GEO IAS

It's about quality

CURRENT AFFAIRS

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Current Affairs

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HISTORY & CULTURE

Fort William

Context:

Fort William, the historic British-era military fortification in Kolkata, has been renamed "Vijay Durg" as part of the Indian government's efforts to shed colonial legacies and promote indigenous traditions.

About Fort William:

- Located in: Fort William is situated in Kolkata, West Bengal, on the eastern banks of the Hooghly River, a major distributary of the Ganga.

Built in:

- The original Fort William was constructed in 1696 and completed in 1706.
- The current fort was rebuilt between 1758 and 1781 after the Battle of Plassey.

Built by:

- The original fort was built by the British East India Company under Sir John Goldsborough.
- The current fort was reconstructed under the supervision of Robert Clive after the British regained control of Kolkata following the Battle of Plassey (1757).

History:

Original Fort (1696-1706):

- Constructed during the early years of British rule in Bengal.
- Named after King William III of England.
- Captured and destroyed by Siraj-ud-Daulah, the Nawab of Bengal, in 1756 during the Siege of Calcutta.

Rebuilt Fort (1758-1781):

- Reconstructed by the British after their victory in the Battle of Plassey (1757).
- Designed as a massive military fortification to prevent future attacks.

Features:

Architecture:

- Spread over 70 hectares, the fort is one of the largest British-era military structures in India.
- Designed in a star-shaped layout for enhanced defense capabilities.

Current Use:

- Headquarters of the Indian Army's Eastern Command.

Historical Significance:

- The site of the infamous "Black Hole of Calcutta" incident in 1756.
- Home to the first Indian Masonic lodge, established in 1730.

Cultural and Military Heritage:

- Houses a war memorial and museum showcasing artifacts from the 1971 Indo-Pakistani War and the Bangladesh Liberation War.

Recent Changes:

- Along with it, Kitchener House renamed Manekshaw House, and St. George's Gate renamed Shivaji Gate as part of the "Indianisation" of military traditions.

Jhumoir Binandini

Context:

Prime Minister attended the largest-ever Jhumoir Binandini event in Guwahati, Assam, celebrating the 200th anniversary of Assam's tea industry.

About Jhumoir Binandini:

What is Jhumoir Binandini?

- A traditional folk dance performed primarily by Assam's tea garden communities.
- Celebrates agricultural festivals and the cultural heritage of migrant tea workers.

Region of Origin:

- Predominantly performed in Assam, especially in districts with a high concentration of tea estates.
- Associated with festivals and social gatherings in tea garden areas.

Theme & Cultural Significance:

- Represents the struggles and aspirations of the tea-tribe community.
- Songs reflect themes of migration, labor exploitation, and resilience.

Key Features of Jhumoir Dance:

- Performed by women in red and white sarees, while men play instruments like madal, dhol, dhak, cymbals, and flutes.
- Dancers hold hands in a synchronized manner, moving gracefully in a circular formation.
- Lyrics borrow from Nagpuri, Khortha, Kurmali, and Assamese languages.

Tribes Associated with Jhumoir Dance:

- The dance is famous among Assam's tea-tribe community, which includes the Santhal, Munda, Kurukh, Oraon, and Kharia tribes.

Historical Background:

- Originated with the tea-tribe community, who were migrants from Jharkhand, Odisha, Chhattisgarh, and West Bengal.
- The British brought these workers to Assam for labor in tea plantations under harsh conditions.
- Jhumoir became a symbol of cultural preservation and social unity among displaced communities.

Chhatrapati Shivaji Maharaj

Context:

The nation commemorates the 395th birth anniversary of Chhatrapati Shivaji Maharaj on February 19, 2025.

About Chhatrapati Shivaji Maharaj:

Birth and Early Life:

- Born: February 19, 1630, at Shivneri Fort, Pune, Maharashtra.
- Parents: Shahaji Bhonsle (Maratha general) and Jijabai (influential mentor).
- Teachers: Dadoji Kondadev (military & administration), Jijabai (ethics & governance).

Coronation and Maratha Empire:

- Crowned as Chhatrapati: June 6, 1674, at Raigad Fort.
- Established Hindavi Swarajya, declaring independence from Mughal and Deccan Sultanates.

Achievements & Administrative Policies:

Military Innovations:

- Developed Guerrilla Warfare (Ganimi Kawa) tactics, outmanoeuvring the Mughals & Deccan rulers.
- Founded the Indian Navy, securing Konkan & western coast from foreign invasions.

Fortifications & Defense:

- Captured and built over 370 forts, including Torna, Raigad, Pratapgad, and Sinhagad.
- Introduced Naval forts such as Sindhudurg and Vijaydurg for coastal security.

Administrative Reforms:

- Introduced Ashta Pradhan Mandal (Council of Eight Ministers) for governance.
- Established progressive revenue policies (Kathi & Chauth system) ensuring stable economy.
- Promoted religious tolerance and included Muslims, Europeans, and people from all castes in administration.

Major Battles & Military Expeditions:

- Battle of Pratapgad (1659): Defeated Afzal Khan (Bijapur Sultanate).
- Battle of Pavan Khind (1660): Defended against Adilshahi forces, legendary sacrifice of Baji Prabhu Deshpande.
- Battle of Purandar (1665): Signed treaty with Mirza Jai Singh (Mughal commander).
- Escape from Agra (1666): Outwitted Aurangzeb's imprisonment, returning to Swarajya.
- Battle of Sinhagad (1670): Recaptured Sinhagad Fort, valor of Tanaji Malusare.
- Southern Conquests (1677–80): Expanded into Tamil Nadu, Karnataka, defeating Adilshah & Golconda.

Chapter-
2

POLITY

Prime Minister Dhan-Dhaanya Krishi Yojana

Context:

The Finance Minister announced the Prime Minister Dhan-Dhaanya Krishi Yojana in the Union Budget 2025-26, targeting 100 districts with low agricultural productivity.

About PM's Dhan-Dhaanya Krishi Yojana:

- Ministry: Ministry of Agriculture and Farmers' Welfare.
- Outlay: No separate allocation, but Rs 1,000 crore allocated for pulses, Rs 500 crore for fruits and vegetables, and Rs 100 crore for hybrid seeds.
- Aim: To boost agricultural productivity, crop diversification, post-harvest storage, irrigation facilities, and credit access in 100 low-productivity districts.

Features:

- Convergence of existing schemes and specialized measures.
- Focus on sustainable agriculture and crop diversification.
- Improved post-harvest storage at panchayat and block levels.
- Enhanced irrigation and credit facilities.
- Targets small and marginal farmers, rural women, and landless families.

Election Commission Neutrality

Context:

The Election Commission of India (ECI) has faced allegations of bias and erosion of neutrality, particularly in handling recent elections like Delhi 2025, raising concerns about its independence and transparency.

About Election Commission of India (ECI)

- Constitutional Basis: Established under Article 324 of the Indian Constitution.

- Composition: A three-member body consisting of the Chief Election Commissioner (CEC) and two Election Commissioners.
- Appointment Process: Previously appointed by the President on the advice of the Prime Minister. Post-2023 Supreme Court ruling (Anoop Baranwal vs Union of India Case, 2023), appointments are made by a selection committee (PM, Leader of Opposition, and Union Cabinet Minister).

Powers and Functions:

- Conducts free and fair elections for Lok Sabha, State Assemblies, and President/Vice President.
- Supervises electoral rolls, voter registration, and model code of conduct.
- Resolves disputes related to elections.

Key Functions and Duties of the Election Commission of India

- Electoral Constituency Management: Defines electoral boundaries under the Delimitation Commission Act to ensure fair representation.
- Electoral Roll Preparation and Revision: Updates voter lists to prevent bogus voting and ensure inclusivity.
- Election Schedule and Nomination Scrutiny: Announces poll dates, verifies nominations, and ensures eligibility.
- Political Party Recognition and Symbol Allocation: Registers parties, assigns election symbols, and resolves disputes.
- Model Code of Conduct (MCC) Implementation: Ensures ethical campaigning and prevents government misuse.

Allegations of Bias in ECI:

- Model Code of Conduct Violations: The central dominant party promoted tax exemptions as an election incentive, violating the Model Code of Conduct (MCC).

  E.g. Tax exemptions as a "gift for Delhi" during campaigns.
- Politically Influenced Appointments: Since 2010, several bureaucrats with political links have been appointed as election commissioners.

  E.g. Ashok Lavasa was sidelined for dissent, and Arun Goel's abrupt resignation fueled speculation of external pressure.
- Manipulation of Electoral Processes: Assam delimitation was alleged to have favored the ruling party by redrawing constituency boundaries strategically.

  E.g. Surat 2024 election saw an uncontested victory in a non-conflict zone, raising concerns over fair competition.
- Lack of Transparency: ECI withheld crucial voter turnout data and weakened disclosure rules, affecting public trust.
- Biased Electoral Calendar: The four-phase polling schedule in Odisha was allegedly designed to align with the national party's campaign plans.

ECI Has Maintained Neutrality:

- Constitutional Autonomy and Judicial Oversight: Operates under Article 324, with Supreme Court checks.
- Three-Member Decision-Making Mechanism: Ensures collective decision-making to reduce bias.
- Voter Awareness and Electoral Reforms: Implements SVEEP program to boost voter participation.
- Digital and Technological Advancements: Introduced EVM tracking and digital voter IDs for transparency.

Way Ahead:

- Electoral Finance Reforms: Implement stricter disclosure norms for political donations to enhance transparency and accountability in electoral funding as per Indrajith Gupta Committee.
- Enhanced MCC Enforcement: Enforce stricter penalties and real-time monitoring to prevent violations of the Model Code of Conduct during elections.
- Public Engagement & Awareness: Expand voter education programs to promote informed participation and awareness of electoral rights nationwide.
- Strengthening EVM Transparency: Mandate 100% VVPAT verification in disputed constituencies to ensure public trust in electoral outcomes.

Conclusion:

The ECI must uphold its constitutional mandate to ensure free and fair elections. Addressing allegations of bias and enhancing transparency will restore public trust and strengthen India's democratic foundations.

State Emblem of India

Context:

The Union Home Ministry has directed states to prevent the improper depiction of the State Emblem of India, emphasizing the mandatory inclusion of the motto "Satyameva Jayate" in Devanagari script.

About State Emblem of India:

- Adoption: Adopted as the State Emblem of India on January 26, 1950 from the Sarnath Lion Capital of Ashoka.

Features of the State Emblem:

- Three Visible Lions: The fourth lion is hidden from view.
- Dharma Chakra: Positioned at the center of the abacus.

Animal Depictions:

1. Bull (Right): Represents the zodiac sign Taurus, symbolizing Buddha's birth.
2. Horse (Left): Symbolizes Kanthaka, the horse Buddha rode while renouncing princely life.
3. Elephant (East): Represents Queen Maya's dream of a white elephant entering her womb.
4. Lion (North): Symbolizes Buddha's enlightenment and Dharma propagation.

- No Bell-shaped Lotus: Omitted in the official State Emblem.
- Motto 'Satyameva Jayate': Taken from the Mundaka Upanishad, meaning 'Truth Alone Triumphs', inscribed below the emblem in Devanagari script.
- Crowned by Dharma Chakra: Represents Buddha's first sermon (Dharmachakra Pravartana).

Legal Provisions:

- State Emblem of India (Prohibition of Improper Use) Act, 2005: Regulates authorized use of the emblem.
- State Emblem of India (Regulation of Use) Rules, 2007: Specifies the permitted authorities and usage rules.

Penalty for Violation:

- Up to 2 years imprisonment or
- Fine up to 5,000 for unauthorized use.

Bill Proposing 100 days Parliamentary Sitting

Context:

Senior Opposition leaders in the Rajya Sabha have introduced Private Member Bills seeking to mandate a minimum of 100-120 parliamentary sittings per year to enhance legislative accountability and scrutiny.

About Proposed 100 Days Sitting in a Year:

Objective of the Proposal:

- Seeks to ensure minimum working days (100-120 days) for Parliament to strengthen deliberative functions and improve governance accountability.
- Inspired by the General Purposes Committee (1955) and National Commission to Review the Working of the Constitution (NCRWC, 2002).

Current Scenario of Parliamentary Sittings:

- No constitutional mandate for minimum sittings, only Article 85 and Article 174 mandate that Parliament and state legislatures must meet at least twice a year.
- The 17th Lok Sabha (2019-2024) had the lowest full-term sitting (274 days) in Indian history.

Comparison with Other Democracies:

- United Kingdom (150-160 days), USA (133-140 days), Canada (130-140 days) have higher parliamentary sittings ensuring robust debates and scrutiny.

Legislative Powers with Respect to Sittings:

Article 85 & Article 174 of the Constitution

- Mandates that the gap between two sessions should not exceed six months, but does not specify a minimum number of sittings.

State Legislature & Governor's Role

- Governor convenes the session on the Cabinet's advice, leading to the executive's control over legislative sittings.

Need for Such a Move:

- Enhancing Legislative Scrutiny: 44% of all Bills in 2023 werepassed within a day of introduction, reducing the scope for debate and scrutiny.
- Strengthening Government Accountability: Ensures detailed deliberations on budgetary allocations, policies, and executive actions, preventing arbitrary decision-making.
- Mitigating Judicial Overload: Proper legislative debate reduces the need for judicial intervention, ensuring constitutional compliance of laws.
- Boosting Public Trust in Legislatures: Declining sittings and disruptions weaken public confidence in legislative institutions.
- Addressing Electoral Pressures: Frequent elections divert political attention from legislative functions, reducing effective policy making.

Challenges to Implementation:

1. Executive Dominance Over Legislature: The ruling government controls session schedules, often curtailing sittings to avoid scrutiny.
2. Rising Disruptions in Parliament: Frequent walkouts, protests, and adjournments lead to non-productive hours, reducing effective discussion time.
3. Political Fragmentation: Increased political polarization and lack of consensus hinder meaningful deliberation.
4. Lack of Parliamentary Committees in States: Unlike Parliament, most state assemblies lack active committee systems, reducing independent scrutiny of bills.
5. Financial and Logistical Constraints: Extending sittings requires additional budgetary allocations for infrastructure, security, and legislative staff.

Way Ahead:

1. Mandating Minimum Sittings via Constitutional Amendment: A constitutionally backed framework would ensure legislatures meet for adequate days annually.
2. Introduction of a Fixed Parliamentary Calendar: A predetermined session schedule, similar to the UK model, would ensure regular sittings.
3. Strengthening Legislative Committees: Expanding standing and select committees to scrutinize bills before passage.
4. Reforming Parliamentary Conduct Rules: Mechanisms to address frequent disruptions and ensure productive sessions.
5. Public Awareness & Civil Society Engagement: Greater citizen involvement in legislative monitoring through live streaming, transparency, and feedback mechanisms.

Conclusion:

Ensuring 100-120 sittings per year will strengthen India's democratic process, improve legislative efficiency, and enhance accountability. With legislatures being the cornerstone of governance, adopting such reforms is crucial for a more transparent, deliberative, and responsible parliamentary system.

NITI Aayog Report on Higher Education

Context:

The NITI Aayog report, "Expanding Quality Higher Education through States and State Public Universities," highlights disparities in state-wise spending on higher education, urging increased public investment, especially in State Public Universities (SPUs).

Key Findings of the NITI Aayog Report on Higher Education Funding:

- States Allocating the Most to Higher Education (% of GDP): Jammu & Kashmir (8.11%), Manipur (7.25%), Meghalaya (6.64%), Tripura (6.19%).
- States with the Lowest Higher Education Expenditure (% of GSDP): Telangana (0.18%), Gujarat (0.23%), Rajasthan (0.23%).
- States with the Highest Higher Education Budget (Absolute Amount): Maharashtra (11,421 crore), Bihar (9,666 crore), Tamil Nadu (7,237 crore).
- States with the Lowest Higher Education Budget (Absolute Amount): Sikkim (142 crore), Arunachal Pradesh (155 crore), Nagaland (167 crore).
- Growth in Per Youth Spending on Higher Education: Increased from 2,174 (2005-06) to 4,921 (2019-20), with widening disparities among states.
- States with Consistently High Per Youth Spending: Kerala, Tamil Nadu, Maharashtra, Andhra Pradesh, Telangana.
- States Lagging in Higher Education Investment: Rajasthan, Punjab, Chhattisgarh.

Policy Recommendations:

The recommendations are divided into short-term (0-2 years), medium-term (2-5 years), and long-term (5+ years) goals:

Key Recommendations:

1. Enhancing Quality of Education & Research:

Short-Term (0-2 Years):

- Develop a National Research Policy aligned with the Anusandhan National Research Foundation (ANRF).
- Establish Research Hubs and Patent Cells in SPUs.
- Create a curated list of high-quality journals in STEM and non-STEM fields.
- Implement performance-based incentives for faculty research.
- Expand student-faculty research pairing programs and mentorship initiatives.
- Increase funding for post-doctoral fellowships, particularly for women.

Medium-Term (2-5 Years):

- Establish R&D Advisory Committees and incubation centers for research commercialization.
- Promote SPU consortia for sharing best practices and innovation.
- Strengthen humanities research collaborations with other institutions.

Long-Term (5+ Years):

- Develop Centers of Excellence in SPUs to address regional challenges.
- Increase funding for fundamental research to attract students from India and abroad.

2. Improving Pedagogy and Curriculum:

Short-Term (0-2 Years):

- Establish curriculum review committees to update syllabi based on industry trends.

- Implement teaching quality evaluation frameworks for faculty.
- Expand multidisciplinary education with electives and minors.
- Integrate Holistic Education (Environment, Human Values, Global Citizenship) into courses.

Medium-Term (2-5 Years):

- Introduce new interdisciplinary courses on sustainability and emerging industries.
- Develop strategies to integrate UN Sustainable Development Goals (SDGs) into academics.

Long-Term (5+ Years):

- Foster a culture of innovation in curriculum design.
- Transition Leading SPUs into Multidisciplinary Education and Research Universities (MERUs).

3. Digitalization of Higher Education:

Short-Term (0-2 Years):

- Upgrade IT infrastructure and provide high-speed internet across SPUs.
- Implement AI-driven student lifecycle management systems for admissions, academics, and exams.
- Establish digital learning centers for online education.

Medium-Term (2-5 Years):

- Provide technical support staff and affordable devices for underprivileged students.
- Train faculty and students in digital literacy and online teaching methods.

Long-Term (5+ Years):

- Collaborate with technology companies to develop advanced digital learning solutions.
- Foster global partnerships for research and capacity-building in digital education.

4. Internationalization of Higher Education:

Short-Term (0-2 Years):

- Improve infrastructure for international students in Leading SPUs.
- Offer scholarships for foreign students and faculty exchange programs.
- Standardize curriculum to match global standards.
- Develop outreach programs to attract Indian researchers from abroad.

Medium-Term (2-5 Years):

- Establish long-term university partnerships for student and faculty exchange.

Long-Term (5+ Years):

- Enhance global ranking and reputation of Leading SPUs through research and collaborations.

5. Funding and Financing Higher Education:

Short-Term (0-2 Years):

- Increase education budget to 6% of GDP as per the NEP 2020 recommendation.
- Establish a dedicated infrastructure finance agency for SPUs.
- Expand alumni engagement for fundraising and resource mobilization.
- Encourage Corporate Social Responsibility (CSR) funds for SPU research and infrastructure.

Medium-Term (2-5 Years):

- Develop sustainable self-financed programs based on market demand.

Long-Term (5+ Years):

- Implement fee autonomy pilot programs for select universities.
- Institutionalize Public-Private Partnerships (PPP) models for research and education financing.

6. Governance & Autonomy of State Public Universities:

Short-Term (0-2 Years):

- Shift to a regulatory-facilitator model to grant SPUs more autonomy.
- Develop a Model Act for State Public Universities to ease governance.
- Establish State Councils for Higher Education (SCHEs) for policy oversight.

Medium-Term (2-5 Years):

- ement credit transfer systems through the Academic Bank of Credits (ABC).

Long-Term (5+ Years):

- Enable de-affiliation of high-potential colleges to create autonomous degree-granting institutions.
- Strengthen localized accreditation frameworks for SPUs.

7. Faculty Recruitment and Capacity Building:

Short-Term (0-2 Years):

- Streamline faculty recruitment and establish centralized hiring systems.
- Provide professional development programs for faculty.
- Optimize faculty workload management for research and teaching balance.

Medium-Term (2-5 Years):

- Ensure full-time faculty hiring for long-term stability.

Long-Term (5+ Years):

- Encourage faculty research and innovation through dedicated funding.

8. Enhancing Employability & Industry Collaboration:

Short-Term (0-2 Years):

- Integrate internships and apprenticeships into curricula.
- Develop Internship Banks and partner with NSDC Skill Councils.
- Promote entrepreneurship & incubation centers in SPUs.

Medium-Term (2-5 Years):

- Establish innovation hubs and startup incubators.
- Develop lifelong learning centers for continuous skill development.

Long-Term (5+ Years):

- Institutionalize physical education and wellness programs for holistic student development.

9. Strengthening Academia-Industry Collaboration:

Short-Term (0-2 Years):

- Set up Industry Relations Cells (IRCs) in SPUs.
- Establish MoUs with industries for research and skill development.
- Promote Professor of Practice appointments.

Medium-Term (2-5 Years):

- Align curriculum updates with emerging industry trends.

Long-Term (5+ Years):

- Institutionalize corporate partnerships and professional certifications in SPUs.

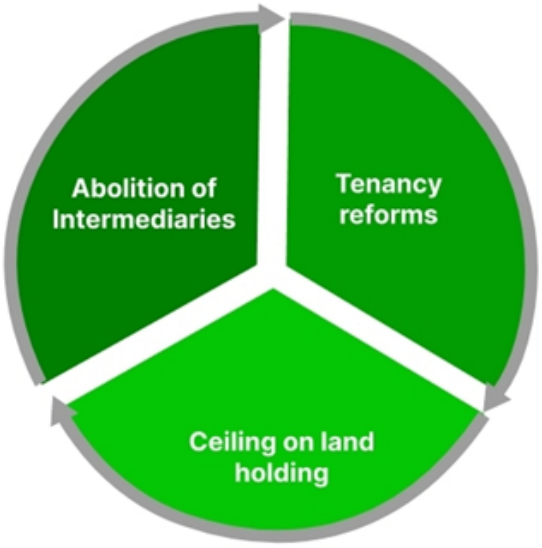
Conclusion:

The proposed short-term, medium-term, and long-term reforms aim to transform SPUs into centers of excellence, ensuring greater autonomy, financial sustainability, and industry relevance in India's higher education landscape.

Zamindari Abolition

Context:

The article discusses the legal and political challenges surrounding the abolition of the Zamindari system in independent India, particularly the landmark Supreme Court case of Sankari Prasad vs. Union of India (1951) that upheld the First Constitutional Amendment enabling land reforms.



About Zamindari System:

What was the Zamindari System?

