through or impose selective restrictions.

2.3. INDIA-ZAMBIA RELATIONS: CRITICAL MINERALS & BILATERAL

Context: India's diplomatic and economic efforts to secure a supply chain for critical minerals have hit a roadblock. Talks with Zambia have stalled due to a lack of specific assurances regarding long-term mining rights.

1. **Key Minerals in Focus**

- **Cobalt: Significance:** A vital component for lithium-ion batteries used in Electric Vehicles (EVs) and mobile phones.
   - **Global Context:** Zambia is one of the world's largest producers of cobalt (often as a byproduct of copper mining).
- **Copper: Significance:** Essential for power generation, electronics, renewable energy infrastructure, and construction.
   - **Strategic Need:** As India pushes for "Green Energy" and infrastructure growth, copper demand is surging.

2. Current Status of the Agreement

- **Land Allocation:** India was previously allocated **9,000 square kilometers** in Zambia for mineral exploration.
- **Exploration Progress:** A team of Indian geologists has already visited the site and collected mineral samples for analysis.
- **Timeline:** The exploration phase was intended to span **three years**.
- **Private Sector Involvement:** New Delhi intends to invite private Indian companies to participate in extraction once the exploration phase is successful and mining rights are legally secured.

3. The Stumbling Block: Mining Rights

- **Issue:** The primary reason for the "stall" in talks is the lack of clear assurances from the Zambian government (Lusaka) regarding **Mining Rights**.
- **Legal Security:** Without guaranteed rights to extract the minerals they find, India is hesitant to commit further investment or involve private players, as exploration is capital-intensive and risky.

4. Key Important Minerals

Mineral	Key Uses	Major Global Producers
Cobalt	EV batteries (Li-ion cathode), mobile phones, aerospace alloys	DRC (~70%), Zambia, Russia
Lithium	EV batteries, grid storage, ceramics	Australia, Chile, Argentina ("Lithium Triangle")
Copper	Power generation, electronics, construction, EVs	Chile, Peru, DRC, Zambia
Graphite	EV battery anodes, lubricants, nuclear reactors	China (~95% of processing)
Rare Earth Elements	Wind turbines, EV motors, defence electronics, magnets	China (~90% of processing)
Nickel	Stainless steel, EV batteries (NMC cathode), plating	Indonesia, Philippines, Russia
Platinum Group (PGE)	Catalytic converters, hydrogen fuel cells, jewellery	South Africa, Russia, Zimbabwe
Silicon	Solar PV cells, semiconductors, electronics	China, Russia, Brazil
Titanium	Aerospace, defence, medical implants, white pigment	China, Russia, Japan
Tungsten	Hard metal tools, armour-piercing ammunition, filaments	China (~80% of global supply)

5. About Zambia

- **Location:** Southern Africa, bordered by eight nations (Angola, DRC, Tanzania, Malawi, Mozambique, Zimbabwe, Botswana, Namibia).
- **Capital:** Lusaka.
- **Part of the Copperbelt region** — one of world's richest copper/cobalt zones (shared with DRC)
- **Global significance**: 2nd largest cobalt producer globally (after DRC)
- **Major copper exporter** — key to India's energy transition supply chain
- **Member of African Union.**
- **Key Landmarks:** Victoria Falls (border with Zimbabwe), Lake Kariba, and the Zambezi River.

2.4. INDIA CALLS FOR PROTECTION OF CIVILIANS AS LEBANON DEATH TOLL RISES

Context: India formally expressed **"deep concern"** over the growing loss of civilian lives in Lebanon following **Israeli airstrikes** on **Beirut**, the Lebanese capital. Speaking at a press briefing at the **National Media Centre, New Delhi**, the Official Spokesperson of the **Ministry of External Affairs (MEA)**, **Randhir Jaiswal**, reiterated India's respect for **"sovereignty and territorial integrity"** of all states as **"essential"**. The **Lebanese Health Ministry** reported the death toll rising to **1,223 people** — with over **357 injured** — within a single week. Israel struck targets in Beirut, claiming they were **command centres of Hezbollah**.

1. India's Official Position on the Lebanon Conflict

- **Deep Concern:** India expressed serious concern over the large number of civilian casualties in Lebanon.
- **Sovereignty & Territorial Integrity:** India emphasised that respect for these principles within the international state system is essential — a consistent cornerstone of India's foreign policy.
- **Protection of Civilians:** India has always prioritised civilian protection as the foremost concern in conflict situations.
- **Indian Embassy in Beirut:** The MEA confirmed it remains in close contact with the Indian community in Lebanon.
- **Notable omission:** India stopped short of directly mentioning Israel by name in its statement.

2. About Lebanon

2.1 Geographic Profile

Parameter	Details
Location	Eastern Mediterranean coast; West Asia (Middle East)
Borders	Syria (north & east), Israel (south), Mediterranean Sea (west)
Capital	Beirut
Area	~10,452 sq km (one of the smallest countries in West Asia)
Official Language	Arabic (French also widely used)
Currency	Lebanese Pound (LBP)
UN Membership	Founding member of the United Nations (1945)

2.2 Political System — Confessionalism

Lebanon follows a unique political system called **confessionalism**, where state power is formally distributed along religious/sectarian lines:

- There are **18 officially recognised religious communities** in Lebanon.

- The **Taif Agreement (1989)** ended the Lebanese Civil War (1975–1990) and rebalanced power between Christians and Muslims.

2.3 Hezbollah

- **Hezbollah** ("Party of God") is a **Shia political party and militant organisation** founded in **1982** with **Iranian backing** following Israel's invasion of Lebanon.
- It operates a **state-within-a-state** in southern Lebanon and parts of Beirut — with its own army, hospitals, schools, and social services.
- Designated a **terrorist organisation** by the **USA, EU, Gulf Cooperation Council (GCC)**, and several Arab states.
- Lebanon's government has **not** designated Hezbollah as a terrorist organisation.
- Hezbollah has representation in the Lebanese Parliament and Cabinet.
- It fought a major war with Israel in **2006 (Second Lebanon War)**.
- Its long-time Secretary-General, **Hassan Nasrallah**, was killed by an Israeli airstrike in **2024**.

2.5. ROHINGYA EXODUS CONTINUES AMID CRISIS

Context: Recently, the **United Nations High Commissioner for Refugees (UNHCR)** highlighted that **2025** was the deadliest year on record for Rohingya refugees. Nearly **900 individuals** died or went missing in the **Bay of Bengal** and **Andaman Sea**. This crisis underscores the desperate humanitarian situation in Myanmar's Rakhine State and the overcrowded camps in Cox's Bazar, Bangladesh.

I. Key Geographic & Conflict Zones

- **Source Points:** Most maritime movements originate from **Cox's Bazar** (Bangladesh) and **Rakhine State** (Myanmar).
- **Transit Routes:** The journeys cross the **Bay of Bengal** and the **Andaman Sea**.
- **Destination Points:** Refugees primarily aim for **Malaysia** and **Indonesia** seeking better livelihood opportunities.
- **Geographic Risk:** The maritime route is described as an "unmarked graveyard," with over **5,000 deaths** recorded in the last decade.

II. Drivers of Migration (The "Push" Factors)

- **Funding Shortfalls:** Reduced international aid in Bangladesh has led to food and security crises in camps.
- **Lack of Prospects:** Limited access to education and legal employment in refugee camps.
- **Statelessness:** The Rohingya remain the world's largest stateless population, denied citizenship by Myanmar's **1982 Citizenship Law**.
- **Vulnerable Demographics:** Over **50%** of those on boats are women and children, making them prime targets for **human trafficking** and exploitation.

III. About the UNHCR (UN Refugee Agency)

1. Evolution and Mandate

- **Established:** 1950, by the UN General Assembly to help millions of Europeans who had fled or lost their homes during **World War II**.
- **HQ:** Geneva, Switzerland.
- **Mandate:** To lead and coordinate international action to protect refugees and resolve refugee problems worldwide. It also has a mandate for **Stateless Persons** (under the 1954 and 1961 Conventions).
- **Governance:** Reports to the **UN General Assembly (UNGA)** and the **Economic and Social Council (ECOSOC)**.
- **Awards:** Won the Nobel Peace Prize twice (1954, 1981).

2. **Key Legal Pillars**
   - **1951 Refugee Convention:** Defines who a refugee is and sets out the rights of individuals and the legal obligations of states.
   - **Principle of Non-Refoulement:** A core tenet of international law (and Article 33 of the 1951 Convention) which prohibits states from returning a refugee to a territory where their life or freedom is threatened.
3. **India's Standing with UNHCR**
   - **Non-Signatory:** India is **not** a signatory to the 1951 Refugee Convention or the 1967 Protocol.
   - **Administrative Relationship:** Despite not being a signatory, India works closely with the UNHCR. The agency handles "mandate" refugees (like Afghans and Myanmarese) in urban areas, while the Government of India directly manages other groups (like Sri Lankan Tamils and Tibetans).
   - **Legal Framework in India:** In the absence of a specific refugee law, refugees are governed under the **Foreigners Act, 1946**, the **Registration of Foreigners Act, 1939**, and the **Passport Act, 1967**.

2.6. INDIA EXPANDS STRATEGIC FOOTPRINT IN AFRICA THROUGH IAFS-IV

Context: **Recently**, External Affairs Minister S. Jaishankar launched the official logo, theme, and website for the upcoming **4th India-Africa Forum Summit (IAFS-IV)**, scheduled to be held in New Delhi from May 28 to 31, 2026. This summit returns after a decade-long hiatus since the third edition in 2015, signaling a renewed strategic push to solidify India's role as a reliable partner for the Global South amidst global energy crises and geopolitical shifts.

1. **Evolution of the Summit**
   - **IAFS-I (2008):** Held in New Delhi; adopted the **Delhi Declaration** and the Africa-India Framework for Cooperation.
   - **IAFS-II (2011):** Held in **Addis Ababa, Ethiopia**; focused on the "Enhanced Partnership" model.
   - **IAFS-III (2015):** Held in New Delhi; saw the largest-ever participation with all 54 African nations invited.
   - **IAFS-IV (2026):** Theme: **"IA SPIRIT: India Africa Strategic Partnership for Innovation, Resilience, and Inclusive Transformation"**.
2. **Diplomatic and Institutional Footprint**
   - **Mission Expansion:** India has significantly increased its diplomatic presence, opening **17 new missions** in Africa since 2018, bringing the total to **46**.

- **G20 Integration:** Under India's 2023 Presidency, the **African Union (AU)** was admitted as a permanent member of the G20, a landmark achievement for South-South cooperation.
- **Educational Institutions:** India has established offshore campuses like **IIT Zanzibar** (Tanzania) and the National Forensic Science University (Uganda).

3. **Economic and Strategic Pillars**
   - **Energy Security:** Amidst disruptions in the Gulf, India is diversifying its energy and fertilizer imports, targeting North African nations like **Algeria, Tunisia, Libya, and Morocco** for phosphates and gas.
   - **Development Assistance:** Africa is the second-largest recipient of India's concessional **Lines of Credit (LoC)**.
   - **Digital Public Infrastructure (DPI):** Deployment of the "India Stack" (UPI, Cowin, DigiLocker) to help African nations build e-governance systems.
   - **Maritime Security:** Cooperation through the **SAGAR doctrine** (Security and Growth for All in the Region) and joint exercises like **AFINDEX**.
4. **The "Living Bridge"**
   - The **3 million-strong Indian diaspora** in Africa acts as a socio-economic bridge, contributing to trade, healthcare, and education sectors across the continent.

2.7. INDIA - SRI LANKA STRENGTHEN NAVAL COOPERATION THROUGH DIVEX 2026

Context: **Recently**, the Indian Navy's Diving Support and Submarine Rescue Vessel, **INS Nireekshak**, arrived at the Port of Colombo, Sri Lanka, to participate in the fourth edition of the **India-Sri Lanka Diving Exercise (DIVEX 2026)**. The week-long exercise (April 21–27, 2026) aims to strengthen interoperability between the diving teams of both navies and involves the handover of essential humanitarian and security aid to Sri Lanka.

1. **About INS Nireekshak (A15)**
   - **Type of Vessel:** It is a sophisticated **Diving Support Vessel (DSV)** that also serves as an interim **Submarine Rescue Vessel (SRV)**.
   - **Manufacturer:** Built by **Mazagon Dock Limited (MDL)**, Mumbai, and commissioned in 1989.
   - **Core Capabilities:** * Equipped with two **Deep Submergence Rescue Vehicles (DSRV)** capable of rescue operations at depths up to 300 meters.
     - Features a **Diving Bell**, recompression chambers, and dynamic positioning systems to maintain a steady station during deep-sea operations.
   - **Record Holder:** In 2013, its saturation divers set a national record by diving to a depth of **257 meters** in the Arabian Sea.
2. **India-Sri Lanka DIVEX 2026**
   - **Edition:** 4th Edition.
   - **Objective:** To undertake specialized underwater operations, enhance operational cohesion, and exchange "Best Practices" in diving and submarine rescue.
   - **Strategic Alignment:** The exercise is part of India's **MAHASAGAR** (Mutual and Holistic Advancement for Security and Growth Across Regions) initiative—a high-level virtual interaction for maritime security in the IOR.

3. **Humanitarian Outreach & Security Assistance**

During this visit, India extended support under its "Neighbourhood First" policy:

- **Project BHISHM (Bharat Health Initiative for Sahyog Hita & Maitri):** India presented two **BHISHM Cubes** to Sri Lanka. These are portable, integrated medical units (part of **Aarogya Maitri**) capable of treating up to 200 emergency cases, including trauma and fractures, in remote areas.
- **Ammunition Handover:** The Indian Navy handed over **50,000 rounds of 9mm ammunition** to the Sri Lankan Navy to bolster their security capabilities.

4. **Broader Strategic Frameworks**

- **SAGAR (Security and Growth for All in the Region):** India's vision to deepen economic and security cooperation with its maritime neighbors.
- **Submarine Rescue Treaties:** India is one of the few nations with advanced DSRV capabilities, often providing "Submarine Rescue Provider" status to friendly foreign navies in the Indian Ocean.

2.8. RAJNATH SINGH TO ATTEND SCO DEFENCE MINISTERS' MEET IN KYRGYZSTAN

Context: **Recently**, India's Defence Minister Rajnath Singh has been scheduled to travel to Bishkek, Kyrgyzstan, on April 27-28, 2026, to participate in the Shanghai Cooperation Organisation (SCO) Defence Ministers' meeting.

This high-level visit aims to address pressing regional security challenges, including terrorism and extremism, amidst rapidly shifting global alignments. The meet is significant as it provides a platform for India to engage in bilateral discussions with member states to enhance strategic partnerships and reinforce its commitment to Eurasian stability.

1. **Overview and Evolution**

The SCO is a permanent intergovernmental international organization established to ensure security and maintain stability across the vast Eurasian region.

- **Genesis:** It evolved from the **Shanghai Five** (1996), which consisted of China, Russia, Kazakhstan, Kyrgyzstan, and Tajikistan.
- **Establishment:** The SCO was officially founded on **June 15, 2001**, in Shanghai, with the addition of **Uzbekistan**.
- **Charter:** The SCO Charter was signed in 2002 and entered into force in 2003, serving as the organization's fundamental legal document.

2. **Membership and Expansion**

The SCO has transitioned from a Central Asian centric group to a major Eurasian power bloc.

- **Current Members (10):** China, Russia, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, India, Pakistan, **Iran** (joined 2023), and **Belarus** (joined 2024).
- **India and Pakistan:** Both countries became permanent members during the Astana Summit in **2017**.
- **The 2025 Reform:** The summit in Tianjin streamlined the organization by merging "Observer States" and "Dialogue Partners" into a single **Partner Status** category to enhance operational efficiency.

3. **Institutional Structure**

The SCO operates through several specialized bodies to handle political and security mandates.

- **Council of Heads of State (CHS):** This is the supreme decision-making body that meets annually to define the organization's primary goals.
- **Secretariat:** Based in **Beijing**, China, it provides administrative and technical support.
- **Regional Anti-Terrorist Structure (RATS):** Headquartered in **Tashkent**, Uzbekistan, it is a permanent organ focused on combating the "three evils": terrorism, separatism, and extremism.
- **Official Languages:** The working languages of the organization are **Russian** and **Chinese**.

4. **Key Principles and Strategic Focus**

- **Shanghai Spirit:** The organization is guided by principles of mutual trust, mutual benefit, equality, and respect for cultural diversity.
- **Security Focus:** A major portion of SCO's activity involves intelligence sharing and joint military exercises, such as the "Peace Mission" series.
- **Economic Connectivity:** The SCO serves as a platform for discussing energy security and the development of transit corridors, though India remains cautious of projects like the Belt and Road Initiative (BRI).

5. **Current Leadership (2025–2026)**

- **Chairmanship:** The **Kyrgyz Republic** currently holds the chairmanship for the 2025–2026 period.
- **Theme:** The motto for the current tenure is "25 Years of the SCO: Together Towards Sustainable Peace, Development, and Prosperity."

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3.1. MONETARY POLICY COMMITTEE

Context: **Recently**, the Monetary Policy Committee (MPC) of the Reserve Bank of India (RBI), led by Governor **Sanjay Malhotra**, unanimously voted to keep the benchmark **Repo Rate** unchanged at **5.25%**.

This decision comes in the wake of a temporary ceasefire in West Asia announced by the U.S. administration. Despite the easing of immediate hostilities, the RBI has adopted a cautious "wait and watch" approach, maintaining a **neutral stance** while factoring in supply-side shocks, elevated energy prices, and their subsequent impact on India's inflation and growth trajectory for the fiscal year 2026-27.

1. What is the Monetary Policy Committee?

The MPC is a statutory and institutionalized framework under the **Reserve Bank of India Act, 1934**, tasked with maintaining price stability while keeping in mind the objective of growth.

- **Origin:** It was established based on the recommendations of the **Urjit Patel Committee**.
- **Mandate:** The primary objective is to fix the benchmark policy rate (Repo Rate) to contain inflation within the specified target level (4% +_ 2%).
- **Legal Provision:** Section 45ZB of the amended RBI Act, 1934.

2. Composition of the MPC

The committee consists of **six members**:

1. **Governor of the RBI** – Chairperson, ex officio.
2. **Deputy Governor of the RBI** in charge of monetary policy – Member, ex officio.
3. **One officer of the RBI** to be nominated by the Central Board – Member, ex officio.
4. **Three external members** appointed by the Central Government – Members (usually economists of international repute).

> **Note for Prelims:** Each member has one vote. In case of a tie, the **Governor has a casting vote** (a second vote). The quorum for the meeting is four members.

3. Key Policy Tools and Terms

- **Repo Rate (Repurchasing Option):** The rate at which the RBI lends money to commercial banks against the collateral of government securities. It is the primary tool to control the money supply.
- **Neutral Stance:** This indicates that the RBI is flexible and can move the interest rates in either direction (increase or decrease) based on incoming data. It suggests that the current rates are neither stimulative nor restrictive.
- **Inflation Targeting:** The RBI uses **Consumer Price Index (CPI)** combined as the headline inflation measure for its targets.

4. Current Macro-Economic Projections (April 2026)

Parameter	New Projection (FY27)	Reason for Change
Real GDP Growth	**6.9%** (Revised down from 7.6%)	Impact of West Asia conflict on energy/infra and supply shocks.

CPI Inflation	**4.6%** (Revised up from 4.4%)	Elevated crude oil prices (factored at $85/barrel) and supply disruptions.
Repo Rate	**5.25%**	Neutral stance to balance growth-inflation trade-off.

3.2. WORLD BANK REVISES INDIA'S FY27 GDP GROWTH ESTIMATE DOWNWARD

Context: The World Bank has revised India's real GDP growth forecast downward for the fiscal year **2026-27 (FY27)** to **6.6%**, down from an earlier projection of **7.2%**. This revision is primarily attributed to the spillover effects of the ongoing **conflict in West Asia (Middle East)** on global energy markets and domestic consumption.

1. **Major Factors Influencing Growth**

   A. Sectoral Trends

   - **Industrial Slowdown:** Growth is expected to moderate to **7.5%**.
   - **Resilient Sectors:** Manufacturing—specifically **electronics and automobiles**—is expected to prop up industrial growth.
   - **Impacted Services:** Business services, food, and accommodation services are likely to be adversely affected by higher input costs (especially **LPG**) and the global slowdown.

   B. External Risks & Vulnerabilities

   - **Energy Prices:** Extended disruptions in global **oil and gas** supply due to the Middle East conflict are expected to last until the end of 2026.
   - **Remittances:** The Gulf economies account for nearly **38% of India's remittance inflows**. Labor market disruptions in this region could significantly lower these inflows, widening the **Current Account Deficit (CAD)**.
   - **Export Demand:** Decreased demand from the Gulf region will weigh on overall industrial growth.

   C. Domestic Challenges

   - **Inflation:** Persistently high global energy prices are expected to eventually lead to higher **retail inflation**, weighing on domestic demand.
   - **Fiscal Consolidation:** Efforts to reduce the fiscal deficit could be reversed if the government increases subsidies or cuts excise rates to shield consumers from high energy prices.

2. **Strategic Recommendations for Resilience**

   - **Private Sector Growth:** Boosting private sector-led growth is deemed critical for strengthening economic resilience.
   - **Workforce Entry:** Supporting more young people to enter the workforce is highlighted as a key priority.
   - **Policy Buffers:** Maintaining energy-source diversification and robust policy buffers can provide some insulation from external shocks.

3. **About World Bank**

   The World Bank is an international financial institution that provides loans and grants to the governments of low- and middle-income countries for the purpose of pursuing capital projects.

   - **Foundation:** Established in **1944** during the **Bretton Woods Conference** alongside the IMF.
   - **Headquarters:** Washington, D.C., USA.
   - **The World Bank Group:** It consists of five institutions:

1. **IBRD:** International Bank for Reconstruction and Development.
2. **IDA:** International Development Association.
3. **IFC:** International Finance Corporation (Private sector arm).
4. **MIGA:** Multilateral Investment Guarantee Agency.
5. **ICSID:** International Centre for Settlement of Investment Disputes.

- Important Reports by World Bank
  - **World Development Report (WDR)**
  - **Global Economic Prospects (GEP)**
  - **Logistics Performance Index (LPI)**

3.3. MSME SECTOR FACES STRESS AMID GLOBAL SUPPLY CHAIN

Context: **Recently**, the Union Government held high-level inter-ministerial meetings to address the escalating **compliance burden** and financial stress on **Micro, Small, and Medium Enterprises (MSMEs)** arising from the **West Asia crisis**. The disruption in maritime routes has led to shipments being rerouted or returned, triggering complex paperwork, regulatory uncertainties, and a "triple whammy" of logistics challenges for Indian exporters.

1. Nature of the Crisis

The conflict in West Asia (specifically affecting the Red Sea and Strait of Hormuz) has shifted the burden from mere logistics to heavy **regulatory compliance**. MSMEs, unlike large corporations, lack dedicated compliance teams and specialized software, making them vulnerable to:

- **Back-to-Town Procedure:** When a cargo is diverted back to India, it must undergo a specific customs procedure to return to the factory. This involves high warehousing costs and excludes the exporter from certain government benefits like the **RELIEF scheme**.
- **Rerouting Challenges:** If a shipping line drops cargo at an alternate port due to safety, the responsibility (and cost) of moving it to the final destination falls entirely on the exporter.
- **Tariff Quotas:** Many regions (e.g., Europe) have quarterly quotas for products like steel. Delays of even a few days can result in missing the quota window, forcing exporters to wait 90 days for the next cycle.

2. Key Government Interventions (2025-26)

- **RELIEF Scheme:** A dedicated financial support mechanism announced by the government to assist exporters specifically impacted by the West Asian crisis.
- **Credit Guarantee Scheme:** Plans for a **₹2.5 lakh crore** credit guarantee to ensure liquidity for businesses affected by war-induced disruptions.
- **Jan Vishwas 2.0 (2026):** Aimed at the **decriminalization** of minor technical and procedural lapses to reduce "compliance anxiety" for small businesses.

3. Significance of the MSME Sector

- **GDP Contribution:** Approximately **30%** of India's GDP.
- **Exports:** MSME-related products account for nearly **45%** of India's total exports.
- **Employment:** The second-largest employer after agriculture, providing livelihoods to over 11 crore people.

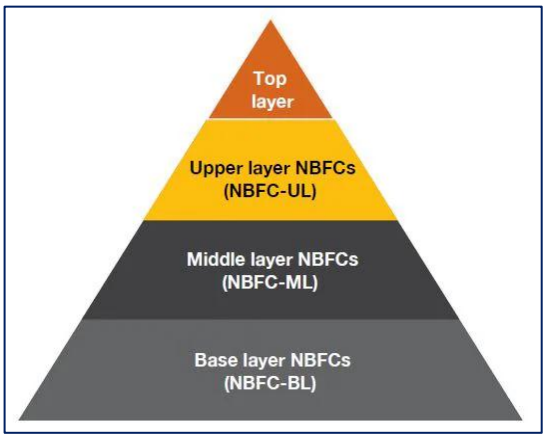
- **Udyam Portal:** The unified digital identity for MSMEs, which has seen over 7 crore registrations by early 2026.

4. **Structural Challenges**
   - **The "Missing Middle":** A high concentration of micro-units but very few firms scaling up to become medium enterprises.
   - **Digital Divide:** Over-reliance on fragmented systems (like basic spreadsheets) instead of integrated Enterprise Resource Planning (ERP) software.
   - **Working Capital Stress:** Delayed payments and rising freight costs (which have surged by up to 10x on certain routes) have stretched the credit cycle from 40 days to nearly 120 days.

3.4. SCALE-BASED REGULATION (SBR) & NBFC-UL FRAMEWORK

Context: **Recently**, the Reserve Bank of India (RBI) issued a draft review of the "Scale Based Regulation" (SBR) to streamline the identification of **Upper Layer NBFCs (NBFC-UL)**. The RBI proposes to replace the current complex scoring methodology with a transparent, absolute asset-size threshold of **₹1,00,000 crore**.

This change aims to provide regulatory clarity for large entities, including Core Investment Companies (CICs) and government-owned lenders, regarding their mandatory listing and enhanced capital requirements.



What is an NBFC?

A **Non-Banking Financial Company (NBFC)** is a financial institution registered under the **Companies Act, 1956/2013**, that provides banking services without meeting the legal definition of a bank.

- **Principal Business:** A company is classified as an NBFC if its financial assets constitute more than **50%** of its total assets, and its income from financial assets constitutes more than **50%** of its gross income (the **50-50 test**).
- **Key Distinctions from Banks:**
  - NBFCs **cannot accept demand deposits** (savings or current accounts).
  - They do not form part of the **Payment and Settlement System**; hence, they cannot issue cheques drawn on themselves.
  - The **Deposit Insurance and Credit Guarantee Corporation (DICGC)** facility is not available to NBFC depositors.
- **Regulation:** Primarily regulated by the RBI under the **RBI Act, 1934**. However, certain NBFCs like Insurance companies (IRDAI), Stock Broking (SEBI), and Nidhi companies (MCA) are regulated by other bodies.

The Scale-Based Regulation (SBR) Framework

The SBR framework (effective since 2022) organizes NBFCs into four layers based on their size, activity, and risk.

Layer	Criteria & Composition
Base Layer (NBFC-BL)	Non-deposit taking NBFCs with assets < ₹1,000 crore; includes P2P platforms and Account Aggregators.
Middle Layer (NBFC-ML)	All **deposit-taking NBFCs** (regardless of size); Non-deposit NBFCs with assets ≥ ₹1,000 crore; HFCs and SPDs.

Upper Layer (NBFC-UL)	Identified by RBI as "systemically significant." Requires higher capital (CET-1) and mandatory listing.
Top Layer (NBFC-TL)	Remains empty by default; populated only if the RBI finds a specific NBFC-UL poses extreme systemic risk.

Key Proposed Changes in the RBI Review

1. **Simplified Threshold:** Instead of the current "top 10" rule and parametric scoring, any NBFC with assets of **₹1 lakh crore and above** will automatically enter the Upper Layer.
2. **Inclusion of PSUs:** Government-owned NBFCs (like PFC and REC) will no longer be restricted to the Middle Layer. If they meet the asset size, they will face the same stringent regulations as private NBFC-ULs.
3. **Credit Risk Transfers:** NBFC-ULs can now use **State Government Guarantees** as risk mitigants without a cap, attracting a lower risk weight of **20%**, aligning them with bank-like standards.
4. **Mandatory Listing:** Entities identified as NBFC-UL are required to list on a stock exchange within **three years**. The new asset-based rule reinforces this requirement for large conglomerates and core investment companies (CICs) that exceed the ₹1 lakh crore mark

3.5. INDIA EXPANDS FISHERIES INFRASTRUCTURE

Context: The **Union Budget 2026-27** emphasizes the integrated development of fisheries in **500 reservoirs** and **Amrit Sarovars** to enhance the income of fish farmers and strengthen market access through cooperatives and Fish Farmer-Producer Organisations (FFPOs). This initiative aligns with the **Blue Revolution** and **Viksit Bharat@2047** vision.

1. **India's Global Position and Production Trends**
   - **Rank:** India is the **second-largest fish producer** in the world and the **second-largest globally in aquaculture production**.
   - **Growth:** National fish production witnessed a **106% increase** since 2013-14.
   - **Total production** ≈ 197.75 lakh tonnes (2024–25).
   - **Sectoral Share: 75%** of India's fish production comes from **inland fisheries** (freshwater, brackish, and saline water resources).
   - **Productivity:** Fish productivity in reservoirs has increased from 50 kg per hectare (2006) to **100 kg per hectare** today. ICAR-CIFRI suggests a potential of up to 300 kg per hectare.
2. **Geographical Distribution in India**
   - **Maximum Area under Reservoirs:** Rajasthan topped the list of Indian states by reservoir area, followed by Madhya Pradesh, which ranked second.
   - **Highest Number of Reservoirs:** Tamil Nadu (over 8,000).
   - **Regional Significance:** Reservoirs are primarily located in eastern, central, and peninsular regions, serving as lifelines for economically backward and water-scarce areas.
3. **Technological Interventions: Cage Culture**
   - **Mechanism:** Floating or stationary cages made of synthetic netting/mesh. They allow natural water flow, ensuring oxygen and nutrient exchange.

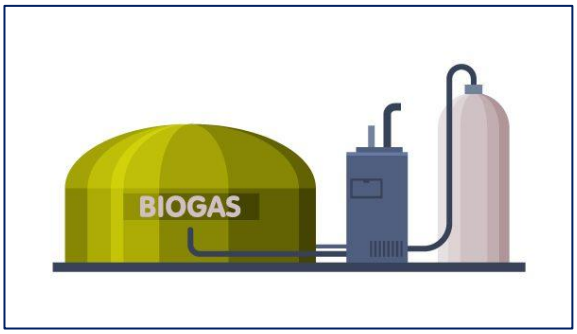
- **Advantages:** Facilitates easier feeding, monitoring, and disease management.
- **Species Focus:**
  - **Indian Major Carps:** Catla, Rohu, Mrigal (core species).
  - **Additional Species:** Tilapia, Pangasius.
  - **Ornamental Fish:** Stocking in specific projects like Amrit Sarovars in Arunachal Pradesh.

4. Government Initiatives on India's Fisheries Sector

- **Pradhan Mantri Matsya Sampada Yojana (PMMSY):** A flagship scheme providing budgetary support for cage culture and quality seed stocking.
- **National Fisheries Development Board (NFDB):** Implementing a **cluster-based strategy** to enhance competitiveness.
- **Reservoir Clusters:** Announced for **Halali and Indra Sagar dams** in Madhya Pradesh to address sectoral gaps and enhance economies of scale.
- **Blue Revolution 2.0:** Focuses on the "Integrated Development and Management of Fisheries."
- **Kisan Credit Card (KCC) Extension:** The government extended **KCC facilities to fishers and fish farmers**.
- **Mission Amrit Sarovar:** Focuses on conserving surface and groundwater in district ponds.
  - Standard: Each Sarovar has a minimum pondage area of **one acre** with a capacity of **10,000 cubic metres**.

3.6. MODERN BIOMASS STOVES GAIN POLICY

Context: The ongoing LPG crisis has driven many rural households — especially in rural regions — back to firewood for cooking. This has renewed policy interest in improved biomass cookstoves as a sustainable, affordable, and cleaner alternative.



1. The Problem: LPG Crisis and Return to Firewood

- Many areas, especially **rural regions**, have reported going back to **firewood** due to rising LPG costs.
- Firewood use is seen as **increasing drudgery for women** and causing:
  - **Air pollution**
  - **Health hazards** (indoor air quality concerns)
- Traditional **chulhas** (mud stoves) waste most of their heat through **poor airflow** and have an efficiency of barely **10%**.

2. Comparison: Traditional Chulhas vs. Improved Cookstoves (ICS)

Feature	Traditional Chulha	Modern Improved Cookstoves (ICS)
Thermal Efficiency	Barely **10%**	**38% to 45%**
Fuel Consumption	High (wasteful airflow)	Cuts fuel use by up to **two-thirds** (66%).
Emissions	High soot, smoke, and health hazards.	Dramatically reduced smoke and harmful gases.

Key Technology	Open combustion.	**Secondary aeration** (catches soot before it turns to smoke).

3. **Sustainability and Fuel Diversification**
   - **Firewood as a Renewable Resource:** It remains sustainable only if the **rate of extraction** does not exceed the **rate of regrowth**.
   - **Alternative Biomass Fuels:** Modern stoves are versatile and can run on:
     - **Pellets** and **Briquettes** (made from sawdust).
     - **Agricultural Waste** (reduces pressure on raw firewood).
4. **Economics and Financing Mechanisms**
   - **Upfront Costs:** Household models are affordable (starting below **₹2,000**), while commercial systems can exceed ₹20,000.
   - **Operating Costs:** Firewood remains highly cost-effective compared to LPG during price surges.
   - **Carbon Finance:** Emission savings from ICS can be tracked and converted into **Carbon Credits**. This creates a funding stream to make stoves even more affordable for lower-income families.
   - **Financing Partners:** Microfinance, Corporate Social Responsibility (**CSR**) programs, and carbon finance are crucial for large-scale deployment.
5. **Key Government Initiative**
   - **Pradhan Mantri Ujjwala Yojana (PMUY):** Launched in May 2016 by the Ministry of Petroleum and Natural Gas, PMUY provides LPG to rural poor households, reducing health and environmental risks from traditional fuels.
   - **National Biogas and Manure Management Programme (NBMMP):** The Central Sector Scheme on NBMMP, launched in 1981–82, promotes family-type biogas plants through State Nodal Agencies, District Rural Development Agencies (DRDAs) and Khadi and Village Industry Commission (KVIC) centres.

3.7. GOVERNMENT CONSIDERS SULPHUR EXPORT RESTRICTIONS

Context: **Recently**, the Indian government has begun considering a proposal to restrict the export of sulphur to ensure domestic availability. This move comes in response to soaring global prices and severe supply disruptions from the Middle East, particularly due to the ongoing **Iran war** which has impacted shipping through the Strait of Hormuz.

Additionally, the domestic industry has raised concerns as other major players, like **China**, are also set to restrict sulphuric acid exports, and **Turkey** has implemented similar bans, creating a tightening global market for this critical mineral.

1. **Physical and Chemical Properties**
   - **Element:** Sulphur is a non-metallic chemical element (Atomic Number 16).
   - **Appearance:** In its elemental form, it is a bright yellow, brittle solid at room temperature.
   - **Abundance:** It is the **10th most abundant** element by mass in the universe and the **5th most common** on Earth.
   - **Biogeochemical Cycle:** It follows a **sedimentary cycle** (Sulphur Cycle), primarily stored in rocks and salts or buried deep in the ocean.

2. Sources and Extraction

- **Natural Deposits:** Found near volcanoes and hot springs (native sulphur).
- **By-product of Fossil Fuels:** Most modern sulphur is obtained as a by-product of **petroleum refining** and **natural gas processing** to remove hydrogen sulphide.
- **Frasch Process:** A method used to extract elemental sulphur from underground deposits by using superheated water to melt the mineral.
- **Industrial By-product:** It is also recovered during the smelting of sulphide ores (like copper, zinc, and lead).

Applications of Sulphur

1. Agriculture (The "Fourth Major Nutrient")

Sulphur is often considered the fourth major plant nutrient after Nitrogen (N), Phosphorus (P), and Potassium (K).

- **Fertilizers:** It is a key ingredient in **Single Super Phosphate (SSP)**, **Ammonium Sulphate**, and **Ammonium Phosphate Sulphate**.
- **Plant Physiology:** It is essential for the synthesis of oils, vitamins, and chlorophyll. It is a constituent of three amino acids (methionine, cystine, and cysteine) which are the building blocks of proteins.
- **Soil Health:** Used as a soil conditioner to reduce the pH of highly alkaline soils.

2. Industrial Uses

- **Sulphuric Acid:** About 90% of sulphur is converted into sulphuric acid, the most widely used industrial chemical globally.
- **Mining:** Used in the leaching process for metals like copper and nickel.
- **Refining:** Critical in the manufacturing of detergents, plastics, and explosives.

India's Sulphur Dynamics

- **Import Dependency:** India imports over **50%** of its annual sulphur requirement (approx. 2 million metric tons), primarily from the Middle East (Qatar, UAE, Oman).
- **Domestic Production:** India produces sulphur as a by-product in its oil refineries.
- **Policy Intervention:** The government has recently prioritized the supply of refinery sulphur to domestic fertilizer companies to stabilize prices for farmers ahead of the **Kharif season**.

3.8. ALTERNATIVE INVESTMENT FUND

Context: **Recently**, the Securities and Exchange Board of India (SEBI) sharply reduced the minimum investment threshold for individual investors in **Social Impact Funds (SIFs)** from ₹2 lakh to just **₹1,000**.

This amendment aims to democratize access and widen retail participation on the **Social Stock Exchange (SSE)** by aligning the minimum application size with Zero Coupon Zero Principal (ZCZP) instruments.

What is an AIF?

An Alternative Investment Fund is a pooled investment vehicle that collects money from investors to invest in non-traditional asset classes. Unlike mutual funds (which invest in stocks and bonds), AIFs often target startups, private equity, or social ventures.

- **Regulator:** SEBI (Alternative Investment Funds) Regulations, 2012.

- **Legal Structure:** Can be a trust, company, LLP, or body corporate.
- **Target Audience:** Traditionally aimed at high-net-worth individuals (HNIs) due to high entry costs, though recent rules are lowering bars for "Social" categories.

Comprehensive Classification of AIFs

SEBI regulates AIFs under three distinct categories. Each category has a specific "flavor" based on where the money goes and how the fund operates.

1. **Category I AIF: Socially and Economically Desirable**

   These funds invest in sectors that the government and regulators want to promote because they create jobs or improve infrastructure.

   - **Venture Capital Funds (VCF):** Focus on new, high-growth potential startups that face a capital crunch in their early stages.
   - **Angel Funds:** A sub-category of VCF where "Angel Investors" provide very early-stage funding to startups.
   - **Infrastructure Funds:** Invest in public assets like roads, rail, and power plants.
   - **Social Impact Funds (SIF):** Formerly known as Social Venture Funds, these invest in NPOs or social enterprises. As per recent rules, they now allow small-ticket entry (₹1,000) for social causes.
   - **SME Funds:** Dedicated to investing in Small and Medium Enterprises that are listed or unlisted.

2. **Category II AIF: The "Residual" Category**

   This is the most common category. These funds do not get special tax incentives like Category I, nor do they use high-risk strategies like Category III. They cannot borrow money except for basic operational needs.

   - **Private Equity (PE) Funds:** Invest in unlisted private companies. They usually take a management stake to help the company grow before selling it for a profit.
   - **Debt Funds:** Instead of buying shares (equity), these funds lend money to companies. They are preferred for companies with high capital needs but lower credit ratings.
   - **Fund of Funds (FoF):** A fund that does not invest in companies directly but instead invests in other AIFs.
   - **Distressed Asset Funds:** These invest in "sick" companies or those undergoing bankruptcy to turn them around.

3. **Category III AIF: Complex and Leveraged**

   These are the most "aggressive" funds. They aim for high short-term returns and are allowed to borrow money (leverage) to make larger bets.

   - **Hedge Funds:** These use pooled funds and various strategies (like short-selling or derivatives) to earn active returns regardless of whether the market is going up or down.
   - **Private Investment in Public Equity (PIPE) Funds:** These funds buy large chunks of shares in publicly traded companies at a discounted price.

Understanding the Recent Change (Social Impact Funds)

- **The "Social" Angle:** Social Impact Funds are a sub-category of Category I AIFs. They invest in securities of Not-for-Profit Organizations (NPOs) or social enterprises.
- **Retail Inclusion:** By dropping the minimum investment from **₹2 lakh to ₹1,000**, SEBI is allowing regular individuals (retail investors) to support social causes through the Social Stock Exchange.
- **ZCZP Instruments:** These are "Zero Coupon Zero Principal" instruments. They are like donations; you don't get interest (Zero Coupon) and you don't get the initial money back (Zero Principal), but you get a certificate showing you funded a social project.

3.9. INDIA'S COTTON MARKET

Context: **Recently**, domestic cotton prices in India have surged by **8.5%** in April 2026, with the popular **Shankar-6 variety** reaching ₹60,500 per candy. This price rally is driven by a combination of a **0.42% drop in Indian production** (estimated at 291 lakh bales) and a significant global supply crunch in major producing nations like the U.S. and Brazil due to lower rainfall.

Furthermore, the ongoing geopolitical tensions—specifically the **U.S.-Israel-Iran conflict**—have inflated crude oil prices, making synthetic alternatives like polyester more expensive and causing a strategic shift in demand back toward natural cotton fiber.

1. **Geographical and Climatic Requirements**

   Cotton is a **subtropical Kharif crop** that requires specific environmental conditions to thrive:

   - **Temperature:** It grows best in temperatures ranging between **21°C and 30°C**. High temperatures are beneficial during the ripening and bursting of bolls.
   - **Frost-Free Days:** A critical requirement for cotton is at least **210 frost-free days**. A hard frost is fatal to the crop.
   - **Rainfall:** Moderate rainfall of **50 to 100 cm** is ideal. However, heavy rain during the boll-opening stage is harmful as it can ruin the fiber.
   - **Soil:** The **Black Soil (Regur)** of the Deccan Plateau is the most suitable due to its high moisture-retention capacity. It also grows well in the alluvial soils of the Satluj-Ganga plain and red soils of South India.
   - **Sunshine:** Bright, clear sunshine is necessary during the harvesting period to ensure high-quality fiber.

2. **Cotton Production: The Indian Scenario**

   - **Global Rank:** India is the **second-largest producer** of cotton globally, following China, and is also the largest consumer.
   - **Acreage vs. Productivity:** While India has the **largest area** under cotton cultivation in the world, its **productivity (yield per hectare)** remains significantly lower than the global average, ranking around 36th globally.
   - **Major Producers:** The leading states are **Gujarat, Maharashtra, and Telangana**. Gujarat is generally the top producer due to better irrigation facilities.
   - **Species:** India is the only country that grows all four cultivated species of cotton: *Gossypium arboreum*, *G. herbaceum* (Desi cotton), *G. hirsutum* (American cotton), and *G. barbadense* (Egyptian/Sea Island cotton).

3. **Key Government Initiatives (2025-2026)**

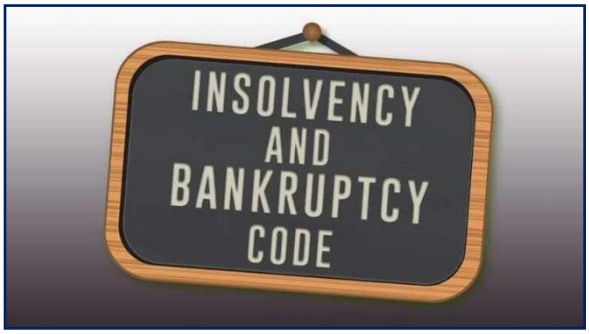
   - **Kasturi Cotton Bharat:** A joint initiative by the Ministry of Textiles, CCI, and industry bodies to provide a **unique brand identity** to Indian cotton. It focuses on "Fiber to Fashion" traceability using **Blockchain technology**.
   - **Mission on Cotton Productivity (2025-26):** A five-year mission focusing on **Extra Long Staple (ELS)** cotton to reduce import dependence. It promotes **High-Density Planting Systems (HDPS)** to increase yields.
   - **KapasKisan App:** Launched by the CCI for digital self-registration and smooth procurement under the Minimum Support Price (MSP).

- **Cotton Zones:** India is divided into three zones: **North** (Punjab, Haryana, Rajasthan), **Central** (Gujarat, Maharashtra, MP), and **South** (Telangana, Andhra Pradesh, Karnataka, TN).

4. **Pests and Biotechnology**

- **Bt Cotton:** The only **Genetically Modified (GM)** crop approved for commercial cultivation in India. It contains the *Cry1Ac* and *Cry2Ab* genes from *Bacillus thuringiensis* to resist the American Bollworm.
- **The Pink Bollworm (PBW) Crisis:** Recently, the Pink Bollworm has developed resistance to **Bollgard-II (Bt cotton)**, leading to significant crop losses in Punjab and Haryana. This has prompted the government to push for **Integrated Pest Management (IPM)** and new seed technologies.

3.10. INSOLVENCY AND BANKRUPTCY CODE 2016



Context: **Recently**, the State Bank of India (SBI) has moved a review petition in the Supreme Court against its February 13 judgment. The apex court had previously ruled that **telecom spectrum**, being a finite public resource owned by the Union of India in trust for the people, cannot be treated as an "asset" owned by Telecom Service Providers (TSPs) during IBC proceedings. This development is significant for the banking sector as it challenges the ability of lenders to recover dues from bankrupt telecom groups like Aircel, potentially impacting future bank financing and risk assessment for companies reliant on natural resource licenses.

Core Pillars of IBC 2016

The IBC was enacted to consolidate the existing framework (like SICA, SARFAESI) into a single law for time-bound insolvency resolution.

1. **The Four Pillars of Institutional Infrastructure**

- **Insolvency Professionals (IPs):** Licensed professionals who take over the management of the debtor during the resolution process.
- **Insolvency Professional Agencies (IPAs):** Regulatory bodies that enroll and monitor IPs.
- **Information Utilities (IUs):** Centralized repositories that maintain electronic records of contractual liabilities and evidence of default (e.g., NeSL).
- **Insolvency and Bankruptcy Board of India (IBBI):** The apex regulator overseeing the entire ecosystem.

2. **Adjudicating Authorities**

- **National Company Law Tribunal (NCLT):** Handles insolvency for **Companies and Limited Liability Partnerships (LLPs)**.
- **Debt Recovery Tribunal (DRT):** Handles insolvency for **Individuals and Partnership Firms**.

Key Provisions & 2026 Amendments

1. **Corporate Insolvency Resolution Process (CIRP)**

- **Initiation:** Can be triggered by a Financial Creditor (banks), Operational Creditor (suppliers), or the Corporate Debtor itself upon a minimum default of **₹1 Crore**.
- **The 2026 Shift:** Admission is now **mandatory** within 30 days if the default is proven via Information Utilities, removing the discretionary power of NCLT that previously caused years of delay.

2. **Creditor-Initiated Insolvency Resolution Process (CIIRP)**
   - **New Mechanism:** Introduced in 2026, this allows financial creditors with **51% approval** to initiate out-of-court resolutions. This reduces the burden on the NCLT and accelerates the rescue of stressed firms.
3. **The Waterfall Mechanism (Section 53)**

   This dictates the order of priority for payout during liquidation:

   1. Insolvency resolution process costs.
   2. Secured creditors and workmen's dues (up to 24 months).
   3. Other employee wages.
   4. Unsecured creditors.
   5. **Government dues** (The 2026 Amendment clarifies these are placed lower than secured creditors to encourage private investment).
   6. Equity shareholders (Last).
4. **Group and Cross-Border Insolvency**
   - The 2026 law introduces a framework to handle **interconnected companies** (Group Insolvency) and provides a mechanism to coordinate with foreign jurisdictions for assets located abroad (based on the UNCITRAL Model Law).

3.11. INDIA'S RICE EXPORTS DECLINE

Context: **Recently**, data released by the Ministry of Commerce and Industry indicated that India's rice exports declined by **7.5%**, falling to **$11.53 billion** in the 2025-26 financial year compared to $12.5 billion in the previous year. This contraction is primarily attributed to the escalating **U.S.-Israel-Iran conflict**, which has severely disrupted trade routes through the Strait of Hormuz, impacted payment cycles for Indian exporters, and caused a sharp 15.36% dip in shipments during the month of March 2026 alone.

1. **Export Performance and Trends (2025-26)**
   - **Quantitative Decline:** After reaching a peak of approximately **20.1 million tonnes** in 2024-25, exports faced a downward trend due to regional instability.
   - **Major Destinations:** West Asian nations, including **Iran, Saudi Arabia, the UAE, and Oman**, remain the top destinations for Indian Basmati rice.
   - **The Iran Factor:** Iran is traditionally the largest buyer of Indian Basmati rice. Current geopolitical stress has led to "payment cycle" delays and high freight costs, hampering order flows.
2. **Institutional Framework: APEDA**
   - **Status:** The Agricultural and Processed Food Products Export Development Authority (APEDA) is a **statutory body** established under the APEDA Act, 1985.
   - **Administrative Control:** It functions under the **Ministry of Commerce and Industry**.
   - **Functions:** Registration of exporters.
   - Fixing standards and specifications for scheduled products.
   - Monitoring the export of **Basmati Rice** (listed under the Second Schedule of the Act).
   - Implementing the National Programme for Organic Production (NPOP).

3. **Export Policy and Categories**
    - **Basmati Rice:** High-value, long-grain rice primarily grown in the GI-tagged regions of the Indo-Gangetic plains. Its export is generally "Free," subject to a **Minimum Export Price (MEP)** or specific registration requirements by APEDA.
    - **Non-Basmati Rice:** Includes parboiled rice, broken rice, and white rice. The government often uses **Export Duties** or "Prohibited/Restricted" status on these to ensure domestic food security and control inflation.
    - **Recent Changes:** In April 2026, the DGFT mandated a **Certificate of Inspection** from the Export Inspection Council (EIC) for rice exports to EU member states and certain European countries to ensure quality compliance.
4. **Challenges: The "West Asia Crisis"**
    - **Logistics:** The closure or disruption of the **Strait of Hormuz** has forced rerouting, leading to "war-risk surcharges" and a spike in ship fuel prices.
    - **Input Costs:** Rising crude oil prices have increased the cost of fertilizers and diesel, indirectly affecting the cost of production for export-oriented rice varieties.

Rice: Essential Geographical & Environmental Features

Climate and Soil

- **Temperature:** Requires high temperatures, ideally between **22°C and 32°C**.
- **Rainfall:** High moisture is mandatory; thrives in areas with **>100 cm** annual rainfall.
- **Soil:** Best grown in **alluvial, clayey, and loamy soils** that can retain standing water.

Sowing Seasons in India

- **Kharif (Main):** Sown in June-July (Southwest Monsoon); harvested in Nov-Dec.
- **Rabi (Winter):** Grown in southern/eastern India (e.g., TN, AP, WB) under irrigation.
- **West Bengal Variants:** Three crops grown annually—**Aus, Aman, and Boro**.

Environmental Dimension

- **Methane:** Submerged paddies produce methane via anaerobic decomposition; rice accounts for ~12% of global agricultural CH_4.
- **Water Footprint:** Requires **3,000–5,000 liters** for 1 kg of rice; causing massive groundwater depletion in the Northwest.
- **Stubble Burning:** Post-harvest residue burning in Punjab/Haryana contributes to severe air pollution (PM2.5) in the NCR.

Sustainable Solutions

- **SRI (System of Rice Intensification):** Uses 25–50% less water and fewer seeds by keeping soil moist but not flooded.
- **DSR (Direct Seeded Rice):** Sowing seeds directly into the field, saving water, labor, and reducing methane.
- **AWD (Alternate Wetting and Drying):** Periodically drying fields to stop methanogenesis.

Trade & Governance

- **Global Share:** India holds ~40% of the global rice trade.
- **Institutional Body: APEDA** (Statutory body under the **Ministry of Commerce**) handles export promotion and quality standards.

3.12. FOREIGN DIRECT INVESTMENT

Context: Recent data released by the Reserve Bank of India (RBI) for February 2026 shows that Net Foreign Direct Investment (FDI) into India has turned positive, reaching **$4.6 billion**. This marks a significant recovery after a six-month period of negative net inflows, representing the highest level since May 2022.

1. Key Highlights from the February 2026 Data

- **Negative net FDI:** India experienced negative net FDI for six consecutive months (August 2025 – January 2026) due to high outflows. February 2026 reversed this slump.
- **Gross FDI Surge:** Gross inflows grew by **61.6%** to reach nearly **$9 billion**, a seven-month high.
- **Reduced Outflows:** A primary driver for the net increase was a sharp decrease in "repatriation and disinvestment" by foreign companies, which fell to $1.7 billion (a 30% year-on-year drop).
- **Sectoral Leaders:** Manufacturing, computer services, financial services, and communication services accounted for over two-thirds of total equity inflows in FY 2025-26.
- **Source Countries:** Singapore, the U.S., Mauritius, Japan, and the Netherlands remain the top sources, accounting for roughly 75% of total inflows.
- **Greenfield Projects:** While the RBI maintains India is an attractive destination for new (Greenfield) projects, data shows a slight 11% dip in project announcements for the April-January period compared to the previous year.

2. Understanding Foreign Direct Investment (FDI)

I. What is FDI?

- FDI is an investment made by a firm or individual in one country into business interests located in another country.
- In India, it generally involves establishing business operations or acquiring business assets, including establishing ownership or controlling interest in a foreign company.
- **Regulatory Framework:** Governed by the FDI Policy 2020 and FEMA rules, primarily **regulated by DPIIT**. **RBI** also plays a key role by enforcing the FDI Rules.
- **FDI Prohibition in India:** FDI is strictly prohibited in sectors like atomic energy generation, gambling and betting, lotteries, chit funds, real estate, and the tobacco industry.
- **FDI Trend:** The services sector emerged as the top recipient of FDI equity in FY 2024–25, attracting 19% of total inflows, followed by computer software and hardware (16%) and trading (8%).
  - Maharashtra accounted for the highest share (39%) of total FDI equity inflows in FY 2024–25, followed by Karnataka (13%) and Delhi (12%).

II. Routes of FDI in India:

1. **Automatic Route:** The non-resident investor or the Indian company does not require any prior arrival from the Government of India or the RBI.
2. **Government Route:** Prior approval from the government is required. Proposals are considered by the respective Administrative Ministry/Department.

III. FDI vs. FPI: Key Differences

Feature	Foreign Direct Investment (FDI)	Foreign Portfolio Investment (FPI)
Definition	Investment in physical assets/ infrastructure or significant stake in a company.	Investment in financial assets like stocks and bonds.
Control	Investor typically gains a degree of management control.	Investor has no direct control over the company's operations.
Nature	Long-term and stable ("Lasting Interest").	Short-term and volatile ("Hot Money").
Entry/Exit	Difficult to exit quickly (low liquidity).	Easy to enter and exit (high liquidity).
Impact	Leads to technology transfer, job creation, and infrastructure.	Enhances capital market liquidity but can lead to market volatility.
Threshold	In India, any investment of **10% or more** of the post-issue paid-up equity capital is treated as FDI.	Any investment **below 10%** of the post-issue paid-up equity capital is treated as FPI.

IV. Some core Concepts

- **Greenfield FDI:** Greenfield Foreign Direct Investment (FDI) is a type of investment where a parent company creates a new subsidiary in a foreign country, constructing new facilities—such as offices, plants, or infrastructure—from scratch.
- **Brownfield FDI:** Brownfield Foreign Direct Investment (FDI) involves a foreign company investing in or acquiring existing, pre-built production facilities and infrastructure, rather than building from scratch. It is a popular, faster market-entry strategy offering lower setup costs, existing supply chains, and trained staff. Common examples include mergers, acquisitions, or leasing existing plants.
- **Net FDI Formula:** Net FDI = (Gross Inflows) - (Repatriation/Disinvestment + Outward FDI by Indians).
- **Repatriation:** The process of converting foreign currency back into the currency of one's own country (e.g., foreign companies sending profits back home).

3.13. PAYTM PAYMENTS BANK LIMITED (PPBL)

Context: Recently, the Reserve Bank of India (RBI) has officially cancelled the banking license of **Paytm Payments Bank Limited (PPBL)** under **Section 22 (4)** of the **Banking Regulation Act, 1949**, effective from April 24, 2026.

This action follows a series of regulatory non-compliance issues and persistent supervisory concerns observed over the last few years. The RBI has further initiated an application before the High Court for the winding up of the bank.

Regulatory Framework and RBI Powers

- **Section 22 of the Banking Regulation Act, 1949:** This section grants the RBI the authority to issue and cancel licenses to banking companies in India. A license can be cancelled if the company ceases to carry on banking business or fails to comply with conditions stipulated by the RBI.

- **Winding Up Process:** Unlike regular companies, the liquidation of a bank is a specialized process involving the High Court and a liquidator, ensuring that depositor interests are prioritized.
- **Deposit Insurance:** Even in a winding-up scenario, depositors are protected by the **Deposit Insurance and Credit Guarantee Corporation (DICGC)**, which provides insurance cover up to **₹5 lakh** per depositor per bank.