- Introduction: Introduced by Lord Cornwallis in 1793 under the Permanent Settlement Act, the Zamindari system made landlords (zamindars) intermediaries responsible for collecting land revenue from peasants and paying it to the British government.
- Revenue Collection: 89% of collected revenue went to the British, and zamindars retained 11%.
- Ownership Rights: Zamindars had absolute control over the land and could lease, sell, or transfer it.
- States Practicing Zamindari: The system was prevalent in West Bengal, Bihar, Uttar Pradesh, Madhya Pradesh, Odisha, and parts of Tamil Nadu and Andhra Pradesh.
- Social Impact: Peasants were subjected to high rents, forced labor (begar), and frequent evictions, creating widespread rural distress.

Issues Surrounding the Zamindari System:

1. Exploitation of Peasants: Peasants had no ownership rights and were forced to pay exorbitant rents, often falling into a cycle of debt.
2. Agricultural Decline: Zamindars focused on revenue collection rather than agricultural productivity, leading to stagnation in farm output.
3. Social Disparities: The system widened the gap between landed elites and landless laborers, fueling class conflicts.
4. Legal Challenges to Abolition: Zamindars contested the Zamindari Abolition Acts in court, citing violations of fundamental rights (Right to Property under Article 19 and 31).

Major Court Cases Related to Land Reforms in India:

- Sankari Prasad vs. Union of India (1951)
- Issue: Challenged the First Constitutional Amendment that placed Zamindari Abolition Acts under the Ninth Schedule to protect them from judicial review.
- Outcome: Supreme Court upheld the amendment, ruling that Parliament had the power to amend the Constitution, including Fundamental Rights.

Kameshwar Singh vs. State of Bihar (1952)

- Issue: Bihar Zamindari Abolition Act challenged on the grounds of inadequate compensation for landlords.
- Outcome: Patna High Court struck down the law, but later amendments allowed land reforms to proceed.

Sajjan Singh vs. State of Rajasthan (1965)

- Issue: Questioned the validity of placing land reform laws under the Ninth Schedule to escape judicial review.
- Outcome: Supreme Court ruled that Parliament had the power to amend Fundamental Rights.

C. Golaknath vs. State of Punjab (1967)

- Issue: Whether Parliament could amend Fundamental Rights, including the Right to Property.
- Outcome: Supreme Court reversed its earlier stance, ruling that Fundamental Rights could not be amended.

Kesavananda Bharati State of Kerala (1973)

- Issue: Whether Parliament's power to amend the Constitution was absolute.
- Outcome: Supreme Court introduced the Basic Structure Doctrine, stating that amendments cannot violate the fundamental framework of the Constitution. However, the Right to Property was later removed as a fundamental right.

Impact of Zamindari Abolition in India:

- Ownership to Tenants: Over 20 million peasants became landowners, leading to rural empowerment.
- End of Feudal Exploitation: Reduced arbitrary evictions and excessive rents.
- Increased Agricultural Productivity: Farmers had greater incentives to invest in modern techniques and improve yield.
- Reduced Bonded Labor: The practice of forced labor (begar) significantly declined.
- Social Justice & Economic Equity: Helped bridge the gap between the landed elite and landless farmers, aligning with Directive Principles of State Policy (DPSP).

Challenges & Limitations:

- Evasion by Zamindars: Many landlords distributed land among family members or created religious trusts to avoid state acquisition.
- Rise of New Intermediaries: Wealthy farmers subleased land to poorer tenants, creating new hierarchies in landholding.
- Poor Implementation: Many states, including Bihar and Uttar Pradesh, failed to fully enforce land redistribution due to political and bureaucratic resistance.
- Legal Loopholes: Judicial interventions often diluted land reform efforts by favouring landlords.

Conclusion:

The abolition of the Zamindari system was a landmark step in post-independence agrarian reforms, promoting social justice and economic equity. However, challenges in implementation and judicial roadblocks hindered full realization of its objectives. While land reforms empowered millions of farmers, loopholes in execution allowed vested interests to retain land, necessitating stronger legal enforcement to ensure true agrarian justice.

President's Rule

Context:

Manipur is facing a potential imposition of President's Rule following the resignation of Chief Minister N. Biren Singh, as BJP struggles to find a consensus candidate.

About President's Rule:

What is President's Rule?

- President's Rule refers to the suspension of a state government and the imposition of direct central administration when a state government fails to function as per the Constitution.
- It is invoked under Article 356 of the Indian Constitution when the President is satisfied that governance in a state cannot be carried out per constitutional provisions.

Constitutional Provisions

- Article 356: Grants the President the power to impose President's Rule in case of failure of constitutional machinery in a state.
- Article 365: If a state government fails to comply with the Centre's directives, the President can assume that the state government cannot function per the Constitution.

Criteria for Imposing President's Rule

- Breakdown of Constitutional Machinery: If the state government fails to function in accordance with the Constitution.
- Failure to Comply with Central Directives: If the state does not follow instructions issued by the Union government under Article 256.
- Governor's Report: If the Governor recommends the imposition of President's Rule, citing political instability or law-and-order issues.
- Other Justifications: Political crisis, loss of majority, or inability to conduct elections.

Procedure for Imposing President's Rule:

- Governor's Report: The Governor submits a report to the President stating that governance in the state has broken down.
- President's Proclamation: The President issues a proclamation imposing President's Rule, initially for two months.
- Parliamentary Approval: Both Lok Sabha and Rajya Sabha must approve the proclamation within two months for it to continue.
- Duration: Initially imposed for six months, extendable up to three years with parliamentary approval every six months.

Extension Beyond One Year: Allowed only if:

National Emergency is in force, or

- The Election Commission certifies that elections in the state cannot be conducted.

Impact of President's Rule:

On State Executive:

- The Governor assumes all executive powers, acting on behalf of the President.
- The Chief Minister and Council of Ministers are removed.
- The state administration is run by bureaucrats under the Centre's control.

On State Legislature:

- The State Legislative Assembly is either dissolved or suspended.
- Parliament assumes legislative powers and can pass laws for the state.
- The President can issue ordinances if Parliament is not in session.

On Judiciary

- The High Court continues to function independently.
- Judicial powers remain unaffected, ensuring the rule of law.

On Fundamental Rights of Citizens

- No direct impact on fundamental rights.
- The state administration must function under constitutional safeguards.
- In extreme cases, civil liberties may be restricted if law-and-order deteriorates.

Midday Meal Scheme and Egg

Context:

The Maharashtra government has withdrawn 50 crore funding for eggs and millet-based dishes in the Mid-Day Meal (PM-POSHAN) scheme, raising concerns over child nutrition and malnourishment.

About Role of Egg in Nutrition for School Students:

- High Protein Source: Provides 6 gm of protein per egg, helping meet the 12-20 gm daily protein requirement under the National Food Security Act (2013).
- Rich in Micronutrients: Contains Vitamin D, B12, Iron, and Choline, essential for brain development and immunity.
- Combatting Malnutrition: Helps address stunting (36%) and underweight cases (35%) among children in Maharashtra (NITI Aayog, 2019).

Impact of Removing Eggs from Midday Meals

- Increased Nutritional Deficiency: Removal deprives children of essential proteins and vitamins, leading to growth issues and cognitive delays.

- Worsening Malnourishment: Maharashtra's child nutrition indicators remain stagnant since 2015-16, making the cutback detrimental to progress.
- Financial Burden on Families: Eggs are costly for low-income groups, especially amid 8%+ food inflation (2023-24, NSO data).
- Equity in Nutrition: With 16 other states providing eggs, Maharashtra's move creates inequality in child nutrition across India.
- Contradiction to Government Policies: PM-POSHAN aims to improve food security, yet the cut contradicts the program's objectives.

Public Accounts Committee (PAC)

Context:

The Public Accounts Committee (PAC) has raised concerns over excessive toll collection on National Highways and the failure of toll operators to provide passenger amenities as per agreements.

About Public Accounts Committee (PAC):

Establishment:

- Introduced in 1921 after the Government of India Act, 1919 (Montford Reforms).
- Constituted annually under Rule 308 of the Rules of Procedure and Conduct of Business in Lok Sabha.

Composition and Membership:

Comprises 22 members:

- 15 members elected from Lok Sabha by the Speaker.
- 7 members elected from Rajya Sabha by the Chairman.
- Tenure: One year.
- Ministers are not eligible to be members.

Appointment of Chairman:

- Appointed by the Lok Sabha Speaker.
- By convention, the chairman belongs to the opposition party.

Functions and Responsibilities:

- Examines government expenditures to ensure funds allocated by Parliament are used within the approved scope of demand.

Scrutinizes:

- Appropriation accounts and finance accounts of the government.
- CAG Reports on revenue, expenditure, and autonomous bodies.
- Evaluates cases of overspending, misallocation, and financial irregularities.
- Holds the executive accountable for financial discipline.

Missing Children in India

Context:

The Supreme Court was informed that nearly 36,000 children remain untraced across India since 2020, despite police recovering the majority of 3 lakh missing children.

About Missing Children in India:

- Total Missing (2020-24): Nearly 3 lakh children went missing.
- Untraced Children: 36,000 children remain missing, highlighting gaps in law enforcement.

State-wise Data:

- Madhya Pradesh: 58,665 missing, 45,585 recovered, 3,955 still missing.
- Bihar and Odisha are next highest in order.
- Non-reporting States: Delhi, Punjab, Nagaland, Jharkhand, Tamil Nadu, West Bengal, J&K, Andhra Pradesh failed to provide data.

Government & Legal Measures

- Khoya-Paya Portal: Centralized online tracking system for missing children.

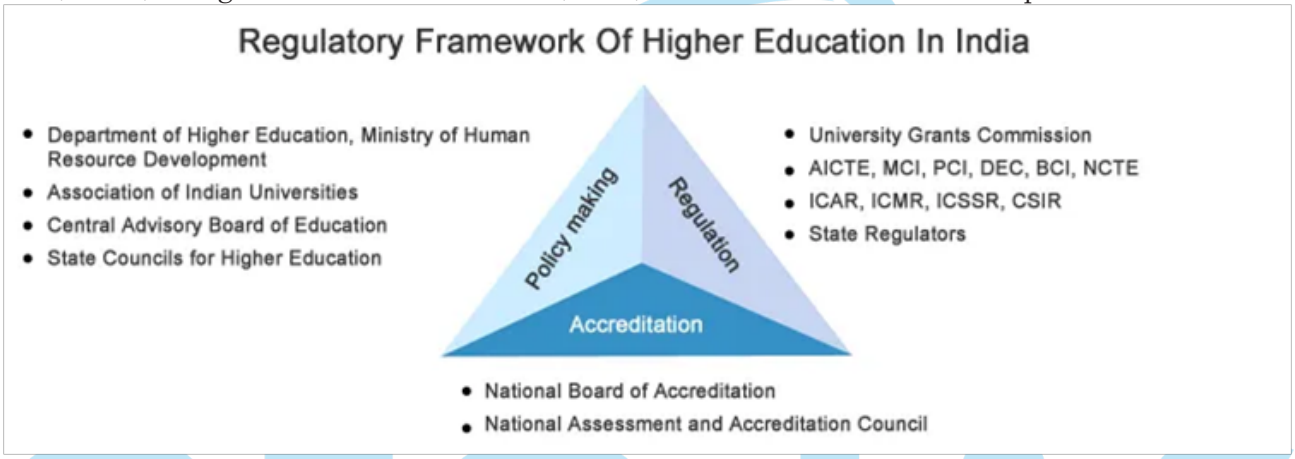
Anti-Human Trafficking Units (AHTUs):

- 100 crore allocated for strengthening AHTUs in every district.
- Untraced cases (4+ months) must be transferred to AHTUs.

UGC Equity Guidelines

Context:

The University Grants Commission (UGC) released draft regulations for the establishment of Equal Opportunity Centres (EOCs) in higher education institutions (HEIs) to combat discrimination and promote inclusion.



Key Features of UGC's Draft "Promotion of Equity in Higher Education Institutions" Regulations, 2025:

1. **Establishment of Equal Opportunity Centres (EOCs):**
   - Mandatory for all HEIs to set up EOCs to handle discrimination complaints and promote diversity.
   - EOC will provide academic, financial, and social support to marginalized students.
2. **Equity Committee and Equity Squads:**
   - A 10-member equity committee will oversee EOC operations and conduct inquiries.
   - Equity squads will monitor discrimination on campus and report violations.
3. **Appointment of Equity Ambassadors:**
   - Each department, hostel, and facility must appoint an equity ambassador.
   - Ambassadors will promote equity and implement anti-discrimination programs.
4. **24/7 Equity Helpline & Online Complaint Portal:**
   - HEIs must set up a 24/7 helpline to report discrimination cases confidentially.
   - Complaints can be lodged via an online portal, and serious cases will be referred to the police.
5. **Strict Penalties for Non-Compliance:**
   - Institutions failing to comply may face debarment from UGC schemes, removal from UGC recognition, and restrictions on degree programs.
   - False complaints will attract monetary penalties decided by the equity committee.

Need for Such a Regulation:

- Rising Caste-Based Discrimination & Suicides in HEIs: Cases like Rohith Vemula (2016) and Payal Tadvi (2019) highlight the urgent need for institutional safeguards.
- Lack of Dedicated Anti-Discrimination Mechanisms: No standardized framework exists to monitor and prevent discrimination in HEIs.

- Ensuring Compliance with Supreme Court Orders: SC has directed UGC to frame strict anti-discrimination regulations to improve campus safety.
- Bridging the Social Inclusion Gap: SC/ST and EWS students face systemic barriers, impacting dropout rates and academic performance.
- Fulfilling India's Commitment to SDG 4 (Quality Education): The regulation aligns with UN Sustainable Development Goals (SDG 4 & SDG 10) on inclusive and equitable education.

Challenges & Negatives in the Draft Regulations:

- Implementation & Monitoring Issues: No clear funding mechanism for setting up and running EOCs in HEIs.
- Bureaucratic Burden on Institutions: HEIs may face administrative delays in setting up equity committees, squads, and helplines.
- Lack of Student Representation: Limited student involvement in decision-making processes.
- Risk of Misuse & False Complaints: The provision to penalize false complaints may discourage genuine victims from coming forward.
- No Mention of Mental Health Support: The draft does not mandate mental health counseling, despite increasing student suicides due to discrimination.

Way Ahead:

- Financial Support & Grants for EOCs: UGC should allocate special funds to support HEIs in implementing these regulations effectively.
- Regular Monitoring & Accountability: An independent oversight body should be set up to track compliance and performance of EOCs.
- Greater Student Participation: Equity committees should include more student representatives, especially from marginalized groups.
- Incorporating Mental Health Support: Mandatory counseling services should be integrated into HEI frameworks.
- Awareness & Capacity Building: Workshops and sensitization programs should be conducted for faculty and students on discrimination laws.

Conclusion:

The UGC's draft regulations for Equal Opportunity Centres mark an important step in addressing caste-based discrimination and ensuring inclusivity in HEIs. However, effective implementation, financial backing, and mental health support must be prioritized to create a truly equitable education system in India.

Delimitation Exercise

Context:

Union Home Minister assured that no parliamentary seats will be reduced in South Indian states after the proposed delimitation exercise, countering Tamil Nadu CM concerns.

About Delimitation Exercise:

What is Delimitation?

- Delimitation refers to fixing the number of seats and defining the boundaries of parliamentary and legislative assembly constituencies in each state.
- It ensures proportional representation based on population while determining reserved seats for Scheduled Castes (SCs) and Scheduled Tribes (STs).

Who Conducts Delimitation?

- Delimitation Commission is established under an act of Parliament.
- It is a high-powered body, whose orders cannot be challenged in any court.
- The Election Commission assists in the process.

Delimitation Commission Members:

- A retired Supreme Court judge (Chairperson).
- The Chief Election Commissioner (CEC) or an Election Commissioner nominated by the CEC.
- The State Election Commissioners of the respective states.

Constitutional Provisions on Delimitation

- Article 82: After every Census, Parliament enacts a Delimitation Act to redefine constituency boundaries.
- Article 170: States are divided into territorial constituencies as per the Delimitation Act after each Census.
- 42nd Amendment Act (1976): Froze the number of Lok Sabha seats for each state at 1971 census levels to encourage population control measures.
- 84th Amendment Act (2001): Allowed territorial adjustments based on the 1991 census without changing the number of seats.
- 87th Amendment Act (2003): Mandated delimitation based on the 2001 Census, keeping the existing seat allocation unchanged.

Delimitation in India So Far:

- Conducted four times: 1952, 1963, 1973, and 2002.
- The first exercise (1950-51) was done by the President with the help of the Election Commission.
- The last full delimitation that changed state-wise seat composition was in 1976, based on the 1971 Census.

Functions and Powers of the Delimitation Commission:

- Redrawing Constituency Boundaries: Ensures equal representation by adjusting seats based on population shifts.
- Reservation of Seats: Identifies and allocates seats for SC/ST candidates as per constitutional provisions.
- Final Authority on Delimitation: Its decisions are legally binding and cannot be challenged in any court.
- Ensuring Electoral Equality: Maintains uniform voter-to-representative ratio across constituencies.
- Improving Electoral Participation: Adjusts boundaries to avoid voter disparity and ensure fair elections.

Doomsday Fish

Context:

Recent sightings of the rare oarfish, popularly called the "Doomsday Fish," near the shores of Baja California Sur, Mexico, have sparked speculation about potential natural disasters.

About Doomsday Fish:

- Scientific Name: Regalecus glesne
- Common Name: Oarfish, Doomsday Fish
- Distribution: Found in deep-sea waters of the Pacific, Atlantic, and Indian Oceans.
- Habitat: Lives at depths of 200-1,000 meters, near continental slopes and oceanic trenches.

Physical & Biological Features:

- Size: The longest bony fish in the world, reaching up to 11 meters.
- Appearance: Ribbon-like, shimmering silver body with red dorsal fins running its length.
- Diet: Feeds on krill, plankton, and small crustaceans.
- Lifespan: Estimated up to 20 years, but rarely seen due to its deep-sea habitat.

Theories Linking Oarfish to Natural Disasters:

Folklore & Earthquake Myths:

- In Japanese mythology, the oarfish is called "Ryugu no tsukai" (Messenger from the Sea God's Palace).
- Believed to surface before earthquakes and tsunamis.
- The theory gained traction when oarfish washed ashore before the 2011 Tōhoku earthquake in Japan.

Scientific Explanations & Skepticism:

- Some researchers believe oarfish may be sensitive to seismic activity due to deep-sea fault lines.
- The 2019 study by the Bulletin of the Seismological Society of America found no proven link between oarfish sightings and earthquakes.
- Experts suggest sightings occur due to illness, deep-sea currents, or changes in water temperature and pressure rather than seismic activity.

Surveillance Capitalism

Context:

Surveillance capitalism is reshaping digital economies, with big tech companies like Google, Meta, and Amazon monetizing user data, raising concerns over privacy, autonomy, and state surveillance.

About Surveillance Capitalism:

What is Surveillance Capitalism?

- An economic model where tech corporations collect, analyze, and monetize personal data to influence behaviour.
- Described by Shoshana Zuboff (2018) as a new economic order that extracts human experience for profit.

How It Works & Characteristics:

- Behavioral Data Extraction: Companies track every click, search, and purchase, creating detailed digital profiles.
- Predictive Analytics: AI-driven algorithms forecast user actions and modify behaviors for commercial gain.
- Instrumentarian Power: Data-driven control mechanisms subtly shape choices, rather than using force or coercion.
- Social Physics Model: Analyses massive datasets to predict and influence collective behaviours
- State-Corporate Alliance: Governments rely on private tech giants for intelligence gathering and surveillance, reducing public accountability.

How It Differs from Traditional Capitalism?

Focus Shift:

- Industrial Capitalism: Depended on physical labor & material production.
- Surveillance Capitalism: Profits from behavioral data mining.
- Monetization of Human Experience: Unlike goods & services-based models, this system commodifies personal data.
- Behavioral Control: Algorithms subtly nudge users toward decisions benefiting corporations.
- Economic & Political Influence: Unlike traditional models, corporate interests are closely linked with state policies.
- Continuous Data Harvesting: Personal data is collected 24/7, affecting consumer choices, elections, and policymaking.

Negative Impacts of Surveillance Capitalism:

- Erosion of Privacy: Companies track and monetize personal data without user consent (e.g., Cambridge Analytica Scandal, 2014).
- Manipulation & Loss of Autonomy: AI algorithms influence choices in shopping, voting, and opinions, limiting individual freedom.
- Threat to Democracy: Targeted political ads influence elections, undermining democratic integrity (e.g., 2016 U.S. Presidential Elections).

- Cybersecurity Risks & Data Breaches: Large-scale data breaches expose users to identity theft & financial fraud.
- State Surveillance & Civil Liberties: Governments use tech firms' data for mass surveillance, limiting free speech and suppressing dissent.

Measures to Counter Surveillance Capitalism:

- Strengthening Data Protection Laws: EU's GDPR & India's Digital Personal Data Protection Act (DPDPA, 2023) ensure user control over personal data.
- Regulating Big Tech: Governments must implement antitrust laws to curb monopolistic data exploitation.
- Enhancing Public Awareness: Digital literacy programs can help users understand privacy settings and data usage policies.
- Tech Accountability & Algorithm Transparency: Companies should be mandated to disclose data collection and AI decision-making processes.
- Banning Data Commodification: Prohibit business models that rely on selling behavioural data, similar to restrictions on child data usage (COPPA, U.S.).

Conclusion:

Surveillance capitalism is shaping economies, politics, and personal freedoms, making privacy a global concern. Governments must enforce strict regulations, promote ethical AI, and educate users about data privacy rights. Only a global framework on digital rights can ensure autonomy and safeguard democracy in the digital age.

Reducing India's Fertilizer Dependence

Context:

The Indian government is strategizing to reduce the consumption of high-analysis fertilizers like Urea, Di-Ammonium Phosphate (DAP), and Muriate of Potash (MOP) due to their heavy import dependence and economic burden.

CONSUMPTION/SALE OF MAJOR FERTILISER PRODUCTS

	UREA	DAP	20:20:0:13@	SSP	MOP	NPKS*
2013-14	306	73.57	33.37	38.79	22.8	72.64
2014-15	306.1	76.26	38.02	39.89	28.53	82.78
2015-16	306.35	91.07	37.82	42.53	24.67	88.21
2016-17	296.14	89.64	37.14	37.57	28.63	84.14
2017-18	298.94	92.94	35.47	34.39	31.58	85.96
2018-19	314.18	92.11	36.9	35.79	29.57	90.28
2019-20	336.95	101	42.25	44.03	27.87	98.57
2020-21	350.43	119.11	51.63	44.89	34.25	118.11
2021-22	341.8	92.72	50.7	56.81	24.56	114.79
2022-23	357.25	104.18	50.42	50.17	16.32	100.74
2023-24	357.8	108.12	53.94	45.44	16.45	110.73
Apr-Jan '23-24	317.5	101.47	49.1	42.37	13.96	100.12
Apr-Jan '24-25	345.73	87.13	65	45.12	18.76	128.38

*fig. in (lakh tonnes) *Includes 20:20:0:13; @Includes 20:20:0:0*
Source: The Fertiliser Association of India.

Status of Urea, DAP, and Potash in India:

1. **Urea:**
   - Production Capacity: India produces 31.4 million tonnes (MT) of Urea (2023-24), up from 22 MT in 2011-12.
   - Import Dependency: Imports have declined from 9.8 MT (2020-21) to 7 MT (2023-24) due to increased domestic production.
   - Economic Survey 2023-24 highlights that energy-efficient urea plants have improved productivity.
2. **DAP:**
   - Import Dependence: India imports both finished DAP and raw materials from Saudi Arabia, Morocco, Jordan, and China.
   - High Cost: The import cost of DAP is $636 (55,150) per tonne, while production costs exceed 65,000 per tonne.
   - Subsidy Burden: Government caps DAP price at 27,000 per tonne, but the subsidy needed to cover costs is high.
3. **Muriate of Potash (MOP):**
   - 100% Imported: India lacks mineable potash reserves, relying on Canada, Russia, and Jordan for supply.
   - Import Costs: Rising global potash prices have inflated import bills, increasing the need for alternatives.

Consequences of Urea, DAP, and Potash Overuse:

Economic Impact:

- Rising Import Bill: Fertilizer imports put a heavy burden on foreign exchange reserves, with 1.75 lakh crore spent on fertilizer subsidies (2023-24).
- Subsidy Drain: The government spends 1,500 per bag of Urea, making it unsustainably cheap for farmers.
- Price Volatility: India is vulnerable to international fertilizer price fluctuations, affecting affordability.

Environmental Impact:

- Soil Degradation: Overuse of Urea and DAP lowers organic carbon content, reducing soil fertility.
- Groundwater Contamination: Excess nitrogen from Urea leaches into water bodies, leading to nitrate pollution.
- Crop Imbalance: Continuous use affects microbial diversity, leading to low productivity over time.

Governance Challenges:

- Subsidy Burden: Rising fiscal costs make it difficult for the government to sustain high subsidies.
- Policy Gaps: The absence of strict regulations on nutrient application causes imbalanced soil nutrition.
- Black Marketing: Cheap subsidized fertilizers are diverted to non-agricultural use, increasing shortages.

Potential Substitutes for Urea, DAP, and MOP:

1. **Ammonium Phosphate Sulphate (APS – 20:20:0:13):**
   - Better Alternative: Provides nitrogen (N), phosphorus (P), and sulphur (S), unlike DAP, which lacks sulphur.
   - Reduces Dependence: Requires less phosphoric acid, cutting import costs
   - Market Growth: APS sales rose by 32.4%, replacing DAP in several regions.
2. **Nano Urea & Nano DAP:**
   - Increases Nutrient Efficiency: More effective nutrient absorption than traditional Urea.
   - Cost-Effective: Requires lower application rates, reducing fertilizer consumption.
   - Trials & Adoption: Indian Farmers Fertiliser Cooperative (IFFCO) introduced Nano Urea, showing 15-20% yield improvement.
3. **Single Super Phosphate (SSP – 16% P, 11% S):**
   - Sulphur-Rich Alternative: Helps in oilseed, pulse, and vegetable production.
   - Low Cost: More affordable than DAP, boosting adoption among small farmers.
4. **Biofertilizers & Organic Manure:**

- Reduces Chemical Usage: Improves soil health without harming the environment.
- Government Promotion: PM-PRANAM scheme promotes alternative fertilizers.

5. **NPKS Complex Fertilizers (10:26:26:0, 12:32:16:0):**

- Balanced Nutrient Composition: Meets crop-specific needs while reducing MOP & DAP dependence.
- Market Growth: Sales of NPKS fertilizers increased to 14 MT in 2024-25 from 7.3 MT in 2013-14.

Effectiveness of Substitutes:

- Reduces Import Costs: Substitutes like APS and Nano Urea cut foreign exchange outflows.
- Improves Soil Health: Balanced fertilizers prevent soil degradation and enhance productivity.
- Promotes Sustainability: Organic and biofertilizers improve ecological balance.
- Enhances Crop Yield: Trials show better absorption rates, improving efficiency.
- Government Policy Support: Initiatives like PM-PRANAM and Nutrient-Based Subsidy (NBS) promote alternatives.

Way Ahead:

- Balanced Fertilization Awareness: Conduct soil health campaigns to educate farmers on nutrient efficiency.
- Subsidy Reforms: Shift subsidy focus to APS, Nano Urea, and complex fertilizers instead of DAP/Urea.
- Technology-Driven Agriculture: Encourage AI-based fertilizer application using Microsoft FarmVibes AI.
- Strengthening Domestic Production: Invest in indigenous fertilizer R&D and biofertilizer manufacturing.
- Policy Integration: Align fertilizer policy with agriculture and climate policies to achieve long-term sustainability.

Conclusion:

India's dependence on imported Urea, DAP, and Potash is unsustainable, both economically and environmentally. Shifting towards balanced fertilizers like APS, Nano Urea, and organic alternatives is critical for long-term agricultural sustainability. Government initiatives, policy support, and farmer awareness will play a crucial role in this transition.

Project Farm Vibes

Context:

Microsoft CEO Satya Nadella highlighted Project Farm Vibes in Baramati, showcasing how AI-driven solutions improved crop yield by 40% and reduced fertilizer use by 25%.

- The Agricultural Development Trust, Baramati, in collaboration with Microsoft, is expanding this AI-driven experiment from 1,000 farmers to 50,000 farmers.

About Project Farm Vibes:

What is Project Farm Vibes?

- A suite of AI-driven agricultural technologies developed by Microsoft Research to enhance farming efficiency, sustainability, and productivity.
- Uses satellite data, IoT sensors, drones, and AI algorithms to generate actionable insights for farmers.
- Organizations Associated: Microsoft Research & Azure AI Team, Agricultural Development Trust, Baramati, Oxford University AI Researchers
- How AI Transformed Agriculture in Baramati:
- Sensor Fusion Technology: Integrated real-time data from drones, satellites, and soil sensors to optimize farm operations.
- AI-Powered Insights:AI analyzed soil moisture, temperature, pH levels, and humidity, offering data-driven recommendations.
- Vernacular AI Assistance: Farmers accessed AI-generated advice in their local language, making technology more accessible and user-friendly.

- Precision Farming: Spot fertilization techniques reduced chemical use by 25%, improving soil health and sustainability.
- Climate-Responsive Farming: AI monitored weather patterns and field conditions, enabling better water management and crop scheduling.

Impact on Agriculture:

- 40% Increase in Crop Yield: AI-driven insights led to better farming practices and higher productivity.
- 25% Reduction in Fertilizer Costs: Precision farming minimized chemical overuse, improving cost-effectiveness.
- 50% Water Conservation: AI-enhanced irrigation strategies optimized water usage, making farming more sustainable.
- Shorter Crop Cycle: Sugarcane harvest time reduced from 18 to 12 months, increasing profitability for farmers.
- 12% Reduction in Post-Harvest Losses: AI applications streamlined logistics and storage, cutting wastage.

National Assessment and Accreditation Council (NAAC)

Context:

The National Assessment and Accreditation Council (NAAC) removed 900 peer reviewers following corruption allegations linked to bribery in accreditation grading.

About National Assessment and Accreditation Council (NAAC):

What is NAAC?

- NAAC is an autonomous body under the University Grants Commission (UGC) responsible for assessing and accrediting higher education institutions (HEIs) in India.
- Established In: Founded in 1994, following recommendations from the National Policy on Education (1986) and Programme of Action (1992).

History & Evolution:

- Created to address the deterioration in higher education quality in India.
- Initially focused on voluntary accreditation, but later made mandatory for funding and recognition.

Headquarters: Bengaluru, Karnataka

Aims of NAAC:

- Enhance Education Quality: Evaluate and ensure standards in higher education institutions.
- Promote Institutional Accountability: Encourage self-evaluation and transparency in HEIs.
- Facilitate Accreditation & Ranking: Provide grading based on performance for academic institutions.
- Encourage Research & Innovation: Support institutions to improve academic and research excellence.
- Strengthen Higher Education Policy: Assist the UGC and Government in policy formulation.

Functions & Powers of NAAC:

- Institutional Accreditation: Assesses colleges, universities, and deemed-to-be universities.
- Eight-Grade CGPA Grading System: Institutions are ranked from A++ to D, with D being unaccredited.
- Periodic Review & Compliance: Monitors institutions and ensures quality control measures.
- Online & Hybrid Evaluation Model: Implements virtual assessments for transparency.
- Fraud Prevention & Integrity Measures: Prevents corruption, bias, and bribery in grading.

Live-in Relationship

Context:

The Nainital High Court recently ruled on the mandatory registration of live-in relationships under the UCC, questioning the infringement of privacy in consensual cohabitation.

What is a Live-In Relationship?

- A live-in relationship is an arrangement where two adults cohabit and share their lives together without formalizing their bond through marriage.
- It is based on the concept of "Mitru Sambhandh," where partners maintain a marital-like relationship without legal marital ties.

Issues Regarding Live-In Relationships:

Privacy vs. Regulation:

- The central issue is whether mandating the registration of live-in relationships infringes on individual privacy.
- Critics argue that compulsory registration amounts to undue state interference in personal matters, while proponents claim it provides necessary legal protections.

Cultural and Social Norms:

- Deep-rooted societal beliefs about marriage and sanctity challenge the acceptance of cohabitation outside of marriage, leading to resistance and controversy.

Various Judgements on Live-In Relationships:

- Badri Prasad v. Dy. Director of Consolidation (1978): Held that prolonged cohabitation creates a strong presumption of marriage, placing the onus on disproving its legitimacy.
- Lata Singh v. State of U.P. (2006): Emphasized the right of an inter-caste couple to cohabit without harassment, underlining societal acceptance.
- S. Khushboo v. Kanniammal (2010): Confirmed that live-in relationships between consenting adults are not illegal.
- Shafin Jahan v. Asokan K.M. (2018): Reinforced the right to autonomy in choosing one's partner, irrespective of marital status.
- Kiran Rawat v. State of U.P. (2023): Highlighted challenges under Islamic law, questioning how live-in relationships are perceived in inter-religious contexts.

Arguments Supporting Live-In Relationships:

- Protection of Individual Autonomy: Upholds the right to personal choice and freedom in matters of intimacy and partnership.
- Legal Safeguards: When registered, live-in relationships can provide rights related to property, maintenance, and inheritance similar to those in marriage.
- Social Modernity: Recognizes evolving societal norms where marriage is not the only acceptable form of partnership.
- Reduction of Stigma: Registration can help destigmatize non-marital cohabitation and offer legal recognition.
- Inclusive Policies: Can serve as a protective mechanism for couples, especially in cases of domestic abuse, by ensuring access to legal recourse.

Arguments Against Live-In Relationships:

- Cultural Opposition: Traditional views hold marriage as a sacred institution, making non-marital cohabitation socially controversial.
- Privacy Concerns: Mandatory registration may be seen as state intrusion into private life, undermining personal freedoms.

- Potential for Exploitation: Critics worry that without the formalities of marriage, individuals may face challenges in legal protection and social security.
- Ambiguity in Definition: Difficulty in defining and distinguishing live-in relationships from other forms of cohabitation can lead to legal and administrative complications.
- Moral and Ethical Debates: Some argue that the lack of a formal commitment undermines the institution of marriage and traditional family values.

Way Ahead:

- Policy Reforms: Re-examine the registration requirements under the UCC to ensure they protect rights without compromising privacy.
- Awareness Campaigns: Educate the public on the legal rights and responsibilities in live-in relationships to reduce stigma.
- Legal Clarity: Formulate clear legal definitions and safeguards that extend to all consenting couples, regardless of marital status.
- Judicial Oversight: Encourage judicial review of the registration process to balance state interests and individual freedoms.
- Inclusive Legislation: Engage with diverse stakeholders to draft policies that respect both cultural values and modern social realities.

Conclusion:

The debate over live-in relationships reflects the evolving social fabric of India, balancing privacy with legal regulation. Judicial precedents have increasingly recognized the legitimacy of consensual cohabitation, yet societal resistance remains. A thoughtful, inclusive legal framework can protect individual rights while addressing cultural sensitivities, ensuring equitable treatment for all.

Code of Ethics on OTT Platform

Context:

The government has issued an advisory mandating OTT platforms to adhere to a strict Code of Ethics under IT Rules, 2021 to curb the spread of obscene and vulgar content.

- This measure follows recent controversies, such as the 'India's Got Latent' row involving Ranveer Allahbadia, highlighting the need for stricter online content regulation.

What is the Code of Ethics for OTT Platforms?

- A set of self-regulatory guidelines aimed at ensuring responsible content dissemination on digital platforms.
- It mandates age-based content classification, access control for 'A' rated content, and adherence to applicable laws to prevent the transmission of prohibited material.

Relevant Laws in India:

Indian Laws:

- IT Rules, 2021: Prescribes obligations for online publishers, including content classification and self-regulation under a Code of Ethics.
- Information Technology Act, 2000: Governs the transmission of digital content and prescribes penalties for prohibited content.
- Guidelines from the Ministry of Information and Broadcasting: Enforce standards for acceptable content on OTT platforms.

Best Practices Worldwide:

- Ofcom Guidelines (UK): Emphasize content classification, age restrictions, and proactive monitoring to protect minors.
- European Audiovisual Observatory's Framework: Advocates for transparency, self-regulation, and regular audits of content to maintain high ethical standards.

Need for a Code of Ethics in OTT:

- Protecting Minors: Ensures that children are shielded from harmful, explicit, or inappropriate content.
- Maintaining Public Decency: Upholds societal standards by preventing the spread of obscene and pornographic material.
- Enhancing Trust: Builds consumer confidence in digital platforms by fostering transparency and accountability in content curation.

Challenges to Effective Implementation:

- Enforcement Gaps: Despite clear regulations, inconsistent enforcement and lack of uniform standards across platforms hinder compliance.
- Ambiguous Definitions: Vague terminologies in the rules can lead to varied interpretations, making it difficult to uniformly apply the Code of Ethics.
- Rapid Content Evolution: The fast-paced nature of digital content creation often outstrips regulatory updates, complicating oversight.
- Resistance from Platforms: Some OTT services may view strict regulation as an impediment to creative freedom and business growth.
- Technological Limitations: Inadequate age verification and content filtering mechanisms can make it challenging to enforce guidelines effectively.

Way Ahead:

- Strengthening Oversight: Establish independent regulatory bodies for continuous monitoring and transparent reporting of content standards.
- Enhanced Collaboration: Foster stronger partnerships between the government, industry stakeholders, and international bodies to share best practices and update guidelines.
- Regular Audits and Reviews: Implement periodic audits of OTT platforms to ensure adherence to ethical guidelines and revise regulations in line with technological advancements.
- Public Awareness Campaigns: Educate consumers about content ratings and their rights, thereby promoting informed viewing habits.
- Incentivize Compliance: Introduce incentives for platforms that consistently meet high ethical standards, such as certification or public endorsements.

Conclusion:

With controversies like the Ranveer Allahbadia remark row, enforcing a robust Code of Ethics is essential to safeguard minors and uphold societal values. A balanced approach combining strict oversight with industry self-regulation will pave the way for a safer, more responsible digital ecosystem.

Article 101(4)

About:

Amritpal Singh, an Independent MP, moved the Punjab & Haryana HC over concerns of losing his Lok Sabha seat due to prolonged absence.

- As per Article 101(4) of the Constitution, an MP's seat can be vacated if absent for 60 consecutive sittings without permission.

About Article 101(4):

What is Article 101(4)?

- States that an MP's seat may be declared vacant if absent for 60 consecutive sittings without permission.
- The House must formally declare the seat vacant; it is not an automatic process.

Constitutional Provisions & Governing Law:

- Article 101 of the Indian Constitution deals with vacation of seats, disqualifications, and dual membership.
- Rules of Procedure and Conduct of Business in Parliament regulate MP attendance.
- Committee on Members' Absence reviews requests and recommends action.

Procedure for Seeking Leave:

- MPs must write to the Committee on Members' Absence requesting permission.
- The committee evaluates reasons (illness, detention, emergencies) and sends a report to the House.
- The House votes to approve or reject the request based on the report.

Limitations on Leave Approval:

- The committee grants leave for a maximum of 59 days at a time.
- If an MP needs additional leave, they must submit a fresh request.

Power to Expel MPs for Absence:

- If an MP fails to seek permission or is denied leave, the House may declare the seat vacant.
- The decision must be approved by a majority vote in the House.

Ragging Complaints Surge

Context:

The University Grants Commission (UGC) Chairman, emphasized that weak enforcement of anti-ragging regulations enables perpetrators to escape accountability.

- Reports indicate a 208% surge in ragging complaints from 2012 to 2022, highlighting persistent regulatory gaps.

What is Ragging?

Definition & Features:

Ragging refers to any act of abuse physical, mental, or psychological by senior students towards juniors in educational institutions. It aims to assert dominance, instill fear, or humiliate the victim, often disguised as an "initiation ritual."

- Forms of Ragging: Can be verbal (abuse, threats), physical (assault, forced activities), psychological (isolation, humiliation), or cyber-based (online harassment, social media bullying).
- Legal Recognition: Defined under UGC Regulations on Curbing the Menace of Ragging, 2009, and penalized under Sections 323, 506, 509 IPC, and IT Act, 2000 (for cyberbullying).

Consequences of Ragging:

1. **Impact on Victims:**
   - Psychological trauma: Leads to depression, anxiety, PTSD, and suicidal tendencies.
   - Academic decline: Fear of harassment causes loss of focus and absenteeism.
   - Health deterioration: Stress can trigger insomnia, eating disorders, and substance abuse.
2. **Consequences for Raggers:**
   - Legal prosecution: Punishable under Indian Penal Code (IPC) Sections 323, 506, 509.
   - Academic penalties: Includes suspension, expulsion, and blacklisting from institutions.
   - Criminal record: Can jeopardize career opportunities and future education.
3. **Impact on Institutions:**
   - Loss of reputation: Recurring ragging incidents harm an institution's public image and rankings.
   - UGC action: Institutions failing to prevent ragging risk funding cuts and de-recognition (UGC Clause 9.4).
4. **Impact on Parents & Society:**
   - Emotional distress: Parents face mental agony and financial burden due to legal battles and medical costs.
   - Erosion of trust: Society loses faith in educational institutions as safe spaces for students.

Challenges in Countering Ragging:

- Poor Implementation of Laws: UGC Clause 9.4 allows action against institutions, but enforcement remains weak. Many colleges fail to display anti-ragging helpline details, limiting awareness.
- Lack of Awareness & Reporting Fear: Students fear retaliation and hesitate to report cases due to institutional inaction. Many victims accept ragging as a tradition, preventing timely intervention.
- Inadequate Monitoring Mechanisms: Weak CCTV surveillance and lack of digital complaint tracking hinder accountability. Helpline inefficiencies lead to several cases going unreported.

- Influence of Senior Students & Peer Pressure: Ragging is often culturally normalized among seniors, making it hard to eliminate. Many institutions hesitate to act due to political and administrative pressure.

Way Ahead:

- Strengthening Legal & Institutional Framework: UGC should invoke Clause 9.4 against non-compliant institutions. Police verification and fast-track trials must ensure strict punishment for offenders.
- Technology-Driven Monitoring: AI-based facial recognition CCTVs should be installed in hostels. A digital ID-based tracking system must be implemented for victim safety.
- Awareness & Behavioral Change: Mandatory anti-ragging workshops and psychological counselling should be introduced. Student mentorship programs should create a culture of inclusivity.
- Strengthening Reporting Mechanisms: The UGC helpline must improve accessibility and response time. Anonymous digital complaint portals with direct police alerts should be established.

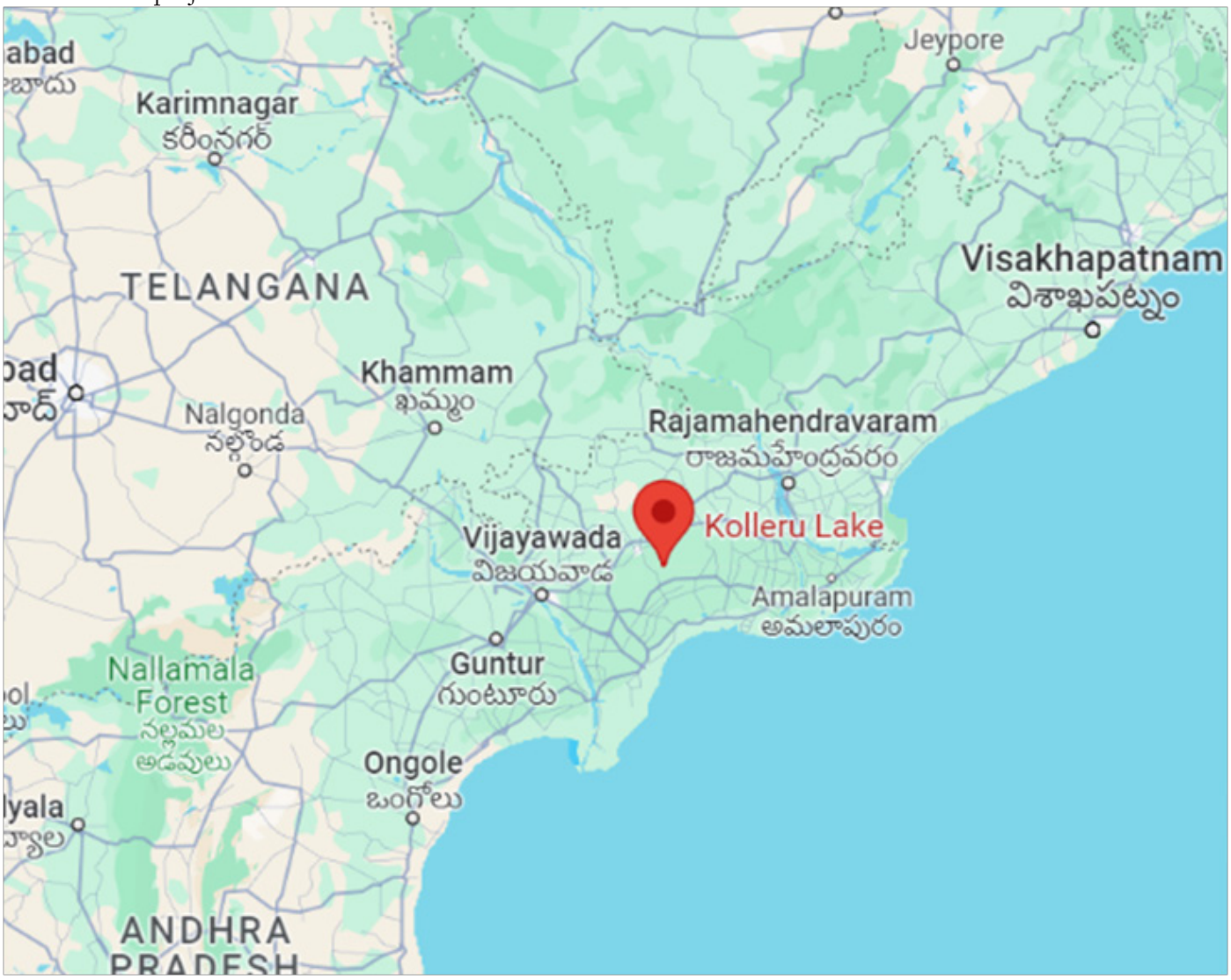
Conclusion:

Ragging continues to plague India's higher education system despite strong laws and Supreme Court guidelines. A multi-pronged approach, involving legal action, institutional reforms, technology integration, and cultural change, is essential. Ensuring strict enforcement and fostering student-led initiatives can help create a ragging-free academic environment.