Integrated Guide to Payments Banks (PBs) in India

Payments Banks were established based on the recommendations of the **Nachiket Mor Committee** to further financial inclusion.

1. **Key Objectives**
   - To provide small savings accounts and payments/remittance services to migrant labor workforce, low-income households, and small businesses.
   - To enable high-volume, low-value transactions in a secured technology-driven environment.
2. **Features and Scope of Activities**
   - **Registration**: Registered as a public limited company under the **Companies Act of 2013.**
   - **Governance:** Governed by the provisions of **Banking Regulation Act of 1949.**
   - **Acceptance of Deposits:** They can accept demand deposits (savings and current accounts). The maximum balance per individual customer is currently capped at **₹2 lakh**.
   - **No Lending:** They are strictly **prohibited** from undertaking lending activities. They **cannot issue credit cards or provide loans**.
   - **Remittance Services:** They can facilitate domestic remittances and act as BCs (Business Correspondents) for other banks.
   - **Issuance of Instruments:** They can issue ATM/Debit cards but **not credit cards**.
3. **Regulatory Requirements**
   - **Minimum Capital:** The minimum paid-up equity capital for PBs shall be **₹100 crore**.
   - **Capital Adequacy Ratio (CAR):** They must maintain a minimum CAR of **15%** of its risk-weighted assets.
   - **Statutory Liquidity Ratio (SLR):** They are required to invest minimum **75%** of their "demand deposit balances" in Government securities/Treasury Bills with maturity up to one year.
   - **Cash Reserve Ratio (CRR):** payments banks in India are required to maintain a Cash Reserve Ratio (CRR) with the Reserve Bank of India (RBI).
   - **FDI Limit:** The Foreign Direct Investment (FDI) limit for these banks is **74%** (consistent with other private sector banks).
4. **Recent Developments and Policy Directions**
   - **Deposit limit raised from ₹1 lakh to ₹2 lakh (2023):** The RBI doubled the per-customer deposit ceiling to improve viability and encourage greater usage
   - **Interoperability mandate:** All payment banks must be fully interoperable with UPI, IMPS, and ATM networks
   - **CBDC (Central Bank Digital Currency) integration:** Payment banks are being considered as key distributors of the Digital Rupee (e-R) for retail use
   - **Account Aggregator Framework:** Payment banks are being integrated into the Account Aggregator ecosystem to enable data-based credit access for their customers through partner lenders.

3.14. SMALL SAVINGS SCHEMES (SSS)

Context: **Recently**, the Government of India announced that interest rates for various **Small Savings Schemes (SSS)** will remain unchanged for the first quarter of the 2026-27 financial year (April-June 2026). This marks the eighth consecutive quarter where the Ministry of Finance has maintained a status quo on rates for popular instruments like the Public Provident Fund (PPF) and National Savings Certificate (NSC), despite fluctuations in benchmark government bond yields.

1. Overview of Small Savings Schemes

Small Savings Schemes are a set of investment vehicles managed by the Central Government to encourage household savings and provide secure investment options to citizens.

- **Administration:** These are managed by the **Department of Economic Affairs (DEA)** under the Ministry of Finance.
- **Operating Agencies:** They are primarily operated through **Post Offices** across the country, though designated public and private sector banks also offer these services.
- **Target Audience:** These schemes are designed to provide "risk-free" returns to small investors, especially in rural and semi-urban areas where formal banking penetration may be lower.

2. The National Small Savings Fund (NSSF)

The NSSF is a critical component of the government's fiscal management.

- **Establishment:** It was set up in **1999** within the **Public Account of India** under Article 266(2) of the Constitution.
- **Mechanism:** All deposits received under small savings schemes are credited to this fund. Conversely, all withdrawals by depositors are made from it.
- **Usage by Government:** The net collections (deposits minus withdrawals) are invested in Special Central Government Securities and Special State Government Securities. This effectively helps the Union Government fund its **Fiscal Deficit**.

3. Classification of Schemes

The schemes are generally categorized into three main buckets:

Category	Key Schemes
Post Office Deposits	Post Office Savings Account, Recurring Deposits, Time Deposits (1, 2, 3, and 5 years).
Savings Certificates	National Savings Certificate (NSC), Kisan Vikas Patra (KVP).
Social Security Schemes	Public Provident Fund (PPF), Sukanya Samriddhi Yojana (SSY), Senior Citizens Savings Scheme (SCSS).

4. Interest Rate Determination

Interest rates on these schemes are not market-linked in real-time but are revised **quarterly** by the Ministry of Finance.

- **The Formula:** Based on the recommendations of the **Shyamala Gopinath Committee (2010)**, the interest rates are supposed to be 25-100 basis points higher than the yields of government bonds (G-Secs) of comparable maturity.
- **Current Status (as of March 31, 2026):**

- **PPF:** 7.1%
- **Sukanya Samriddhi:** 8.2%
- **Senior Citizen Savings Scheme:** 8.2%
- **Savings Deposit:** 4.0%

5. Mahila Samman Savings Certificate (MSSC)

Launched in the 2023-24 Budget, this is a one-time small savings scheme for women.

- **Tenure:** 2 years
- **Deposit Limit:** Maximum of **₹2 Lakh**.
- **Interest:** Fixed at 7.5% per annum, compounded quarterly.
- **Withdrawal:** Partial withdrawal (up to 40%) is allowed after one year.

3.15. INDIAN RUPEE FALLS TO RECORD LOW AS TRADE DEFICIT WIDENS

Context: **Recently**, the Indian Rupee hit a historic low, crossing the **₹94.80 per US Dollar** mark on March 31. This slump is primarily attributed to a widening trade deficit and escalating energy prices triggered by geopolitical tensions in West Asia. The currency has witnessed a significant decline this fiscal year, prompting the Reserve Bank of India (RBI) to intervene in the foreign exchange market to curb excessive volatility.

1. Defining Rupee Depreciation

Rupee depreciation refers to the fall in the value of the Indian Rupee in terms of a foreign currency (usually the US Dollar) in a **Floating Exchange Rate System**.

- **Market-Driven:** It occurs due to the market forces of demand and supply. If the demand for Dollars exceeds the supply of Dollars in the Indian market, the Rupee weakens.
- **Depreciation vs. Devaluation:**
  - **Depreciation:** Happens in a market-determined system.
  - **Devaluation:** A deliberate downward adjustment of the official exchange rate by the Government or Central Bank in a **Fixed Exchange Rate System**.

2. Major Causes of Depreciation

The current trend is driven by a combination of domestic and global factors:

- **Surging Crude Oil Prices:** India imports over 80% of its crude oil. Higher oil prices increase the demand for Dollars to pay for these imports, weakening the Rupee.
- **US Federal Reserve Policy:** When the US Fed raises interest rates, investors pull capital out of emerging markets like India (Foreign Portfolio Investment outflows) to seek higher, safer returns in the US.
- **Trade Deficit:** A persistent gap where imports exceed exports leads to a higher outflow of foreign currency.
- **Safe-Haven Demand:** During global geopolitical crises, investors flock to the "safe" US Dollar, causing it to strengthen against all other currencies (DXY Index rise).

3. Impact on the Indian Economy

The effects of a weaker Rupee are a double-edged sword:

Impact Area	Effect of Depreciation
Imports	Become more expensive. This leads to **"Imported Inflation"** as prices of oil, electronics, and fertilizers rise.
Exports	Become more competitive (cheaper) in the international market, potentially benefiting IT, Textiles, and Pharma sectors.
External Debt	Indian companies with **External Commercial Borrowings (ECBs)** find it harder to repay as they must shell out more Rupees for every Dollar owed.
Remittances	Non-Resident Indians (NRIs) sending money home see their foreign earnings converted into more Rupees, benefiting recipient families.
Current Account	Initially, the Current Account Deficit (CAD) may widen due to higher import bills.

4. RBI's Role in Management

- India follows a **"Managed Float"** system. The RBI does not target a specific level for the Rupee but intervenes to prevent "wild swings."
- **Forex Intervention:** RBI sells Dollars from its reserves and buys Rupees to suck out excess supply.
- **Monetary Policy:** Raising interest rates can make Indian bonds more attractive to foreign investors, encouraging capital inflows.
- **Easing Inflows:** Relaxing norms for **ECBs** and **NRI deposits** to bring more Dollars into the economy.

3.16. IRDAI ACCELERATES TRANSITION TO IND

Context: **Recently**, **IRDAI** has mandated insurance companies to fast-track the transition to **Indian Accounting Standards (Ind AS)**. This systemic shift, specifically aligned with the global **IFRS 17** framework, aims to replace traditional "premium-based" accounting with a "fair value" model. The move is designed to ensure global comparability of Indian insurers' financial health and enhance transparency for foreign investors ahead of the 2026-27 fiscal year.

1. Statutory Framework and Origin

The Insurance Regulatory and Development Authority of India (IRDAI) is the apex body supervising the insurance sector in India.

- **Establishment:** It was constituted following the recommendations of the **Malhotra Committee Report (1994)**.
- **Legal Status:** It is an **autonomous and statutory body** formed under the **IRDAI Act, 1999**.
- **Headquarters:** Initially located in New Delhi, the headquarters shifted to **Hyderabad** in 2001.
- **Nodal Ministry:** It operates under the administrative purview of the **Ministry of Finance**.

2. Composition of the Authority

As per Section 4 of the IRDAI Act, 1999, the body consists of a ten-member team appointed by the Government of India:

- One **Chairperson**.
- Five **Whole-time Members**.
- Four **Part-time Members**.

3. **Key Powers and Functions**

The IRDAI acts as a guardian for policyholders while ensuring the orderly growth of the industry.

- **Licensing:** It issues, renews, modifies, withdraws, suspends, or cancels registrations for insurance and reinsurance companies.
- **Protection of Interests:** It specifies the code of conduct for surveyors, loss assessors, and intermediaries to protect policyholder interests.
- **Financial Oversight:** It regulates the investment of funds by insurance companies and maintains a percentage of the **solvency margin** (the capital an insurer holds relative to the risks it takes).
- **Adjudication:** It adjudicates disputes between insurers and intermediaries or insurance intermediaries.

4. **Transformational Initiatives (The "Trinity" of Insurance)**

To achieve the goal of "Insurance for All by 2047," IRDAI has introduced three pillars:

- **Bima Sugam:** An online platform serving as a protocol for all insurance needs—buying policies, servicing, and claim settlement—modeled after the UPI or ONDC.
- **Bima Vahak:** A women-centric field force aimed at increasing insurance penetration in every Gram Panchayat.
- **Bima Vistaar:** An affordable, bundled insurance product covering life, health, property, and accidents specifically designed for the rural population.

5. **Recent Regulatory Updates (2025-2026)**

- **Removal of Age Bar:** IRDAI recently abolished the age limit (previously 65 years) for purchasing health insurance, making coverage accessible to senior citizens regardless of age.
- **Ind AS Implementation:** The regulator has proposed the implementation of **Indian Accounting Standards (Ind AS)** for all insurers effective from April 1, 2026, to align with global financial reporting standards.
- **Pre-existing Disease (PED) Waiting Period:** The waiting period for covering pre-existing diseases in health insurance has been reduced from 48 months to **36 months**.

3.17. GLOBAL TENSIONS HIT KASHMIR CARPET INDUSTRY

Context: The ongoing war in **West Asia** between Iran and the U.S.-Israel bloc has severely impacted the export of famed **Kashmir carpets**. Key global exhibitions in **Denmark, China, and the UAE** have been cancelled or postponed, threatening the livelihoods of over **80,000 locals** associated with the manufacturing sector in the Union Territory.

1. **Industry Overview and Economic Impact**

- **Employment**: Approximately **80,000 local artisans** in Kashmir are directly involved in the carpet manufacturing sector.
- **Export Trends**:
  - The sector has seen a steady decline, with exports falling to **₹260.70 crore in 2024-25** from ₹357 crore in 2022-23.
  - Historical growth showed a significant jump from ₹84.55 crore in 1990-91 to **₹821.50 crore in 2016-17**.
- **Cancelled Global Events (2026)**:

- Copenhagen Lifestyle Expo (Denmark).
- Qinghai International Carpet Exhibition (China).
- Sharjah Exhibition (UAE).

2. **Institutional Framework**
   - **Carpet Export Promotion Council (CEPC)**:
     - Function: Acts as the nodal agency informing and supporting carpet sellers regarding global market opportunities and exhibitions.
     - Affiliation: Operates under the **Ministry of Textiles**, Government of India.
3. **Historical Context:**
   - Legacy of Zain-ul-Abidin: The carpet craft traces its roots back to the 15th century when Badshah Zain-ul-Abidin invited artisans from Persia and Central Asia to settle in Kashmir.
   - From Shawls to Carpets: Initially, the focus was on weaving exquisite pashmina shawls. However, with the decline of demand due to jacquard looms in Europe, artisans shifted their skills to carpet weaving.
   - British Recognition: Kashmiri carpets gained global acclaim after being exhibited at the Great London Exhibition of 1851.
   - Weaving Secrets: The secret blueprints, known as talim, guide artisans across generations, preserving the ancient techniques.

Pashmina and Shahtoosh

- Pashmina and Shahtoosh differ primarily in legality and sourcing: Pashmina is a legal, sustainable wool from domesticated Ladakh goats, while Shahtoosh is an illegal, unethical fiber from endangered Tibetan antelope (Chiru).
- Shahtoosh offers unparalleled lightness and warmth (often called 'ring shawls'), but its production causes severe animal cruelty and is banned.

3.18. NATIONAL JUTE BOARD TO FOCUS ON MODERNISATION

Context: **Recently**, the Cabinet Committee on Economic Affairs (CCEA) approved a significant increase in the **Minimum Support Price (MSP) for raw jute** for the 2026-27 marketing season. The **Jute Corporation of India (JCI)** continues to serve as the nodal agency for price support operations, while the **National Jute Board (NJB)** focuses on market promotion and technological interventions to modernize the sector.

1. **About Jute: The "Golden Fiber"**

   Jute is a natural fiber with a golden and silky shine, making it the second most important vegetable fiber after cotton in terms of usage and production.

   - **Geographical Conditions:**
   - **Climate:** It requires a hot and humid climate with temperatures ranging between **24°C and 35°C**.
   - **Rainfall:** Heavy rainfall of **120 cm to 150 cm** is essential, with high relative humidity (80-90%).
   - **Soil:** It thrives best in **alluvial soil** (silt-laden) found in the floodplains of the Ganges-Brahmaputra delta.
   - **Production Hubs:** India is the world's largest producer. **West Bengal** is the leading state, followed by **Bihar, Assam, and Odisha**.

- **Environmental Benefits:**
  - Jute is **100% biodegradable** and recyclable.
  - A hectare of jute plants consumes about 15 tonnes of CO_2 and releases 11 tonnes of Oxygen during a single season.
- **The Retting Process:** This is a crucial post-harvest step where jute stems are submerged in water to separate the fiber from the woody core. The government is promoting **In-situ Tank Retting** to save water and improve fiber quality.

2. National Jute Board (NJB)

The National Jute Board is the apex body responsible for the overall development and promotion of the jute industry in India.

- **Establishment:** It is a **statutory body** established under the **National Jute Board Act, 2008**.
- **Ministry:** It functions under the administrative control of the **Ministry of Textiles**, Government of India.
- **Merger:** It was formed by merging the erstwhile Jute Manufactures Development Council (JMDC) and the National Centre for Jute Diversification (NCJD).
- **Headquarters:** Kolkata, West Bengal.
- **Key Functions:**
  - **Market Promotion:** Organizing domestic and international fairs to promote Indian jute products.
  - **Research & Development:** Funding R&D projects for product diversification, such as jute geotextiles and agro-textiles.
  - **Incentive Schemes:** Implementing schemes like the Jute Integrated Development Scheme (JIDS) to support MSMEs and artisans.
  - **Standardization:** Working towards improving the quality of jute fiber through better retting technologies (e.g., JUTE-ICARE).

3. Jute Corporation of India (JCI)

While the NJB handles promotion, the JCI is primarily concerned with the commercial and price-stabilization aspects of raw jute.

- **Establishment:** It was set up in **1971** as a Government of India enterprise.
- **Status:** It is a **Central Public Sector Undertaking (CPSU)** under the **Ministry of Textiles**.
- **Primary Objective:** To protect the interests of jute growers through **Price Support Operations**.
- **Key Functions:**
  - **MSP Procurement:** Acting as the nodal agency to purchase raw jute from farmers at the MSP whenever market prices fall below the threshold.
  - **Commercial Purchase:** Engaging in the commercial purchase of jute to ensure a steady supply to the industry.
  - **Stabilizing Prices:** Managing buffer stocks to prevent extreme price volatility in the market.
  - **Direct Interaction:** Operating through a network of Departmental Purchase Centres (DPCs) to eliminate middlemen.

4. Regulatory and Economic Framework

- **Jute Packaging Materials (Compulsory Use in Packaging Commodities) Act, 1987:** This act mandates the compulsory use of jute packaging for certain commodities. Currently, the government mandates **100% of food grains** and **20% of sugar** to be packed in diversified jute bags.
- **MSP Determination:** The MSP for raw jute is fixed by the government based on the recommendations of the **Commission for Agricultural Costs and Prices (CACP)**.

3.19. LPG TO PNG CONVERSION PLAN

Context: India is currently pushing for a massive expansion of **Piped Natural Gas (PNG)** to replace **Liquified Petroleum Gas (LPG)** for domestic cooking. Recent government data indicates that while India has 32 crore LPG connections, domestic natural gas production is now sufficient to cater to 30 crore connections if converted to PNG. This shift is part of India's broader goal to increase the share of natural gas in its energy mix from the current **~6.7% to 15% by 2030**.

1. Comparative Analysis: LPG, LNG, CNG, and PNG

Feature	**CNG (Compressed Natural Gas)**	**PNG (Piped Natural Gas)**	**LPG (Liquefied Petroleum Gas)**
Nature/Form	Gas (compressed at high pressure)	Gas (supplied via pipeline)	Liquid (stored under pressure)
Main Composition	**Methane (CH4)**	**Methane (CH4)**	**Propane + Butane**
Storage	Cylinders (200–250 bar pressure)	No storage (direct supply)	Cylinders (moderate pressure)
Mode of Delivery	Fuel stations (cylinders)	Pipeline network (CGD system)	Cylinders (portable)
Primary Use	Transport fuel (vehicles)	Domestic & industrial use	Domestic & commercial cooking
Safety	**Lighter than air** (disperses fast)	**Lighter than air**	**Heavier than air** (can accumulate at floor level)
Environmental Impact	Cleanest fossil fuel	Clean	More polluting than CNG/PNG

2. Why is India Pushing for PNG? (The Strategic Drivers)

- **Reduction of Import Dependence:** India imports nearly 60% of its LPG requirements.
  - 90% of these imports were historically routed through the **Strait of Hormuz** (now a geopolitical flashpoint due to conflict in West Asia).
- **Cost and Efficiency:** Natural gas is much lighter than LPG. While energy density varies slightly, PNG acts as a "drop-in replacement" for LPG without requiring significant equipment changes for households.
- **Domestic Production Surplus:** Major fields like the **KG-DWN-98/2 Block (ONGC)** in the **Krishna-Godavari** basin are ramping up production, projected to increase India's total gas production by 10-15%.
- **Infrastructure Efficiency:** Pipelines eliminate the need for the "last-mile delivery" of heavy cylinders via trucks, reducing the carbon footprint of the supply chain.

3. Major Gas Pipelines

- **Location of Natural Gas Fields:** Krishna-Godavari (KG) Basin, Mumbai High, Cauvery Basin and Assam's Digboi, Dibrugarh, Sivasagar regions.
- **Pipeline Geography:** HAJIRA-VIJAIPUR-JAGDISHPUR (HVJ) pipeline, Jagdishpur-Haldia & Bokaro-Dhamra Pipeline (JHBDPL): Part of the Pradhan Mantri Urja Ganga project, Dahej-Uran-Dabhol-Panvel Pipeline (DUPL/DPPL): Operated by GAIL.

4. **Regulatory Body: The Petroleum and Natural Gas Regulatory Board (PNGRB)**
   - **Establishment:** Set up under the PNGRB Act, 2006, effective from March 31, 2006.
   - **Mandate:** Regulate downstream activities (refining, processing, storage, transport, distribution, marketing, and sale).
   - **Functions:** Protects consumer interests, ensures uninterrupted supply, and authorizes City Gas Distribution (CGD) networks.
   - **Exclusion:** Upstream activities (production of crude oil and natural gas) are outside its jurisdiction.
   - **Appellate Authority:** The Appellate Tribunal for Electricity, established under the Electricity Act 2003, handles appeals against PNGRB decisions.

3.20. DGFT EXTENDS RoDTEP SCHEME

Context: The **Directorate General of Foreign Trade (DGFT)** has extended the RoDTEP scheme for an additional **six months**. This extension aims to provide stability and certainty to Indian exporters amidst global economic fluctuations.

1. **What is RoDTEP?**

   The **Remission of Duties and Taxes on Exported Products (RoDTEP)** is a flagship export promotion scheme aimed at refunding central, state, and local taxes incurred during the manufacturing and distribution of exported goods. By ensuring that such embedded taxes are not exported, the scheme enhances the global competitiveness of Indian products.

2. **Launch**

   The scheme was implemented on **January 1, 2021**, replacing the earlier **Merchandise Exports from India Scheme (MEIS)**, which was found to be non-compliant with WTO norms.

3. **Implementing Authority**

   The scheme is administered by the **Ministry of Commerce and Industry**.

4. **Objective**

   RoDTEP seeks to establish a comprehensive mechanism for reimbursing taxes, duties, and levies that are **not covered under existing refund frameworks** such as GST or Duty Drawback, thereby promoting export growth in both volume and value.

5. **Key Features**
   - **Wide Coverage:** Encompasses over 10,000 export products across sectors such as agriculture, marine, leather, and gems and jewellery.
   - **Digital Duty Credit System:** Benefits are provided in the form of transferable duty credit scrips, maintained electronically through the Customs portal.
   - **WTO Compliance:** Based strictly on the principle of tax remission, ensuring conformity with **World Trade Organization** rules.

- **Automated Processing:** Rebates are calculated as a percentage of the **Freight on Board (FOB)** value and are automatically processed upon submission of shipping bills.
- **Inclusion of Embedded Taxes:** Covers previously unreimbursed costs such as mandi tax, VAT on fuel used in transportation, and electricity duties.

6. Significance

- **Enhancing Export Competitiveness:** By eliminating embedded taxes, Indian exports become more price-competitive in global markets.
- **Liquidity Support to Exporters:** Transferable digital scrips provide timely financial assistance, particularly during global disruptions such as geopolitical crises.
- **Ease of Doing Business:** The fully digital, paperless system minimizes delays, reduces human intervention, and improves transparency in the refund process.

3.21. GOVERNMENT PROMOTES: NAMO DRONE DIDI SCHEME

Context: The Union Minister of State for Civil Aviation recently informed the Lok Sabha that **Karnataka** leads the country in training women from **Self-Help Groups (SHGs)** as drone pilots under the Central government's **Namo Drone Didi Yojana**. The initiative aims to modernize agricultural practices while empowering rural women through advanced technical skills.

1. Key Statistics and Performance

- **National Training Totals**: A total of **1,094 SHG members** have been trained as drone pilots across India.
- **State-wise Ranking**:
  - **Karnataka**: Ranked **1st** in the country with **145 members** trained.
  - **Uttar Pradesh**: Ranked **2nd** with **128 members**.
  - **Andhra Pradesh**: Ranked **3rd** with **108 members**.

2. Features of Namo Drone Didi Yojana (NDDY)

- **Objective**: **Central Sector Scheme** to provide drones to women SHGs to improve efficiency in agricultural practices, enhance crop yield, and break traditional stereotypes of SHG activities (moving beyond home-based products like pickles/papads).
- **Financial Outlay**: The scheme has an allocation of **₹1,261 crore**.
- **Financial assistance:** 80% of the total cost of the drone and accessories (up to a maximum of Rs 8 lakh) is provided by the government.
- **Implementation Period**: Planned for the period from **2023-24 to 2025-26**.
- **Target**: The Central government aims to provide **15,000 drones** to women SHGs under this scheme.
- **Economic Impact**: Trained pilots can earn significant seasonal income (up to ₹1 lakh a month) by spraying medicines/pesticides in maize and paddy farms.
- **Eligibility:** SHG registered under DAY-NRLM (Deendayal Antyodaya Yojana – National Rural Livelihoods Mission).
- **Implementation:** implemented by the Department of Agriculture & Farmers' Welfare (DA&FW), under the Ministry of Agriculture & Farmers Welfare.

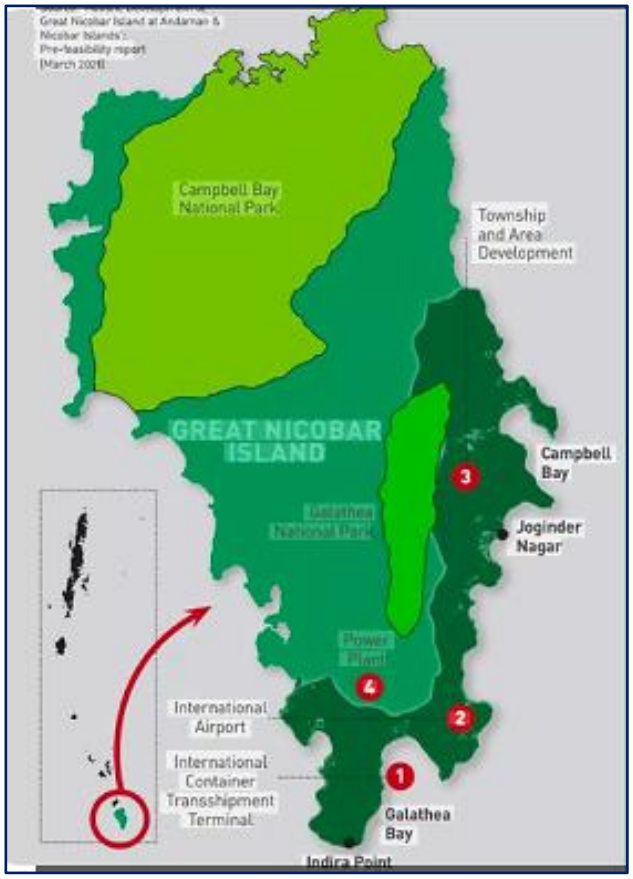
- **The Lead Fertilizer Companies (LFCs)** responsible for the States will be the implementing agencies of the scheme at the State level and they will establish necessary coordination with the State Departments, Drone manufacturers, Cluster Level Federations of SHGs/SHGs and the farmers/beneficiaries etc.

3. Benefits of the Namo Drone Didi Scheme

- **Empowerment of Women:** The scheme trains women in drone technology, enabling efficient crop monitoring, soil analysis, and precision farming.
- **Enhancement of Agricultural Efficiency**: Drone technology enables precise, GPS-guided application of pesticides and fertilizers, reducing chemical overuse, environmental impact, and costs for farmers.
- **Skill Development and Knowledge Expansion:** The scheme provides specialized training in drone technology, enabling women to acquire advanced skills in modern agricultural practices such as applying fertilizers, pesticides, and herbicides accurately, ensuring even distribution and optimal usage.
- **Community and Networking Opportunities**: The scheme fosters networking and collaboration among women through forums and workshops, while providing access to experts and mentors for knowledge sharing and professional growth.

3.22. THE GREAT NICOBAR INFRASTRUCTURE PROJECT

Context: The Union government is moving forward with a **₹92,000-crore mega-infrastructure project** on Great Nicobar Island. Recently, a draft **"Comprehensive Tribal Welfare Plan"** (with a ₹42.52-crore outlay) was circulated to outline the relocation of **Nicobarese tribal communities**. This has triggered fresh concerns regarding **tribal consent, forest rights, and the displacement of indigenous groups.**



1. Key Tribal Groups Involved

- **Nicobarese:** A scheduled tribe primarily affected by the 2004 tsunami and now by the proposed infrastructure project. They are traditionally settled along the coasts.
- **Shompen:** A **Particularly Vulnerable Tribal Group (PVTG)**. They are hunter-gatherers living in the interior forests of Great Nicobar.
- **Legal Protections:** The project is under scrutiny for potential violations of the **Forest Rights Act (2006)** and the requirement of "Informed Consent" from the Tribal Councils.

2. Components of the Project

- The integrated project is designed to transform the island into a major hub through the following developments: **International Transshipment Port**, International Airport, **Power Plant, Greenfield Township**.
- **Promoting Body:** NITI Aayog

- **Implementing Agency:** Andaman and Nicobar Islands Integrated Development Corporation Limited (ANIIDCO)
  - ANIIDCO was incorporated on 28th June 1988 under the Companies Act 1956 for rapid economic growth of the Islands.
- **Operates under:** Ministry of Home Affairs

3. The Relocation Controversy

- **Ambiguity in the Draft:** The government claims the project will not "disturb or displace" tribes, yet the draft plan specifically uses the term **"relocation"** for 62 enumerated families (approx. 218 persons).
- **Ancestral Lands:** Tribal leaders are demanding a return to ancestral sites like **Pulobhabi** on the west coast, which were lost during the tsunami.
- **Consent Issues:** The Tribal Council withdrew its previous consent in 2022, alleging that forest rights were not settled. The Calcutta High Court is currently hearing petitions regarding whether "genuine consent" was obtained.

4. About Andaman and Nicobar Islands (ANI)

- ANI is a UT with 572 islands (Bay of Bengal), of which 38 are inhabited.
- **Comprises two groups:** Andaman Islands and Nicobar Islands, divided by the 10° Channel.
- **Duncan Passage** separates Little Andaman from South Andaman.
- **Closer to equator**: Located between 6° to 14°
- Separated from Thailand and Myanmar by the **Andaman Sea**.
- Island chain is a submerged extension of the **Arakan Mountains.**
- **Dugong** (sea mammal) is the official animal, endemic to the Indo-Pacific coast, especially Andaman.
- In 2018, three islands were renamed to honour **Subhas Chandra Bose**:
  - Ross → Netaji Subhash Chandra Bose Island
  - Neil → Shaheed Island
  - Havelock → Swaraj Island
- In September 2024, the capital of the ANI (Port Blair) was renamed **Sri Vijaya Puram.**

5. PVTGs in Andaman & Nicobar Islands (ANI)

- ANI has **five PVTGs**: Great Andamanese, Jarawa, Onge, Sentinelese, and Shompen.
- They are geographically isolated, depend on hunter-gathering or simple horticulture, have very small populations, and are **highly vulnerable.**
- **Recently,** members of the **Shompen tribe voted for the first time** in the ANI Lok Sabha constituency.

6. Hotspot Status and biodiversity:

- Nicobar fall under the Sundaland Biodiversity Hotspot.
- **Great Nicobar Biosphere Reserve:** It covers 885 km² across **Campbell Bay and Galathea National Parks (core zone).**

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4.1. BAUXITE MINING IN ODISHA SPARKS TRIBAL PROTESTS

Context: **Recently**, violent clashes broke out in Odisha's Rayagada district as local tribal communities protested against the construction of a road leading to the proposed Sijimali bauxite mine. The residents of Kutamal village expressed deep concerns that the mining project, estimated to hold 311 million tonnes of bauxite, would deplete perennial water sources and severely impact their traditional livelihoods.

This incident highlights the ongoing tension between industrial development by companies like Vedanta Limited and the protection of tribal rights under the constitutional framework.

1. **Bauxite: The Ore of Aluminum**
   - **Composition:** Bauxite is not a specific mineral, but a rock consisting mainly of hydrated aluminum oxides.
   - **Geological Formation:** It is formed by the decomposition of a wide variety of rocks rich in aluminum silicates under tropical and sub-tropical conditions (lateralization process).
   - **Usage:** It is the primary ore used to produce Alumina, which is then smelted to create Aluminum—a critical metal for the aerospace, construction, and packaging industries.
2. **Bauxite Distribution in India**
   - India is home to significant bauxite reserves, estimated at approximately **650 million tonnes** as of 2026. Production is dominated by a few key states, with the **Eastern Ghats** being the most productive region.
     a. **Odisha (The Leader)**
        - **Share:** Produces over **50%** of India's total output.
        - **Key Belts:** The 300-km-long belt across **Kalahandi and Koraput** is the largest bauxite-bearing region in the country.
        - **Major Mines: Panchpatmali (Koraput):** Often cited as Asia's largest bauxite mine; it supplies the NALCO refinery at Damanjodi.
          - **Gandhamardan (Bargarh):** A high-grade deposit of strategic importance.
          - **Kodingamali (Rayagada):** A major site for OMC (Odisha Mining Corporation).

     b. **Gujarat**
        - **Share:** Second largest producer (~15-18%).
        - **Key Locations:** The deposits are found in a belt between the Gulf of Kachchh and the Arabian Sea.
        - **Districts:** Jamnagar (Kalyanpur), Devbhumi Dwarka, Junagadh, and Bhavnagar.

     c. **Jharkhand**
        - **Key Locations:** The **Patlands** of **Lohardaga and Gumla** are famous for high-grade bauxite.
        - **Districts:** Lohardaga, Gumla, Latehar, and Ranchi.

d. Chhattisgarh & Madhya Pradesh

- **Maikala Range:** Deposits are abundant in the Maikala range covering Bilaspur and Durg (Chhattisgarh).
- **Amarkantak Plateau:** Spans across Shahdol and Mandla (MP) and Surguja (Chhattisgarh).
- **Katni (MP):** Known for specialized grades used in the refractory and chemical industries.

3. Top Bauxite Producing Countries

- **Australia and Guinea** are the world's leading bauxite producers, together driving global supply, with **China and Brazil** also ranking among the top producers.

4. Constitutional and Legal Protections for Tribal Areas

- **Fifth Schedule:** Most bauxite-rich areas in **Odisha fall under the Fifth Schedule** of the Constitution, which provides for the administration and control of Scheduled Areas and Scheduled Tribes.
- **PESA Act, 1996:** The Provisions of the Panchayats (Extension to Scheduled Areas) Act mandates that the **Gram Sabha** must be consulted before making any decision on land acquisition or mining leases in these areas.
- **Forest Rights Act (FRA), 2006:** Recognizes the rights of forest-dwelling communities over forest land and resources, requiring their consent for diversion of forest land for non-forest purposes.

5. Environmental and Social Concerns

- **Water Depletion:** Bauxite cappings on hills act as natural aquifers that feed perennial streams; mining these caps can lead to the drying up of water sources.
- **Displacement:** Mining often leads to the involuntary displacement of tribal communities, resulting in the loss of cultural heritage and traditional economic structures.
- **Ecological Impact:** Open-cast mining leads to large-scale deforestation and loss of biodiversity in the Eastern Ghats region.

4.2. CLIMATE CHANGE EMERGES AS A MAJOR PUBLIC HEALTH CRISIS

Context: **Recently**, a comprehensive report titled *"Under the Weather: India's Climate-Health Intersections and Pathways to Resilience"* was released by the **ClimateRISE Alliance** in collaboration with **Dasra**.

The report highlights that climate change has evolved from an environmental concern into a systemic public health emergency in India, with nearly **40% of districts** now at high risk from extreme weather events. It underscores how rising temperatures and erratic rainfall are not just ecological shifts but are actively reshaping disease landscapes and straining the national healthcare infrastructure.

1. Shifting Disease Patterns

Climate change acts as a **"health-risk multiplier,"** exacerbating the burden of both communicable and non-communicable diseases (NCDs).

- **Vector-Borne Diseases (VBDs):** Rising temperatures and shifting rainfall patterns are expanding the reach of malaria and dengue into previously unaffected high-altitude regions like **Shimla**, parts of **Jammu & Kashmir**, and the **Himalayan foothills**. **Pune** has been identified as a major emerging dengue hotspot.

- **Water-Borne Diseases:** Increased frequency of floods triggers outbreaks of cholera, hepatitis, and leptospirosis due to contaminated water sources.
- **Non-Communicable Diseases:** Heat exposure is directly linked to higher cardiovascular mortality. Air pollution (PM2.5) is worsening respiratory illnesses and chronic conditions.

2. **Socio-Economic Impact and Vulnerability**

The report highlights a "cycle of vulnerability" where the impact is disproportionately borne by marginalized groups.

- **Labour Productivity:** India lost approximately **160 billion labour hours** due to heat exposure in 2021 (equivalent to ~5.4% of GDP).
- **Maternal & Child Health:** Exposure to extreme heat is linked to a **16% increase** in the odds of preterm births. It also increases risks of pre-eclampsia (high blood pressure during pregnancy) and low birth weight.
- **Vulnerable Groups:** Rural populations, informal workers (outdoor labourers), women, and children are the most "climate-vulnerable" due to limited thermoregulation abilities and poor access to healthcare.

3. **Institutional Framework in India**

India has transitioned from general climate policies to targeted health-centric interventions:

- **National Action Plan on Climate Change and Human Health (NAPCCHH):** Launched by the Ministry of Health and Family Welfare (MoHFW) to strengthen healthcare capacity against climate-sensitive illnesses.
- **Heat Action Plans (HAPs):** Implemented at city and district levels to provide early warnings and preparedness for heatwaves.
- **National Programme on Climate Change and Human Health (NPCC&HH):** Aims to create awareness, strengthen surveillance of climate-sensitive diseases, and build the capacity of healthcare professionals.

4. **Key Challenges Identified**

- **Data Gaps:** Lack of local, disaggregated data linking climate events specifically to health outcomes.
- **Funding:** Adaptation funding remains constrained and skewed heavily toward mitigation (reducing emissions) rather than building health resilience.
- **Infrastructure:** Fragmented data systems and weak public awareness hinder effective emergency responses.

4.3. SPECIES CONCEPT GAINS ATTENTION AFTER IUCN UPDATE

Context: Recently, the **International Union for Conservation of Nature (IUCN)** declared the **Emperor Penguin** an endangered species, bringing the concept of **sentinel species** back into focus.

1. **What is a Sentinel Species?**

- Sentinel species are organisms—including animals, plants, and microbes—that act as **early warning signals** for environmental degradation, pollution, or ecological imbalance. Their health, population levels, or behavior reflect the overall condition of their ecosystem, providing vital data often before humans notice broader environmental issues.

- They are among the **first to respond to stressors** in their environment such as **pollution, disease, and environmental change**.
- Their response to threats tends to be **more apparent than most other species**.

Key Characteristics

- **High Sensitivity:** They are often among the first to respond to environmental stressors like pollutants, disease, or climate changes.
- **Bioaccumulation:** They often accumulate toxins in their tissues, acting as natural indicators of hazardous levels of pollution.
- **Fixed Territory:** Many sentinel species occupy a specific area, allowing researchers to pinpoint the source of a problem.
- **Physiological Indicators:** Their physiology often amplifies environmental changes, making it easier to detect issues.

2. Examples of Sentinel Species and Their Significance

Species	Ecosystem/Environment	Stressor/Indicator
Frogs (Amphibians)	Aquatic & Terrestrial	Permeable skin absorbs pesticides and pathogens; indicates overall ecological stress.
Canaries	Coal Mines	Faster metabolism makes them succumb to **Carbon Monoxide** before humans notice.
Honeybees	Agricultural Lands	Used to track agricultural chemical loads (pesticides).
Polar Bears	Arctic Region	Monitor the accumulation of Arctic contaminants.
Emperor Penguins	Antarctic Region	Sentinel for **Climate Warming**; their population is projected to halve by the 2080s.
Fish Species	Rivers/Oceans	Used to detect industrial runoff and water pollution.

3. Emperor Penguin

- **IUCN Status:** Endangered (declared April 9, 2025)
- **Habitat:** Antarctic region
- **Role:** Sentinel species for **warming in the Antarctic region**
- **Threat:** Climate change is projected to **halve their population by the 2080s**
- **Scientific significance:** Their declining population signals broader Antarctic ecosystem stress

4. Why Scientists Monitor Sentinel Species

- They help **detect pollution** (chemical, industrial, agricultural)
- They serve as **bio-indicators** of ecosystem health
- Their physiological sensitivity makes them **natural early-warning systems**
- Monitoring them is **cost-effective** compared to direct environmental testing
- A declining sentinel population often signals **wider ecological stress** even before other indicators detect the problem

5. Difference Between Sentinel Species and Indicator Species

Feature	Sentinel Species	Indicator Species
Primary Goal	**Early Warning:** To alert humans to a specific threat (pollution, disease) before it affects the wider population.	**Assessment:** To reflect the general health, quality, or character of an ecosystem.

	Sentinel = Health Signal: Think of a medical check-up for the planet. It's about the **physiology** of the animal (e.g., a bird getting a tumor from toxic runoff).	**Indicator = Presence Signal:** Think of a census. It's about whether the animal **can exist** there (e.g., if the forest is healthy, the Spotted Owl will be there).
Observation	Focuses on the **physical health or physiological changes** in individuals (e.g., getting sick).	Focuses on the **presence, absence, or population density** of the species in a habitat.
Response Time	Responds very rapidly to stressors.	Responds over a period of time as the habitat changes.
Example	**Canaries** in coal mines (dying from gas before humans notice).	**Lichens** on trees (their presence indicates clean air/lack of sulfur dioxide).

4.4. HONEYBEES, BOOSTING KASHMIR'S APPLE HONEY PRODUCTION

Context: The CSIR-Indian Institute of Integrative Medicine has developed a protocol enabling Apis mellifera to survive sub-zero winters in the Kashmir Valley.

Earlier, beekeepers in Jammu and Kashmir had to migrate colonies to warmer northern plains (Punjab, Haryana, Rajasthan) for six months, incurring high costs and about 30% bee mortality.

The intervention eliminates migration and has enabled the region's first mono-floral apple honey, advancing India's Sweet Revolution.

1. **Who Lives in the Hive? (Social Structure)**

   A honeybee colony is like a well-organized city where everyone has a specific job:

   - **The Queen:** There is only **one queen** per hive. She is the mother of all bees and her only job is to lay eggs to keep the colony growing.
   - **The Workers:** These are all **females** but they do not lay eggs. They do all the hard work: cleaning the hive, feeding the babies, guarding the door, and flying out to collect nectar.
   - **The Drones:** These are the **males**. They don't have stingers and they don't collect food. Their only job is to mate with a new queen.

2. **How do Bees Talk? (The Dance)**

   Bees don't use words; they use "dances" to tell their friends where the flowers are:

   - **Round Dance:** This means "Food is very close (less than 100 meters)!"
   - **Waggle Dance:** This is for food that is far away. The bee shakes its body in a figure-eight pattern. The **angle** of the dance tells the other bees which direction to fly (using the sun as a map), and the **length** of the shake tells them how far to go.

3. **Common Honeybees in India**

   - **Rock Bee (*Apis dorsata*):** Large, wild, and aggressive. They build huge single combs on tall trees or buildings.
   - **Indian Bee (*Apis cerana*):** The most common local bee that farmers keep in boxes.
   - **Italian Bee (*Apis mellifera*):** Brought from Europe because they are very calm and produce a lot of honey.
   - **Stingless Bee:** Very tiny bees that don't sting. Their honey is used mostly as medicine.

4. **Important Bee Related Facts**

- **Shimmering:** When a predator (like a wasp) comes near a Rock Bee nest, thousands of bees move their wings together to create a "shimmer" effect to scare it away.
- **Pollination:** This is the most important job. While collecting food, bees move pollen from one flower to another. Without this, many of our favorite fruits and vegetables wouldn't grow.
- **Five Eyes:** Bees have two big eyes to see shapes and three tiny eyes on top of their head to help them navigate using light.

The Sweet Revolution (Mithi Kranti)

The "Sweet Revolution" is a strategic government initiative aimed at promoting apiculture to increase honey production and rural income.

- **Pollination Services:** Bees contribute to the pollination of approximately **75% of food crops**. Estimates suggest that bee pollination can increase crop yields by **15% to 20%**.
- **Mono-floral Honey:** This is honey sourced primarily from a single plant species (e.g., Apple, Litchi, or Mustard). It commands a premium price in the international market due to its specific flavor and medicinal properties.
- **Madhukranti Portal:** An online platform for the registration and **traceability** of honey sources to prevent adulteration and ensure quality for exports.

National Beekeeping and Honey Mission (NBHM)

- Launched in 2020 under the **Atmanirbhar Bharat** package, it is a **Central Sector Scheme** implemented by the National Bee Board (NBB).
- Focuses on production and productivity through scientific beekeeping and pollination.
- Focuses on post-harvest management, including processing, storage, and marketing.
- Focuses on Research & Development (R&D) for specific agro-climatic zones (like the Kashmir sub-zero protocol).

Global Standing

- India has risen to become the **second-largest exporter of honey** globally (as of 2024-25 data).
- Major honey-producing states include Uttar Pradesh, West Bengal, Punjab, and Bihar

4.5. NATURE CLIMATE CHANGE: HIGHLIGHTS RISKS TO URBAN AIR QUALITY

Context: A recent study published in *Nature Climate Change* highlights a concerning trend: **global warming is weakening the sea-land breeze systems** in major coastal megacities. This "erosion" of coastal winds poses significant risks to urban health, temperature regulation, and air quality.

1. **Basic Geography: The Sea-Breeze Mechanism**

The sea-land breeze is a local wind system caused by the **differential heating** of land and water.

- **Sea Breeze (Daytime):** Land heats up faster than the sea. The air above the land rises (Low Pressure), and cooler air from the sea (High Pressure) blows toward the shore.
- **Land Breeze (Nighttime):** Land cools down faster than the sea. The air over the sea is now warmer and rises, causing cooler air from the land to blow toward the sea.

2. **Why the Breezes are Weakening**

The core driver of these winds is the **thermal contrast** (temperature difference) between land and sea.

- **Ocean Warming:** Global warming is heating the oceans significantly.

- **Reduced Gradient:** As sea surface temperatures rise, the temperature gap between the coastal land and the adjacent water shrinks.
- **The Result:** A weaker pressure gradient leads to less frequent and slower sea breezes.

3. **Key Findings of the Study**
   - **Historical Decline:** Ocean warming has already reduced the number of "breeze days" by **3%** in most studied cities.
   - **Affected Cities:** Mid-latitude cities like **London, New York, Shanghai, and Buenos Aires** have seen the most dramatic declines. Mumbai has also recorded a 3% reduction.
   - **Future Projections (2050):** If carbon emissions remain high, these breezes could weaken **4.5 times faster** than historical rates.
4. **Ecological and Urban Implications**

   The weakening of these breezes is considered an "overlooked threat" because:
   - **Urban Heat Island (UHI) Effect:** Sea breezes are essential for cooling down coastal concrete jungles; without them, urban heat becomes more intense.
   - **Air Quality:** Breezes help in the dispersion of pollutants. Weaker winds lead to stagnant air and **worsening air pollution** in coastal megacities.
   - **Habitability:** The combination of higher heat and poor air quality threatens the long-term habitability of coastal hubs.

Quick Check for Prelims

Feature	Sea Breeze	Land Breeze
Occurrence	Daytime	Nighttime
Movement	Sea to Land	Land to Sea

4.6. MICROPLASTICS DISRUPT CARBON DYNAMICS IN SUNDARBANS MANGROVE ECOSYSTEM

Context: **Recently**, researchers from the Indian Institute of Science Education and Research (IISER), Kolkata, published a study in the *Journal of Hazardous Materials Advances* revealing that microplastics in the Sundarbans are acting as a "novel carbon reservoir." The study highlights how plastic waste, breaking down into nanoplastics, leaches organic carbon into the water, which fuels unnatural bacterial growth and threatens to alter the delicate carbon budget of the world's largest contiguous mangrove forest.

1. **The Sundarbans as a Blue Carbon Sink**
   - **Blue Carbon:** This refers to the carbon captured by the world's ocean and coastal ecosystems, such as mangroves, seagrasses, and salt marshes.
   - **Sundarbans' Role:** The Sundarbans, situated at the confluence of the Ganga and Brahmaputra, is a highly efficient ecosystem for sequestering carbon dioxide from the atmosphere and storing it in biomass and soil.
   - **Ecological Threat:** The influx of urban waste from upstream brings a high concentration of microplastics (ranging from 5 to 58 particles per liter), particularly during the monsoon due to surface runoff.

2. **The "Novel Carbon Reservoir" Phenomenon**
   - **Leaching Carbon:** As microplastics (roughly 90% carbon) weather and break down, they release **dissolved organic carbon (DOC)** into the marine environment.
   - **Biogenic Carbon:** Microbes living on the surface of plastic particles, known as **Plastispheres**, produce their own carbon, further complicating the natural carbon cycle.
   - **Impact on Food Web:** This artificial carbon source allows bacteria to multiply faster than natural rates, which can disrupt the natural food web and reduce the efficiency of mangroves as carbon sinks.
3. **Some Important concept**
   - **Plastisphere:** A term used to describe the ecosystems that have evolved to live in human-made plastic environments.
   - **Microplastics:** Plastic particles less than 5mm in diameter.
   - **Nanoplastics:** Extremely small particles (typically less than 1 micrometer) that can penetrate cellular membranes in marine life.

The Sundarbans

- **Geographic Confluence:** Formed by the delta of the **Ganges, Brahmaputra, and Meghna** rivers on the Bay of Bengal.
- **Largest Mangrove Forest:** It is the largest contiguous mangrove forest in the world, with roughly **40%** of its area in India (West Bengal) and the remaining in Bangladesh.
- **Flora and Fauna:**
  - **Sundari Tree (*Heritiera fomes*):** The dominant mangrove species that gives the forest its name.
  - **Pneumatophores:** Specialized "breathing roots" that grow vertically up from the mud to obtain oxygen in waterlogged soil.
  - **Royal Bengal Tiger:** The Sundarbans is the only mangrove habitat in the world inhabited by tigers.
  - **Other Species:** Estuarine crocodile, Indian Python, Irrawaddy dolphin, and Olive Ridley turtle.
- **International Recognition:**
  - **UNESCO World Heritage Site:** Designated in 1987 (India) and 1997 (Bangladesh).
  - **Ramsar Site:** The Indian Sundarban Wetland was recognized as a "Wetland of International Importance" in **January 2019**.
  - **Biosphere Reserve:** Designated under the Man and Biosphere (MAB) Programme.

4.7. DRAFT RULES FOR E85 ROLLOUT SIGNAL PUSH TOWARD

Context: The Government of India is set to notify draft rules for the introduction of **E85 fuel** (a high-ethanol blend) in response to global oil supply vulnerabilities and the need to reduce vehicular pollution. This move aligns with India's broader strategy of achieving energy security and meeting net-zero carbon targets.

1. **Analysis of Ethanol Blends**
   - **E85:** E85 is a **high-octane, renewable fuel** blend containing **51% to 85% ethanol mixed** with gasoline, designed specifically for **Flex Fuel Vehicles (FFVs).** It offers cleaner burning and higher performance (104+ octane) but results in lower fuel efficiency (roughly 20-30% lower MPG) compared to standard petrol.

- **E20 Fuel (20% Ethanol + 80% Petrol):**
  - The National Policy on Biofuels (2018, amended in 2022) advanced the 20% ethanol blending target from 2030 to 2025-26.
  - From April 1, 2026, all petrol vehicles in India must be compatible with E20 fuel (20% ethanol blend), requiring engines designed for higher ethanol compatibility, specifically with a minimum 95 RON (Research Octane Number) rating as per BIS standards.
- **E50 Fuel (50% Ethanol + 50% Petrol):** Requires Flex-Fuel Vehicles (FFVs) — specially designed engines capable of running on any petrol-ethanol blend from E20 to E85.

2. E-Fuel Quick Comparison Table

Feature	E20	E50	E60	E85
Ethanol %	20%	50%	60%	Up to 85%
Petrol %	80%	50%	40%	~15%
India Status	Mandatory (2023)	Transitional /Planned	Not notified separately	Draft rules being framed (2025-26)
Engine Needed	Standard/E20 compatible	FFV	FFV	Strictly FFV only
CO_2 Reduction (approx.)	~20%	~40%	~50%	~60–70%
Fuel Economy Impact	~1-2% lower	~10% lower	~15% lower	~20-25% lower
Octane Number Benefit	Moderate	High	High	Very High
Infra Changes Needed	Minimal	Moderate	Significant	Separate pumps & tanks
Global Examples	USA, India	Brazil	Sweden	USA (Midwest), Brazil

3. Key Institutions Involved

- **Ministry of Petroleum & Natural Gas (MoPNG):** Nodal ministry for EBP; issues blending mandates.
- **NITI Aayog:** Policy coordination; authored the Ethanol 100 roadmap.
- **Ministry of Road Transport (MoRTH):** Vehicle compatibility regulations; FFV mandate.
- **Ministry of Food & Agriculture:** Controls feedstock availability and pricing of sugarcane.
- **BIS (Bureau of Indian Standards):** Sets fuel quality standards for E20, E85 blends.
- **Oil Marketing Companies (OMCs):** IOCL, BPCL, HPCL — procure, blend, and distribute ethanol-blended fuel.

4. Comparison of Biofuel Generations

Feature	1st Generation (1G)	2nd Generation (2G)	3rd Generation (3G)	4th Generation (4G)
Feedstock	**Edible Food Crops** (Sugarcane, Corn, Wheat, Vegetable oils)	**Non-Edible Waste** (Rice straw, Corn stover, Wood chips etc.)	**Algae** (Microalgae & Seaweed)	**Genetically Engineered** Algae & Carbon Capture Tech

Technology	Conventional (Fermentation/ Distillation)	Advanced (Cellulosic ethanol, Gasification)	Biotechnological (Lipid extraction from Algae)	Synthetic Biology + Carbon Sequestration
Key Issues	**"Food vs. Fuel"** debate; high water usage.	High capital cost; complex pretreatment.	Currently expensive; mostly in R&D/Pilot stage.	Theoretical/Experimental; aiming for **Carbon Negative**.
GHG Reduction	Moderate (30–50%)	High (60–90%)	Very High (>90%)	**Carbon Negative** (Absorbs more than it emits)
Examples	Bioethanol, Biodiesel, Biogas	Cellulosic Ethanol, Bio-oil	Algal Biodiesel, Butanol	Photobiological Solar Fuels

4G –Microbes

- Fourth-generation (4G) biofuels primarily utilize genetically engineered or modified microorganisms—specifically **microalgae, cyanobacteria, fungi, and bacteria**—to enhance lipid/sugar production and directly synthesize fuels like biodiesel, biobutanol, and bioethanol.
- Key microbes include **Chlorella, Nannochloropsis, and engineered E. coli or Saccharomyces cerevisiae**, which are designed for high-efficiency photosynthesis or direct fuel secretion, often combined with carbon capture.

5. Flex-Fuel Vehicles (FFVs)

- **Definition:** Flex-Fuel Vehicles (FFVs) can operate on any mixture of petrol and ethanol, from pure petrol (E0) to high-ethanol blends (E85 or even E100).
- **Technology:** FFVs use sensors to detect the ethanol content and automatically adjust fuel injection, spark timing, and air-fuel ratio.
- **Key Fact: Brazil is the world's largest FFV market with over 30 million FFVs; USA is the second largest.**

4.8. SAFETY CONCERNS RENEW DEBATE ON FIREWORKS REGULATIONS

Context: Recently, a major explosion at a firecracker manufacturing unit in Thrissur resulted in the death of 14 people and left over 40 injured, occurring just days before the Thrissur Pooram festival.

In the previous year, the same festival had already raised serious safety concerns when a fireworks display led to chaos after a disoriented elephant went on a rampage, injuring 42 individuals. Additionally, another elephant had attacked its handler a day prior to the incident.

1. Noise Pollution Standards in India

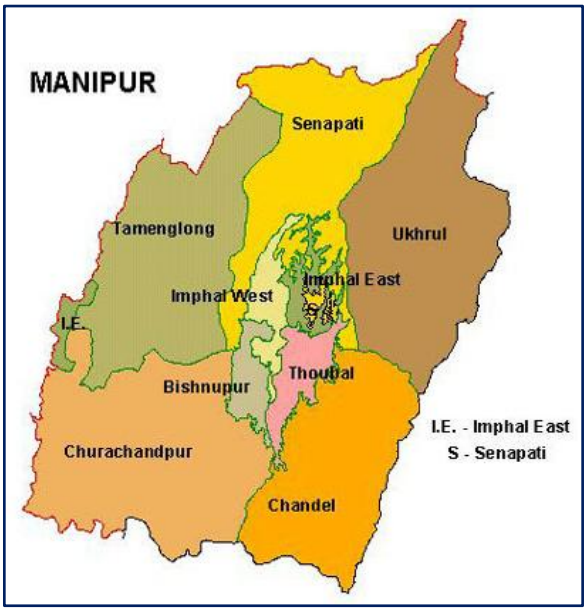
- **Regulatory Body:** Central Pollution Control Board (CPCB).
- **Noise Standards for Firecrackers:** Prohibits manufacture, sale, or use of firecrackers generating noise levels exceeding **125 decibels (dB)** at 4 metres distance from the point of bursting.

- **Ambient Noise Limits (National Ambient Noise Monitoring Network):**
  - **Residential Areas:** 45–55 dB.
  - **Silence Zones (Hospitals/Educational Institutions):** 40–50 dB.
- **Health Impact:** The WHO identifies noise pollution as the **third most hazardous environmental threat** to human health, following air and water pollution.