Kolleru Lake

Context:

The National Green Tribunal (NGT) has restrained the Andhra Pradesh government from proceeding with six infrastructure projects in the Kolleru wetland area.



About Kolleru Lake:

- Location: Andhra Pradesh, between the Krishna and Godavari River deltas.
- States: Andhra Pradesh.
- Rivers: Fed by the Budameru and Tammileru rivers.

Features:

- One of India's largest freshwater lakes.
- Declared a Ramsar site in 2002 for its ecological importance.
- A key hotspot for the Central Asian Flyway, a major bird migratory route.
- Supports diverse aquatic and bird species, making it a critical wetland ecosystem.

About Kolleru Bird Sanctuary:

- Located in: Andhra Pradesh, within the Kolleru Lake region.

Features:

- Home to the Grey Pelican, an indicator species of the sanctuary.
- Wetland marsh habitat supporting migratory birds like Glossy Ibis, Open-billed Stork, Purple Moorhen, and Painted Storks.
- Declared a wildlife sanctuary to protect its rich biodiversity and aquatic habitats.

Kara Sea

Context:

A Russian nuclear-powered icebreaker, 50 Let Pobedy, collided with a cargo vessel in the Kara Sea, raising concerns about Arctic navigation safety.

About Kara Sea:

- Located in: A marginal sea of the Arctic Ocean, north of Siberia, Russia.
- Nations Bordering: Russia (exclusively).
- Rivers Draining Into: Kara, Ob, Pyasina, and Yenisei rivers.

Unique Features:

- One of the world's coldest seas, ice-covered from September to May.
- Home to significant islands like Bely, Dikson, and Taymyr, and the Nordenskiold Archipelago (90+ islands).
- Strategically important for the Northern Sea Route (NSR), crucial for Arctic shipping.

Straits in the Sea:

- Kara Strait: Separates the Kara Sea from the Barents Sea in the west.
- Vilkitsky Strait: Connects the Kara Sea to the Laptev Sea in the east.

Glacier Meltdown

Context:

A recent study revealed that 110 glaciers in Arunachal Pradesh's eastern Himalayas have disappeared over 32 years (1988-2020), with glacial cover shrinking by 309.85 sq. km.

About Glacier Meltdown:

What is Glacier Meltdown?

- Glacial retreat occurs when glaciers melt faster than the accumulation of new ice and snow, leading to reduced ice cover and formation of glacial lakes.
- It is a key indicator of global climate change, affecting water resources, ecosystems, and disaster risks.

Reasons Behind Glacier Meltdown

- Rising Global Temperatures: The eastern Himalayas are warming faster than the global average (0.1°–0.8°C per decade).
- Increased Carbon Emissions: Accelerates atmospheric heating, leading to faster ice melting.
- Changing Precipitation Patterns: More rainfall instead of snowfall, disrupting glacial accumulation.
- Anthropogenic Activities: Deforestation, infrastructure projects, and tourism add to local warming.
- Black Carbon Deposits: From burning fossil fuels, reduces glacier reflectivity, increasing heat absorption.

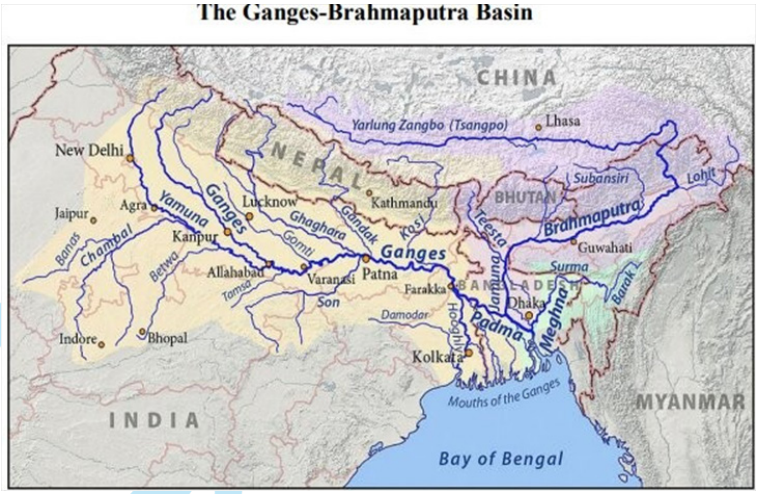
Impacts of Glacier Meltdown

- Glacial Lake Outburst Floods (GLOFs): Rising water levels in glacial lakes increase the risk of catastrophic floods.
- Disruption of River Systems: Himalayan rivers, such as Teesta and Brahmaputra, face irregular flow patterns, affecting agriculture and hydroelectric projects.
- Threat to Biodiversity & Ecosystems: Shrinking glaciers impact flora, fauna, and water-dependent species.
- Water Scarcity & Food Security: Reduced glacier-fed water availability affects irrigation and drinking water supply.

Teesta River

Context:

The Environment Appraisal Committee (EAC) has approved the reconstruction of the Teesta-3 dam in Sikkim, despite concerns over environmental safety and disaster risks.



About Teesta River:

Origin:

- The Teesta River originates from Tso Lhamo Lake in the Himalayas, near the Pahurni and Khangse glaciers in Sikkim.
- States it passes through: Sikkim and West Bengal.

Tributaries:

- Left-bank Tributaries: Lachung Chhu, Chakung Chhu, Dik Chhu, Rani Khola, Rangpo Chhu.
- Right-bank Tributaries: Zemu Chhu, Rangyong Chhu, Rangit River.

End Point:

- The river merges with the Brahmaputra (Jamuna) in Bangladesh.

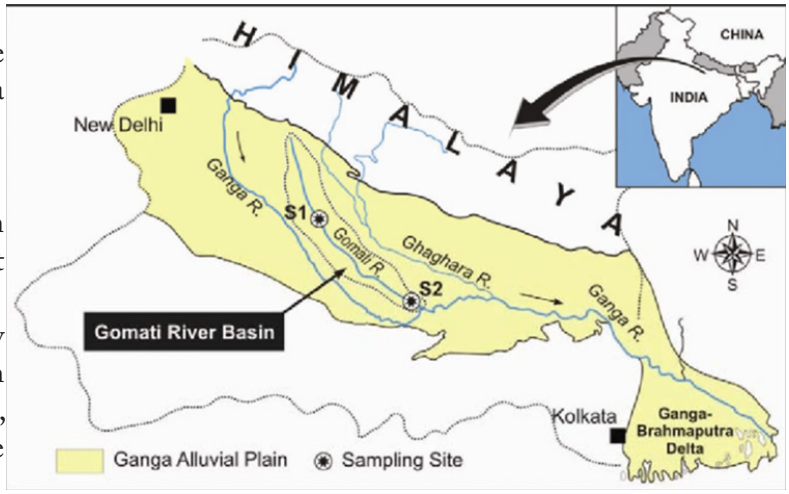
Unique Features

- Vital for Agriculture & Hydropower: Teesta's waters are crucial for irrigation and hydroelectric projects in India and Bangladesh.
- Glacial Lake Outburst Flood (GLOF) Risks: The river is vulnerable to flash floods from glacial lakes, as seen in the 2023 Sikkim disaster.
- Disputed Water Sharing: India and Bangladesh have long debated the Teesta water-sharing treaty, affecting bilateral relations.

Gomti River

Context:

Lucknow is set to launch cruise services on the Gomti River, enhancing tourism and offering a scenic view of the city's skyline.



About Gomti River:

- Origin: The Gomti River originates from Gomat Taal (Fulhaar Jheel) in Pilibhit district, Uttar Pradesh.
- States Flowing Through: It flows entirely within Uttar Pradesh, passing through Lucknow, Barabanki, Sultanpur, Faizabad, and Jaunpur before merging with the Ganga River.

- Tributaries: Major tributaries include the Sai River, Kathina River, Chowka River, and Saryu River.
- Significant Cities Along Its Course: Lucknow (state capital), Jaunpur, Sultanpur, and Barabanki are key urban centers along the river.
- Tributary of: The Gomti is a right-bank tributary of the Ganges (Ganga) River.
- Hydrological Characteristics: It is a perennial river with a sluggish flow, except during the monsoon season, when heavy rainfall leads to increased runoff.
- Environmental Concerns: The river suffers from pollution due to urban waste and industrial discharge, particularly in Lucknow and Jaunpur.

Cook Islands

Context:

New Zealand has raised "significant concern" over the Cook Islands' plan to sign a strategic partnership deal with China, citing a lack of prior consultation.

About Cook Islands:

- Region: The Cook Islands are in Polynesia in the South Pacific Ocean. They have 15 islands spread over a large area.
- Terrain: The islands are a mix of volcanic islands and coral atolls, with lush landscapes, lagoons, and coral reefs.
- Capital: Avarua, situated on Rarotonga Island, serves as the political and economic hub of the Cook Islands.
- Highest Point: Te Manga (652m) is the tallest peak, located on Rarotonga, featuring steep volcanic slopes and dense vegetation.

Relationship with New Zealand:

- Political Status: The Cook Islands is a self-governing territory. It is in free association with New Zealand. This means it governs itself but keeps strong ties with Wellington.
- Citizenship: All Cook Islanders hold New Zealand citizenship, allowing them to live, work, and travel freely in New Zealand.
- Support from New Zealand: New Zealand gives financial aid, defense help, and manages foreign affairs for the Cook Islands. This strengthens their long-standing partnership.

Baltic Sea

Context:

Security analysts warn of a high risk of an oil spill in the Baltic Sea due to Russia's "shadow fleet" of old and technically deficient oil tankers operating without Western insurance.

About the Baltic Sea:

Location & Geography:

- The Baltic Sea is a semi-enclosed inland sea in Northern Europe, forming an arm of the North Atlantic Ocean.
- It separates the Scandinavian Peninsula from continental Europe.
- Connected to the Atlantic Ocean through the

Danish Straits.

- Neighboring Countries: Denmark, Germany, Poland, Lithuania, Latvia, Estonia, Russia, Finland, and Sweden.

Major Rivers Flowing into the Baltic Sea:

- Over 250 rivers drain into the Baltic Sea.
- The Neva River (Russia) is the largest among them.
- Key Gulfs: Gulf of Bothnia, Gulf of Finland, Gulf of Riga

Key Features & Environmental Concerns:

- Covers an area of 377,000 sq. km, with a length of 1,600 km and a width of 193 km.
- Shallow & Brackish Waters: Salinity is lower than in the world's oceans due to freshwater inflow.

Connected to:

- White Sea (via White Sea Canal)
- North Sea's German Bight (via Kiel Canal)
- Largest Island: Gotland (Sweden).

Hawaii's Kilauea Volcano

Context:

Hawaii's Kilauea volcano erupted again, sending lava over 300 feet high into the air, marking its ninth eruption episode since December 2024.

About Kilauea Volcano:

Location of Kilauea Volcano:

- Situated on the southeastern shore of Hawaii's Big Island, approximately 200 miles southeast of Honolulu.
- Part of the Hawaiian–Emperor seamount chain, formed by the Hawaiian hotspot.

Features of Kilauea Volcano

- Type: Shield volcano, known for effusive lava flows rather than explosive eruptions.
- Age: Estimated to be 210,000 to 280,000 years old, emerging above sea level around 100,000 years ago.

Structure:

- Large caldera (Halema uma u Crater) at its summit.
- Other Major Volcanoes in the Hawaiian Region:

Mauna Loa:

- Largest active volcano on Earth by volume.
- Shares magma plumbing system with Kilauea.
- Last erupted in November 2022 after a 38-year dormancy.

Mauna Kea:

- Tallest mountain (from base to peak) in the world at 33,500 feet (10,210 m).
- Considered dormant, with its last eruption around 4,500 years ago.

Hualālai:

- Third most active volcano on Hawaiian Big Island.
- Last erupted in 1801, with future eruptions predicted.

Lo'ihi Seamount:

- Underwater volcano southeast of Big Island, emerging as the next Hawaiian island in the coming millennia.

New Ramsar Sites

Context:

India has added four new Ramsar sites, taking the total to 89. Tamil Nadu leads with 20 wetlands, while Sikkim and Jharkhand added their first Ramsar sites, marking a significant step in wetland conservation.

About New Ramsar Site:

Site Name	State	Features
Therthangal Bird Sanctuary	Tamil Nadu	ü Established on December 15, 2010, to conserve avian species and wetland habitats. ü Covers 29.29 hectares, home to diverse flora like Aponogeton nutans, Hydrilla verticillata, and Tamarindus indica. ü Popular among birdwatchers during the migratory season (October to March).

Sakkarakottai Bird Sanctuary	Tamil Nadu	ü Established on April 17, 2012, to protect avifauna and wetland ecosystems. ü Spreads over 230.490 hectares, hosting flora like Neem, Palmyra Palm, and Gloriosa superba. ü Home to diverse fauna, including Lion-tailed Macaque, Giant Squirrel, and migratory birds.
Khecheopalri Wetland	Sikkim	Sacred for both Buddhists and Hindus, believed to be a wish-fulfilling lake. ü Local name: Sho Dzo Sho ('Oh Lady, Sit Here'). ü Part of the revered Demazong valley and Buddhist pilgrimage circuit. ü Unique feature: Birds prevent leaves from floating on the lake by picking them up. ü Home to diverse bird species like house swifts, fishing eagles, and Brahminy kites. ü Integral to ecotourism and biodiversity conservation efforts in Sikkim.
Udhwa Lake	Jharkhand	ü Comprises two large water bodies: Pataura Jheel (155 ha) and Brahma Jamalpur Jheel (410 ha). ü Notified as a bird sanctuary in 1991 due to its rich avian biodiversity. ü Attracts migratory birds during winter, starting as early as September. ü Located near the sacred Ganga River stream, enhancing its scenic beauty and ecological significance. ü Provides an ideal habitat for nesting, roosting, and survival of resident and migratory birds.

Ethanol Production India

Context:

Union Minister of Road Transport & Highways said that India will achieve its target of 20% ethanol blending of petrol in the next two months, at least a year ahead of what was originally planned.

- The government has expanded ethanol production capacity to 1,600 crore litres, with maize emerging as a crucial feedstock.

Ethanol Fuel Production

What is Ethanol Fuel?

- Ethanol is a renewable biofuel derived from sugarcane, grains, and other biomass.
- It is blended with petrol to reduce crude oil dependency, lower emissions, and promote energy security.

How is Ethanol Produced?

1. Fermentation: Sugars from sugarcane juice, molasses, grains (maize, rice, jowar, bajra, millets) are fermented using yeast.
2. Distillation: Ethanol is separated from the fermented mixture and purified.
3. Dehydration: Water is removed to produce anhydrous ethanol for blending with petrol.
4. Blending: Mixed with petrol at 5%, 10%, or 20% (E5, E10, E20) ratios.

Current Status of Ethanol Production in India:

- Ethanol blending reached 15% in 2024, targeting 20% (E20) by 2025.
- Ethanol distillery capacity expanded to 1,600 crore litres, aiming for 1,700 crore litres by 2025.
- Sugar-based ethanol contributes 400 crore litres, grain-based ethanol (maize, rice) contributes 700 crore litres.

Challenges in Ethanol Production:

- Feedstock Availability: Dependence on sugarcane and grains risks affecting food security.
- Water-Intensive Crops: Sugarcane and rice require high water usage, raising sustainability concerns.
- Infrastructure Gaps: Limited ethanol storage and blending infrastructure in many states.
- Logistics & Transportation: Interstate ethanol movement faces regulatory hurdles.
- Economic Viability: High production costs and fluctuating raw material prices impact profitability.

Role of Maize in Ethanol Production:

- Maize contributes nearly 400 crore litres of ethanol, a significant increase from near-zero in 2020.
- Maize-based ethanol is more sustainable than sugarcane due to lower water consumption.
- Government promoting maize cultivation, leading to a 10% increase in maize farming area.
- Distiller's Dried Grains with Soluble (DDGS), a byproduct of maize ethanol, is used as poultry feed, balancing food security.

Way Ahead for Ethanol Production:

- Diversifying Feedstock: Increase use of damaged grains, agricultural waste, and lignocellulosic biomass.
- Infrastructure Development: Expand ethanol blending depots and storage across India.
- R&D in Advanced Biofuels: Invest in 2G and 3G biofuels for sustainable ethanol production.
- Policy Reforms: Streamline state-level ethanol movement and ensure stable pricing.
- Farmer Incentives: Promote crop diversification and support for ethanol-producing farmers.

Conclusion:

India's ethanol push is a major step towards energy security, reduced oil imports, and sustainable fuel use. However, challenges related to feedstock availability, infrastructure, and economic feasibility need strategic policy interventions. A balanced approach with maize, sugarcane, and advanced biofuels will ensure a resilient ethanol economy.

Extra-Long Staple (ELS) Cotton

Context:

Union Finance Minister announced a five-year mission to boost the productivity and sustainability of Extra-Long Staple (ELS) cotton farming in India during the Union Budget 2025-26.

About Extra-Long Staple (ELS) Cotton:

What is ELS Cotton?

- ELS cotton refers to cotton varieties with fibre lengths of 30 mm and above, known for their superior quality, softness, and durability.
- Primarily derived from the Gossypium barbadense species, also known as Egyptian or Pima cotton.

Features:

- Longer Fibres: Fibre length exceeds 30 mm, making it ideal for premium textiles.

- High Quality: Produces finer, stronger, and smoother yarns, used in luxury fabrics.
- Durability: Resistant to wear and tear, suitable for high-end clothing and home textiles.

Regions Grown In:

- Global: Mainly grown in Egypt, China, Australia, and Peru.
- India: Cultivated in Atpadi taluka (Maharashtra), Coimbatore (Tamil Nadu), and parts of Karnataka and Madhya Pradesh.

Difference Between Short, Medium, and Long Staple Cotton:

Parameter	Short Staple	Medium Staple	Long Staple (ELS)
Fibre Length	Below 25 mm	25-28.6 mm	30 mm and above
Species	Gossypium hirsutum	Gossypium hirsutum	Gossypium barbadense
Quality	Coarser, less durable	Moderate quality	Superior quality
Uses	Low-cost textiles	Everyday fabrics	Luxury textiles
Yield per Acre	High	Moderate	Low (7-8 quintals)

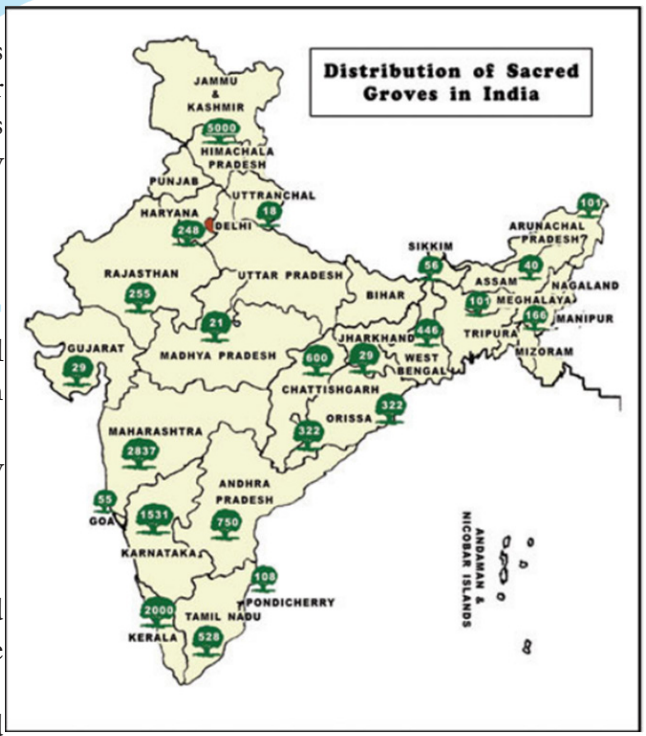
Issues with ELS Cotton in India:

- Low Yield: ELS cotton yields 7-8 quintals per acre, significantly lower than medium staple varieties (10-12 quintals).
- Lack of Market Linkages: Farmers struggle to secure premium prices for ELS cotton due to inadequate market access and infrastructure.
- Technological Gaps: Limited access to advanced seeds, agronomic practices, and pest-resistant technologies like HtBT cotton.
- Import Dependency: India imports 90% of its ELS cotton(20-25 lakh bales annually) to meet textile industry demands.

Sacred Grooves

Context:

The Supreme Court's December 18, 2024 ruling directs Rajasthan to map and classify sacred groves as forests under the Wildlife Protection Act (WLPA), 1972. This contradicts the Forest Rights Act (FRA), 2006, which upholds community ownership over forest lands instead of government control.



About Sacred Groves:

What are Sacred Groves?

- Community-protected Forest patches with cultural and ecological significance, conserved through traditional customs and religious beliefs.
- Found across India, these groves serve as biodiversity hotspots and water recharge zones.

The Supreme Court Case:

- T.N. Godavarman v. Union of India (1996) established that any land with forest characteristics should be considered forest land.
- Rajasthan's expert committee (2004) identified sacred groves as forests only if they met specific criteria (e.g., 5 hectares with 200+ trees per hectare).
- The SC's December 18 ruling overrides this, directing that all sacred groves be mapped, classified as forests, and declared as community reserves.

The Issue:

Conflict between WLPA and FRA:

- The FRA, 2006, recognizes community forest resources under gram sabhas, while the SC directive places them under government control.
- This could disrupt traditional conservation practices and weaken community rights over these forests.

Distribution of Sacred Groves in India

- Sacred groves exist across all states, with the highest concentration in:
- Western Ghats & Central Plateau: Kerala, Karnataka, Maharashtra, Chhattisgarh.
- Northeastern States: Meghalaya, Assam, Arunachal Pradesh.
- Tribal Belts: Odisha, Jharkhand, Madhya Pradesh.
- Estimated 100,000 to 150,000 sacred groves exist in India, making it the highest globally.

Significance of Sacred Groves:

- Biodiversity Conservation: Home to rare and endemic species, acting as genetic reservoirs.
- Water Conservation: Many groves are associated with springs, ponds, and rivers, ensuring aquifer recharge.
  E.g. Sarpa Kavu groves in Kerala are crucial for maintaining local water tables and streamflow.
- Soil Conservation & Climate Regulation: Dense vegetation prevents soil erosion and stabilizes ecosystems.
  E.g. Sarna forests in Jharkhand, conserved by tribal communities, prevent land degradation and desertification.
- Cultural & Religious Importance: Integral to local traditions, rituals, and spiritual beliefs across tribal and rural communities.
  E.g. Mawphlang sacred forest in Meghalaya is central to Khasi tribal rituals and remains untouched for centuries
- Disaster Mitigation: Helps prevent floods, landslides, and droughts, supporting climate resilience.

Challenges to Sacred Groves:

- Urbanization & Encroachment: Rapid development, land conversion, and infrastructure projects threaten sacred groves.
  E.g. Sacred groves in Gujarat's Dahod region are shrinking due to road expansion and real estate projects.
- Decline in Traditional Beliefs: Modernization and loss of indigenous knowledge weaken community-driven conservation.
- Sanskritization & Religious Conversion: Replacement of nature worship with temple-centric rituals affects grove preservation.
- Invasive Species: Exotic species like Lantana camara, Eupatorium odoratum, and Prosopis juliflora degrade native flora.
  E.g. Lantana invasion in Madhya Pradesh's sacred groves has displaced indigenous medicinal plants.
- Government Policies & Legal Conflicts: The WLPA's community reserve framework contradicts FRA's recognition of community forest rights, causing administrative conflicts.
  E.g. Tamil Nadu's temple-controlled groves face excessive regulation, restricting community involvement.

Way Forward:

- Recognition Under Forest Rights Act (FRA): Sacred groves must be recognized as community forest resources under gram sabhas.
- Inventorization & Mapping: Conduct a nationwide survey to document sacred groves and their ecological significance.
- Strengthen Community-Based Conservation: Empower local communities, elders, and tribal groups in grove management.
- Regulating Urban Expansion: Implement buffer zones to protect groves from infrastructure projects and deforestation.
- Reviving Indigenous Practices: Promote traditional ecological knowledge and involve youth in conservation initiatives.

Conclusion:

While the SC directive aims at conservation, it risks disrupting community rights and customs. A balanced approach that respects indigenous traditions while ensuring ecological protection is essential for the sustainable preservation of sacred groves.

Olive Ridley Sea Turtle

Context:

A surge in Olive Ridley Sea turtle deaths has been reported along the Chennai and Chengalpattu coasts of Tamil Nadu, with over 1,200 carcasses found in January 2025.

About Olive Ridley Sea Turtle:

Scientific Classification:

- Scientific Name: Lepidochelys olivacea
- IUCN Status: Vulnerable.

Physical & Biological Features:

- Smallest sea turtle species, weighing up to 45 kg, with a heart-shaped olive-green carapace.
- Omnivorous diet, feeding on crustaceans, algae, mollusks, and jellyfish.
- Unique arribada (mass nesting) behavior, with thousands nesting simultaneously on select beaches.
- The mating season of Olive Ridley turtles occurs between November and April, leading to mass nesting (arribada) on select beaches.

Habitat & Distribution:

- Found in tropical waters of the Pacific, Indian, and Atlantic Oceans.
- Nesting sites in India include Odisha (Gahirmatha, Devi, Rushikulya), Tamil Nadu, Andhra Pradesh, and Andaman & Nicobar Islands.

Recent Mortality Along Indian Coast:

- Tamil Nadu (Chennai, Chengalpattu): 1,200+ carcasses found, three times the annual average.
- Andhra Pradesh (Tirupati, Nellore, Visakhapatnam): Over 2,000 deaths reported in January 2025.

Reasons for Mass Deaths:

- Illegal bottom trawling & gill nets: Turtles drown after getting entangled in fishing gear.
- Lack of Turtle Excluder Devices (TEDs): Many trawl boats violate marine regulations.
- Plastic Pollution & Habitat Destruction: Polluted beaches and coastal infrastructure (groynes, seawalls) obstruct nesting.
- Climate Change & Rough Sea Conditions: Extended monsoons & strong currents disrupt turtle migration patterns.
- Poaching & Egg Harvesting: Though illegal, turtle eggs are still collected in some regions.

Gandhi Sagar Wildlife Sanctuary

Context:

Madhya Pradesh's Gandhi Sagar Wildlife Sanctuary is set to become India's second cheetah habitat, with six to eight cheetahs from South Africa expected to arrive before summer 2025.

About Gandhi Sagar Wildlife Sanctuary:

Location:

- Situated in northwestern Madhya Pradesh, along the Madhya Pradesh-Rajasthan border.
- Covers 368 sq. km and lies within the Khathiar-Gir

dry deciduous forest ecoregion.
- Divided into two parts by the Chambal River, forming a diverse habitat.

Habitat & Climate:

- Climate: Semi-arid, with hot summers and moderate winters.
- Vegetation: Northern tropical dry deciduous forests and scrublands, providing ideal open grasslands for cheetahs.
- Key Flora: Khair, Salai, Kardhai, Dhawda, Tendu, and Palash trees.

Fauna: Rich Biodiversity

- Herbivores (Prey for Cheetahs): Chinkara, Nilgai, Spotted Deer.
- Carnivores: Indian Leopard, Striped Hyena, Jackal (managed to prevent conflicts).

Unique Features of the Sanctuary:

- Designated as an Important Bird and Biodiversity Area (IBA).
- Prehistoric Rock Art & Human Settlement: The Chaturbhuj Nala rock shelters, protected by the Archaeological Survey of India (ASI), feature prehistoric cave paintings depicting early human life, including hunting scenes with spotted animals resembling cheetahs.
- Once a Cheetah Habitat: Oral traditions and local folklore suggest that cheetahs once roamed the region before their extinction in India in 1952.

Why is Gandhi Sagar Suitable for Cheetahs?

- Open savanna-like habitat, resembling African cheetah ecosystems.
- Prey base management: Spotted deer and Nilgai introduced to maintain sufficient food supply.
- Low predator density: Leopards population is actively controlled to reduce competition, ensuring cheetah survival.

First Cheetah Reintroduction Site in India:

- Kuno National Park, Madhya Pradesh: Hosted first cheetah translocation from Namibia (8) and South Africa (12) in 2022-2023.
- Gandhi Sagar Wildlife Sanctuary now selected as second cheetah habitat to expand the species' range and ensure long-term conservation.

Ramakrishna Beach (RK Beach)

Context:

The sand at Ramakrishna Beach (RK Beach) in Visakhapatnam has turned black, raising concerns over sewage pollution, as locals suspect contamination from drainage canals.

About Ramakrishna Beach (RK Beach):

Location & State:

- Situated in Visakhapatnam, Andhra Pradesh on the east coast of the Bay of Bengal.
- Located near Dolphin's Nose and INS Kursura Submarine Museum.

History & Uniqueness:

- Named after Ramakrishna Mission Ashram, located near the beach.
- Features sculptures and art installations depicting Buddhist heritage, fishermen, and cultural symbols.
- Maintained by Visakhapatnam Urban Development Authority (VUDA), with several small parks along the beachside.

Reason Behind Sand Pollution:

- Locals suspect sewage discharge from drainage canals contaminating the beach.
- Experts ruled out mineral deposits, as black sand patches are rare in this region.
- GVMC (Greater Visakhapatnam Municipal Corporation) is implementing measures to divert sewage to treatment plants along the coast.

Elephant Trumpeting

Context:

A new study published in Mammalian Biology reveals that Asian elephants use trumpeting sounds in diverse social interactions, contrary to previous beliefs that they only trumpet in response to disturbances.

About Elephant Trumpeting:

What is Elephant Trumpeting?

- Trumpeting is a loud, high-frequency sound produced by elephants to communicate with herd members.
- It serves multiple functions, including alerting others, expressing excitement, play, and signaling danger.

How is Trumpeting Formed?

- Elephants produce trumpets by blowing air in sudden bursts through their trunks.
- Unlike rumbles or roars, trumpeting does not necessarily involve the vocal cords, making it a distinct form of sound production.

Features of Elephant Trumpeting:

- High-frequency communication: Audible over long distances in dense forests.
- Multi-contextual use: Used during social bonding, play, distress, and intergroup interactions.
- Species-Specific Variations: African and Asian elephants exhibit different trumpeting patterns.

Differences Between African & Asian Elephant Trumpeting:

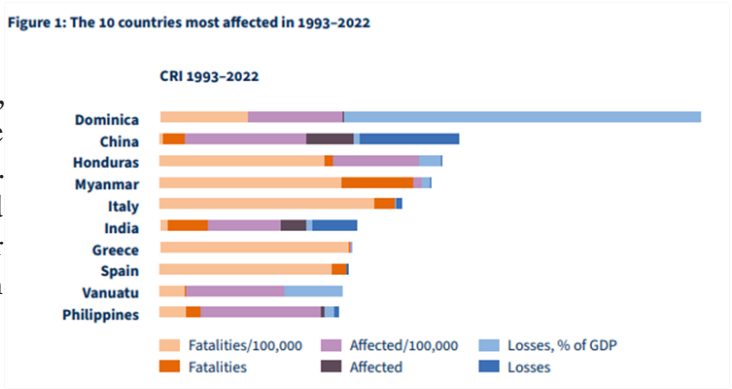
Feature	African Elephant (Loxodonta)	Asian Elephant (Elephas maximus)
Primary Context	Used mainly for distress and alarm	Used for social interactions, play, and group coordination
Vocal Mechanism	Typically combines trunk bursts with vocal cord activation	Often produced without vocal cord involvement
Acoustic Frequency	Broader range, with some lower-pitched trumpets	More consistent duration, higher frequency calls
Combination Calls	Rarely recorded in African elephants	First documented case of roar-rumble combination in Asian elephants
Environmental Adaptation	Used in savanna landscapes where sound needs to travel far	Used in dense forests where high-pitched calls are more effective

Climate Risk Index (CRI) 2025

Context:

The Climate Risk Index (CRI) 2025 was released, highlighting the increasing global impact of extreme weather events and the need for stronger climate action.

- India ranked sixth among the most affected countries (1993-2022) due to extreme weather events, despite improving its short-term ranking to 49th in 2022.



About Climate Risk Index (CRI) 2025:

What is the Climate Risk Index?

- The Climate Risk Index (CRI) ranks countries based on their vulnerability to extreme weather events.
- It assesses the human and economic losses due to climate-induced disasters.

Released by and Frequency:

- Published by Germanwatch, an environmental think tank.
- Annual publication since 2006, with data covering the past 30 years.

Aim of CRI:

- To provide a comparative analysis of the impact of extreme weather events.
- To guide global climate policies and risk mitigation efforts.
- To highlight the most affected nations and emphasize the urgency of climate resilience.

CRI Methodology and Criteria:

The CRI ranks countries based on:

- Fatalities (direct and indirect deaths due to extreme weather).
- Affected population (injured, displaced, and impacted people).
- Economic losses (damage to infrastructure, agriculture, and GDP).
- Number of extreme weather events (floods, storms, heatwaves, droughts, wildfires, etc.).
- Long-term impact assessment (1993-2022) and short-term impact (2022 alone).

Key data insights from report:

Most Affected Countries (1993-2022):

- Dominica, China, and Honduras ranked as the worst-affected nations.
- India, Myanmar, Italy, and Vanuatu also feature among the top 10.

Most Affected Countries in 2022:

- Pakistan, Belize, and Italy suffered the most damage.
- Heatwaves, storms, and floods were the primary causes of destruction.

Top Disasters by Impact (1993-2022):

- Storms (35%) caused the highest economic losses (~$2.33 trillion).
- Heatwaves (30%) caused significant fatalities.
- Floods (27%) affected the most people.

India's Performance in CRI 2025:

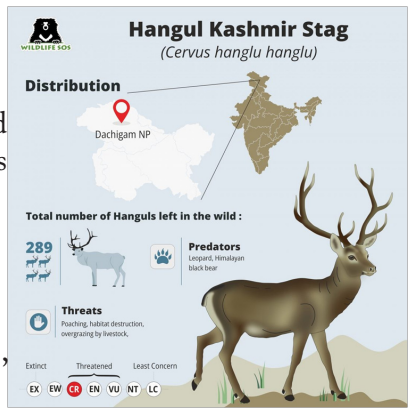
Long-term ranking (1993-2022):

- India ranked 6th globally among the worst-affected nations.
- Over 400 extreme weather events have been reported in 30 years.
- 80,000+ deaths and $180 billion in losses due to climate disasters.

Short-term ranking (2022):

- India ranked 49th in 2022, showing improvement from 7th in 2019.
- Severe floods, cyclones, and heatwaves remained major climate threats.

Hangul Deer



Context:

Scientists at CSIR-Centre for Cellular & Molecular Biology (CCMB) have found that human disturbances during mating and birthing seasons are increasing stress levels in Hangul deer, affecting their reproduction.

About Hangul Deer (Kashmir Stag):

What is Hangul Deer?

- A subspecies of the Central Asian red deer (Cervus hanglu hanglu), endemic to Kashmir and northern Himachal Pradesh.

- The state animal of Jammu and Kashmir and the only surviving Asiatic subspecies of the Red Deer family.

Habitat & Protected Areas:

- Found in dense riverine forests, valleys, and mountainous regions of Jammu & Kashmir and northern Himachal Pradesh.

Key Protected Areas:

- Dachigam National Park (J&K) – The primary habitat of Hangul deer.
- Tral Wildlife Sanctuary (J&K) – Offers additional protection.

IUCN Status:

- Listed as Critically Endangered (CR) on the IUCN Red List due to rapid population decline.
- Population has fallen from 3,000-5,000 in the 1940s to just 289 in 2023.

Key Features of Hangul Deer

- Large Antlers: Males possess impressive multi-tined antlers with 11-16 points.
- Seasonal Mating & Birth Patterns: Mating from October to December, birthing in April-May.
- Herbivorous Diet: Feeds on grasses, leaves, and forest vegetation.

Reasons Behind Population Decline:

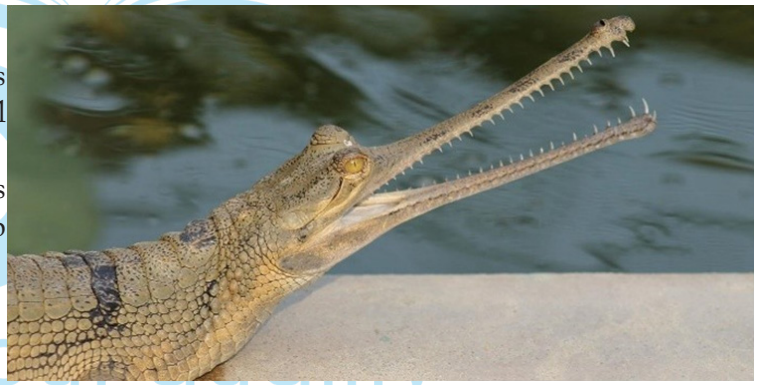
- Habitat Destruction: Deforestation and land encroachment have reduced their natural habitat.
- Overgrazing: Competition with livestock reduces available food resources.
- Poaching & Illegal Hunting: Hangul is targeted for its antlers and meat.
- Human Disturbance: Grazing, herder movements, and tourism disrupt mating and birthing cycles, increasing stress levels.
- Climate Change: Affects food availability and habitat conditions, worsening survival rates.

Gharial

Context:

Madhya Pradesh Chief Minister released 10 gharials into the Chambal River at the National Chambal Gharial Sanctuary to boost conservation efforts.

- The state now hosts over 80% of India's gharial population, reaffirming its leadership in gharial conservation.



About Gharial:

What is a Gharial?

- A critically endangered species of crocodilian (Gavialis gangeticus) with a long, narrow snout adapted for catching fish.
- The name "gharial" comes from the Hindi word "ghara", referring to the bulbous snout tip seen in males.

Locations in India:

Found in major river systems:

- Chambal River (Madhya Pradesh, Uttar Pradesh, Rajasthan) – Largest population.
- Ganges, Yamuna, Son, Gandak, Mahanadi, and Brahmaputra Rivers – Scattered populations.

IUCN Status & Conservation Status:

- Critically Endangered on the IUCN Red List.
- Included in Schedule I of the Wildlife Protection Act, 1972, granting it the highest legal protection in India.

Biological & Physical Features:

- Size: Males grow up to 6 meters, females 2.6 to 4.5 meters.

- Diet: Primarily fish, using its slender snout and interlocking teeth for efficient hunting.
- Reproduction: Mates during November–January, nests on sandbanks and islands, and lays eggs March–May.

Major Threats

- Habitat destruction: Dams, embankments, irrigation canals, and sand mining disrupt nesting areas.
- Overfishing & Bycatch: Gharials get trapped in fishing nets (gillnets), leading to accidental deaths.
- Pollution: Industrial waste and pesticides poison river ecosystems.
- Historical Exploitation: Once hunted for skin, trophies, and traditional medicine.

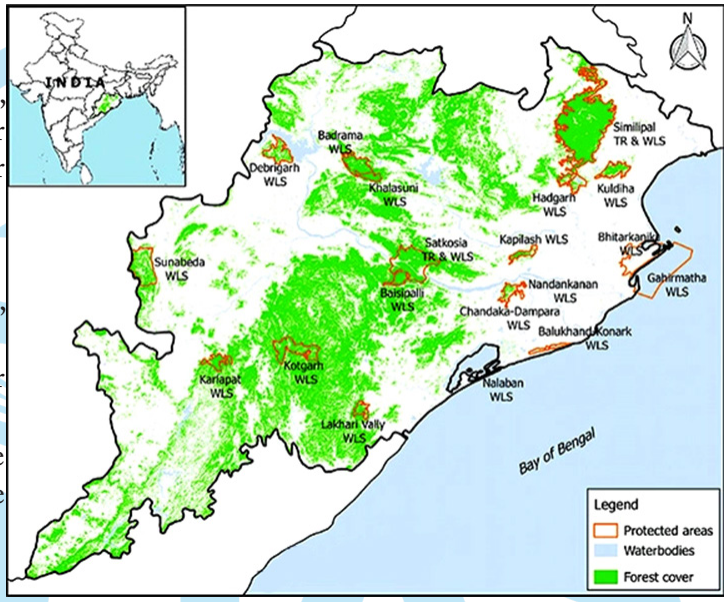
Chambal River Conservation Efforts:

- National Chambal Sanctuary (435 km stretch): Protects one of India's cleanest rivers.
- Captive Breeding & Release: Since 1975, hatchlings are raised in centers and released into rivers.
- Restoring Sandbanks: Ensures safe nesting sites.
- Community Involvement: Engaging locals in conservation efforts to protect riverine ecosystems.

Similipal Tiger Reserve (STR)

Context:

Munda tribals of Similipal Tiger Reserve (STR), Odisha, protested against being denied access to their sacred groves, which have been turned into a tiger enclosure for translocated tigress Zeenat.



About Similipal Tiger Reserve:

- Location: Situated in Mayurbhanj district, Odisha.
- Declared a Tiger Reserve under Project Tiger in 1973 and a wildlife sanctuary in 1979.
- Designated as a UNESCO Biosphere Reserve in 2009 under the Global Network of Biosphere Reserves.

Flora & Fauna:

- Dominated by tropical moist deciduous forests with semi-evergreen patches.
- Hosts the highest tiger population in Odisha along with elephants and hill mynahs.

Unique Features:

- Waterfalls: Joranda & Barehipani waterfalls add to its scenic beauty.
- High Peaks: Khairiburu and Meghashini (1515m above sea level) are the highest peaks.
- Part of Mayurbhanj Elephant Reserve: Connected with Hadgarh & Kuldiha Wildlife Sanctuaries.
- Conservation Legacy: Known for Padma Shri Saroj Raj Chowdhury, its founder, and his fostered tigress Khairi.

About Munda Tribe:

- Habitat: Primarily found in Chhotanagpur Plateau covering Jharkhand, Bihar, Odisha, West Bengal, Madhya Pradesh, Tripura, and Bangladesh.
- Additionally, Similipal Tiger Reserve is home to two indigenous tribes, the Erenga Kharias and Mankirdias, who practice traditional agriculture.
- One of the largest Scheduled Tribes in India, with significant populations in Similipal Tiger Reserve.

Historical Significance:

- Ancient Presence: Munda languages arrived in India 4,000 years ago from Southeast Asia.
- British Resistance: Munda freedom fighter Birsa Munda led anti-British revolts, advocating for Munda Raj.

Culture & Traditions:

- Clan System: Patrilineal clans (Killi), believed to descend from a common ancestor.
- Traditional Occupation: Hunter-gatherers turned farmers, skilled in weaving & basket-making.
- Sacred Groves & Rituals: Worship nature, practice animism, and conduct sacred rites at burial sites.
- Folk Music & Dance: Known for Sarhul festival, Karam festival, and indigenous songs & dance.
- Totemic Beliefs: Each clan has a totemic animal or plant, symbolizing its identity.

Northern White Rhino

Context:

The northern white rhino, with only two individuals left, is on the brink of extinction. However, a breakthrough in in-vitro fertilisation (IVF) offers hope for the subspecies' survival, with 36 embryos ready for implantation.

About Northern White Rhino:

What is a White Rhino?

- The white rhino, also known as the square-lipped rhinoceros, is one of the five rhino species.
- Its name originates from the Afrikaans word "weit," meaning "wide," referring to its broad muzzle.

Habitat:

- Found in long and short grass savannahs.
- Southern white rhinos are primarily located in South Africa, with smaller populations in Kenya, Namibia, and Zimbabwe.
- Northern white rhinos are critically endangered, with only two individuals remaining at the Ol Pejeta Conservancy in Kenya.

Types:

- Southern White Rhino (Ceratotherium simum simum): Near Threatened.
- Northern White Rhino (Ceratotherium simum cottoni): Critically Endangered.

Features:

- Food Habits: Exclusive grazers, feeding almost entirely on short grasses.

Biological:

- Second-largest land mammal after elephants.
- Two horns on the nose, with the front horn being significantly larger.

Physical:

- Square upper lip adapted for grazing.
- No difference in skin color between white and black rhinos.

AI-Driven Genetic Testing

Context:

AI-driven genetic testing is revolutionizing genomic research and precision medicine, enabling rapid analysis of vast genetic datasets.

AI in Genetic Testing:

- AI-Powered Genome Sequencing: Machine Learning (ML) deciphers DNA patterns, identifying mutations, genetic disorders, and disease risks.

  E.g. John's Hopkins researchers identified 1,200 junk DNA elements linked to tumors using AI in 2024.
- Deep Learning for Mutation Detection: AI models analyze gene variations to detect potential cancerous mutations and hereditary diseases.