2. **Cold Spark Technology (Noiseless Alternatives)**
   - **Mechanism:** Uses a chemical combustion reaction of fine granulated metal alloy powders (typically **Titanium and Zirconium**).
   - **The "Cold Sparkular":** A device equipped with a heater and fan. The heater warms the alloy powder to increase activation energy, and the fan ejects the glowing particles.
   - **Key Differences from Traditional Fireworks:**
     - **Temperature:** Traditional sparklers emit temperatures around 1,200°C. Cold sparklers/anars operate at significantly lower temperatures (**60–100°C**), reducing burn risks.
     - **Combustion:** Utilizes rapid exothermic reactions without explosive combustion, heavy smoke, or high-decibel noise.
     - **Deployment:** Can be arranged in arrays for sequential triggering to create visual effects like "cascading bursts" or "vertical expansion" without sound.
3. **Ecological and Social Impact**
   - **Animal Welfare:** High decibel levels and specific sound frequencies disorient captive animals (e.g., festival elephants), leading to unpredictable behavior and public safety risks.
   - **Vulnerable Populations:** High noise levels near hospitals pose significant risks to Neonatal Intensive Care Units (NICUs), potentially impacting infant brain development.
   - **Economic Barriers:** Cold spark pyrotechnics remain expensive and are currently largely imported, though indigenous manufacturing is technologically feasible.

4.9. MANIPUR: STATE PROFILE & STRATEGIC IMPORTANCE

Context: Ethnic tensions have intensified in Manipur following clashes between Naga and Kuki communities in Kangpokpi and Senapati districts. The violence was triggered by the killing of two Tangkhul Naga civilians in Ukhrul on April 18, prompting the United Naga Council to impose a 72-hour shutdown across Naga-inhabited areas. The situation escalated when Kuki villagers attempted to remove roadblocks, leading to physical confrontations. These developments indicate a departure from the earlier neutrality of Naga groups in the Meitei-Kuki conflict and revive memories of the Naga-Kuki clashes of the 1990s.



1. **Geography and Topography**
   - **Location:** Manipur is a "Landlocked State" in Northeast India, sharing international borders with **Myanmar** (Sagaing Region and Chin State) to the east and south.
   - **Internal Borders:** It is bounded by **Nagaland** to the north, **Mizoram** to the south, and **Assam** to the west.

- **Terrain:** The state is physically divided into two distinct regions: the central **Imphal Valley** (occupying about 10% of the land) and the surrounding **Hill Ranges** (occupying 90% of the land).
- **River Systems:** The state is drained by the **Barak River** (flowing towards Assam/Bangladesh) and the **Manipur River** (a tributary of the Chindwin River in Myanmar).

2. **Biodiversity and Environment**
   - **Loktak Lake:** It is the largest natural freshwater lake in Northeast India and is a designated **Ramsar Site**. It is also included in the **Montreux Record** due to ecological changes.
   - **Phumdis:** These are heterogeneous masses of vegetation, soil, and organic matter at various stages of decomposition that float on the lake surface.
   - **Keibul Lamjao National Park:** It is the **world's only floating national park**, located in the southern part of Loktak Lake.
   - **Sangai Deer:** Also known as the "Dancing Deer," it is the **State Animal** of Manipur and is found exclusively in the Keibul Lamjao National Park. It is listed as "Endangered" in the IUCN Red List.
3. **Demographic and Ethnic Profile**
   - **Meiteis:** They are the largest ethnic group (approx. 53%) and primarily inhabit the fertile Imphal Valley. They mostly practice Vaishnavism (Hinduism) and speak **Meiteilon** (Manipuri), which is an 8th Schedule language.
   - **Tribal Communities:** The hill areas are inhabited by various tribes, broadly classified into **Nagas** and **Kuki-Zomi** groups. These tribes are protected under the **Fifth or Sixth Schedule** concepts (specifically Article 371C for Manipur).
   - **Article 371C:** This special provision provides for a "Hill Areas Committee" in the Manipur Legislative Assembly to ensure the development and autonomy of the tribal regions.
4. **Administrative and Historical Milestones**
   - **Integration:** Manipur was a Princely State that signed the Instrument of Accession in 1947 and officially merged with the Indian Union on **October 15, 1949**.
   - **Statehood:** It became a full-fledged state on **January 21, 1972** (along with Meghalaya and Tripura) under the North-Eastern Areas (Reorganisation) Act, 1971.
   - **Inner Line Permit (ILP):** Manipur was extended the ILP system in **December 2019** to protect the indigenous population from unregulated influx. It is the fourth state in the Northeast to have ILP after Arunachal Pradesh, Nagaland, and Mizoram.
   - **AFSPA:** Large parts of the state have historically been under the **Armed Forces (Special Powers) Act**, though the "Disturbed Area" tag has been removed from several police station jurisdictions in the valley in recent years.

4.10. ENVIRONMENTAL RISKS OF TOXIC RAINFALL AND AIR POLLUTION

Context: A long-burning fire at the **Tuapse oil refinery** (Russia) following a Ukrainian drone strike has highlighted significant environmental risks, specifically **toxic rainfall** and particulate matter pollution. This event serves as a case study for the intersection of geopolitical conflict, energy infrastructure, and environmental science.

1. **Geographical Significance: Tuapse & The Black Sea**
   - **Location:** Tuapse is a major port city in **Krasnodar Krai, Russia**, situated on the northeast shore of the **Black Sea**.
   - **Strategic Importance:** It is home to a massive oil refinery and terminal, serving as a primary hub for Russian energy exports.

- **UPSC Tip:** Map-based questions often focus on Black Sea port cities (e.g., Novorossiysk, Sevastopol, Odessa, Tuapse).

2. Environmental Impact: Toxic Rainfall & Air Quality

I. Toxic Rainfall (Black Rain)

- **Mechanism:** Large-scale combustion of hydrocarbons (oil) releases massive quantities of **Soot (Black Carbon)** and sulfur/nitrogen oxides into the atmosphere.
- **Precipitation:** When these particles interact with moisture in the clouds, they fall as "toxic rainfall," leaving a **carbonaceous black coating** on surfaces.
- **Impact:** This can lead to soil acidification, water contamination, and damage to local flora.
- **Comparison to Acid Rain:** While traditional acid rain involves sulfur and nitrogen oxides lowering the pH of precipitation, toxic "black rain" often refers to direct contamination from heavy pollution loads.

II. Particulate Matter (PM) & Emissions

- **Concentration:** Local authorities reported toxic particle levels **2–3 times higher** than permissible limits.
- **Health Hazards:** High concentrations of PM 2.5 penetrate deep into the lungs and enter the bloodstream.
- **Public Health Protocol:** Mitigation strategies include:
  - Staying indoors (Shelter-in-place).
  - Using **N95/Face masks** to filter out fine soot particles.
  - Sealing windows to prevent indoor infiltration of toxic plumes.

3. WHO Air Quality Guidelines (AQG)

The WHO significantly tightened limits in 2021 due to new evidence of health impacts at lower concentrations.

- **PM 2.5 Annual Mean:** Reduced from **10mu g/m^3** to **5mu g/m^3.**
- **PM 10 Annual Mean:** Reduced from **20mu g/m^3** to **15mu g/m^3**.

Note for Prelims: These guidelines are **not legally binding** for countries. They serve as a scientific template for nations to set their own national standards (like India's **NAAQS**).

4.11. CAFE-III NORMS FINALIZED TO ADVANCE FUEL EFFICIENCY

Context: **Recently**, the Ministry of Power, through the **Bureau of Energy Efficiency (BEE)**, finalized the draft for the third phase of fuel efficiency standards, known as **CAFE-III norms**, which are set to take effect from **April 1, 2027**. This move comes as the government seeks to balance India's ambitious "Net Zero 2070" goals with the practical challenges faced by the domestic automobile industry, particularly regarding the revival of the small car segment and the transition to electric mobility.

1. What are CAFE Norms?

CAFE stands for **Corporate Average Fuel Efficiency**. These are regulations aimed at lowering the fuel consumption (and thus CO_2 emissions) of a manufacturer's entire fleet of vehicles rather than focusing on a single model.

- **Mechanism:** It is a "sales-weighted average." A manufacturer can sell high-emission vehicles (like heavy SUVs) as long as they balance them by selling enough low-emission vehicles (like EVs or Hybrids) to keep the average within the prescribed limit.
- **Legal Basis:** These norms are notified by the Ministry of Power under the **Energy Conservation Act, 2001**.
- **Applicability:** They apply to passenger vehicles weighing less than **3,500 kg**, including petrol, diesel, CNG, LPG, hybrids, and electric vehicles.

2. Key Features of CAFE-III (2027–2032)

The CAFE-III phase introduces several strategic shifts compared to its predecessors:

- **Stricter Emission Targets:** The fleet-wide CO_2 emission target is proposed to be reduced significantly. While CAFE-II (2022-2027) set a limit of **113 g/km**, CAFE-III aims for approximately **91.7 g/km**.
- **The "Super Credit" System:** To incentivize green technology, manufacturers earn "super credits" for selling EVs and hybrids. In the calculation of the fleet average:
  - **Electric Vehicles (EVs):** Counted as **3 units**.
  - **Plug-in Hybrids:** Counted as **2.5 units**.
  - **Strong Hybrids:** Counted as **2 units**.
- **Incentives for Small Cars:** To revive the declining small car market, a relaxation of up to **9 g/km** of CO_2 is provided for compact cars (under 4m length, <1200cc engine, and <909 kg weight).
- **Emissions Pooling:** Up to three automakers can form a "pool" to meet targets jointly. This allows a company lagging in EV tech to partner with an EV-only manufacturer to avoid penalties.
- **Block Period Compliance:** Unlike the annual assessment in CAFE-II, CAFE-III proposes a **3-year block period** (followed by a 2-year phase), allowing manufacturers more flexibility to time their new model launches.

3. CAFE Norms vs. Bharat Stage (BS) Norms

Feature	CAFE Norms	Bharat Stage (BS) Norms
Primary Focus	Fuel efficiency and **CO_2** emissions.	Toxic pollutants (**NOx, PM, CO, SOx**).
Measurement	**Fleet-wide** sales-weighted average.	**Individual** vehicle exhaust testing.
Objective	Reduce oil imports & climate impact.	Improve air quality & public health.
Nodal Agency	Bureau of Energy Efficiency (**BEE**).	Central Pollution Control Board (**CPCB**).

4.12. GROUNDWATER MANAGEMENT AND REGULATION

Context: The **Public Accounts Committee (PAC)** recently presented its **41st report**, titled **'Ground Water Management and Regulation,'** in the Lok Sabha. The report highlights the alarming rate of groundwater depletion in India and the need for urgent regulatory intervention.

1. Key Findings: India's Global Footprint

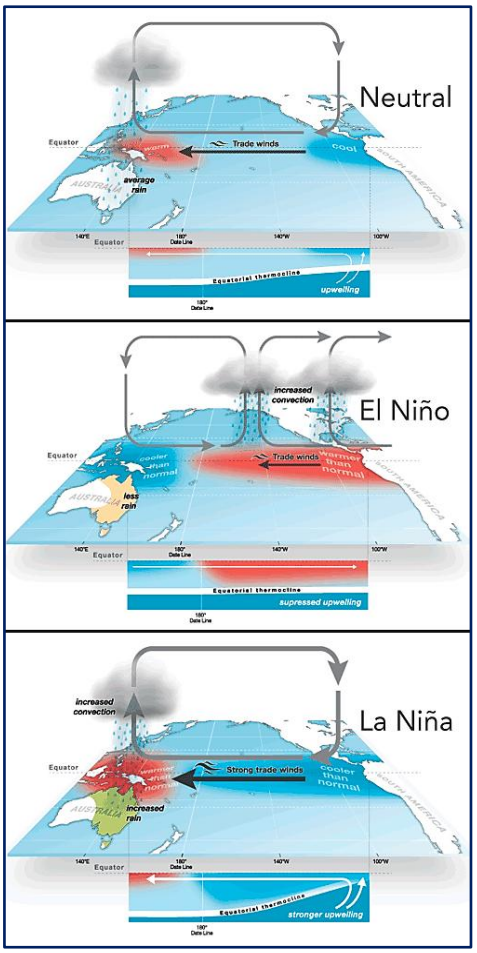
- **Global Share:** India accounts for approximately **25% of global groundwater withdrawals**.
- **PAC Flagship:** The Public Accounts Committee has flagged this massive extraction rate as a critical concern for the country's water security.

2. **Institutional Framework & Monitoring Networks**
   - **Central Ground Water Board (CGWB):** The apex central organization under the **Ministry of Jal Shakti** responsible for monitoring groundwater levels and quality.
     - The Central Ground Water Authority (CGWA) was constituted under Section 3 of the Environment (Protection) Act, 1986
   - **Monitoring Infrastructure: National Network:** Approximately **27,000** stations for water level and **20,000** for water quality.
     - **Digital Integration:** Around **22,000 Digital Water Level Recorders (DWLRs)** with Telemetry transmit real-time data to central servers under the National Hydrology Project (NHP) and Atal Bhujal Yojana (ABY).
   - **Jal Shakti Kendras (JSKs):** 712 district-level centers established as community hubs for knowledge dissemination and local dialogue on water issues.
3. **Key Schemes and Initiatives**
   - **Jal Shakti Abhiyan (JSA):** An annual mission-mode campaign for water harvesting and artificial recharge. Over **2 Crore** works have been completed through convergence.
   - **Jal Sanchay Jan Bhagidari (JSJB):** Launched in **2024** to turn rainwater harvesting into a mass movement; over **49 lakh** structures have been constructed.
   - **National Aquifer Mapping & Management (NAQUIM):**
     - **Phase 1.0:** Completed mapping of the entire mappable area (**25 lakh sq. km**).
     - **Phase 2.0:** Focuses on high-resolution data for priority areas using state-of-the-art technologies.
   - **Atal Bhujal Yojana (ABY):** A unique, community-led participatory scheme implemented in **8,203 water-stressed Gram Panchayats** across 7 states (Gujarat, Haryana, Karnataka, MP, Maharashtra, Rajasthan, and UP).
   - **Mission Amrit Sarovar:** Aimed at developing/rejuvenating **75 water bodies per district**.
4. **Regulatory & Legal Framework**
   - **Constitutional Status:** 'Water' is a **State subject**.
   - **Model Groundwater Bill:** Drafted by the Centre to provide a framework for states to curb indiscriminate extraction and mandate rainwater harvesting. **21 States/UTs** have adopted it so far.
   - **Central Ground Water Authority (CGWA):** Established for central-level regulation. It issues **No Objection Certificates (NOCs)** for industrial, infrastructure, and mining extraction in 19 States/UTs.
     - **Penalty Mechanism:** Environmental Compensation (EC) charges and penalties are imposed for unlawful extraction.

4.13. IMD WARNS OF INCREASED HEATWAVE

Context: The **India Meteorological Department (IMD)** has forecasted an increased number of **heatwave days** across most parts of East, Central, and Northwest India from April to June 2026. This occurs alongside concerns regarding the emergence of a **"super" El Niño**, which could potentially diminish monsoon rainfall and disrupt agricultural output.

1. **IMD Heatwave Forecast (April–June 2026)**
   - **Affected Regions:** Above-normal maximum temperatures are expected in East, Northeast, Central India, and the adjoining peninsular regions.
   - **Specific States:** Coastal Odisha, West Bengal, Tamil Nadu, Puducherry, Andhra Pradesh, Gujarat, Maharashtra, and Karnataka are likely to see more heatwave days in April.
   - **Anomalies:** North India is predicted to experience a cooler-than-normal summer, with the country overall expected to receive **12% more rainfall** in April due to increased western disturbances.



2. **The El Niño Factor and Monsoon Performance**
   - **Super El Niño Concerns:** Forecasts suggest a potential **1+ degree Celsius warming** in the Central Pacific Ocean, a pattern frequently linked to reduced rainfall in India.
   - **Impact on Monsoon:** While cooler summers in the north typically lead to less heating of the landmass—reducing the natural "pull" for moisture—experts suggest it is still early to definitively link these to a diminished monsoon.
   - **Drought Management:** Climatologists emphasize that if El Niño signals persist through May, the government must prioritize **drought management**.

3. **Mechanism of Heatwaves and strategic linkages**

A. Geography:

- **Definition:** A heatwave is a period of abnormally high temperatures, more than the normal maximum temperature.
- **IMD Criteria:**
  - **Plains:** Maximum temperature reaches at least **40°C**.
  - Coast- The maximum temperature recorded at a station is 37 degrees Celsius or more.
  - **Hilly Regions:** Maximum temperature reaches at least **30°C**.
  - **Departure from Normal:** Heatwave is declared if the departure from normal is **4.5°C to 6.4°C**.

B. Climatology

- **El Niño:** The warming of sea surface temperatures in the Central and Eastern Pacific. It usually weakens the trade winds and results in **deficient monsoon rainfall** in India.
- **La Niña:** The cooling phase, often leading to better-than-normal monsoons in India.

C. Impact on Agriculture

- **Kharif Sowing:** Weak rainfall and heatwaves could severely impact the sowing of Kharif crops.
- **Impact on Water Resources:** Heatwaves exacerbate water scarcity issues in India due to drying up of water bodies and decrease in the groundwater table.

4. **Causes of Heatwaves**
   - **Hot & Dry Air Masses:** Large reservoirs of hot air spread via winds, raising temperatures.
   - **Low Moisture Levels:** Dry air allows more solar heating and faster daytime temperature rise.
   - **Clear Skies:** Absence of clouds permits maximum solar radiation reaching the surface.
   - **Anticyclonic Conditions:** Anticyclones are high-pressure systems characterized by sinking air, creating stable, dry, and sunny conditions, which often cause severe heatwaves by trapping heat near the surface.
   - **Geographical Factors:** Arid/semi-arid regions (e.g., Northwest India) are more heatwave-prone.
   - **Climate Change:** Rising global temperatures intensify and increase frequency of heatwaves.

4.14. PLASTIC WASTE MANAGEMENT RULES 2026

Context: **Recently**, the Ministry of Environment, Forest and Climate Change (MoEFCC) notified the **Plastic Waste Management (Amendment) Rules, 2026**.

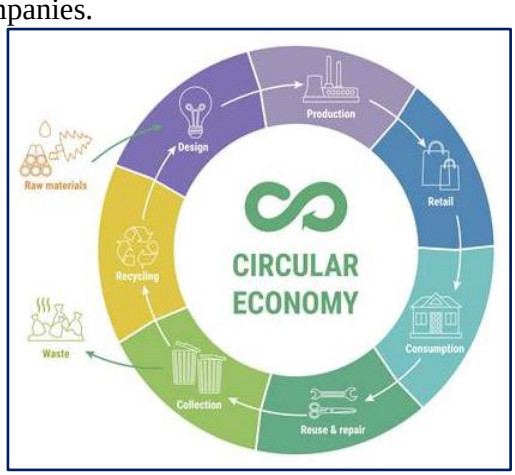
These rules are in the news because they mandate, for the first time, a minimum percentage of **recycled plastic content** in all new packaging and introduce a centralized digital tracking system using QR codes.

The amendment aims to accelerate India's transition toward a **Circular Economy** by making "Extended Producer Responsibility" (EPR) targets more stringent and enforceable through independent environmental audits starting from the 2026-27 financial year.

Key Highlights of the 2026 Amendment Rules

1. **Mandatory Recycled Content Targets**
   - **Graded Requirements:** The rules specify that all plastic packaging must contain a minimum percentage of recycled plastic. For **Rigid Plastic Packaging**, the target has been raised to **60%** for the 2026-27 period.
   - **Flexible and Multi-layered Plastics:** These categories also have specific, albeit lower, mandatory recycled content goals to encourage the recycling industry while maintaining material integrity.
   - **Exceptions:** The rules provide limited exemptions where recycled plastic is legally prohibited, such as in certain highly sensitive medical or food-contact applications as per FSSAI standards.
2. **Enhanced "Reuse" Mandates**
   - **Rigid Plastic Focus:** Large brand owners are now required to meet specific reuse targets, particularly for rigid containers (e.g., beverage bottles, bulk chemical containers).
   - **Target Levels:** For specific large-format packaging, the reuse percentage is mandated to reach as high as **85%**, significantly reducing the demand for virgin plastic.
3. **New Definitions & Accountability**
   - **Sellers:** A new category of "Sellers" has been defined to include any entity dealing in plastic raw materials like resins, pellets, or intermediate materials. They must now register and report annually to ensure the source of plastic is tracked.
   - **Microplastics:** Defined as any solid plastic particle insoluble in water with dimensions between **1 micron and 1,000 microns**.
   - **End-of-Life Disposal:** The rules now provide a clear legal definition for disposal methods like waste-to-energy, co-processing in cement kilns, and road construction.

4. **Digital Traceability and QR Codes**
    - **Mandatory Labeling:** Every piece of plastic packaging must now carry a **traceable QR code** or barcode.
    - **Purpose:** This allows regulators and consumers to verify the origin of the plastic, the percentage of recycled content, and the EPR registration status of the producer.
5. **Registered Environmental Auditors**
    - **Independent Verification:** The 2026 rules introduce **Registered Environmental Auditors** who are tasked with certifying the EPR claims made by companies.
    - **Anti-Fraud Mechanism:** This step is designed to eliminate "paper-only" compliance and ensures that the reported recycling and reuse figures are physically verified.



6. **Strategic Implementation Framework**
    - **Polluter Pays Principle:** Environmental compensation is strictly levied for non-compliance, with fines ranging from ₹10,000 to ₹15 lakhs depending on the scale of the violation.
    - **Four-Stream Segregation:** While linked to the Solid Waste Management Rules 2026, the plastic rules rely on the mandatory segregation of waste into **Wet, Dry (Plastic/Paper/Metal), Sanitary, and Special Care** streams at the source.

4.15. INDIA–BANGLADESH BORDER SECURITY

Context: **Recently**, the Border Security Force (BSF) has been directed to explore the feasibility of deploying predatory reptiles, such as **crocodiles and snakes**, to patrol the riverine gaps along the India-Bangladesh border. This directive, reportedly in line with instructions from the Union Home Ministry, aims to create a "biological deterrent" in areas where traditional physical fencing is impossible due to the difficult topography, frequent flooding, and shifting river courses.

1. **The Geography of the India-Bangladesh Border**
    - **Length:** India shares its longest international land border with Bangladesh, stretching **4,096.7 km**.
    - **States Involved:** West Bengal, Assam, Meghalaya, Tripura, and Mizoram.
    - **Riverine Gaps:** Approximately **175 km to 371 km** (depending on seasonal flooding) consists of riverine stretches and marshy terrain (e.g., the Brahmaputra in Assam and the Ichamati in West Bengal).
    - **The "Porous" Nature:** Unlike the desert or mountain borders, this boundary passes through densely populated villages, paddy fields, and rivers, making it one of the most complex borders to manage globally.
2. **Security Challenges**
    - **Infiltration & Illegal Migration:** Porous riverine gaps are frequently used for illegal crossing.

- **Transnational Crime:** Smuggling of cattle, narcotics (like Phensedyl), and Fake Indian Currency Notes (FICN) is rampant.
- **Anti-National Activities:** The border serves as a conduit for insurgent groups in the Northeast to find safe havens.

3. **Current Border Infrastructure Status**

- **Physical Fencing:** Of the total sanctioned length, approximately **3,326 km** has been approved for fencing, with roughly **2,954 km** completed as of 2024-25 records.
- **Floodlights:** To curb nighttime activities, the government has sanctioned phase-wise installation of floodlights along the border.
- **Technological Solutions (CIBMS):** In areas where fencing is not feasible, the **Comprehensive Integrated Border Management System (CIBMS)** is deployed. This includes:
  - Thermal imagers and infrared sensors.
  - Underground and underwater sensors.
  - Drones and high-resolution cameras.

4. **The Proposal: "Biotic Patrols"**

The internal communication within the BSF suggests exploring **"biological barriers"**:

- **The Rationale:** Crocodiles in the water and venomous snakes in marshy bushes could act as a psychological and physical deterrent to illegal crossers.
- **Challenges Identified:**
  - **Human-Wildlife Conflict:** The border is densely populated; reptiles do not distinguish between a smuggler and a local villager.
  - **Ethical & Ecological Concerns:** Introducing or augmenting predator populations can disrupt local ecosystems.
  - **Procurement & Control:** Managing wildlife behavior in an open, flowing river system is practically impossible compared to "moats" used in ancient forts.

4.16. WHY BIRDS MOVE: THE ENERGY EFFICIENCY EMERGES

Context: **Recently**, a groundbreaking study published in the journal *Science Advances* has challenged long-standing beliefs about why birds move up and down mountains. While it was previously assumed that birds migrate primarily to "track" specific temperatures they are adapted to, researchers from the University of East Anglia (UK) and other global institutions have found that **energy efficiency**—the optimization of food intake against energy expenditure—is the true driver of seasonal mountain migration.

1. **What is Elevational Migration?**

Elevational (or altitudinal) migration refers to the seasonal movement of animals, particularly birds, up and down mountain slopes.

- **Summer:** Birds typically move to higher elevations to exploit seasonal flushes of food (insects/fruits) and find breeding grounds.
- **Winter:** They descend to lower, more productive elevations to escape harsh conditions and resource scarcity at the summits.

2. **The New Paradigm: Energy Efficiency vs. Temperature**
   - **Traditional View:** Birds are "climate trackers" who stay within a narrow temperature range (thermal niche) to which they are evolutionarily adapted.
   - **The New Finding:** The study analyzed **34 mountain regions** and nearly **11,000 avian populations**. It revealed that many birds move **against the temperature gradient** (moving into cooler areas during winter) if that is where resources are most abundant.
   - **Core Driver:** The movement is a strategic choice to optimize their **energy budget**. Birds prioritize areas with high food availability and low competition from other species, even if the temperature is not "ideal."
3. **The SEDS Model (Seasonally Explicit Distributions Simulator)**

   Researchers utilized the **SEDS model** to simulate how birds *should* be distributed if they were perfectly optimizing their energy.
   - The model starts with an "empty mountain" and adds bird populations one by one based on where they can find the most food with the least effort.
   - The simulation matched real-world bird distribution patterns in **28 out of 34** mountain ranges studied, confirming that energy optimization is a global biological pattern.
4. **Case Study: The Yellow-billed Chough (Alpine Chough)**
   - **Scientific Name:** *Pyrrhocorax graculus*.
   - **Habitat:** High-altitude specialist found in the Himalayas (including North Sikkim), Alps, and Central Asia.
   - **Specialty:** It is known to nest at higher altitudes than almost any other bird (up to 6,500m).
   - **Dietary Shift:** In summer, they feed on invertebrates at high elevations; in winter, they shift to fruits or human-provided food at lower elevations/tourist sites to maintain their energy balance.
   - **IUCN Status: Least Concern**.

Conservation and Climate Change Implications

- **Habitat Management:** Understanding that birds follow "resources" rather than just "cold air" helps conservationists protect specific foraging corridors.
- **Agricultural Impact:** Changes in land use (like farming at mid-elevations) can disrupt the energy budgets of migrating birds by altering food availability.
- **Climate Predictions:** The study predicts an average **upslope shift of ~129 meters** by the year 2100 due to climate change, not just because of heat, but because primary productivity (plants and insects) will shift higher.

4.17. HECTOCOTYLUS REINTERPRETED

Context: Recent scientific research has redefined our understanding of the **hectocotylus**, a specialized arm in male octopuses. Previously regarded solely as a reproductive tool for sperm delivery, it is now recognized as a sophisticated **sensory organ** capable of "tasting" and identifying mates through chemical detection, even in complete darkness.

1. **Functional Evolution: From Delivery to Detection**
   - **Traditional Understanding:** Historically, scientists viewed the hectocotylus primarily as a mechanical appendage used to transfer spermatophores (sperm packets) into the female's mantle cavity.

- **The New Discovery:** Research indicates that the arm functions as a **chemosensory organ**. It allows the male to detect **progesterone**, a hormone present in the female's skin and reproductive tract.
- **Mechanism:** By physically touching the female, the male "tastes" the hormonal signals. This sensory assessment ensures reproductive success during the rare and brief encounters between solitary octopuses.

2. **The Role of CRT1 Receptors**
   - **The CRT1 Receptor:** Scientists have identified a specific receptor called **CRT1** that triggers mating behavior.
   - **Evolutionary Origin:** CRT1 evolved from ancient neurotransmitter receptors.
   - **Dual Functionality:**
     - 1. **Predation:** Similar receptors are used by octopuses to hunt prey by sensing chemicals on the seafloor.
     - 2. **Reproduction:** Over millions of years, CRT1 specialized to recognize progesterone with high affinity, facilitating mate identification.
3. **Biological and Evolutionary Significance**
   - **Efficiency in Darkness:** The ability to sense hormones through touch allows cephalopods to locate the female oviduct for insemination in the deep sea or nocturnal environments where visual cues are absent.
   - **Integrated Appendage:** The hectocotylus represents a "merged" evolutionary innovation, combining **sensory assessment** and **gamete delivery** into a single limb.
   - **Biodiversity:** This discovery highlights how minute changes in **protein structures** (like the CRT1 receptor) can lead to complex new behaviors and drive the vast biodiversity found in marine ecosystems.

4.18. SAND MINING REGULATIONS

Context: **Recently**, the Supreme Court's scrutiny of illegal mining in the National Chambal Sanctuary has brought the spotlight back to the "Sand Mafia" and the collapse of riverine governance. While sand is essential for the construction boom in North India, its extraction has moved from a regulated activity to an organized crime, threatening the structural integrity of bridges and the survival of aquatic species.

1. **Legal Status: A "Minor Mineral"**

   In India, minerals are classified into 'Major' and 'Minor' under the **Mines and Minerals (Development and Regulation) Act, 1957 (MMDR Act)**.
   - **Minor Mineral:** Sand is classified as a minor mineral.
   - **Regulatory Authority:** Unlike major minerals (where the Union has significant control), the **State Governments** have the power to frame rules for the grant of concessions, fixing royalty rates, and monitoring minor minerals.
   - **Constitutional Link:** This falls under the **State List (List II)** of the Seventh Schedule, though the Union can provide a broad framework for conservation.
2. **Ecological and Physical Impact**

   Unregulated or "instream" sand mining causes irreversible damage to river systems:

- **Riverbed Incision:** Excessive mining lowers the riverbed, leading to bank erosion and the deepening of the river channel.
- **Loss of Biodiversity:** As seen in the Chambal region, mining destroys the sandbars required by **Gharials and Turtles** for nesting.
- **Water Quality:** Increased turbidity (muddiness) affects the penetration of sunlight, harming aquatic plants and fish.
- **Infrastructure Risk:** By lowering the water table and eroding banks, mining can undermine the foundations of **bridges and piers**.

3. **Regulatory Framework: Guidelines & Monitoring**

To balance development with ecology, the MoEF&CC issued two key documents:

- **Sustainable Sand Mining Management Guidelines (SSMG) 2016:** Focused on the "District Survey Report" (DSR) to identify areas where mining is sustainable. It emphasizes that the amount of sand extracted should not exceed the annual rate of replenishment.
- **Enforcement & Monitoring Guidelines 2020:** Introduced technical tools like **Drones, GPS tracking of vehicles, and Night Vision Surveillance** to prevent illegal extraction. It also mandated "Replenishment Studies" to be conducted before renewing mining leases.

4. **Environmental Clearance (EC)**

Following the Supreme Court's judgment in the **Deepak Kumar vs. State of Haryana (2012)** case:

- **Mandatory EC:** Environmental clearance is mandatory for mining minor minerals even in areas **less than 5 hectares**.
- **Categorization:** Large projects (Category A) require clearance from the Central Government (MoEF&CC), while smaller projects (Category B) are cleared by the **State Environment Impact Assessment Authority (SEIAA)**.

4.19. NGT FLAGS WETLAND VIOLATION

Context: **Recently**, the National Green Tribunal (NGT) ruled that the National Highway Authority of India (NHAI) violated environmental regulations during the construction of the **Urban Extension Road-II (UER-II)** in Delhi. The tribunal found that the NHAI encroached upon a protected wetland in **Goyla Khurd village** by constructing permanent concrete pillars within the water body.

This violation came to light through a media report, prompting the NGT to take *suo motu* cognizance of the 80% disappearance of the pond. The court has now directed the Ministry of Environment, Forest and Climate Change (MoEF&CC) to review the environmental clearance granted to the project and take corrective measures within six months.

1. **The Wetlands (Conservation and Management) Rules, 2017**

Wetlands are often called the "kidneys of the landscape" due to their water purification abilities. In India, they are protected under these specific rules:

- **Prohibited Activities (Rule 4):** The rules strictly prohibit any reclamation of wetlands or the construction of any permanent structures on them.
- **Definition:** Wetlands include areas of marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary.
- **State Wetland Authority:** The 2017 rules decentralized power, making State/UT Wetland Authorities responsible for identifying and notifying wetlands in their jurisdiction.

- **Digital Inventory:** Authorities are required to maintain a digital inventory of all wetlands to prevent encroachment.

2. Environmental Impact Assessment (EIA)

The EIA is a statutory process under the **Environment Protection Act, 1986**, used to evaluate the likely environmental impacts of a proposed project.

- **Transparency:** Project proponents (like NHAI) must disclose all potential impacts, such as construction within water bodies.
- **The Violation:** In the Urban Extension Road-II (UER-II) case, the NGT noted that NHAI failed to disclose the construction of pillars within the pond during the clearance process, leading to a lack of proper impact assessment by the MoEF&CC.

3. National Green Tribunal (NGT)

Established under the **NGT Act, 2010**, it is a specialized body for the effective disposal of environmental cases.

- **Suo Motu Power:** As affirmed by the Supreme Court, the NGT has the power to take up cases on its own (without a formal complaint) based on media reports or other information.
- **Composition:** It consists of a Chairperson (Judicial Member) and both Judicial and Expert Members to ensure technical accuracy in judgments.
- **Mandate:** It must endeavor to dispose of cases within **6 months** of filing.
- **Principles of natural justice:** The Tribunal shall not be bound by the procedure laid down under the Code of Civil Procedure, 1908, and 1908 or the Indian Evidence Act, 1872 but shall be guided by principles of natural justice.
- **Key Environmental Laws Handled by NGT:**
  - The Water (Prevention and Control of Pollution) Act, 1974,
  - The Water (Prevention and Control of Pollution) Cess Act, 1977,
  - The Forest (Conservation) Act, 1980,
  - The Air (Prevention and Control of Pollution) Act, 1981,
  - The Environment (Protection) Act, 1986,
  - The Public Liability Insurance Act, 1991 and
  - The Biological Diversity Act, 2002.

4. Urban Wetlands: Challenges and Importance

Urban wetlands like the one in Goyla Khurd are critical for:

- **Groundwater Recharge:** Essential for cities like Delhi facing water scarcity.
- **Flood Mitigation:** Acting as sponges during heavy monsoon rains.
- **Biodiversity:** Supporting local flora and avian species.

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5.1. ISRO INVITES SCIENTIFIC PROPOSALS FOR ADITYA-L1

Context: The Indian Space Research Organisation (ISRO) has issued its second **Announcement of Opportunity (AO)**, inviting proposals from the Indian solar physics community for observation time on the **Aditya-L1 mission**. This initiative aims to enhance scientific utilization of the data collected by India's **first dedicated solar observatory**.

Core Mission

- **Primary Objective:** Aditya-L1 is **India's first dedicated space-based solar mission**.
- **Operational Location:** The spacecraft is positioned at the **Sun-Earth L1 (Lagrange Point 1- 1.5 million km from Earth)**.
- **Observation Capabilities:** It conducts continuous, uninterrupted observations of the Sun from its stable orbit at the L1 point.
- **Data Policy:** Scientific data gathered from the mission is regularly released into the **public domain** for global scientific use.

Launch Details:

- Launch Vehicle: PSLV-C57
- Launch Date: 2 September 2023
- Launch Site: Satish Dhawan Space Centre

Technical Significance of L1 (Lagrange Point 1)

- **Uninterrupted View:** A major advantage of placing a satellite in a halo orbit around the L1 point is that it provides a continuous view of the Sun without any occultation or eclipses.
- **Real-time Monitoring:** This position allows for real-time tracking of solar activities and their impact on space weather.

Payloads (Instruments)

- VELC – Visible Emission Line Coronagraph (main payload)
- SUIT – Solar Ultraviolet Imaging Telescope
- ASPEX – Solar wind particle experiment
- PAPA – Plasma Analyser
- MAG – Magnetometer

Key Achievements

- Successfully inserted into halo orbit around L1 (Jan 2024)
- Continuous solar observation started

Key Solar Missions (Globally)

- **PUNCH (NASA):** It uses four suitcase-sized satellites to image the sun's inner corona, bridging the gap between the sun and Earth to understand the origins of solar flares.
- **Proba-3 (ESA):** The European Space Agency's Proba-3 is designed to study the solar corona and solar winds by creating a solar eclipse using two high-precision satellites.

- **Solar Polar Orbit Observatory (China/NSSC**): Planned for 2029, this mission aims to provide high-inclination views of the sun, which is crucial for understanding its magnetic field structure.
- **Parker Solar Probe (NASA):** Currently orbiting in the sun's atmosphere to analyze its structure, launched in 2018.
- **Solar Orbiter (ESA/NASA):** Active since 2020, capturing high-resolution images of the Sun's polar regions.

5.2. INS ARIDHAMAN (S4)

Context: **Recently**, the Union Defence Minister Rajnath Singh formally commissioned **INS Aridhaman** (S4) into the Indian Navy at the Shipbuilding Centre (SBC) in Visakhapatnam. This induction is a landmark event as it marks the completion of a critical phase in India's **Advanced Technology Vessel (ATV)** project.

The commissioning coincided with the induction of the stealth frigate **INS Taragiri**, further emphasizing India's push toward *Aatmanirbharta* (self-reliance) in the maritime defense sector.

1. **Classification and Project**
   - **Class:** It is the third **Arihant-class** nuclear-powered ballistic missile submarine (**SSBN**).
   - **Project:** Developed under the highly classified **Advanced Technology Vessel (ATV) Project**, managed by the DRDO, Department of Atomic Energy (DAE), and the Indian Navy.
   - **Name Meaning:** "Aridhaman" is a Sanskrit word translating to "Vanquisher of Foes" or "Destroyer of Enemies."
2. **Technical Specifications**
   - **Displacement:** Approximately **7,000 tonnes**, making it larger and heavier than its predecessors, INS Arihant (~6,000 tonnes) and INS Arighaat.
   - **Length:** The submarine features a "stretched hull" (approx. 130 meters) to accommodate additional weaponry and equipment.
   - **Propulsion:** Powered by an indigenously developed **83 MW Pressurized Light-Water Reactor (PLWR)**, allowing it to remain submerged for months, limited only by food supplies and crew endurance.
   - **Indigenization:** It boasts nearly **70-75% indigenous content**, involving over 200 Indian MSMEs and major firms like L&T and Tata.
3. **Weaponry and Firepower**
   - **Vertical Launch Tubes:** INS Aridhaman is equipped with **8 launch tubes**, which is double the capacity of INS Arihant and INS Arighaat (which have 4 each).
   - **Missile Payload:**
     - **K-4 SLBM:** It can carry up to **8 K-4 intermediate-range missiles** with a strike range of **3,500 km**.
     - **K-15 Sagarika:** Alternatively, it can carry **24 K-15 short-range missiles** with a range of **750 km**.
   - **Strategic Reach:** The inclusion of K-4 missiles allows the submarine to target deep-seated regional threats while remaining safely stationed in the deep waters of the Indian Ocean or the Bay of Bengal.

4. **Advanced Features**
   - **Stealth:** Features advanced silencing technologies and an upgraded reactor design that significantly reduces its acoustic signature, making it harder to detect.
   - **Sensors:** Equipped with the indigenous **USHUS** sonar suite and **Panchendriya** unified fire control systems.
5. **Strategic Significance**

   A. Completion of the Nuclear Triad
   - The nuclear triad refers to a country's ability to launch nuclear strikes from land, air, and sea. While land and air legs were established earlier, a survivable sea leg is crucial.
   - With three SSBNs (Arihant, Arighaat, and Aridhaman), India can now maintain **Continuous At-Sea Deterrence (CASD)**, ensuring at least one submarine is always on patrol while others are in transit or maintenance.

   B. Credible Second-Strike Capability
   - As a nation with a **"No First Use" (NFU)** nuclear doctrine, India requires a guaranteed retaliatory capability.
   - SSBNs are the most survivable platform in the event of a first strike because they are hidden deep underwater, ensuring that India can deliver a "credible second strike."

5.3. INDIA'S PFBR ACHIEVES CRITICALITY, MARKING MILESTONE IN NUCLEAR ENERGY PROGRAMME

Context: **Recently**, the 500 MWe Prototype Fast Breeder Reactor (PFBR) at Kalpakkam, Chennai, achieved "criticality," marking a historic leap in India's civil nuclear journey. This milestone signifies that the nuclear fission chain reaction within the reactor has become self-sustaining and controlled.

Developed by **Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI)**, the PFBR serves as the essential bridge to the second stage of India's nuclear programme, paving the way for the eventual utilization of thorium for long-term energy security.

1. **The Prototype Fast Breeder Reactor (PFBR)**
   - **Location:** Kalpakkam, Tamil Nadu.
   - **Capacity:** 500 MWe (Megawatt electrical).
   - **Agency:** Designed by **Indira Gandhi Centre for Atomic Research (IGCAR)** and built by **BHAVINI**.
   - **Fuel:** Uses **Mixed Oxide (MOX) fuel**, which is a combination of Plutonium-239 (derived from Stage 1) and depleted Uranium-238.
   - **Coolant:** Uses **Liquid Sodium**. Unlike water, sodium does not slow down neutrons, which is necessary for a "fast" reactor.
2. **The "Breeder" Concept**
   - A breeder reactor is designed to produce more fissile material than it consumes.
   - In the PFBR, neutrons trigger fission in Plutonium-239 to produce energy. Simultaneously, these "fast" neutrons convert the surrounding **Uranium-238 (blanket)** into more **Plutonium-239**.

- In the future, a **Thorium-232 blanket** will be used to breed **Uranium-233**, which is the fuel for the third stage.

3. India's Three-Stage Nuclear Programme

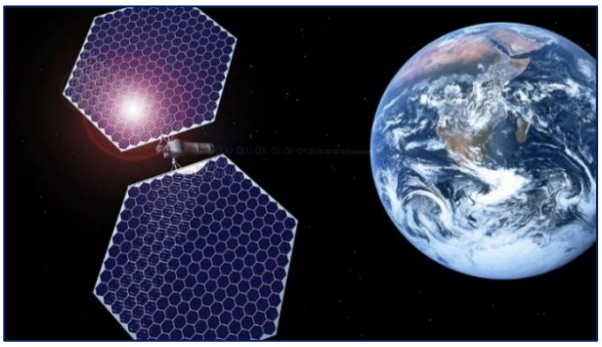
The programme was formulated by **Dr. Homi J. Bhabha** to make India self-reliant by utilizing its modest uranium and vast thorium reserves.

Stage	Reactor Type	Fuel Used	Key By-product/Goal
Stage 1	Pressurised Heavy Water Reactor (PHWR)	Natural Uranium	Plutonium-239
Stage 2	**Fast Breeder Reactor (FBR)**	MOX (Pu-239 + U-238)	More Pu-239 / U-233
Stage 3	Advanced Heavy Water Reactor (AHWR)	Thorium-232 + U-233	Energy from Thorium

4. Technical and Safety Features

- **Pool-type Reactor:** The entire primary circuit (core, pumps, and heat exchangers) is immersed in a large pool of liquid sodium, providing high thermal inertia (safety against overheating).
- **Closed Fuel Cycle:** The **Demonstration Fast Reactor Fuel Reprocessing Plant (DFRP)** at Kalpakkam is designed to "close" the loop by reprocessing spent fuel from the FBR to extract plutonium and unburnt uranium.
- **Liquid Sodium Challenge:** Sodium is highly reactive with air and water; hence, the reactor requires sophisticated leak-detection and intermediate cooling loops.

5.4. SPACE-BASED SOLAR POWER GAINS ATTENTION AMID RENEWED



Context: **Recently**, the global scientific community has intensified its focus on sustainable energy alternatives, with the **Artemis II mission** achieving record-breaking lunar flybys in April 2026, renewing interest in lunar-based infrastructure.

Against this backdrop, concepts like the **Shimizu Corporation's "Lunar Ring"**—a proposed 11,000 km belt of solar power plants on the moon's equator—have moved from speculative science fiction to serious academic and policy discussion. These systems aim to collect uninterrupted solar energy and beam it back to Earth via microwave radiation to provide a constant, clean power source.

1. What is Space-Based Solar Power?

SBSP refers to the collection of solar energy in outer space (either in Earth's orbit or on the lunar surface) and its subsequent transmission to Earth.

Working Mechanism:

- **Collection:** Large solar arrays or mirrors reflect sunlight onto photovoltaic cells.
- **Conversion:** The electricity generated is converted into **microwaves** or **laser beams**.
- **Transmission:** These beams are transmitted through the atmosphere to a ground-based receiving antenna (often called a **rectenna**).
- **Re-conversion:** The rectenna converts the microwave/laser energy back into electricity for the grid.

2. Key Concepts & Projects

- **Lunar Ring (Luna Ring):** A Japanese proposal (Shimizu Corp) to build a solar belt around the moon's equator. It utilizes **In-Situ Resource Utilization (ISRU)**, where robots build the structure using lunar soil (regolith).

- **Constant Energy:** Unlike Earth-based solar, an orbital satellite or a 360-degree lunar ring can collect sunlight **24/7**, regardless of weather, seasons, or day-night cycles.
- **Wireless Power Transfer (WPT):** The fundamental technology used to "beam" energy across the vacuum of space.

3. Advantages Over Terrestrial Solar

- **High Intensity:** Solar radiation in space is roughly **35-40%** more intense than on Earth's surface due to the absence of atmospheric scattering.
- **Zero Intermittency:** Space-based systems are not affected by cloud cover, dust, or the 12-hour night cycle.
- **Global Reach:** Energy can theoretically be beamed to any location on Earth, including remote islands or disaster-hit zones.

4. Critical Challenges

- **Economics:** The "levelized cost of energy" remains prohibitively high due to the massive cost of launching thousands of tonnes of hardware.
- **Transmission Loss:** Significant energy is lost as **heat** during the conversion and atmospheric entry phases.
- **Space Debris:** The **Kessler Syndrome** (cascading collisions) poses a major risk; a single piece of debris could destroy a billion-dollar array.
- **Environmental Impact:** Potential heating of the ionosphere or release of hazardous chemicals during frequent rocket launches required for assembly.
- **Maintenance:** Dependence on **tele-robotics** since human-led maintenance in high orbits (GEO) or on the moon is extremely costly and dangerous.

5. Institutional & Global Efforts

- **ISRO (India):** Has expressed interest in SBSP as part of its long-term space vision to ensure energy security.
- **China:** Developing "Bishantai," a space-based solar power station test facility.
- **Caltech (USA):** Recently demonstrated the first successful wireless power transfer from space to Earth via the **MAPLE** experiment.

5.5. PULSAR RESEARCH ENHANCES ACCURACY OF GALACTIC DISTANCE ESTIMATION

Context: **Recently**, Indian astronomers have pioneered a more accurate method to measure distances in the universe by studying the radio emissions of **Pulsars** as they travel through ionized gas clouds in the Milky Way.

Published in the *Monthly Notices of the Royal Astronomical Society*, the research focuses on how signals from these pulsating stellar remnants are distorted by the interstellar medium, specifically using the **Vela pulsar wind nebula** as a primary subject of study. This breakthrough addresses long-standing inaccuracies in distance estimation caused by turbulent plasma in complex regions of our galaxy.

1. What are Pulsars?

Pulsars (short for Pulsating Radio Sources) are highly magnetized, rapidly rotating **Neutron Stars**—the dense cores left behind after a massive star undergoes a supernova explosion.

- **Emission Mechanism:** They emit beams of electromagnetic radiation (radio waves) from their magnetic poles. Because these beams sweep across Earth like a lighthouse beam, they appear as "pulses."
- **Cosmic Clocks:** Due to their extraordinarily stable rotation rates, pulsars are used as high-precision timekeepers, similar to atomic clocks on Earth.
- **Millisecond Pulsars:** These spin hundreds of times per second and are critical for detecting gravitational waves.

2. **Measuring Distance: The "New Way"**

   Traditional methods often rely on models of electron distribution which can be unreliable. The new method combines two distinct physical effects:

   - **Dispersion Measure (DM):** As radio waves travel through the interstellar medium, free electrons slow down lower-frequency waves more than higher-frequency ones. By measuring this delay, scientists estimate the number of electrons between Earth and the pulsar.
   - **Scatter Broadening:** Interstellar plasma is not smooth; its irregularities scatter radio waves, causing the signal to appear "smeared" or stretched. This is similar to the twinkling of stars but occurs in the radio spectrum.
   - **The "k-factor":** The researchers combined DM and scattering into a single parameter called the $k-factor$ to refine distance estimates in complex regions like the **Gum Nebula**.

3. **Comparison with Parallax Method**

   - **Parallax Method:** Considered the "gold standard," it uses trigonometry to measure distances based on the Earth's orbit. However, it has a "hard limit" and becomes less effective for objects at extreme distances.
   - **The Novel Method:** Does not have a specific distance limitation. It can potentially be used to measure distances to objects outside the Milky Way, such as **Fast Radio Bursts (FRBs)**.

4. **Key Institutions and Regions Involved**

   - **IIT-Kanpur & Raman Research Institute:** Leading Indian institutions involved in the study.
   - **Gum Nebula:** A vast region of ionized gas where the new model was tested against 10 different pulsars.
   - **Vela Pulsar Wind Nebula:** A key celestial target used to validate the scattering and dispersion models.

5.6. GAGANYAAN MISSION

Context: **Recently**, discussions regarding the safe return and recovery of Indian astronauts under the **Gaganyaan Mission** have gained prominence as ISRO intensifies its testing phase. As of April 2026, with the uncrewed G1 mission on the horizon, the focus has shifted toward the critical "Descent and Recovery" phase.

Unlike the Russian Soyuz or Chinese Shenzhou which primarily use land-based landings, India's Gaganyaan will utilize a water-based splashdown in the **Bay of Bengal**, necessitating a complex multi-stage parachute system and coordinated naval recovery operations.

1. **Mission Overview**

   The Gaganyaan programme aims to demonstrate India's indigenous capability to send a human crew to **Low Earth Orbit (LEO)** and bring them safely back to Earth.

- **Orbit:** 400 km circular orbit.
- **Duration:** 1 to 3 days (expandable up to 7 days).
- **Crew:** 3 members (Astronaut-designates: Gp Capt P.B. Nair, Gp Capt Ajit Krishnan, Gp Capt Angad Pratap, and Wg Cdr Shubhanshu Shukla).
- **Landing:** Planned splashdown in the **Indian Ocean**.

2. **Spacecraft Components**

The Gaganyaan spacecraft, known as the **Orbital Module**, consists of two main parts:

- **Crew Module (CM):** A double-walled, pressurized habitable space designed to maintain an Earth-like environment (temperature, oxygen, humidity) for the astronauts.
- **Service Module (SM):** An unpressurized structure containing the propulsion system, power systems (solar arrays), and avionics to support the CM in orbit.

3. **Launch Vehicle: Human-Rated LVM3 (HLVM3)**

ISRO's heavy-lift launcher, **LVM3**, has been re-configured to meet "Human Rating" standards, ensuring high reliability and safety.

- **Three Stages:**
  1. **S200 Solid Boosters:** Two large solid motors.
  2. **L110 Liquid Core:** Powered by clustered Vikas engines.
  3. **C25 Cryogenic Stage:** Powered by the CE-20 engine (liquid hydrogen and liquid oxygen).
- **Safety Factor:** Includes an **Integrated Health Monitoring System** to detect anomalies in real-time.

4. **Key Safety and Technology Elements**

- **Crew Escape System (CES):** A crucial safety mechanism that can pull the Crew Module away from the rocket in case of an emergency during launch or ascent.
- **Environmental Control and Life Support System (ECLSS):** Maintains pressure, removes CO_2, and manages waste and temperature.
- **Vyommitra:** A female-looking humanoid robot ("Half-humanoid") designed to simulate human functions and monitor module parameters during uncrewed missions to ensure safety before humans fly.

5. **Phases of the Mission**

1. **TV-D1 (Test Vehicle Abort Mission):** Successfully demonstrated the Crew Escape System in October 2023.
2. **Gaganyaan G1 (Uncrewed):** Expected in 2026; will carry Vyommitra.
3. **Gaganyaan G2:** Second uncrewed mission for final system validation.
4. **H1 (Manned Mission):** The final crewed flight (tentatively 2026-2027).

5.7. ANDHRA PRADESH TO LAUNCH INDIA'S FIRST AMARAVATI QUANTUM REFERENCE FACILITY

Context: Recently, the Andhra Pradesh state government announced that India's first **quantum computing testing beds**, known as the **Amaravati Quantum Reference Facility (AQRF)**, will be launched. The facility is scheduled to be dedicated to the nation by Honorable Chief Minister N. Chandrababu Naidu on **April 14**, a date that coincides with **World Quantum Day**.

This initiative is part of the **"Amaravati Quantum Valley"** programme, making Andhra Pradesh the first state in the country to take such a significant step in quantum infrastructure.

1. **Core Significance and Functionality**
   - **The Reference Gap:** Prior to this launch, India did not have a dedicated quantum testing computer that could serve as a **reference** to validate various components of the burgeoning quantum computing ecosystem.
   - **Testing Bed:** The AQRF will function as a standardized platform where researchers and scientists can test and assemble quantum hardware and software components.
   - **Location:** The testing beds are being developed and hosted at **SRM University, Andhra Pradesh**.
2. **Collaborative Framework**

   The development involves a specialized team of 50 researchers, students, and scientists working on building the ecosystem. The project is a partnership between:
   - **SRM University A.P.**
   - **Amaravati Quantum Research Facility**
   - **Qubit Force**
3. **What is Quantum Technology?**
   - Quantum science studies how **matter and energy** behave at very small scales—atoms, electrons, and photons.
   - It is based on **Quantum Mechanics**, which explains phenomena that classical physics cannot.
   - **Quantum technology** leverages the principles of **quantum mechanics**—specifically **superposition, entanglement, and tunneling** (Particles pass through barriers)—to perform tasks impossible for conventional technologies.
4. **Key Pillars of Quantum Technology**
   - **Quantum Computing**: Instead of binary bits (0 or 1), quantum computers use **qubits** that can exist in multiple states simultaneously **(superposition).** This allows them to process complex problems exponentially faster than classical supercomputers.
   - **Quantum Communications**: Utilizing principles like **quantum entanglement**, this technology ensures secure communication channels, such as Quantum Key Distribution (QKD), which makes eavesdropping physically impossible to go undetected.
     - **Entanglement:** Particles become connected, sharing information instantly regardless of distance.
   - **Quantum Sensing:** These sensors measure **environmental changes** with unprecedented precision. Examples include atomic-level MRI scans for early cancer detection and navigation systems that do not require GPS.
   - **Quantum Materials:** Research into engineering materials that exhibit quantum properties, which can lead to new electronic devices or energy solutions.
5. **Applications**
   - **Quantum Computing** – Fast computation, optimization, AI, drug discovery
   - **Quantum Cryptography** – Ultra-secure communication (QKD)
   - **Quantum Communication** – Secure satellite & fiber-based data transfer
   - **Quantum Sensing** – High-precision measurement (gravity, magnetic fields)
   - **Atomic Clocks** – Ultra-accurate timekeeping (GPS, navigation)
   - **Healthcare & Pharma** – Drug discovery, molecular simulation
   - **Cybersecurity** – Next-gen encryption systems

- **Artificial Intelligence** – Faster machine learning & big data processing
- **Finance** – Risk analysis, portfolio optimization
- **Climate Modeling** – Better prediction of climate change
- **Material Science** – Development of new materials (superconductors, etc.)
- **Space Technology** – Satellite communication, deep-space navigation
- **Defence & Military** – Secure communication, advanced radar systems
- **Energy Sector** – Battery design, nuclear simulations

6. About National Quantum Mission

- **Launched:** For a period from 2023-24 to 2030-31 by Department of Science and Technology (DST).
- **Objectives of National Quantum Mission (Concise)**
  - **Quantum Computing:** Develop quantum computers with 20–50 qubits (3 yrs), 50–100 (5 yrs), and up to 1000 (8 yrs) using superconducting & photonic technologies.
  - **Quantum Communication (Satellite**): Establish 2000 km satellite-based secure quantum communication within India and extend globally.
  - **Quantum Key Distribution (QKD):** Enable 2000 km secure communication over optical fiber using trusted nodes & WDM.
  - **Quantum Networks**: Build multi-node quantum networks (2–3 nodes) using entanglement, quantum repeaters & memories.
  - **Quantum Sensing & Clocks:** Develop high-precision sensors (magnetometers, gravity sensors) and ultra-accurate atomic clocks.
  - **Quantum Materials & Devices**: Develop advanced materials (superconductors, semiconductors) for qubits, photon sources, and quantum devices.
- **Implementation Strategy: Thematic Hubs (T-Hubs)**
  - **Under the National Quantum Mission,** 4 Thematic Hubs (T-Hubs) drive quantum innovation nationwide. They integrate 14 Technical Groups across 17 states and 2 UTs for research and development.
- **Key Institutions:**
  - IISc Bengaluru
  - IIT Madras (with C-DOT, New Delhi)
  - IIT Bombay
  - IIT Delhi

5.8. INHERITED PERIPHERAL NEUROPATHY & ARS MUTATIONS

Context: **Recently**, new scientific research has clarified a long-standing mystery regarding why specific genetic mutations lead to debilitating nerve diseases while other, seemingly more severe mutations, do not. By utilizing yeast models to simulate human genetic behavior, researchers discovered that certain faulty proteins possess a "dominant-negative" property. This means the mutated protein does not simply disappear; it actively interferes with the healthy version, causing a critical shortage of the components needed for protein synthesis. This discovery is significant for the medical field as it identifies a specific target for future gene-silencing therapies.