  E.g. Gene Box AI predicts genetic predispositions with 98% accuracy.
- Personalized Genetic Profiling: AI integrates gene-environment interactions, offering tailored health recommendations based on genetic traits.

  E.g. AI-driven reports in consumer genetic testing services.
- CRISPR Gene Editing Optimization: AI assists CRISPR-Cas9 precision editing by predicting off-target effects, improving gene therapy success rates.

  E.g. AI models enhance CRISPR accuracy in genetic disorder treatments.
- Predictive Genetic Risk Analysis: AI forecasts disease risks (e.g., Alzheimer's, diabetes) based on genetic markers, guiding early prevention strategies.

  E.g. 80 genes linked to Alzheimer's identified using AI.

Significance of AI in Genetic Testing:

1. Faster and Cost-Effective Analysis: AI reduces genome sequencing time from weeks to hours, cutting costs by 50%.
2. Enhanced Diagnostic Accuracy: AI improves mutation detection by analyzing large genomic datasets, increasing early disease identification.

3. Advancement in Drug Discovery: AI accelerates precision medicine by identifying gene-drug interactions, leading to personalized treatments.
4. Expansion of Preventive Healthcare: AI aids in early genetic screening, reducing lifestyle disease burdens through targeted interventions.
5. Integration with Digital Health Platforms: AI-driven genetic reports integrate with wearable tech & electronic health records (EHRs) for real-time monitoring.

Limitations of AI-Driven Genetic Testing:

- Data Privacy and Security Risks: Genetic data breaches, like 23andMe (2023), expose sensitive patient information to cyber threats.

  E.g. 6.9 million genetic profiles leaked, leading to identity theft risks.
- Ethical and Psychological Concerns: AI predictions on mental health or genetic predispositions may cause anxiety and discrimination.

  E.g. Genetic tests for depression lack clear clinical guidelines.
- Risk of Algorithmic Bias: AI models trained on limited ethnic/genetic datasets may yield inaccurate predictions for diverse populations.

  E.g. AI-based genetic studies are 90% Euro-centric, limiting global applicability.
- Uncertainty in Clinical Relevance: AI identifies genetic variations, but not all mutations lead to diseases, causing misinterpretations.

  E.g. 40% of genetic markers for Alzheimer's are still under research.
- Regulatory and Compliance Gaps: AI in genetics lacks strict regulations under HIPAA laws, leading to unmonitored data usage.

  E.g. Genetic startups operate in legal grey zones regarding data ownership.

Way Forward for AI in Genetic Testing:

- Strengthening Data Protection Laws: Governments must enforce strict regulations on genetic data security to prevent breaches and misuse.

  E.g. EU's GDPR mandates explicit consent for genetic data processing.
- Developing Inclusive AI Models: Expanding genetic datasets to diverse populations ensures fair and accurate predictions.

  E.g. Global Genome Initiative aims to include genetic diversity from all continents.
- Enhancing AI Transparency and Explainability: AI models must be interpretable, allowing clinicians & patients to understand genetic insights clearly.

  E.g. Explainable AI frameworks help in validating genetic test results.
- Public Awareness and Genetic Literacy: Educating users on genetic testing limitations, ethical concerns, and data risks promotes informed decision-making.

  E.g. Government-backed genetic awareness programs to debunk myths.
- Robust Clinical Validation Before Adoption: AI-driven genetic findings should undergo rigorous clinical trials before integration into mainstream medicine.

  E.g. AI-based cancer mutation tests require FDA approvals before usage.

Conclusion:

AI-driven genetic testing enhances diagnostic precision, speeds up genome analysis, and supports preventive healthcare. However, privacy risks, ethical concerns, and regulatory gaps remain major hurdles. By enforcing stricter data security measures and improving AI inclusivity, genetic AI can be a transformative force in medicine while ensuring ethical and safe implementation.

Fentanyl Crisis

Context:

The US President has imposed 25% tariffs on China, Mexico, and Canada over fentanyl trafficking, linking the opioid crisis to trade policies.

About Fentanyl:

What is Fentanyl?

- Fentanyl is a potent synthetic opioid approved for pain relief and anesthesia, nearly 100 times stronger than morphine.

- It is commonly used in medical settings for treating severe pain, but illicitly produced versions contribute to the opioid epidemic.

Why is Fentanyl a Crisis in North America?

- Highly Addictive: It mimics opioid effects, causing euphoria and dependence, leading to abuse.
- Illicit Supply Chain: China supplies precursor chemicals, which are processed in Mexico and smuggled into the US.
- Overdose Deaths: In 2021, over 75% of 107,000 US drug overdose deaths involved opioids, mainly fentanyl.
- Policy Challenge: Strained US-China relations hinder cooperation on drug control measures.
- Stealth Distribution: Often laced into other drugs, leading to unintentional overdoses.

Amplifiers

Context:

The role of amplifiers in transforming communication, entertainment, and technology has been highlighted, focusing on their working principles, types, and applications.

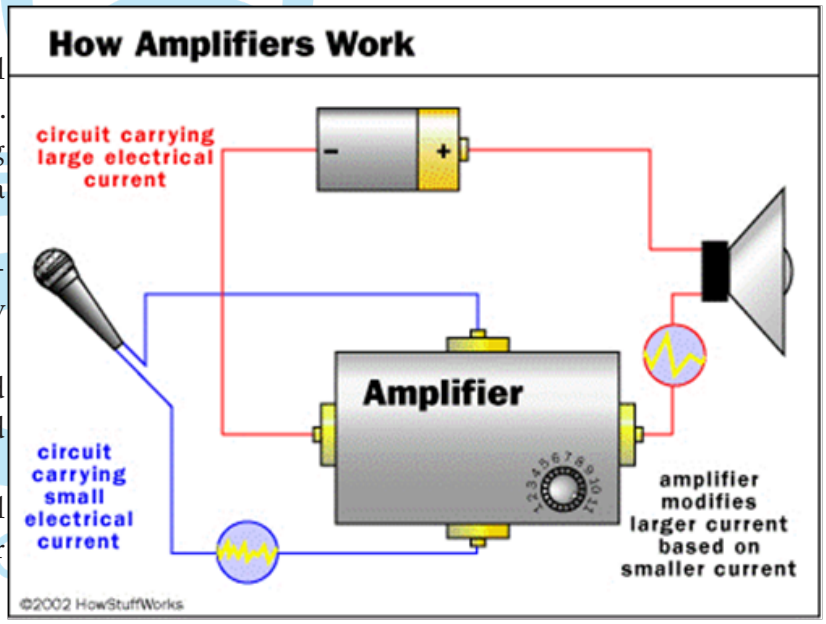
About Amplifiers:

What is an Amplifier?

- An electronic device that enhances the amplitude of an electrical signal without altering its original characteristics.
- Used in audio systems, telecommunications, medical devices, and scientific instruments.

How Does an Amplifier Work?

- Signal Input: A weak electrical signal from a source (e.g., microphone, sensor).
- Pre-amplification: Initial boosting of signal with minimal noise using a preamp circuit.
- Voltage Amplification: A transistor-based circuit increases voltage by controlling collector current.
- Current & Power Boosting: Driver and power stages ensure stable voltage and increased current.
- Output Stage: The amplified signal is delivered to a speaker, antenna, or recording device.



Types of Amplifiers:

- Class A: High fidelity, used in audio equipment but low efficiency.
- Class B: More efficient but introduces signal distortion, used in basic sound systems.
- Class AB: A mix of Class A & B, preferred in home theatres and professional audio.
- Class C: Highly efficient but distorted, used in radio frequency transmitters.
- Class D: Digital switching amplifiers, highly efficient, used in public address systems.

Applications of Amplifiers:

- Audio Systems: Enhances sound in speakers, microphones, and PA systems.
- Telecommunication: Used in radio transmitters, mobile networks, and fiber optics.
- Medical Devices: Found in ECG, ultrasound, and hearing aids for signal processing.
- Scientific Research: Used in astronomy, particle physics, and seismology.
- Industrial & Military: Radar, sonar, and electronic warfare applications.

Plastic Degradation Bacteria

Context:

Scientists are exploring bacteria-based solutions for plastic degradation, with companies and research institutions developing engineered enzymes and microbial strains to accelerate the breakdown of polyethylene terephthalate (PET) and other plastics.

Bacteria and Plastic Degradation:

Bacteria That Break Down Plastic:

- Ideonella sakaiensis: Discovered in Kyoto Institute of Technology, breaks down PET plastics using two enzymes.
- X-32 Bacteria: Degrades PET, polyolefins, and polyamides, effective against tough carbon-carbon bonds.
- Vibrio natriegens: Genetically engineered to attach PET-degrading enzymes for rapid plastic breakdown.
- Bacillus subtilis: Incorporated into biodegradable plastics, activated in compost for gradual degradation.

Enzymatic Plastic Degradation:

- Scientists have engineered enzymes like PETase and MHETase, enhancing their efficiency for large-scale use.
- French company Carbios developed heat-stable PET-degrading enzymes that break down 90% of PET in 10 hours.
- Enzyme-derived breakdown products can be used for recycling and circular economy models.

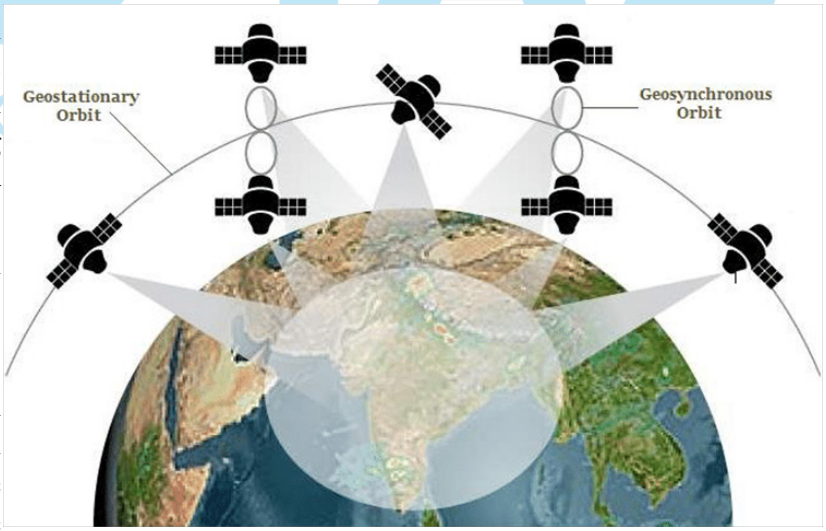
Challenges & Limitations:

- Time Factor: Bacterial degradation can take months to years, slowing industrial applications.
- Scalability: Producing and deploying bacteria or enzymes at an industrial scale is costly.
- Selective Efficiency: Many strains work only on specific plastics, limiting universal application.
- Regulatory Issues: Concerns exist over introducing engineered bacteria into ecosystems.
- Crystalline PET Resistance: Most bacteria struggle to degrade highly crystalline PET, like plastic bottles.

Navigation With Indian Constellation (NavIC) System

Context:

The partial failure of the NVS-02 navigation satellite marks another setback for India's indigenous Navigation with Indian Constellation (NavIC) system, highlighting challenges in maintaining a fully operational satellite navigation network.



About NavIC (Navigation with Indian Constellation):

What is NavIC?

- NavIC, formerly known as the Indian Regional Navigation Satellite System (IRNSS), is India's indigenous satellite navigation system designed to provide accurate positioning, navigation, and timing services over India and its surrounding regions.
- Organization: Indian Space Research Organisation (ISRO).
- Aim: NavIC aims to reduce India's dependence on foreign navigation systems like GPS (USA), GLONASS (Russia), and Galileo (Europe) by providing a reliable and autonomous positioning system for both civilian and strategic applications.

How it Works:

- NavIC operates through a constellation of seven satellites: three in geostationary orbit (GEO) and four in geosynchronous orbit (GSO).
- The system uses dual-frequency signals (L5 and S bands) to provide accurate positioning data.
- Ground stations, including control centers and monitoring stations, ensure seamless operation and signal integrity.

Features:

- Coverage: Provides services over India and a region extending up to 1,500 km beyond its borders.
- Accuracy: Offers position accuracy better than 20 meters and timing accuracy better than 50 nanoseconds.

Dual Services:

1. Standard Positioning Service (SPS): For civilian use, including transportation, disaster management, and personal navigation.
2. Restricted Service (RS): Encrypted service for strategic and military applications.
   - Interoperability: NavIC signals are compatible with other global navigation systems like GPS, GLONASS, and Galileo.
   - New Developments: Introduction of L1 band signals (1575.42 MHz) for enhanced civilian use, starting from 2023.

Applications:

- Transportation (land, air, and marine navigation).
- Disaster management and resource monitoring.
- Scientific research and surveying.
- Time synchronization for critical infrastructure.
- Strategic and defense applications.

India's AI Independence: Should We Build Our Own Foundational Model?

Context:

As AI becomes a strategic and economic driver, India must decide whether to build its own foundational AI model or rely on foreign ones.

Why is a Sovereign Foundational AI Model Needed?

1. Technological Sovereignty: AI models are primarily controlled by U.S. firms like OpenAI, Google, and Meta. Future sanctions, similar to U.S. restrictions on Huawei's AI chips, could limit India's access.
2. Dependence on Foreign AI: Proprietary models like GPT-4 require licensing, making India reliant on external pricing and policy changes, potentially increasing costs for businesses and governance.
3. India-Specific AI Applications: A sovereign model can cater to India's diverse linguistic needs (22 official languages, 121 spoken by over 10,000 people).

   E.g. AI for Bharat is already developing Indic language AI tools.

   - Strategic Economic Growth: AI is projected to contribute $500 billion to India's GDP by 2025. Developing a sovereign model ensures India captures a larger share of this value instead of relying on foreign providers.

Advantages of a Sovereign AI Model

- Control Over AI Ethics and Regulations: India can ensure AI aligns with national interests and cultural values, avoiding biased datasets from Western-trained models.

  E.g. Facial recognition biases in Western AI models often fail to recognize Indian faces accurately.

- Long-Term Cost Savings: Developing a model is expensive, but licensing foreign AI repeatedly costs more in the long run.

E.g. OpenAI's GPT-4 API charges businesses for every query, making large-scale adoption expensive.

- Innovation and Job Creation: Building AI models can create high-value jobs in machine learning, data science, and chip manufacturing, helping retain talent within India.

  Eg: The AI industry in India is expected to create 2 million jobs by 2030.
- Resilience in Global AI Competition: Countries like China (Baidu's ERNIE) and the EU (Aleph Alpha) are developing their own AI models to reduce dependency on U.S. firms. India risks falling behind if it does not act.

Challenges in Building a Foundational AI Model

- High Costs of Development: Training a foundational model costs hundreds of millions of dollars.

  E.g. DeepSeek V3's training cost was $5.6 million per run, and Meta's LLaMA-4 is expected to cost $1 billion.
- Lack of AI-Specific Hardware: India does not manufacture advanced GPUs like Nvidia H100, essential for AI training.

  E.g. DeepSeek relies on Huawei's Ascend 910C chips, which India currently cannot produce.
- Limited AI Research Infrastructure: India's R&D spending is 0.7% of GDP, far lower than the U.S. (3%) and China (2.4%). A lack of high-end research institutes delays AI innovation.
- Small Domestic AI Market: AI automation is not as cost-effective in India due to lower labor costs.

  E.g. In the U.S., AI can replace a $4000/month employee, whereas in India, that cost is only $200/month.
- Government Procurement Bottlenecks: AI research requires risk-taking and iteration, but India's bureaucratic public funding process is slow and risk-averse.

  E.g. Unlike the U.S., where DARPA funds cutting-edge research with high failure rates, India lacks similar mechanisms.

Way Forward

1. Focus on Applied AI Solutions: Instead of competing with OpenAI's GPT-4, India should focus on AI for governance, healthcare, and Indic languages.

   E.g. AI for Bharat's IndicTrans2 for local language translation.

1. Public-Private Collaboration: Encouraging startups and universities to build on open-weight models can accelerate innovation.

   E.g. DeepSeek modified Meta's LLaMA model instead of building from scratch.

1. Investment in AI Chip Manufacturing: Partnering with TSMC or Samsung for semiconductor manufacturing and developing indigenous chip capabilities will ensure long-term AI independence.

2. AI-Specific Policy Reforms: Increasing AI R&D funding and creating a flexible public funding model can encourage innovation.

   E.g. The IndiaAI Mission's GPU cluster subsidies are a step in the right direction.

1. Targeted GPU Resource Allocation: Government-backed GPUs should be used for high-impact research areas.

   E.g. AI for Bharat's text-to-speech system for Indian languages needs only 500–1000 GPUs for effective results.

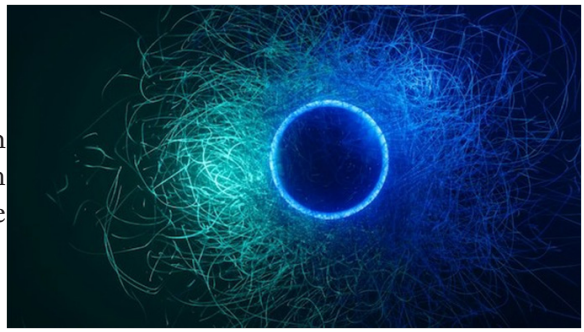
Conclusion:

Building a sovereign AI model can strengthen India's technological and economic position, but financial and infrastructural constraints require a strategic approach. Instead of directly competing with U.S. AI giants, India should prioritize applied AI solutions, invest in AI hardware, and foster a strong R&D ecosystem to ensure long-term AI self-reliance.

Quantum Teleportation

Context:

Scientists at the University of Oxford have achieved a breakthrough in distributed quantum computing, successfully linking quantum computers via quantum teleportation for the first time, paving the way for large-scale networked quantum computing.



About Quantum Teleportation:

What is Quantum Teleportation?

- A quantum phenomenon where the state of a particle is transmitted instantly to another distant particle using quantum entanglement, without physical transfer.
- Used in quantum computing and secure quantum communication.

How Does It Works?

- Quantum Entanglement: Two particles become interlinked, so changes in one instantly reflect in the other, even at large distances.
- Quantum State Transfer: Instead of moving physical qubits, their state is transferred across a network link, enabling distributed computing.
- Logical Gate Teleportation: Researchers teleported quantum gates (fundamental computational components) instead of individual qubits, enhancing scalability.

Key Features of Quantum Teleportation:

- Instantaneous State Transfer: Allows faster, more secure quantum communication.
- No Physical Movement Required: Eliminates information loss or decoherence during transfer.
- Enhances Distributed Computing: Enables linking small quantum processors into large-scale quantum networks.
- High Computational Speed: Reduces bottlenecks, making quantum computing scalable and efficient.
- Potential for Quantum Internet: Opens pathways for global quantum networks with ultra-secure data transmission.

Scientific & Technological Significance:

- Advances Quantum Computing Scalability: Overcomes challenges in expanding quantum processors.
- Boosts Cryptographic Security: Enables unbreakable encryption for cybersecurity.
- Revolutionizes Data Transmission: Supports high-speed, lossless quantum communication.
- Bridges the Gap Between Theory and Practical Application: Shows real-world feasibility of large-scale quantum computing.
- Foundation for Future Quantum Networks: Can lead to the development of global quantum internet.

AI in Governance

Context:

The AI-powered National Consumer Helpline (NCH) has led to 10 times increase in grievance calls, showing how AI is improving consumer services.

- The resolution time for complaints has also dropped from 66 days in 2023 to 48 days in 2024, making the system faster and more effective.

Key Benefits of AI in Governance:

- Quicker Complaint Resolution: The AI-powered NCH handled 1,55,138 calls in December 2024, compared to just 12,553 in 2015. Monthly complaints resolved increased from 37,062 in 2017 to 1,12,468 in 2024.
- Better Problem Solving: AI studies consumer complaints to find patterns and helps the government fix common issues quickly.
- More Efficient Services: Over 1,038 companies are now actively resolving complaints through AI, leading to faster results.
- Predicting Future Problems: AI can identify repeating problems and help policymakers take action before they get worse.
- Stronger Consumer Rights: Digital complaints increased from 54,893 in FY 2023-24 to 68,831 in FY 2024-25, showing more people trust AI-driven services.

SRY Gene

Context:

Recent studies from Italy and the USA report rare cases where biological females carried the SRY gene, challenging conventional understanding of sex determination.

About Baby Sex Determination:

What is Sex Determination?

- Sex determination is the biological process that decides whether a baby develops as a male or female, influenced by genetic and hormonal factors.

Role of Chromosomes in Sex Determination:

- Humans have 23 pairs of chromosomes, including one pair of sex chromosomes: XX (female) or XY (male).
- Egg cells always carry an X chromosome, while sperm cells carry either X or Y.
- If a sperm with an X chromosome fertilizes an egg, the baby is female (XX); if a Y-carrying sperm fertilizes the egg, the baby is male (XY).

About SRY Gene:

What is the SRY Gene?

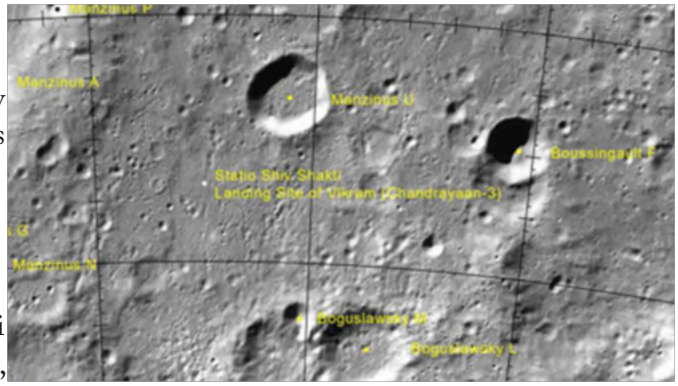
- The SRY (Sex-determining Region Y) gene is found on the Y chromosome and acts as the master switch for male development.
- Function: It activates a cascade of genes that trigger the formation of testes in the embryo, which then produce testosterone, promoting male characteristics.
- SRY Absence: If the SRY gene is missing or non-functional, the embryo develops female reproductive structures by default.

How SRY Gene Influences Sex Determination?

- Normal Process: If the SRY gene is present and functional, the embryo develops into a male; if absent, it follows the female pathway.
- Rare Exceptions: Sometimes, the SRY gene translocates (moves) from the Y chromosome to the X chromosome due to mutation. This can lead to:
- SRY-Positive Males (XX): Individuals with an SRY-bearing X chromosome develop as males but remain sterile.
- SRY-Positive Females (XX): In exceptional cases, females carrying the SRY gene develop normally due to biased X chromosome inactivation, preventing the gene's function.

Study on Chandrayaan-3's Landing Site

Context:



A recent study by ISRO's Physical Research Laboratory (PRL) has estimated the region around Chandrayaan-3's landing site, Shiv Shakti Point, to be 3.7 billion years old.