1. **What is Peripheral Neuropathy?**

   Peripheral neuropathy refers to a condition where the peripheral nerves—the vast communications network that transmits signals between the central nervous system (brain and spinal cord) and all other parts of the body—are damaged.

   - **Symptoms:** High foot arches, curled toes, muscle wasting (thin calves), loss of sensation, and coordination issues.
   - **Prevalence:** Inherited versions (IPN) affect approximately **1 in 2,500 individuals**.

2. **The Role of Aminoacyl-tRNA Synthetases (ARS)**

   ARS are essential enzymes dubbed "housekeeping" enzymes because they are critical for the very first step of protein synthesis in every cell.

   - **Function:** They are responsible for **"charging" tRNA**. They attach specific amino acids (like alanine or asparagine) to their corresponding tRNA molecules.
   - **The Process:**
     - DNA is copied into **mRNA**.
     - ARS enzymes ensure the correct amino acid is loaded onto the tRNA.
     - tRNA delivers these amino acids to the **ribosome** (the protein factory) to build a polypeptide chain.
   - **Genetic Count:** Humans have 37 genes coding for ARS enzymes; mutations in at least 7 of these are known to cause IPN.

3. **The "Dominant-Negative" Phenomenon**

   The core question of the research was why some people with a "null" mutation (one gene copy completely missing) remain healthy, while those with a specific "missense" mutation become ill.

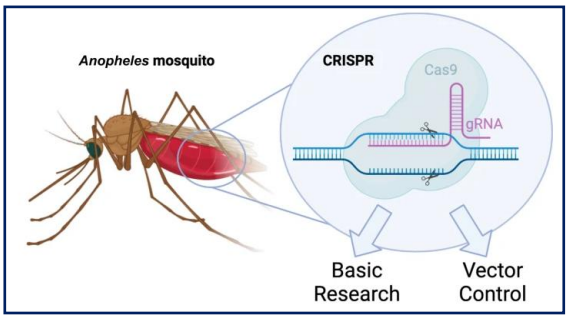
   - **Normal State:** Humans have two copies of every gene. One functional copy is usually enough to maintain health.
   - **Dominant-Negative Property:** In certain mutations, the faulty protein produced by the mutated gene does not just "stop working." Instead, it **actively interferes** with the healthy protein produced by the normal gene copy.
   - **Dimerization:** These proteins often work in pairs (dimers). A mutant protein can pair with a healthy one to create a "broken duo," effectively reducing the total pool of functional enzymes to levels far below 50%, leading to cellular failure.

4. **Why are Long Nerves Sensitive?**

   - Peripheral nerves are unique because of their extreme length (e.g., from the spine to the toe). The cell body must supply proteins to the very end of the axon. Even a slight decrease in the efficiency of protein synthesis due to these "dominant-negative" mutations can cause these long-distance supply lines to fail, leading to nerve degeneration.

5.9. GENE DRIVE TECHNOLOGY

Context: Recently, the **"Transmission Zero"** project—a collaboration between Imperial College London and the Ifakara Health Institute in **Tanzania**—achieved a breakthrough by demonstrating that genetically modified mosquitoes could block malaria parasite transmission in a real-world endemic setting. This marks a shift from laboratory-only success to potential field application of **Population Modification** using **CRISPR-Cas9 gene drives**.



1. **Understanding Gene Drive Technology**
   - **Definition:** A genetic engineering technology that bypasses traditional **Mendelian inheritance** to ensure a specific trait is passed to almost **100% of offspring** (instead of the usual 50%).
   - **Mechanism:** Uses the **CRISPR-Cas9** system to "copy and paste" a modified gene into the partner chromosome during reproduction.
   - **Goal:** Rapidly spread a desired trait through an entire wild population over a few generations.
2. **Highlights of the Tanzania Study**
   - **First for Africa:** It demonstrated that modified mosquitoes could suppress malaria parasites from **real-world infections**, not just laboratory cultures.
   - **Localized Engineering:** Conducted in a high-containment insectary in **Bagamoyo, Tanzania**, using local **Anopheles gambiae** mosquitoes.
   - **Effector Molecules:** Engineered mosquitoes produced two antimicrobial peptides in their midgut upon taking a blood meal, preventing the *Plasmodium* parasite from reaching the salivary glands.
   - **Safety Features:** Researchers are exploring **"Self-limiting"** drives (which disappear over time) and "Off-switches" to reverse the spread if needed.
3. **Key Approaches in CRISPR-Cas9 Malaria Control**
   - **Population Suppression (Gene Drives):** CRISPR-Cas9 disrupts essential female reproduction genes (e.g., AGAP005958, AGAP011377), leading to a drastic reduction in mosquito numbers and, consequently, reduced transmission.
   - **Population Modification/Replacement:** Mosquitoes are engineered to be resistant to the malaria parasite, making them unable to transmit it, such as through the knockout of the FREP1 gene.
   - **Precision-Guided Sterile Insect Technique (pgSIT):** A specialized CRISPR approach that releases sterile males to reduce the population without using a self-sustaining gene drive.
4. **Comparative Analysis: Malaria vs. Dengue**

Feature	Malaria	Dengue
Causative Agent	**Protozoa** (*Plasmodium* species like *P. falciparum*, *P. vivax*)	**Virus** (*Flavivirus* - DENV 1, 2, 3, 4)
Primary Vector	**Anopheles** Mosquito (Female)	**Aedes aegypti** (and *Aedes albopictus*)
Feeding Pattern	Mostly **Night-biters** (Dusk to Dawn)	Mostly **Day-biters** (Early morning/Late afternoon)
Breeding Habitat	**Clean, stagnant water** (Puddles, ponds, slow streams)	**Artificial containers** (Coolers, tires, pots, trays)
Incubation Period	Longer (Usually 10–15 days)	Shorter (Usually 3–14 days)
Key Symptoms	High fever with **chills and rigors** (shaking); cycling fever patterns.	High fever, **severe "break-bone" joint/muscle pain**, behind-the-eye pain, skin rash.
Major Complication	Cerebral Malaria, Severe Anemia.	**Dengue Hemorrhagic Fever** (DHF), Platelet drop.
Diagnostic Test	Blood Smear (Microscopy) or RDT (Rapid Diagnostic Test).	NS1 Antigen test (early), IgM/IgG Antibody tests.
Vaccine Status	**RTS,S** and **R21/Matrix-M** (Approved for children).	**Dengvaxia** (limited use); **Qdenga**.

Some Key Facts

- World Malaria Day, observed on **25th April annually**, was established by the World Health Organization (WHO) in 2007 to raise awareness and drive action against malaria.
- Malaria is a life-threatening disease caused by the **Plasmodium parasite**, transmitted to humans by infected **female Anopheles mosquitoes**.
- **Treatment & Prevention:** Advanced with effective drugs like chloroquine and artemisinin, supported by tools like insecticide-treated nets (ITNs) and indoor spraying.
- **Vaccine:** In October 2021, the WHO recommended widespread use of the **RTS,S/AS01 (Mosquirix) vaccine** for children in sub-Saharan Africa and moderate-to-high malaria transmission areas.
- **WHO E-2025 initiative:** The World Health Organization (WHO) launched the E-2025 initiative in April 2021 to support 25 identified countries in eliminating malaria by 2025.

5.10. GLOBAL DEBATE ON LUNAR GOVERNANCE

Context: **Recently**, the global discourse on lunar governance has intensified following the **65th session of the Legal Subcommittee** of the **UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS)** held in April 2026. The session focused on the urgent need for a transparent and sustainable framework to manage accelerating lunar activities, particularly concerning the extraction of resources like water ice in the Moon's South Pole.

1. The International Legal Framework

Lunar governance is primarily anchored in the "Five UN Treaties on Outer Space," with the following being most relevant:

- **Outer Space Treaty (1967):** Considered the "Magna Carta" of space law. It stipulates that space is the **"province of all mankind"** and prohibits national appropriation by claim of sovereignty. It forbids the placement of weapons of mass destruction (WMDs) on the Moon.
- **The Rescue Agreement (1968):** Mandates the rescue and return of astronauts (envoys of mankind) in distress.
- **Liability Convention (1972):** Established that launching states are "absolutely liable" to pay compensation for damage caused by their space objects.
- **Registration Convention (1975):** Requires states to maintain a registry of objects launched into space.
- **The Moon Agreement (1979):** Declares the Moon and its resources as the **"Common Heritage of Mankind."** It is controversial because it restricts commercial exploitation. **India has signed but not ratified** this agreement, while major powers like the USA, Russia, and China have not signed it at all.

2. Emerging Blocs: Artemis vs. ILRS

The modern "Space Race" has led to two distinct governance models:

- **Artemis Accords (US-led):** A non-binding set of principles for civil space exploration. India became a signatory in 2023. Key features include **"Safety Zones"** (to prevent harmful interference) and the affirmation that extracting lunar resources does not constitute national appropriation.

- **International Lunar Research Station (ILRS) (China-Russia led):** A rival mission aimed at building a permanent lunar base. It emphasizes a "multipolar" governance model and invites global partners, primarily from the Global South.

3. **Key Governance Concepts for Prelims**
   - **In-Situ Resource Utilization (ISRU):** The practice of collecting, processing, and using materials found on the Moon (like water ice for oxygen/fuel) to support missions. Legal ambiguity exists whether ISRU violates the "non-appropriation" principle of the 1967 Treaty.
   - **Safety Zones:** Areas established around lunar bases to prevent "harmful interference" from other nations' activities. Critics argue these could become "de facto" territorial claims.
   - **Space Situational Awareness (SSA):** The monitoring of space debris and traffic. With the Moon becoming crowded, SSA is vital for "Lunar Traffic Management."
4. **India's Lunar Roadmap**
   - **Indian Space Policy 2023:** Encourages **Non-Government Entities (NGEs)** to participate in end-to-end space activities, including lunar exploration.
   - **Space Vision 2047:**
   - **Bharatiya Antariksh Station (BAS):** India's own space station by 2035.
   - **Crewed Moon Landing:** Targeted for 2040.
   - **Chandrayaan-4:** A mission designed to demonstrate docking/undocking and lunar sample return capabilities.

5.11. EXTRACELLULAR RNA CAN PERSIST IN DISINFECTED DRINKING WATER

Context: **Recently**, scientists and researchers from various global institutes have reported that **Extracellular RNA (ExRNA)** derived from bacteria can surprisingly persist in **disinfected drinking water**, challenging the long-held belief that RNA is too fragile to survive outside a cellular environment for extended periods.

What is Extracellular RNA (ExRNA)?

Extracellular RNA refers to RNA molecules that exist outside the cells in which they were originally transcribed. While traditional biology focused on RNA's role within the cell (Protein synthesis), ExRNA represents a paradigm shift in understanding intercellular communication.

- **Presence in Body Fluids:** It is found in almost all biological fluids, including **blood (plasma/serum), saliva, urine, breast milk, and cerebrospinal fluid**.
- **Types of RNA involved:** ExRNA is a heterogeneous population consisting of both **coding RNA (mRNA)** and **non-coding RNA (miRNA, siRNA, lncRNA, and tRNA)**.
- **Stability Mechanism:** Since the extracellular environment is rich in **RNases** (enzymes that degrade RNA), ExRNA survives by traveling in "molecular containers." These include:
  - **Extracellular Vesicles (EVs):** Such as exosomes and microvesicles (lipid-bilayer enclosed).
  - **Lipoprotein Particles:** Such as High-Density Lipoprotein (HDL).
  - **Protein Complexes:** Binding with proteins like **Argonaute2 (Ago2)** which shield them from degradation.

Functions and Significance

1. **Intercellular Communication:** ExRNA acts as a "long-distance" signaling messenger. Cells release ExRNA to deliver genetic instructions to recipient cells, thereby influencing their behavior, gene activation, and protein translation.
2. **Immune Response:** It helps coordinate the body's response to infections, tissue repair, and general development.
3. **Disease Biomarker:** Because ExRNA patterns change during illness, they serve as "liquid biopsies." They are being researched for the early detection of **cancer, heart disease, and neurodegenerative disorders** without the need for invasive tissue biopsies.
4. **Therapeutic Potential:** Start-ups and research centers (like those collaborating with the **University of Hyderabad**) are exploring ExRNA to develop novel therapeutic agents for both communicable and non-communicable diseases.

5.12. FALCON 9 RE-ENTRY ANALYSIS FUELS DISCUSSION

Context: **Recently**, scientific assessments published in March 2026 have raised significant concerns regarding the chemical footprint left by the frequent re-entry of large rocket stages like Falcon **9**. Researchers have detected a substantial increase in metallic particles, specifically **lithium** and **aluminum oxides**, in the upper atmosphere following uncontrolled re-entries. This "metal rain" is increasingly scrutinized for its potential to trigger chemical reactions that could deplete the **ozone layer** and alter the Earth's thermal balance.

1. **Basic Overview of Falcon 9**
   - **Manufacturer:** Developed by **SpaceX**, it is a two-stage-to-orbit medium-lift launch vehicle.
   - **Fuel and Engine:** It is powered by **Merlin engines** which utilize a combination of **Rocket-Grade Kerosene (RP-1)** and **Liquid Oxygen (LOX)**.
   - **Propellant Type:** It is a **liquid-propellant** rocket. Unlike the solid boosters used in India's PSLV/GSLV for initial thrust, Falcon 9 relies entirely on liquid engines that can be throttled and restarted.
2. **Reusability: The Game Changer**
   - **First Stage Recovery:** The first stage (booster) is designed to return to Earth and land vertically on a landing zone or a drone ship.
   - **Economic Impact:** By reusing the booster (some have flown over **30 times** by 2026), SpaceX has drastically reduced the cost of access to space, making it the most cost-effective launcher globally.
   - **Fairing Recovery:** The payload fairings (the protective "clamshell" at the top) are also recovered using parachutes and specialized ships to be refurbished and flown again.
3. **Capability and Orbits**
   - **Low Earth Orbit (LEO):** Capable of carrying approximately **22,800 kg**.
   - **Geostationary Transfer Orbit (GTO):** Capable of carrying **8,300 kg** (expendable) or **5,500 kg** (reusable).
   - **Crewed Missions:** It is the primary vehicle for the **Crew Dragon** capsule, transporting astronauts to the International Space Station (ISS).

India's Strategic Shift with Falcon 9

India's **NewSpace India Limited (NSIL)**, the commercial arm of ISRO, recently utilized Falcon 9 to launch the **GSAT-N2 (GSAT-20)** satellite.

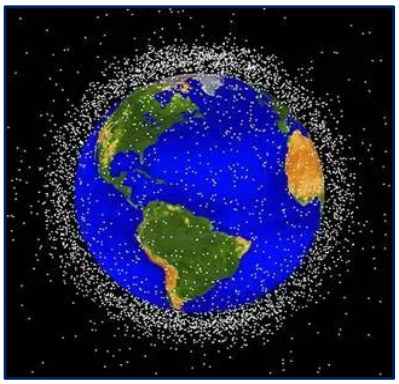
- **Reason for Choice:** The satellite weighed approximately **4,700 kg**, which exceeded the maximum **4,000 kg** GTO capacity of India's heaviest rocket, the **LVM3 (GSLV Mk-III)**.
- **Significance:** This marked a departure from India's traditional reliance on the European **Ariane** rockets for heavy-lift missions, showcasing a pragmatic shift toward cost-effective private players like SpaceX.

India's Efforts: Building the Reusable Future

To reduce dependence on foreign private entities like SpaceX and lower launch costs, India is pursuing two major tracks:

1. **RLV-TD (Reusable Launch Vehicle - Technology Demonstrator)**
   - **Design:** A winged body vehicle (often called a "Space Plane") that looks like a mini-shuttle.
   - **Key Mission (RLV-LEX):** ISRO successfully conducted the **Landing Experiment (LEX)** where the vehicle performed an autonomous high-speed landing on a runway in Chitradurga.
   - **Objective:** To master technologies like hypersonic flight, autonomous landing, and powered cruise flight.
2. **NGLV (Next Generation Launch Vehicle) - "Project Soorya"**
   - **Capability:** Designed as a three-stage, partially reusable heavy-lift rocket.
   - **Fuel:** It will use **Green Propulsion** (likely Methalox—Liquid Methane and Liquid Oxygen) or Semi-cryogenic engines.
   - **Goal:** To replace the LVM3 and provide a 10-tonne payload capacity to GTO in reusable mode, supporting the future **Bharatiya Antariksh Station (BAS)** by 2035.

5.13. RISING SPACE DEBRIS CRISIS



Context: Recently, an article published by World Economic Forum highlighted the escalating crisis of orbital crowding, noting that space governance has failed to keep pace with the rapid deployment of satellite mega-constellations. According to the Indian Space Situational Assessment Report (ISSAR) 2026 released by ISRO, there are currently 129 trackable objects of Indian origin—including defunct satellites and spent rocket stages—cluttering the Earth's orbit.

1. **What is Space Debris?**

   Space debris encompasses all non-functional, human-made objects in Earth's orbit or those re-entering the atmosphere.

   - **Sources:** Defunct satellites spent rocket stages (like those from PSLV or LVM3), fragments from explosions, and even small particles like paint flakes.
   - **The Threat:** These objects travel at speeds of approximately **7.8 km/s** in LEO. At such velocities, even a 1-centimeter fragment can deliver the impact of a hand grenade, threatening active missions like the International Space Station (ISS) or the upcoming **Bharatiya Antariksha Station**.
   - **Kessler Syndrome:** This is a theoretical tipping point where the density of objects in LEO is so high that a single collision starts with a chain reaction, creating a cloud of debris that makes space flight and satellite operations impossible for centuries.

2. India's Strategic Initiatives

India has evolved a multi-layered approach to Space Situational Awareness (SSA) and debris management.

A. Project NETRA (Network for space object Tracking and Analysis)

- **Status:** An early warning system with a dedicated control center in Bengaluru.
- **Utility:** It uses high-precision radars and telescopes to detect and track hazards, allowing ISRO to perform **Collision Avoidance Maneuvers (CAM)** for its active satellites.

B. IS4OM (ISRO System for Safe and Sustainable Operations Management)

- **Function:** Launched to centralize India's SSA activities, it provides 24/7 monitoring and coordinates with global agencies to ensure the long-term sustainability of outer space.

C. Debris Free Space Mission (DFSM) 2030

- **Objective:** To ensure no new debris is left in orbit by Indian launches after 2030.
- **Methods:** Includes "Life-extension" missions or "De-orbiting" maneuvers where satellites use remaining fuel to re-enter and burn up in the atmosphere at the end of their functional life.

3. Global Frameworks and Modern Challenges

- **IADC (Inter-Agency Space Debris Coordination Committee):** An international forum of 13 space agencies (including ISRO) that sets the global benchmark for debris mitigation.
- **UNCOPUOS Guidelines:** India aligns its policies with the United Nations' "Guidelines for the Long-term Sustainability of Outer Space Activities."
- **The "25-Year Rule":** A widely accepted international norm that suggests satellites should be de-orbited or moved to a "graveyard orbit" within 25 years of mission completion.
- **Atmospheric Concerns:** Recent research highlights that the frequent re-entry of "mega-constellations" (like Starlink) is increasing the concentration of **aluminum oxides** in the upper atmosphere, which could potentially deplete the ozone layer.

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6.1. CHAR DHAM YATRA 2026 TO BEGIN FROM APRIL 19 IN UTTARAKHAND

Context: The sacred Char Dham Yatra in Uttarakhand has recently been scheduled to commence from April 19, 2026, marking the beginning of one of the most significant pilgrimages in Hinduism.

The Char Dham Yatra is one of the most sacred Hindu pilgrimages in India, located in the Garhwal region of Uttarakhand. It consists of four holy sites nestled in the Himalayas, traditionally visited in a specific clockwise direction (Parikrama).

1. **About Char Dham:**

   The 4 Dham (Char Dham) refers to two sets of sacred Hindu pilgrimages. The primary Bada Char Dham (nationwide) includes Badrinath (North), Puri (East), Rameswaram (South), and Dwarka (West), established to promote national unity. The Chota Char Dham (Himalayas) features Yamunotri, Gangotri, Kedarnath, and Badrinath, usually visited from May to October.

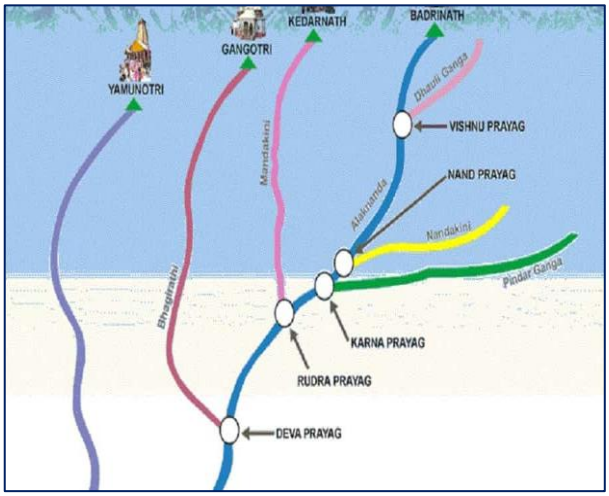
2. **The Four Sacred Sites**

   - **Yamunotri:** Dedicated to **Goddess Yamuna**. It is the first stop and the source of the Yamuna River. Pilgrims often cook rice in the Surya Kund (hot springs) as *Prasad*.
   - **Gangotri:** Dedicated to **Goddess Ganga**. Located on the banks of the Bhagirathi River, it marks the place where the Ganges is said to have descended from heaven.
   - **Kedarnath:** One of the 12 **Jyotirlingas** dedicated to **Lord Shiva**. Located in Rudraprayag district of Uttarakhand at an altitude of 3584 m near the **Mandakini River**, is a sacred abode of Lord Shiva and one of the 12 Jyotirlingas.
   - **Badrinath:** Badrinath Temple, situated at 3415 m in the Garhwal Himalayas along the **Alaknanda River,** is a major Char Dham shrine dedicated to Lord Vishnu (Badri form). Linked to his penance under the Badri tree, it houses a meditative shaligram idol, was revived **by Adi Shankaracharya** in the 9th century.

3. **Winter Char Dham Circuit**

   During winter (typically November to April/May), the high-altitude Char Dham deities in Uttarakhand are moved to lower altitudes to allow for continued worship.

   - Kedarnath moves to Omkareshwar Temple in **Ukhimath.**
   - Badrinath moves to Yogadhayan Badri in Pandukeshwar/Joshimath.
   - Gangotri moves to Mukhba village.
   - Yamunotri moves to Kharsali (Khushimath).



4. Panch Prayag

The Panch Prayag refers to five sacred river confluences in the Garhwal Himalayas of Uttarakhand, India, where tributaries meet the Alaknanda River before it becomes the Ganga at Devprayag. These sites—**Vishnuprayag, Nandaprayag, Karnaprayag, Rudraprayag, and Devprayag.**

- **Vishnuprayag:** Confluence of **Dhauliganga** and Alaknanda; linked to sage Narada and a Vishnu temple.
- **Nandaprayag:** Meeting of Alaknanda and **Nandakini**; associated with King Nanda's yajna.
- **Karnaprayag:** Confluence of Alaknanda and **Pindar**; linked to Karna's penance.
- **Rudraprayag:** Meeting of Alaknanda and **Mandakini**; associated with Lord Shiva.
- **Devprayag:** Confluence of Alaknanda and **Bhagirathi** forming the Ganga; the most sacred.

6.2. ELEPHANTA ISLAND DISCOVERY

Context: **Recently**, the Archaeological Survey of India (ASI) unearthed a significant 1,500-year-old stepped reservoir at Morabandar on **Elephanta Island** (also known as **Gharapuri)** near Mumbai.

This discovery is monumental because it reveals a sophisticated, **engineered water management system** distinct from the island's famous rock-cut caves.

The excavation also yielded silver and copper coins of the **Kalachuri ruler Krishnaraja** and imported pottery, providing vital links to ancient global trade networks.

1. Archaeological Highlights of the Discovery

- **Structure:** It is a massive **T-shaped stepped reservoir** approximately **14.7 meters long**, built with perfectly aligned stone blocks ferried from the mainland.
- **Engineering:** Unlike the existing rock-cut cisterns on the island, this is a **built structure**, signifying a mature phase of ancient civil engineering designed to tackle the island's rocky terrain and freshwater scarcity.
- **Location:** The site is located at **Morabandar**, one of the three ancient port localities on the island (the others being Rajbandar and Shethbandar).
- **Associated Artifacts:** Excavations revealed a **dyeing vat** for textiles, terracotta figurines, stone anchors, and over 3,000 potsherds.

2. The Kalachuri Dynasty of Mahishmati

- **Timeline:** Ruled during the **6th and 7th centuries CE** over parts of present-day Maharashtra, Gujarat, and Malwa.
- **Key Ruler (Krishnaraja):** The earliest known powerful king of this dynasty (c. 550–575 CE). He was a **Parama-Maheshvara** (devotee of Shiva).
- **Numismatic Evidence:** Coins found at the site feature a **seated bull (Nandi)** on the obverse and a temple symbol with the legend **"Siri Krishnaraja"** on the reverse. These coins were widely circulated and served as a standard currency in the Western Deccan for decades.
- **Cultural Legacy:** Scholars believe the main Shiva complex (Cave 1) at Elephanta was likely patronized during the Kalachuri reign.

3. **Ancient Maritime Trade Networks**
    - **Amphorae Sherds:** Discovery of Mediterranean **amphorae** (used for wine and oil) indicates strong trade links with the **Roman Empire**.
    - **Torpedo Jars:** These vessels originate from **Mesopotamia (West Asia)** and were used to transport fish sauce and oils.
    - **Strategic Port:** The findings confirm Elephanta Island as a critical maritime hub connecting the Indian mainland with the Persian Gulf and the Mediterranean during the Early Historic period.
4. **Elephanta Caves**
    - **UNESCO Status:** Designated as a World Heritage Site in **1987**.
    - **Architecture:** Famous for rock-cut basalt sculptures, primarily dedicated to **Lord Shiva**.
    - **Iconography:** Notable for the **Trimurti Sadashiva** (three-faced Shiva representing Creator, Preserver, and Destroyer), **Nataraja, and Ardhanarishvara.**
    - **Historical Layers:** While predominantly **Shaivite (5 Hindu caves)**, the island also contains **two Buddhist caves**.
    - **Gujarat Sultanate** surrendered Elephanta to the **Portuguese** in 1534 who named the island "**Elephanta Island**" in honour of a huge rock-cut black stone statue of an elephant that was then installed on a mound.

6.3. ODISHA HIGH COURT ORDERS FIRST-EVER 3D INVENTORY OF JAGANNATH TEMPLE'S

Context: Recently, the **Odisha High Court** ordered an inventory of valuables stored in the **Bhitara Ratna Bhandar** (inner chamber) of the **Shree Jagannath Temple, Puri** — the first such exercise since **1978** (after 48 years). A team of goldsmiths, RBI representatives, and temple priests is conducting this exercise using **3D mapping and colour-coded categorization.**

1. **Historical and Architectural Context**
    - **Temple Era:** The Shree Jagannath Temple was constructed in the **12th century**.
    - **Dynastic Link:** It was commissioned by King **Anantavarman Chodaganga Deva** of the Eastern **Ganga Dynasty.**
    - **Architectural Style:** It is a classic example of **Kalinga Architecture**, specifically the **Rekha Deul** (Sanctum with a curvilinear spire) style.
    - **Deities:** The temple is dedicated to **Lord Jagannath, Lord Balabhadra, and Goddess Subhadra.** Unlike traditional stone idols, these are made of **wood** and are ritually replaced during the *Nabakalebara* ceremony.
    - **The Four Dhams:** It is one of the four holiest pilgrimage sites (**Char Dham**) in Hinduism.
    - **Associated Bhakti Saints:** Many great Vaishnava saints, such as Chaitanya Mahaprabhu, Ramanujacharya, Madhvacharya, Nimbarkacharya, Vallabhacharya and Ramananda were closely associated with the temple.
2. **The Ratna Bhandar and Inventory Process**
    - **Bhitara Ratna Bhandar:** This is the inner chamber of the treasury used to store unused jewelry and ancient valuables of the temple.

- **Supervision:** The documentation is conducted by a team including goldsmiths, representatives of the **Reserve Bank of India (RBI)**, and temple priests.
- **Modern Technology:** For the first time, **3D mapping** is being used to document items, along with a systematic weighing and cataloging process.
- **Color-Coding System:** A specific system is used for storage—gold ornaments are wrapped in **yellow velvet**, while silver and precious stones are stored in **white and red clothing**.

3. **Kalinga Temple Architecture: Key Features**

- Rekha Deula (Main Shrine): A tall, vertical, sugar-loaf-shaped building covering the sanctum sanctorum, designed to look like a mountain peak. Examples include the main spire of the Lingaraj and Konark Sun temples.
- Pidha Deula (Assembly Hall): A rectangular or square hall featuring a pyramid-shaped roof built with horizontal tiers (pidhas), typically used for the jagamohana (audience hall).
- Khakhra Deula (Shakti Temples): Rare rectangular structures with a barrel-vaulted roof (resembling a pumpkin or gourd), often dedicated to female deities like Shakti (e.g., Baitala Temple).

4. **Important Festivals Associated with Jagannath Temple**

Festival	Significance
Rath Yatra	Annual chariot procession; deities taken out in three massive chariots — Nandighosa (Jagannath), Taladhwaja (Balabhadra), Darpadalana (Subhadra)
Snana Yatra	Bathing festival of the deities on Jyeshtha Purnima
Nabakalebara	Ritual replacement of wooden deities (Daru Brahma) — occurs once in 8, 12, or 19 years
Chandan Yatra	42-day festival involving boat processions
Bahuda Yatra	Return chariot procession after Rath Yatra

5. **UNESCO and Heritage Status**

- Jagannath Temple is part of the **Puri Heritage Corridor** project
- Puri is being developed as a **heritage smart city**
- The **Konark Sun Temple** (also in Odisha, Eastern Ganga dynasty) is a **UNESCO World Heritage Site**
- The three major temples of Odisha — Jagannath (Puri), **Lingaraj** (Bhubaneswar), and **Konark** (Sun Temple) — represent the pinnacle of Kalinga architecture

6.4. NATION OBSERVES ADI SHANKARACHARYA JAYANTI

Context: Recently, the **1238th birth anniversary** of Jagadguru Adi Shankaracharya is being celebrated as **Sri Shankara Jayanti Mahotsav** on **April 21, 2026** (**Vaishakha Shukla Panchami**). Major celebrations are organized by the **Dakshinamnaya Sringeri Sharada Peetham** from April 18 to April 21, 2026, highlighting the rediscovery of his birthplace, **Kalady**, and his role in the national and dharmic integration of India.

1. **Life and Background**

- **Birthplace:** Born in **Kalady**, Kerala, on the banks of the **River Poorna** (Periyar) to **Aryamba** and **Shivaguru**.

- **Early Genius:** At age 8, he set out to find a Guru, eventually studying under **Sri Govinda Bhagavatpadacharya** on the banks of the Narmada.
- **The Rediscovery of Kalady:** His birthplace had faded from public memory for centuries until it was rediscovered in the late 19th century by **Sri Sacchidananda Shivabhinava Narasimha Bharati Mahaswamiji** (the 33rd Shankaracharya of Sringeri).
- **The Four Amnaya Peethams:** To unify India spiritually and geographically, he established four main monasteries (Mathas) based on the *Mathamnaya Stotra*:
  - **Jyotir Math (North):** Badrinath (Uttarakhand).
  - **Govardhan Math (East):** Puri (Odisha).
  - **Dwarka Sharada Peeth (West):** Dwarka (Gujarat).
  - **Sringeri Sharada Peeth (South):** Sringeri (Karnataka).

2. Philosophy: Advaita Vedanta

Adi Shankaracharya is the most famous exponent of **Advaita** (Non-dualism).

- **The Ultimate Reality:** He taught that **Brahman** is the only truth (*Satya*), while the world (*Jagat*) is an appearance (*Mithya*) caused by the power of **Maya**.
- **Concept of Liberation:** True liberation (*Moksha*) comes from realizing that the individual soul (**Atman**) is identical to Brahman.

3. Key Contributions to National Integration

- **Bridging Regional Identities:** He fostered a shared national identity by appointing priests from specific regions to serve in distant corners (e.g., **Kerala Nambudiri** priests to serve at Badrinath in the North, and **Maharashtra priests** to conduct worship at Rameswaram in the South).
- **Shanmata System:** He resolved sectarian conflicts by reviving the **Panchayatana Puja** (Shanmata), encouraging the simultaneous worship of Shiva, Vishnu, Shakti, Ganesha, and Surya & Lord Kartikeya.
- **Literary Gems:** Apart from philosophical texts, he composed soul-stirring hymns like the **Kanakadhara Stotram** (composed as a young boy to help a poor household) and **Bhaja Govindam**.
- **Role of Women:** He demonstrated the importance of women in the Vedic tradition, notably evidenced by the appointment of **Ubhaya Bharati** (Mandana Mishra's wife) to adjudicate his famous debate.
- **Dashanami Sampradaya:** He organized monks into ten orders to protect the Dharma: *Giri, Puri, Bharati, Vana, Aranya, Tirtha, Ashrama, Saraswati, Parvata,* and *Sagara*.

Comprehensive Literary Works

Shankaracharya's literary output is categorized into three distinct types, all written in Sanskrit.

1. Bhashyas (Commentaries)

These are his most scholarly works, interpreting the **Prasthanatrayi** (The three sources of authority):

- **Brahmasutrabhashya:** His commentary on the Brahma Sutras of Badarayana (the foundational text of Advaita).
- **Gita Bhashya:** Commentary on the Bhagavad Gita.
- **Upanishad Bhashyas:** Commentaries on the ten principal (*Mukhya*) Upanishads, including the **Brihadaranyaka**, **Chandogya**, and **Taittiriya**.

2. Prakarana Granthas (Introductory Treatises)

These texts simplify complex non-dualistic philosophy for students:

- **Vivekachudamani** (The Crest Jewel of Discrimination).
- **Upadesasahasri** (A Thousand Teachings).
- **Atma Bodha** (Self-Knowledge).
- **Tattva Bodha** (Knowledge of Truth).

3. Stotras (Devotional Hymns)

Though a philosopher of the "Abstract Brahman," he composed many emotional hymns:

- **Bhaja Govindam:** Highlighting the futility of worldly attachments.
- **Saundarya Lahari** and **Ananda Lahari:** Tantric and devotional hymns in praise of Shakti.
- **Nirvana Shatakam:** A six-verse summary of the identity of the soul with Shiva (Brahman).
- **Kanakadhara Stotram:** Composed in his childhood to bring a rain of golden amlas to a poor woman.

6.5. RONGALI BIHU 2026 CELEBRATIONS

Context: **Recently**, the vibrant festivities of Rongali Bihu (also known as Bohag Bihu) have commenced across Assam, marking the onset of the Assamese New Year and the spring seeding season.

This cultural milestone coincides with several other major harvesting and New Year festivals across India, such as Baisakhi in Punjab, Poila Boishakh in West Bengal, Puthandu in Tamil Nadu, and Vishu in Kerala, reflecting the diverse yet unified agricultural heritage of the nation.

1. Rongali Bihu: The Heart of Assam

Bihu is the most significant cultural festival of Assam, deeply rooted in the agrarian lifestyle of the Brahmaputra Valley. It is celebrated thrice a year to mark different stages of the paddy crop cycle.

The Three Types of Bihu

- **Rongali or Bohag Bihu (April):** This is the most important Bihu, marking the **Assamese New Year** and the beginning of the seeding season. It is a festival of joy ("Rong" means joy) and lasts for seven days (Saat Bihu).
  - **Goru Bihu:** Dedicated to the health and safety of livestock.
  - **Manuh Bihu:** People wear new clothes (including the traditional **Gamosa**) and seek blessings from elders.
- **Kongali or Kati Bihu (October):** A solemn occasion where lamps (*Saaki*) are lit in the paddy fields to pray for the protection of the standing crops during the growing stage.
- **Bhogali or Magh Bihu (January):** Marks the end of the harvesting season. It is characterized by feasting ("Bhoga" means eating). Community feasts are held in temporary thatched structures called **Bhelaghar**, and the festival concludes with the burning of the **Meji** (bonfire).

Cultural Elements

- **Bihu Dance:** An energetic folk dance performed by both men and women. In 2023, it was recognized by **UNESCO** for its unique Intangible Cultural Heritage.

- **Instruments:** Traditional music is played using the **Dhol** (drum), **Pepa** (buffalo horn pipe), **Gogona** (jaw harp), and **Toka** (bamboo clapper).
- **Cuisine:** Special delicacies like *Pitha* (rice cakes), *Laru* (sweet balls), and *Jolpan* are prepared.

2. Harvest Festivals Across India

Harvest festivals in India are generally celebrated when the sun enters the sign of *Mesha* (Aries) or during the transition of the sun into *Makara* (Capricorn), signifying the end of winter or the beginning of a new harvest cycle.

Festival	Region / State	Key Significance
Baisakhi	Punjab & Haryana	Marks the harvest of Rabi crops and the formation of the **Khalsa Panth** (1699).
Vishu	Kerala	Characterized by the *Vishukkani* (first sight in the morning) and the yellow *Kanikkonna* flowers.
Puthandu	Tamil Nadu	The Tamil New Year; houses are decorated with *Kolams* (rice powder patterns).
Poila Boishakh	West Bengal	The Bengali New Year; starts with cleaning houses and traditional business accounting (*Haal Khata*).
Pana Sankranti	Odisha	Also known as Maha Bishuba Sankranti; marks the Odia New Year.
Gudi Padwa	Maharashtra	Marks the New Year; a *Gudi* (decorated pole) is hoisted outside homes to symbolize victory.
Ugadi	Andhra, Telangana, Karnataka	Known for *Ugadi Pachadi*, a dish with six tastes representing different emotions of life.
Nuakhai	Odisha (Western)	Celebration of the "New Rice" harvest, usually held in August/September.
Wangala	Meghalaya (Garo Tribe)	Known as the "100 Drums Festival"; a thanksgiving for a bountiful harvest.

***

MISCELLANEOUS

7.1. NARI SHAKTI VISION

Context: The paradigm shift from **"Development for Women"** to **"Women-led Development"** marks a cornerstone of India's strategy for Viksit Bharat @2047. Nari Shakti (Women Power) is no longer viewed as a welfare objective but as a critical driver of the nation's socio-economic and political transformation.

Key Pillars of Women Empowerment in India

1. **Political Empowerment: The Legislative Milestone**

   The **Nari Shakti Vandan Adhiniyam (106th Constitutional Amendment Act, 2023)** is the flagship reform intended to restructure the political landscape.

   - **Key Provisions:**
   - Reserves **33%** of seats for women in the Lok Sabha, State Legislative Assemblies, and the Delhi Assembly.
   - Applies to seats reserved for SCs and STs within these bodies.
   - Implementation is contingent upon the **post-2026 Delimitation** exercise and the completion of the next Census.
   - **Significance:**
   - **Breaking the "Proxy" Governance:** Aims to replicate the success of the 73rd/74th Amendments (where over **1.4 million** women serve in local bodies) at the national and state levels.
   - **Policy Inclusivity:** Ensures gender-sensitive legislation in areas like finance, defense, and labor.

2. **Economic Empowerment: From Job Seekers to Job Creators**

   The focus has shifted toward building "Technical Sovereignty" and financial independence for women.

   - **Lakhpati Didi Initiative:** Targets the creation of **3 crore** Lakhpati Didis (rural women earning ₹1 lakh+ annually) by leveraging the network of nearly 10 crore Self-Help Group (SHG) members.
   - **Financial Inclusion:** Under **PM Mudra Yojana**, approximately **70%** of loans have been sanctioned to women entrepreneurs.
   - **Stand-Up India** reserves 80% of its beneficiaries for women, specifically focusing on greenfield enterprises.
   - **STEM Participation:** India currently boasts a **43% female enrollment** rate in higher education STEM courses, one of the highest globally, signaling a shift in the traditional workforce.

3. **Social and Life-Cycle Interventions**

   True reform requires removing structural "bottlenecks" that limit a woman's time and agency.

   - **Dignity and Safety: Swachh Bharat Mission:** Construction of over 11 crore toilets addressed sanitation-related health risks and safety concerns.
   - **Jal Jeevan Mission:** Providing tap water to rural households reduces the "time poverty" of women who traditionally spent hours fetching water.
   - **Asset Ownership: PM Awas Yojana (PMAY)** prioritizes women as owners or co-owners of houses, significantly enhancing their bargaining power within the household.
   - **Mission Shakti 2.0:** A unified umbrella scheme for the safety (Sambal) and empowerment (Samarthya) of women through a life-cycle approach.

Emerging Opportunities for Nari Shakti

1. **Frontier Tech & Digital Economy**
   - **"AI by HER" Initiative:** Direct funding (up to ₹2.5 Cr) for women-led AI startups targeting healthcare and agriculture.
   - **Drone Sakhis (Namo Drone Didi):** Evolution from pilots to **Agri-Tech service providers**, managing drone fleets for precision farming.
   - **Semiconductor Mission:** Increasing integration into high-end VLSI design and assembly-test-mark-pack (ATMP) roles.
2. **Green Energy & Circular Economy**
   - **Decentralized Renewable Energy (DRE):** Transition from consumers to **owners** of solar mini-grids and solar-powered industrial units.
   - **Oorja Sakhis:** A technical cadre managing solar infrastructure and EV charging stations in Tier-2 and Tier-3 cities.
   - **Waste-to-Wealth:** SHG partnerships with global brands for sustainable fashion and ethical plastic recycling.
3. **Financial & Strategic Inflection Points**
   - **WEP Next & Mudra 2.0:** Enhanced credit limits and specialized techno-entrepreneurship incubation for the North-East and hilly regions.
   - **SHE-Mart & GeM:** Direct access for women-led SHGs to compete in large-scale government public procurement.
   - **Blue Economy:** New leadership roles in maritime logistics and sustainable aquaculture.
4. **Space & Defense**
   - **Space-Tech:** Expansion into **Satellite Data Analytics** and private space-tech startups following Chandrayaan-3's success.
   - **Combat & Command:** Entry into all Armed Forces branches, specifically in Cyber Security and Electronic Warfare leadership.

Challenges to Nari Shakti and Women-led Development

1. **Political and Governance Hurdles**
   - **The "Proxy" Phenomenon:** Despite 44% representation in local bodies, "Sarpanch Patis" often hijack decision-making, reducing empowerment to tokenism.
   - **Legislative Lag:** Implementation of the **Nari Shakti Vandan Adhiniyam (2023)** awaits the post-2026 census and delimitation, delaying national representation until 2029 or 2034.
   - **The "Stained Glass Ceiling" in Judiciary:** Structural barriers in the collegium system and late-stage appointments lead to critically low female representation in the Supreme Court and High Courts.
2. **Economic and Labor Market Barriers**
   - **The "Sticky Floor" Effect:** Nearly 94% of women work in the informal sector (agriculture/textiles), trapped in low-paying roles with zero social security.
   - **The Motherhood Penalty:** A "leaky pipeline" at mid-management persists due to lack of flexible infrastructure, forcing high-potential women to exit the workforce.
   - **Credit Rationing:** Women-led startups receive only **4% of total venture funding**, hindered by a lack of collateral and systemic investor bias.

3. **Socio-Cultural and Structural Constraints**
    - **Systemic Time Poverty:** Women perform 84% of unpaid care work, creating a "double burden" that limits skill acquisition and leadership opportunities.
    - **The "Missing" Asset Base:** Disproportionately low ownership of land and assets weakens women's economic bargaining power within households.
    - **Digital Harassment:** Deepfakes and tech-facilitated abuse create a new frontline of violence, silencing women in digital public spaces.
4. **Emerging Challenges**
    - **AI and Design Bias:** With only 22% of AI professionals being women, algorithmic designs often lack gender-sensitive safety and privacy perspectives.
    - **Climate-Induced "Triple Burden":** Climate-led male migration forces rural women to manage farm labor, domestic care, and resource scarcity without legal land titles.

Way Forward

- **Transforming Political Representation:** Move beyond tokenism by institutionalizing governance training for women and creating digital whistleblowing channels to eliminate "Sarpanch Pati" (proxy) interference.
- **Judicial and Institutional Diversity:** Reform the collegium system to ensure a mandatory minimum threshold for female representation in the High Courts and Supreme Court.
- **Scaling Economic Independence:** Utilize the LokOS app and Digital Aajeevika Register to monitor income growth, ensuring 3 crore rural women achieve "Lakhpati Didi" status.
- **Market and Career Equity:** Bridge the "Motherhood Penalty" through performance normalization policies and provide SHGs direct market access via SHE-Mart and GeM integration.
- **Digital and Technological Sovereignty:** Increase female participation in AI and STEM to 50% to ensure gender-neutral algorithms while strengthening the Digital India Act against deepfakes and tech-abuse.
- **Climate and Asset Resilience:** Transition women to "Agri-Managers" through climate-smart hiring centers and incentivize joint property titling to secure credit collateral for rural women.

7.2. RE-ENGAGEMENT WITH TURKIYE AND AZERBAIJAN SIGNALS FOREIGN POLICY

Context: India's foreign policy is witnessing a significant pivot from "emotional diplomacy" to "strategic pragmatism." Following a period of diplomatic freeze triggered by the **May 2025 India-Pakistan conflict (Operation Sindoor)**, New Delhi has initiated a re-engagement process with **Turkiye and Azerbaijan**. This shift underscores India's traditional strength in maintaining bilateral ties based on national interest rather than being confined to rigid multilateral "camps" or hyphenated with Pakistan.

Background of Strained Relations -The "Diplomatic Chill"

The conflict led to a sharp freeze in relations with countries perceived as supportive of Pakistan's stance or military capabilities.

A. Adversarial Groupings

- **The "Triple Adversary" Concept:** For the first time, Indian military briefings explicitly named **Turkiye** as a functional adversary alongside Pakistan, citing their diplomatic and military support.

- **Azerbaijan's Role:** Baku was believed to have provided technological and intelligence support to Pakistan during the 96-hour conflict.
- **Malaysia & The OIC:** Statements from Malaysia and several OIC members questioning India's decision to launch strikes led to immediate diplomatic demarches.

B. Economic and Social Hardline

- **Boycott Movements:** Significant drops in trade and tourism occurred as influential Indian social media accounts called for boycotts of Turkish and Azerbaijani goods/travel.
- **Visa & Trade Restrictions:** India suspended the SAARC Visa Exemption Scheme for Pakistani nationals and kept the **Indus Waters Treaty** in abeyance as a pressure tactic.

C. Strategic Counter-Alignments

- **The Armenia-Greece Axis:** India pointedly built a counter-alignment with **Armenia and Greece** (traditional rivals of Azerbaijan and Turkiye).
- **Alternative Land Routes:** During the evacuation of Indians from Iran in June 2025 (following Israel-Iran tensions), the MEA explicitly directed citizens to use Armenia and Turkmenistan, avoiding Turkiye and Azerbaijan.

Key Drivers of the Recent Diplomatic Shift

1. Regional Volatility and the "Iran Factor"

- **Logistical Necessity:** The June 2025 U.S.-Israel strikes on Iran made the boycott of Turkiye/Azerbaijan land routes unsustainable.
- **Humanitarian Icebreaker:** Azerbaijan's recent facilitation of **200+ Indian evacuees** from Iran prompted a diplomatic rethink.
- **Energy Resilience:** Restoring ties ensured the resumption of Azerbaijani crude (98% of bilateral trade) and protected **ONGC Videsh** investments.

2. Breaking the Trilateral "Axis"

- **Strategic De-hyphenation:** Revived Foreign Office Consultations (Baku, April 3; Delhi, April 8) force bilateral engagement, bypassing their "brotherly" ties with Pakistan.
- **Mirror Diplomacy:** Leveraging strong partnerships with **Greece and Armenia** to signal that India has viable alternatives if Ankara and Baku remain recalcitrant on Kashmir.

3. Economic "Realpolitik"

- **Economic Recovery:** Reversing the 2025 "Boycott Turkiye" impact, which caused a **36% drop in tourism** and a **16% trade decline**.
- **Mutual Interests:** India seeks market access in Turkiye (its 2nd largest market after China), while Turkish firms target "Make in India" opportunities.
- **Connectivity:** Engagement is essential for the **INSTC**, India's primary gateway to Europe and Central Asia.

4. "Counter-Terrorism" as a Common Language

- **Direct Engagement:** Post-Operation Sindoor, India is centering "Cross-border Terrorism" in formal FOC readouts.
- **Conditional Normalization:** Security cooperation is now a prerequisite for trade, signaling an end to India's tolerance for pro-Pakistan rhetoric while keeping the door open for functional ties.

Key Challenges in Re-engagement

- **The Trilateral Entrenchment:** The deeply rooted **Pakistan-Azerbaijan-Turkiye axis** remains a hurdle, as these nations often coordinate their diplomatic stances against India on international forums like the OIC.

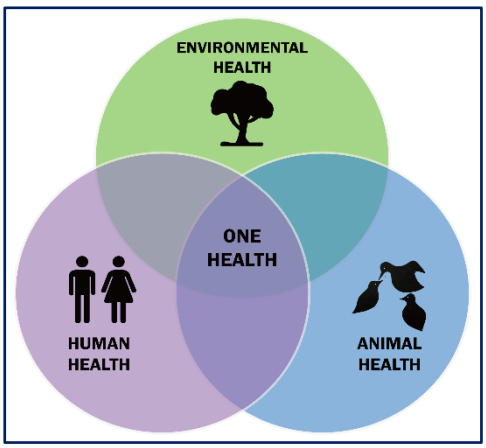
- **Sovereignty & Kashmir Rhetoric:** Ankara's persistent tendency to comment on India's internal security and the **Kashmir dispute** continues to trigger diplomatic friction and limits the scope of a full "strategic partnership."
- **Public Sentiment & Digitized Outrage:** The rapid escalation from **online boycott campaigns** to official policy makes diplomacy vulnerable to domestic emotional outbursts, which can undermine long-term pragmatic goals.
- **The "Armenia-Greece" Balancing Act:** India must carefully manage its new, robust defense and strategic ties with **Armenia and Greece** without letting them become a permanent barrier to functional engagement with their rivals, Baku and Ankara.
- **Military Distrust:** Overcoming the lingering military suspicion from **Operation Sindoor**, where Turkiye was viewed as a "functional adversary," requires significant transparency and confidence-building measures (CBMs).
- **Multilateral "Camp" Pressure:** Navigating a fractured global order without being forced into rigid blocs, ensuring India maintains its **Strategic Autonomy** while dealing with nations that are historically closer to its adversaries.

Way Forward

- **Pragmatic Compartmentalization:** Decouple core economic/connectivity interests (like INSTC) from political disagreements on Kashmir. Engage where interests align and hold firms where they don't.
- **Institutionalizing Dialogue:** Transition from sporadic, reactive meetings to regularized **Foreign Office Consultations (FOC)**. This ensures communication channels remain open even during periods of high tension.
- **Leveraging "Mirror Diplomacy":** Use the strong strategic ties with **Armenia and Greece** as a diplomatic stabilizer. It creates a balance of power that encourages Baku and Ankara to treat India with greater parity.
- **Shifting the Narrative:** Move the bilateral conversation toward **trans-national challenges**—such as climate change (DAC technology), energy security, and digital public infrastructure—to dilute the focus on historical rivalries.
- **Counter-Terrorism Diplomacy:** Firmly integrate "cross-border terrorism" into all bilateral frameworks, making it clear that regional stability is a shared responsibility and a prerequisite for advanced trade ties.
- **Managing Domestic Perception:** The government needs to balance nationalistic public sentiment with strategic goals, ensuring that **online outrage** does not restrict the state's room for diplomatic maneuvering.

7.3. ONE HEALTH APPROACH

Context: One Health is an integrated, multi-sectoral paradigm that recognizes the fundamental **interdependence** between human health, animal health and the resilience of our shared environment.



- **Evolution:** The term was officially coined in 2003-04 (post-SARS), though the concept of "One Medicine" dates back to Rudolf Virchow (19th century).
- **The Quadripartite:** Formally led by a collaboration between:
  - **WHO** (World Health Organization)
  - **FAO** (Food and Agriculture Organization)

- **UNEP** (UN Environment Programme)
- **WOAH** (World Organisation for Animal Health)

Significance of the 'One Health' Approach

1. **Zoonotic Disease Burden:** According to the **World Organisation for Animal Health (WOAH)**, **60%** of known infectious diseases in humans are zoonotic and **75%** of emerging infectious diseases (like COVID-19, Ebola, and Nipah) originate in animals.
2. **Antimicrobial Resistance (AMR):** Overuse of antibiotics in livestock and humans creates "superbugs" that cycle through the environment.
3. **Food Security:** As per the **FAO**, animal diseases reduce global livestock production by at least **20%**, directly impacting the nutritional security of nearly **1.3 billion people** who depend on livestock for livelihoods.
4. **Climate Change & Biodiversity Loss:** Deforestation and warming temperatures force animals out of natural habitats, increasing human-wildlife conflict and "spillover" events.
5. **Economic Stability:** The **World Bank** estimates that implementing One Health would cost roughly **$10 billion to $11 billion annually**, whereas the cost of a major pandemic (like COVID-19) is measured in **trillions of dollars** of lost GDP.

Global Institutional Frameworks

- **One Health Joint Plan of Action (2022-2026):** A 5-year roadmap by the Quadripartite focusing on health system strengthening and emerging zoonoses.
- **WHO Pandemic Agreement:** A legally binding treaty under Article 19 of the WHO Constitution.
  - **Key Pillar:** The **Pathogen Access and Benefit-Sharing (PABS)** system for equitable access to vaccines and data.
- **Manhattan Principles (2004): Based on the Wildlife Conservation Society's foundational documents**, these 12 principles were the first to formally recognize that "the health of one is the health of all."

India's One Health Ecosystem

A. National One Health Mission (NOHM)

Launched by the **PM-STIAC** (Prime Minister's Science, Technology and Innovation Advisory Council), it is a cross-ministerial effort coordinated by the **Department of Animal Husbandry & Dairying (DAHD)** and the **Ministry of Health**.

- **Surveillance:** Integrated digital platforms for real-time tracking of human and animal disease.
- **Lab Network:** Creation of a network of **BSL-3 and BSL-4 laboratories** across the country (currently 22 labs in the network).
- **Response:** Establishing a "One Health Support Unit" to develop a national roadmap.

B. State-Led Best Practices

- **Odisha:** Pioneering the **Climate Budget** to track resilient development.
- **Kerala:** Participatory carbon-neutral plans (e.g., Meenangadi model).
- **Tamil Nadu:** Green Climate Company and "Cool Roof" projects to mitigate environmental stressors.

Challenges of the 'One Health' Approach

- **Institutional Silos: As per the PM-STIAC**, fragmented coordination persists because human, animal and environmental health fall under separate ministries with conflicting mandates (as per **NITI Aayog**).
- **Funding Asymmetry: According to World Bank and WHO assessments**, global and national funding is skewed toward curative care and preventative sectors like animal health receive less than **15%** of the total budget.

- **Data Fragmentation: Based on NCDC reports**, India lacks a unified digital architecture, as human and veterinary data are stored in incompatible formats, hindering real-time AI outbreak predictions.
- **Legal & Regulatory Gaps:** India lacks a dedicated "One Health Act." **As per the Observer Research Foundation (ORF)**, existing laws like the **Epidemic Diseases Act (1897)** do not address the complex modern human-animal interface.
- **Infrastructure & HR Deficit: According to ICMR and WOAH**, there is a critical shortage of **BSL-3 laboratories** at the district level and a veterinarian-to-livestock ratio that falls below global standards.
- **Socio-Economic Barriers: As per FAO reports**, low awareness among farmers and fear of economic loss (due to culling) often lead to the under-reporting of zoonotic illnesses.

Way Forward

- **Integrated Legislative Framework:** India should move toward a dedicated "One Health Act." **As per legal recommendations from the Observer Research Foundation (ORF)**, this would provide the statutory backing needed to mandate inter-ministerial cooperation and shared budgeting.
- **Operationalizing "One Health" Units: According to NITI Aayog's Vision 2035**, India must establish integrated surveillance units at the district level, co-locating medical, veterinary and environmental officers to ensure grassroots rapid response.
- **Unified Data Architecture: Based on Digital India initiatives**, the creation of a "National One Health Digital Portal" is essential to sync data from the **IDSP** (human) and **NADRS** (animal) systems via AI.
- **Incentivized Reporting : According to FAO guidelines**, the government should implement "loss-compensation" schemes for farmers to prevent under-reporting of zoonotic outbreaks due to fear of economic ruin.
- **Strengthening "Environmental" Health: As per UNEP's recommendations**, India must integrate forest officials and ecologists into urban planning to better manage the "wildlife-human interface."
- **Global Leadership:** Leveraging **G20 New Delhi Declaration** commitments, India should lead the Global South in operationalizing the **WHO Pandemic Agreement's PABS system** for equitable sharing of medical countermeasures.

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