Summary of Recent Study Findings:

Age Estimation:

- The study determined the age of the Shiv Shakti Point region to be approximately 3.7 billion years, using crater distribution and morphological analysis.
- This age aligns with the emergence of microbial life on Earth, providing a comparative timeline for planetary evolution.

Geographical Context:

- The landing site is surrounded by three large impact craters: Manzinus (3.9 billion years), Boguslawsky (4 billion years), and Schomberger (3.7 billion years).
- These craters have significantly influenced the terrain through ejecta deposits and secondary cratering.

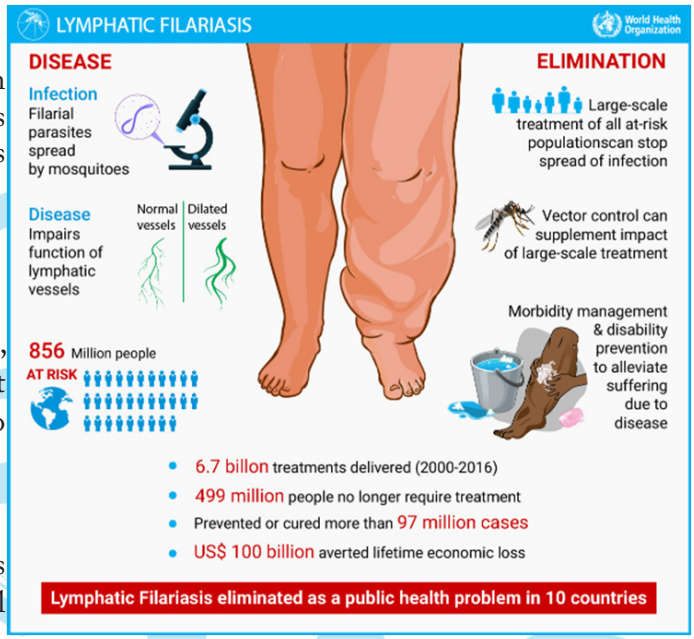
Rock Distribution:

- The Pragyan rover encountered numerous rock fragments, with higher concentrations near a fresh crater 14 km south of the landing site.
- This fresh crater, less affected by space weathering, provided valuable insights into the region's geological activity.

Lymphatic Filariasis (LF)

Context:

India has launched a nationwide Mass Drug Administration (MDA) campaign covering 111 endemic districts across 13 states, with the goal of eliminating Lymphatic Filariasis (LF) by 2027.



About Lymphatic Filariasis:

What is Lymphatic Filariasis?

- Lymphatic Filariasis (LF), also called Elephantiasis, is a parasitic disease caused by filarial worms that infect the human lymphatic system, leading to severe swelling and disability.

India's Status:

- India is among the highest-burden countries for LF, contributing significantly to the global caseload.
- Bihar, Uttar Pradesh, and Odisha are among the states with the highest number of LF cases
- The government aims to eliminate LF by 2027 through mass drug administration, morbidity management, and vector control strategies.

Causes and Transmission:

- Caused by Wuchereria bancrofti (most common), Brugia malayi, and Brugia timori parasites.
- Transmitted through mosquito bites (Anopheles, Culex, Aedes species).
- Requires repeated mosquito bites over months or years for infection to establish.

Symptoms:

- Asymptomatic in early stages but leads to chronic lymphatic damage over time.

Common symptoms:

- Lymphedema: Swelling of arms, legs, breasts, or genitals.
- Elephantiasis: Thickening of the skin and severe swelling.
- Hydrocele: Swelling of the scrotum (in males).
- Recurrent infections due to weakened immunity.

Prevention and Treatment

- Mass Drug Administration (MDA): Annual distribution of anti-filarial drugs (Diethylcarbamazine + Albendazole).
- Triple Drug Therapy in select districts to accelerate LF elimination efforts.
- Triple Drug Therapy include diethylcarbamazine (DEC) + Albendazole + Ivermectin.
- Morbidity Management & Disability Prevention (MMDP): Ensuring access to care for affected individuals.
- Surgical intervention: Hydrocelectomy under Ayushman Bharat PM-JAY scheme.

- Vector Control: Use of mosquito nets, insecticides, and community awareness.

Bombay Blood Group

Context:

India has successfully performed its first-ever cross-blood kidney transplant for a patient with the rare Bombay (hh) blood group.

Blood group	Antibody	Antigen	Compatibility
A	B	A	Blood group A and O
B	A	B	Blood group B and O
AB	Nil	AB	Blood group A, B, AB and O
O	AB	Nil	Only group O
HH	ABH	Nil	HH

About Bombay Blood Group:

What is the Bombay Blood Group?

- A rare blood type (hh phenotype) first discovered in Mumbai (Bombay) in 1952 by Dr. Y.M. Bhende.
- Lacks the H antigen, which is the base structure for A and B antigens in the ABO blood group system.

Unique Characteristics

- Individuals with this blood type cannot receive blood from any ABO group, including O-negative, as it contains the H antigen.
- Can only receive blood from another Bombay blood group donor, making transfusions highly difficult.
- Prevalence: 1 in 10,000 in India, 1 in 1 million globally.

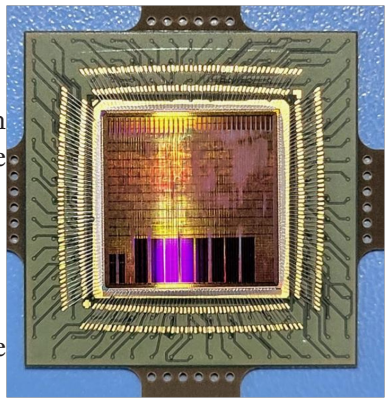
Challenges in Blood Transfusion:

- Routine blood tests often misidentify Bombay blood group as O-type, leading to misdiagnosis and transfusion complications.
- Receiving blood with the H antigen can trigger an acute hemolytic transfusion reaction, causing severe immune responses.

Recent Medical Significance:

- In mid-2024, Chennai doctors at MIOT International successfully performed a cross-blood kidney transplant using a special plasmapheresis technique to remove antibodies.
- India's first successful Bombay blood group kidney transplant was also reported at Jaslok Hospital, Mumbai, in February 2025, setting a medical precedent.

Shakti Semiconductor Chips



Context:

India's first indigenous aerospace-grade semiconductor chip, 'Shakti', has been developed by IIT Madras and ISRO under the Digital India RISC-V initiative (DIRV) to strengthen India's semiconductor ecosystem and strategic autonomy.

About Shakti Semiconductor Chips:

What is it?

- Shakti is an indigenous microprocessor based on the RISC-V open-source Instruction Set Architecture (ISA).

- It is designed to meet the high-reliability and security needs of India's space, defense, and computing industries.

Developed by:

- IIT Madras in collaboration with ISRO, supported by the Ministry of Electronics and Information Technology (MeitY) under the Digital India RISC-V (DIRV) initiative.

Key Features:

- End-to-End Indigenous: Fully developed, fabricated, and tested in India.
- Fault-Tolerant Design: Enhanced reliability for aerospace and defense applications.
- RISC-V Architecture: Uses an open-source 64-bit processor for flexibility and customization.
- High-Performance Computing: Supports command and control systems, sensor integration, and AI-based applications.
- Advanced Security: Designed for strategic sectors requiring robust cybersecurity measures.
- Multiple Boot Modes: Expandable for future space missions and secure computing requirements.

Applications:

- Space Missions: Used in satellites, avionics, and embedded controllers for ISRO applications.
- Defense & Aerospace: Strengthens India's self-reliance in military-grade electronics.
- IoT & AI Applications: Supports high-performance computing for smart systems.
- Command & Control Systems: Critical for real-time operations and automation.
- R&D in Semiconductor Industry: Advances India's position in indigenous chip fabrication.

What is the Digital India RISC-V (DIR-V) Program?

Launched In: April 2022

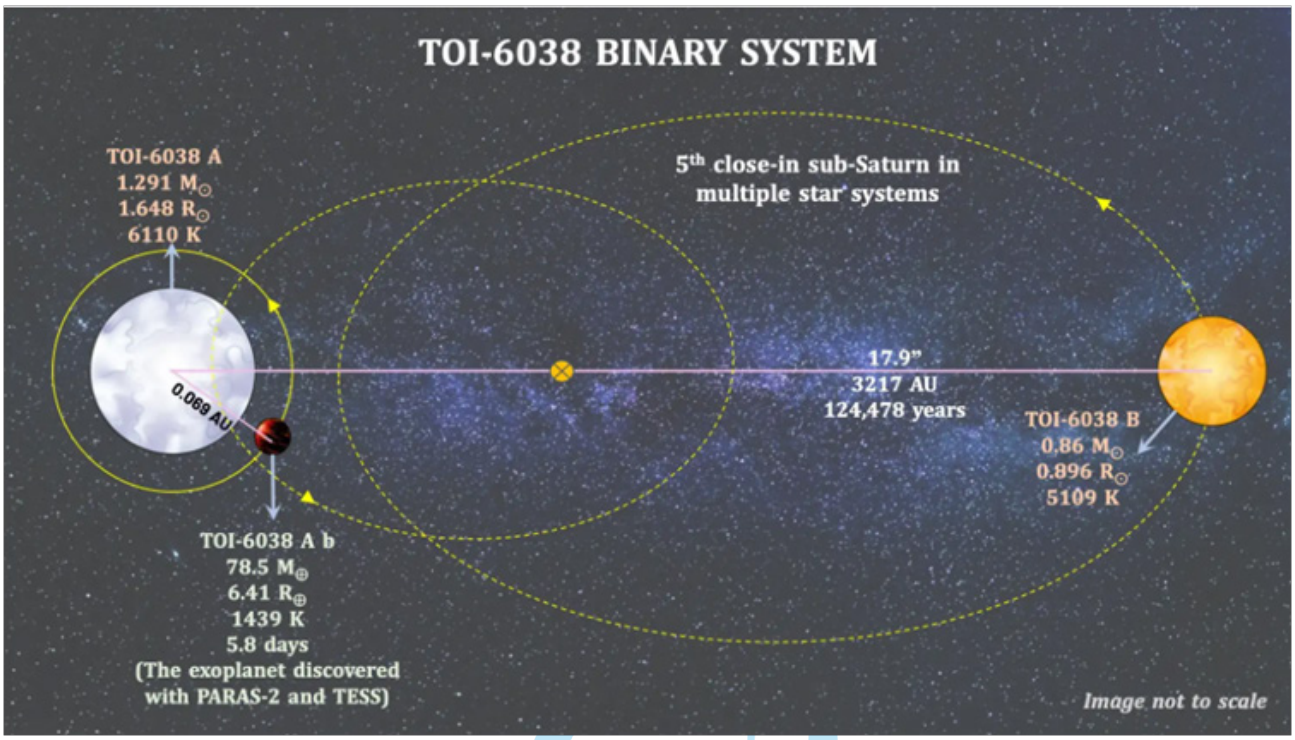
- Ministry: Ministry of Electronics and Information Technology (MeitY).
- Aim: To strengthen India's semiconductor ecosystem by developing indigenous RISC-V-based microprocessors for self-reliance in the digital sector.
- Key Features of the DIR-V Program:
- Indigenous Innovation & Self-Reliance: Promotes the development of domestic microprocessor technology to reduce dependency on foreign semiconductor solutions.
- High-Performance Computing: Focuses on cloud services, IoT, AI, sensors, and advanced computing, ensuring India's presence in next-generation digital infrastructure.
- Collaboration with Industry & Academia: Works closely with C-DAC, IITs, ISRO, and private industry partners to develop scalable RISC-V microprocessor solutions.
- Applications in Emerging Technologies: Supports 5G/6G, AI, and automation, creating a foundation for future technology advancements.

PARAS-2 spectrograph

Context:

Scientists from Physical Research Laboratory (PRL), Ahmedabad, have discovered TOI-6038A b, a dense sub-Saturn exoplanet in a wide binary system.

- The discovery, made using the PARAS-2 spectrograph, enhances India's expertise in exoplanet research and astronomical instrumentation.



About PARAS-2 Spectrograph:

What is PARAS-2?

- High-resolution Radial Velocity (RV) Spectrograph, used for exoplanet detection and mass measurement.

Built by:

- Developed by Physical Research Laboratory (PRL), Ahmedabad, and installed at the 2.5-meter telescope at Mt. Abu Observatory.

Functions & Features:

- Exoplanet Detection: Measures minute stellar wobbles to confirm planetary presence.
- Precision Mass Measurement: Determines exoplanet mass using radial velocity technique.
- Asia's Highest-Resolution RV Spectrograph: Provides stabilized and accurate measurements for astronomical studies.
- Speckle Imaging Capability: Aids in high-resolution planetary system validation.

New Discovery TOI-6038A b:

- Key Characteristics
- Size & Mass: 6.41 Earth radii, 78.5 Earth masses, classified as a dense sub-Saturn.
- Density: 1.62 g/cm^3, indicating a massive rocky core (~75% mass) and H/He envelope.
- Binary System: Part of a wide binary system, with K-type companion TOI-6038B at 3217 AU.

Significance of the Discovery:

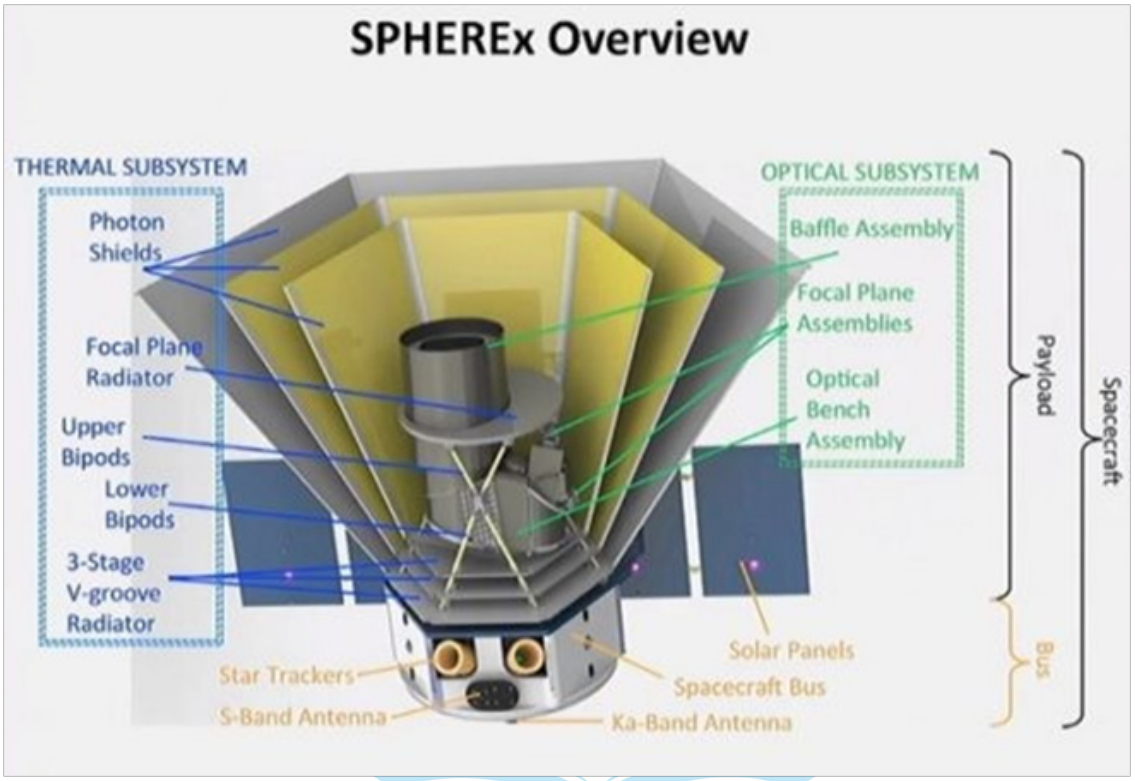
- Enhancing Exoplanet Research: Provides insights into planetary formation and evolution, especially sub-Saturn transition.
- Validating Exoplanet Migration Theories: Challenges existing models of high-eccentricity tidal migration (HEM) and disk-driven migration.
- Advancing Indian Space Science: Marks India's second exoplanet discovery using PARAS-2, showcasing scientific capabilities in astronomy.
- Binary System Planetary Evolution: One of only five known sub-Saturns in a binary system, aiding studies on gravitational influences on planetary orbits.

SPHEREx Space Telescope

Context:

NASA's SPHEREx space telescope is set to launch, aiming to explore the origins of the universe and search for water and organic molecules in the Milky Way.

- This mission will create a 3D map of the cosmos, providing insights into cosmic inflation and the formation of galaxies.



About SPHEREx Space Telescope:

What is SPHEREx?

- Full Form: Spectro-Photometer for the History of the Universe, Epoch of Reionization, and Ices Explorer.
- Mission Type: Space telescope designed to survey the sky in optical and near-infrared light.
- Duration: A two-year mission to map the universe and study its origins.

Launched By:

- Agency: NASA (National Aeronautics and Space Administration).
- Rocket: SpaceX Falcon 9.

Aim of SPHEREx:

- Study Cosmic Inflation: Investigate the rapid expansion of the universe after the Big Bang.
- Map Galaxies: Survey over 450 million galaxies to understand their distribution and evolution.
- Search for Water and Organic Molecules: Identify reservoirs of water and life-essential molecules in the Milky Way.
- Create a 3D Cosmic Map: Develop a detailed map of the universe in 102 color bands.

Key Features:

- Advanced Technology: Uses near-infrared light to observe objects invisible to the human eye.
- All-Sky Survey: Will map the entire sky every six months.
- High-Resolution Data: Provides data in 102 color bands, surpassing previous all-sky maps.
- Target Identification: Will identify objects for further study by missions like the James Webb Space Telescope.

Significance:

- Insight into Cosmic Inflation: Helps scientists understand the universe's exponential expansion after the Big Bang.

- Search for Life's Building Blocks: Detects water and organic molecules in star-forming regions and planetary systems.
- Foundation for Future Missions: Provides data to guide upcoming space exploration projects.
- Global Collaboration: Involves international partners like the Korea Astronomy and Space Science Institute.

Black Plastic

Context:

A recent study on black plastic found that it contains toxic flame retardants, raising concerns over food contamination and health risks.

About Black Plastic:

What is Black Plastic?

- A type of plastic material often produced from recycled electronic waste like TVs, computers, and appliances.
- Commonly used in kitchen utensils, takeout containers, packaging, and toys.

Composition of Black Plastic:

- Made from polypropylene (PP), polystyrene (PS), and polyethylene (PE).
- Contains flame retardants such as bromine, decabromodiphenyl ether (BDE-209), and heavy metals like lead, mercury, and cadmium.

Production Process:

- Derived from recycled electronic waste, often including banned toxic materials.
- Difficult to sort and recycle, as black pigments absorb infrared sorting rays, making recycling inefficient.

Applications of Black Plastic:

- Kitchen utensils: Spatulas, peelers, and food containers.
- Electronics: Housings for TVs, cables, and chargers.
- Automobile industry: Dashboards and interiors.
- Consumer goods: Toys, cosmetics packaging, and furniture.

Is Black Plastic Safe to Use?

- Studies suggest trace amounts of toxic chemicals may leach into food when exposed to heat.
- Despite low contamination risks, the long-term effects of these chemicals remain uncertain.

Harmful Effects of Black Plastic:

- Health Risks: Contains neurotoxic heavy metals and carcinogenic compounds.
- Food Contamination: Heat exposure may cause chemical leaching into food.
- Environmental Hazard: Difficult to recycle, leading to increased plastic pollution.

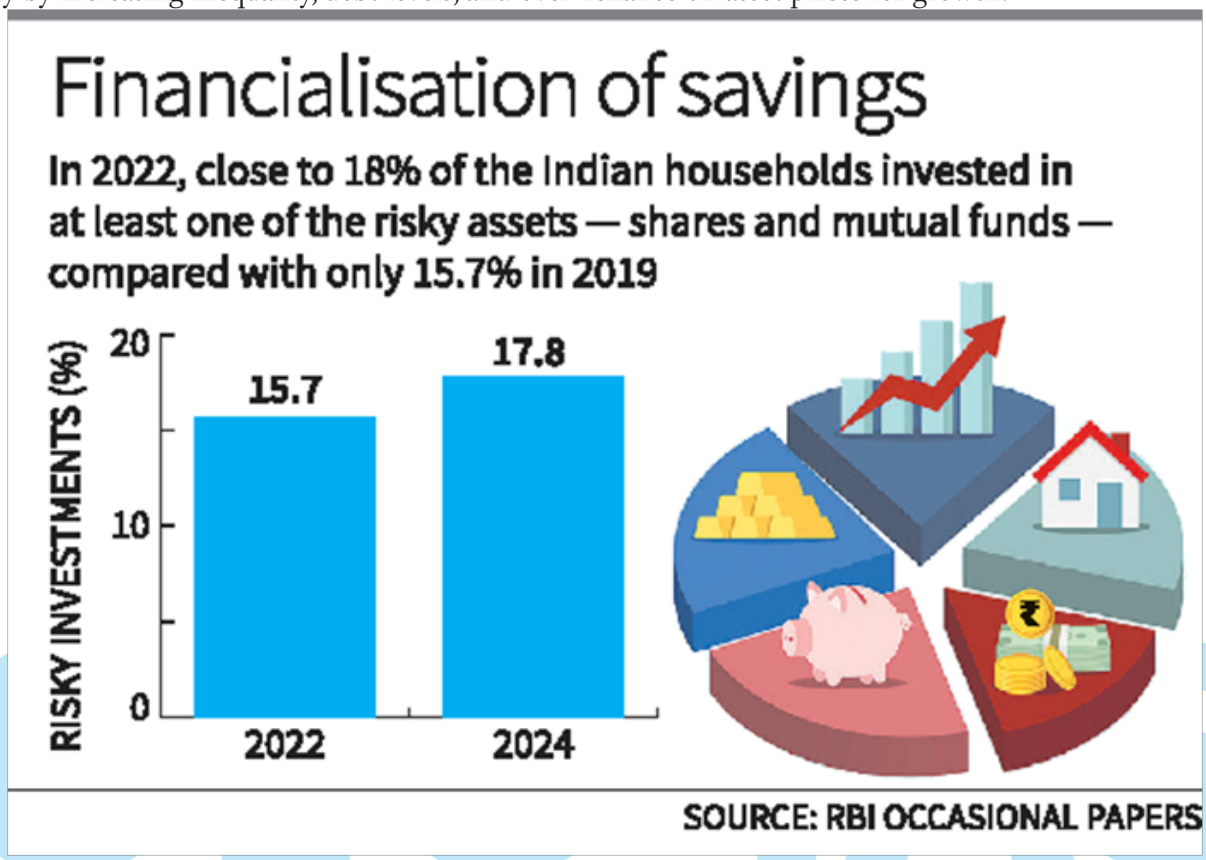
Chapter-
6

ECONOMY

Financialisation

Context:

The Economic Survey 2025 cautions against excessive financialisation in India, warning that it could harm the economy by increasing inequality, debt levels, and over-reliance on asset prices for growth.



About Financialisation:

- What it is: Financialisation refers to the growing dominance of financial markets, institutions, and motives in shaping economic policies and outcomes.

Factors leading to it:

- Increased household savings flowing into stock markets.
- Rising participation of retail investors in financial markets.
- Over-reliance on asset prices to offset leverage.
- Policy and regulatory frameworks influenced by financial market considerations.

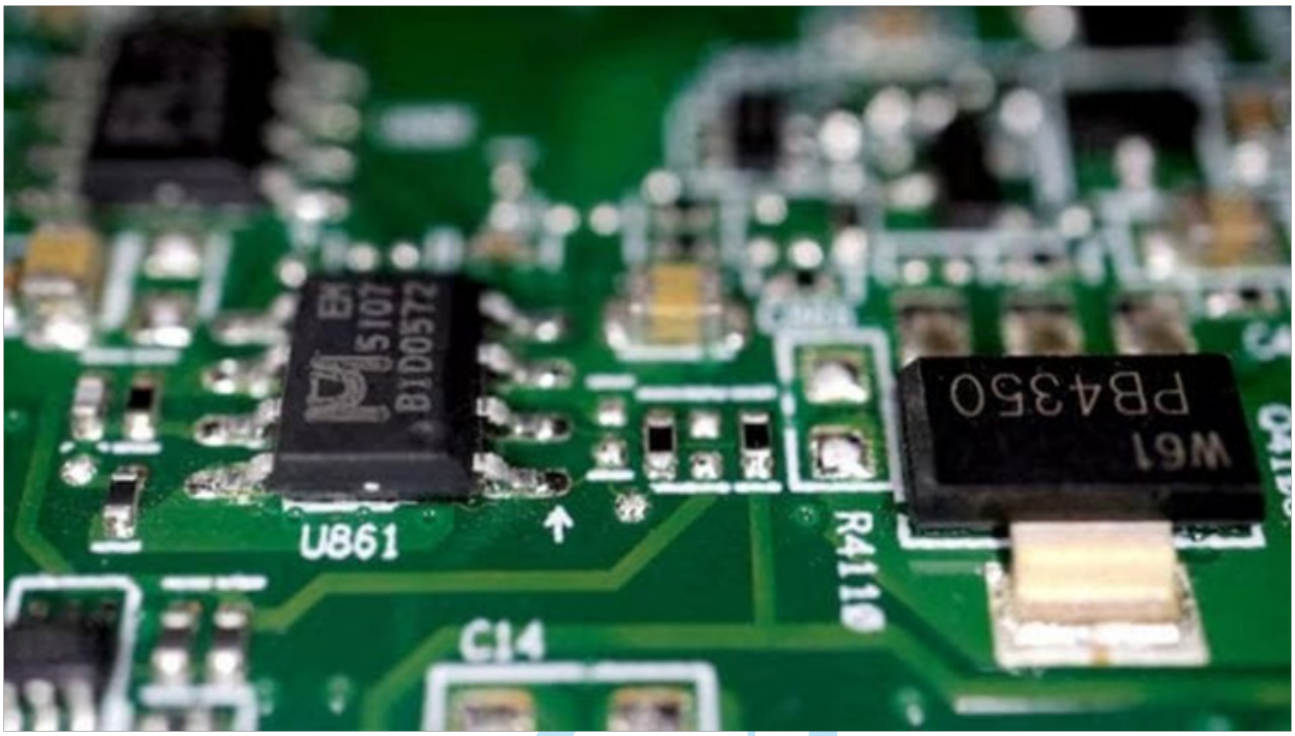
Implications:

- Rising public and private sector debt.
- Exacerbation of economic inequality.
- Over-dependence on financial markets for economic growth.

Presumptive Taxation

Context:

Finance Minister introduced a presumptive taxation regime for non-residents in the Union Budget 2025-26, specifically targeting those providing services in India's electronics manufacturing sector.



About Presumptive Taxation:

What is Presumptive Taxation?

- A simplified tax scheme where income is calculated based on a presumed rate of profit rather than actual income.
- Designed to reduce compliance burden and simplify tax filing for small businesses and professionals.

Eligibility:

- Non-residents providing services or technology to Indian companies setting up or operating electronics manufacturing facilities.
- Excludes businesses like goods carriage, agency work, and professions requiring detailed bookkeeping.

Why Imposed?

- To attract foreign technicians and companies to India's electronics and semiconductor sectors.
- To provide tax certainty and reduce compliance burdens for non-residents.
- To align with India's goal of becoming a global manufacturing hub under initiatives like Make in India.

Impacts on Economy:

- Boost to Electronics Manufacturing: Encourages foreign investment and technology transfer in critical sectors like semiconductors.
- Job Creation: Increased foreign presence will create skilled and semi-skilled jobs.
- Reduced Compliance Burden: Simplifies tax filing for non-residents, making India a more attractive destination for business.
- Global Competitiveness: Enhances India's position as a preferred manufacturing base for electronics and semiconductors.

Key Highlights of Presumptive Taxation in Budget 2025

1. **New Section 44BBD:**
   - Introduced in the Income Tax Act for non-residents in electronics manufacturing.
   - 25% of gross receipts deemed as income, taxed at 35%, resulting in an effective tax rate of less than 10%.
2. **Exclusion from Significant Economic Presence (SEP):**
   - Non-residents purchasing goods in India for export will not be considered to have a significant economic presence in India.
   - Provides clarity and reduces tax liability for export-oriented activities.

3. **Effective Date:**
   - Applicable from April 1, 2026, for the assessment year 2026-27 and subsequent years.

Cardamom

Context:

An international research team has identified two new species of cardamom in Kerala's Western Ghats, expanding the genus Elettaria to seven species.

About Cardamom:

What is Cardamom?

- Known as the "Queen of Spices," cardamom (Elettaria cardamomum) is a highly aromatic spice belonging to the Zingiberaceae (ginger) family.
- Native to the evergreen rainforests of the Western Ghats in South India, it is primarily cultivated in Kerala, Karnataka, and Tamil Nadu.

Climatic Conditions for Growth:

- Rainfall: 1500–4000 mm annually.
- Temperature: 10°C to 35°C.
- Altitude: 600–1500 meters above sea level.
- Soil: Acidic, loamy, and humus-rich forest soils with a pH of 5.0–6.5.

State-wise Production:

- Kerala: Contributes 58% of India's cardamom production, primarily in Idukki district.
- Karnataka: Major production in Kodagu and Chikmagalur districts.
- Tamil Nadu: Cultivated in the Nilgiri hills.
- Newly Identified Cardamom Species:
- Elettaria facifera: Found in Periyar Tiger Reserve, Idukki.
- Elettaria tulipifera: Discovered in Agasthyamalai hills (Thiruvananthapuram) and Munnar (Idukki).
- These species were previously misclassified under the genus Alpinia and have now been reclassified under Elettaria.

Significance of the Discovery:

- Biodiversity Conservation: Highlights the rich flora of the Western Ghats, a global biodiversity hotspot.
- Genetic Resources: Offers potential for developing new cardamom varieties with enhanced traits like disease resistance and higher yield.
- Economic Impact: Strengthens India's position as a leading cardamom producer and exporter, second only to Guatemala globally.

Falling Indian Rupees

Context:

The Indian rupee is falling continuously against the US dollar, hitting a record low due to US President new tariffs on imports from China, Mexico, and Canada.

What is Exchange Rate?

- The exchange rate is the value of one currency in terms of another, determining how much domestic currency is needed to buy one unit of foreign currency.

- Exchange rates fluctuate based on demand and supply in the currency market, influenced by trade, investments, and monetary policies.

How Does Exchange Rate Work?

- Demand-Supply Dynamics: If demand for the US dollar rises more than the rupee, the dollar strengthens, and the rupee weakens.
- Trade and Investments: Higher US imports, foreign investments, and capital outflows reduce rupee demand, depreciating its value.
- Inflation & Interest Rates: Higher inflation or lower interest rates in India reduce investor confidence, leading to rupee depreciation.

Factors Leading to Fall of Rupee:

- Trade Imbalances & Tariffs:
- US tariffs on China, Mexico, and Canada have strengthened the US dollar, weakening emerging market currencies, including the rupee.
- India's higher imports vs. exports increase demand for US dollars, depreciating the rupee.
- Strengthening US Dollar & Fed Policy:
- The US Federal Reserve's tight monetary policy has led to higher bond yields, attracting global investors to US assets.
- The dollar index rose to 109.8, strengthening the US dollar against major global currencies.

Foreign Institutional Investment (FII) Outflows:

- Global investors are pulling out funds from Indian equity markets, leading to higher dollar demand.
- The fear of a trade war and global economic slowdown has triggered capital outflows.

Inflation & Interest Rate Differential:

- Higher inflation in India compared to the US reduces purchasing power, making the rupee less attractive.
- Lower interest rates in India discourage foreign investments, further weakening the rupee.

Impact of Falling Rupee on Indian Economy

Negative Impacts

- Higher Import Costs: India imports 80% of its crude oil, making fuel, raw materials, and essential goods more expensive.
- Inflation Surge: Costlier imports increase input costs, leading to higher inflation and reduced purchasing power.
- Widening Current Account Deficit (CAD): Rising trade deficit and costlier dollar-denominated imports worsen India's CAD, pressuring forex reserves.
- FII Outflows: A weak rupee reduces investor confidence, leading to stock market declines and capital flight.

Positive Impacts:

- Stronger Export Competitiveness: A weaker rupee makes Indian exports cheaper, boosting IT, pharma, and textile exports.
- Higher Remittances: NRIs sending money to India benefit from better exchange rates, increasing remittance inflows.

Way Ahead:

- Enhancing Export Competitiveness: Strengthen Make in India and promote value-added exports to reduce trade imbalances.
- Managing Inflation & Interest Rates: Ensure monetary policies align with inflation control while maintaining growth momentum.
- Boosting Forex Reserves: Encourage higher FDI inflows and reduce non-essential imports to stabilize the rupee.
- Diversifying Trade & Reducing Oil Dependence: Invest in renewable energy and explore alternative trade partners to reduce reliance on crude oil and dollar transactions.

- Improving Investor Confidence: Strengthen India's macroeconomic fundamentals, ensuring policy stability to attract long-term foreign investments.

Conclusion:

The rupee's decline reflects global economic volatility, trade war fears, and strong US dollar dynamics. While higher exports and remittances provide some relief, rising inflation and CAD remain concerns. India must focus on macroeconomic stability, trade diversification, and policy interventions to sustain economic growth amid currency fluctuations.

Debt-to-GDP Ratio

Context:

The Union Government has announced a shift from fiscal deficit to debt-to-GDP ratio as the primary fiscal anchor from FY 2026-27, targeting a 50±1% ratio by 2031.

About Debt-to-GDP Ratio:

- It represents the proportion of a country's total debt to its GDP, indicating economic stability and repayment capacity.

Formula:

What it represents?

- A higher ratio signals increased risk of default and financial instability.
- A lower ratio indicates better fiscal health and investor confidence.
- Debt sustainability depends on growth rates, fiscal deficit trends, and interest payments.

Limitations of Debt-to-GDP Ratio

- Does Not Reflect Debt Composition: Ignores internal vs. external debt dynamics.
- Fails to Consider Fiscal Policy: Does not capture spending efficiency or investments.
- No Direct Correlation with Default Risk: Some high-debt countries remain solvent due to economic strength.

Need for India's Shift to a New Fiscal Anchor

- Long-term Fiscal Stability: Debt-based targets ensure sustainable government borrowing.
- Greater Policy Flexibility: Reduces reliance on annual fiscal deficit limits.
- Transparency & Accountability: Addresses off-budget borrowings and improves public finance management.
- Global Alignment: Aligns India's fiscal strategy with international best practices.
- Growth-Enhancing Expenditure: Ensures public spending focuses on productive sectors without excessive debt accumulation.

Monetary Policy Committee (MPC)

Context:

The Reserve Bank of India's (RBI) Monetary Policy Committee (MPC) is set to begin its meeting in Mumbai, with expectations of a potential rate cut amid efforts to boost consumption-led demand post the Union Budget.

About Monetary Policy Committee (MPC):

What is MPC?

- The MPC is a statutory body established under the Reserve Bank of India Act, 1934, as amended by the Finance Act, 2016. It is responsible for setting the benchmark policy rate (repo rate) to control inflation within a specified target range.

Members:

- RBI Governor (Chairperson)
- RBI Deputy Governor in charge of monetary policy
- One official nominated by the RBI Board
- Three external members representing the Government of India

Tenure:

- External members serve a four-year term.
- RBI Governor and Deputy Governor serve ex-officio.

Meetings:

- The MPC meets at least four times a year.
- Additional meetings can be convened if necessary.

Quorum for Decision:

- A minimum of four members is required for a quorum.
- The Governor (or Deputy Governor in their absence) must be present.
- Decisions are made by majority vote; in case of a tie, the Governor has the casting vote.

Function and Role:

- Primary role: To determine the repo rate to maintain inflation within the target range (currently 4% +/- 2%).
- Replaced the earlier Technical Advisory Committee.
- Decisions are binding on the RBI.
- The RBI's Monetary Policy Department (MPD) assists the MPC in policy formulation.

Grameen Credit Score

Context:

The Grameen Credit Score, introduced in the Union Budget 2025 by Finance Minister, aims to enhance financial inclusion for rural women entrepreneurs and Self-Help Groups (SHGs).

About Grameen Credit Score:

What it is:

- The Grameen Credit Score is a digital framework designed to assess the creditworthiness of rural women entrepreneurs and Self-Help Groups (SHGs). It aims to bridge the gap between informal rural economies and formal financial systems.

Aim:

- To promote financial inclusion for rural women and SHGs.
- To formalize SHG transactions and integrate them into India's central credit system.
- To empower rural women entrepreneurs by providing them access to credit, loans, and financial products.

How it works:

Credit Assessment:

- The score evaluates the creditworthiness of SHGs and rural women based on their financial transactions, repayment history, and business activities.
- It uses a digital framework to analyze data, ensuring transparency and accuracy.

Integration with Financial Institutions:

- Public sector banks are primarily responsible for developing and implementing the scheme.
- Financial institutions use the score to offer tailored financial products, such as loans and credit cards, to SHGs and rural women.
- Institutions Covered: Public sector banks, Regional Rural Banks (RRBs), Microfinance institutions (MFIs), Other financial institutions involved in rural credit.

Features:

Enhanced Financial Access:

- Enables rural women to access credit cards, loans, and other financial products.
- Introduces concepts like EMIs, creditworthiness, and loan repayment to SHGs.

Customized Financial Products:

- Offers tailored credit cards for micro-enterprises with limits up to 5 lakh.
- Provides flexible loan options to support business expansion.

Improved Credit Assessment:

- Addresses gaps in the current credit bureau system, which often overlooks SHG members.
- Ensures a fair and transparent evaluation of creditworthiness.

Economic Stability:

- Empowers rural women to contribute more effectively to their households and communities.
- Promotes sustainable development and poverty alleviation.

Digital Framework:

- Leverages technology to create a seamless and efficient credit assessment system.
- Ensures easy access to credit scores and financial products for rural women.

Organic Farming India

Context:

The Government of India is actively promoting organic farming through Paramparagat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development for North Eastern Region (MOVCDNER).

Government Initiatives to Promote Organic Farming:

Paramparagat Krishi Vikas Yojana (PKVY):

- Implemented across all states and UTs (except the Northeast) to support organic farming practices.
- Financial assistance of 31,500/ha for 3 years, including 15,000 via Direct Benefit Transfer (DBT) for organic inputs.
- Encourages value addition, certification, marketing, and capacity building.

Mission Organic Value Chain Development for North Eastern Region (MOVCDNER):

- Dedicated scheme for Northeastern states focusing on farmer producer organizations (FPOs) and organic input support.
- 46,500/ha for 3 years, with 32,500 for organic inputs, including 15,000 as DBT.

Organic Certification Systems:

- Third-Party Certification (NPOP): Under Ministry of Commerce, ensuring compliance for export-oriented organic produce.
- Participatory Guarantee System (PGS-India): A self-regulatory system under Ministry of Agriculture for the domestic market.

Market & Value Addition Support:

- Financial assistance under PKVY (4,500/ha for 3 years) and MOVCDNER (10,000/ha for 3 years) for certification, training, and marketing.
- Jaivik Kheti Portal: An online marketplace connecting organic farmers with consumers, with 6.22 lakh farmers registered.

Awareness & Promotion:

- Seminars, trade fairs, workshops, and organic festivals to enhance the reach of organic produce in domestic and global markets.

Repo Rate

Context:

The Reserve Bank of India (RBI) reduced the repo rate by 25 basis points (bps) to 6.25%, marking the first rate cut in nearly five years.

About Repo Rate:

What is Repo Rate?

- The repo rate is the interest rate at which the RBI lends money to commercial banks for short-term needs. It is a key monetary policy tool used to control inflation, manage liquidity, and influence economic growth.

How Does It Work?

- When the RBI lowers the repo rate, borrowing costs for banks decrease, enabling them to offer loans at lower interest rates to consumers and businesses.
- Conversely, an increase in the repo rate makes borrowing expensive, curbing excessive spending and controlling inflation.

Impact of Repo Rate Reduction on the Economy:

- Cheaper Loans: A lower repo rate reduces interest rates on loans, making home, vehicle, and personal loans more affordable.
- Boost to Spending and Investment: Lower borrowing costs encourage individuals and businesses to spend and invest, stimulating economic activity.
- Job Creation: Increased investment and spending can lead to higher employment opportunities.
- Inflation Management: While a rate cut can spur growth, it may also risk higher inflation if not managed carefully.
- Global Alignment: The rate cut aligns India with global trends, where many central banks have adopted accommodative monetary policies to support growth.

Quality of Public Expenditure

Context:

The Reserve Bank of India (RBI) recently released a study on the "Quality of Public Expenditure" (QPE) index, highlighting improvements in government spending efficiency since 1991.

- The report underscores the positive impact of fiscal discipline and increased capital expenditure on India's economic growth and social development.

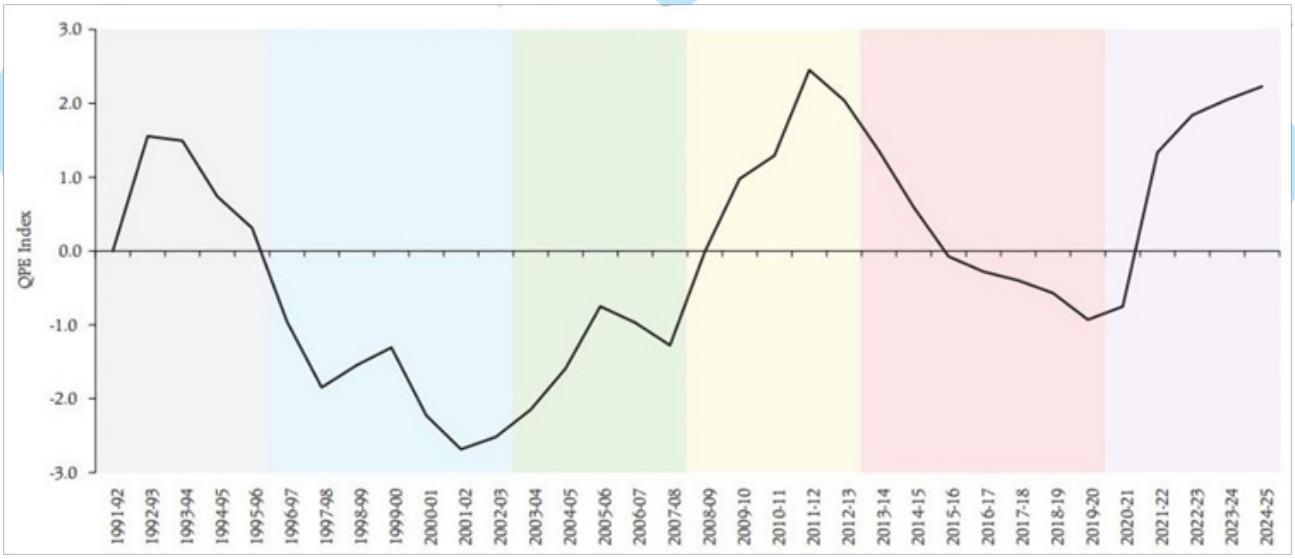
What is Socio-Economic Expenditure?

Socio-economic expenditure refers to government spending aimed at improving social and economic outcomes, such as education, healthcare, infrastructure, and welfare schemes. It includes:

1. Capital Expenditure (Capex): Investments in infrastructure like roads, railways, and ports.
2. Revenue Expenditure: Day-to-day spending on salaries, subsidies, and welfare programs.
3. Development Expenditure: Long-term investments in education, healthcare, and R&D.
4. Interest Payments: Costs incurred due to past borrowings.
5. Subsidies: Financial support for essential goods and services like food and fuel.

Data and Trends in India's Socio-Economic Expenditure:

1. Capital Outlay to GDP Ratio: Increased from 1.5% in 2000 to 2.5% in 2023, reflecting higher infrastructure spending.
2. Revenue Expenditure to Capital Outlay Ratio: Declined from 8:1 in 2000 to 5:1 in 2023, indicating better spending quality.
3. Development Expenditure to GDP Ratio: Rose from 6% in 2000 to 8% in 2023, driven by investments in health and education.
4. Interest Payments to Total Expenditure Ratio: Fell from 25% in 2000 to 20% in 2023 due to fiscal consolidation.
5. State-Level Spending: States' development expenditure increased post-14th Finance Commission recommendations, with higher fiscal devolution.



Analysis: Positive Outcomes:

1. Economic Growth: Higher capex boosted GDP growth, averaging 6.5% annually since 2000.
2. Infrastructure Development: Improved road, rail, and port connectivity enhanced trade and mobility.
3. Social Indicators: Increased spending on health and education improved literacy (77.7% in 2023) and life expectancy (70 years).
4. Fiscal Discipline: FRBM Act (2003) reduced fiscal deficits, stabilizing debt-to-GDP ratios.
5. Crisis Management: Counter-cyclical spending during the 2008 Global Financial Crisis and COVID-19 mitigated economic shocks.

Challenges to Quality of Public Expenditure:

1. Revenue Deficit: Persistent revenue deficits (3.3% of GDP in 2023) limit funds for capex.
2. Freebies and Subsidies: Rising populist measures strain fiscal resources.
3. Inefficient Spending: Leakages in welfare schemes like MGNREGA and PDS reduce effectiveness.
4. Debt Burden: High interest payments (20% of total expenditure) constrain developmental spending.
5. State-Level Disparities: Uneven fiscal capacity among states affects equitable development.

Way Ahead:

1. Boost Capex: Increase capital expenditure to 3% of GDP to sustain infrastructure growth.
2. Rationalize Subsidies: Implement direct benefit transfers (DBT) to reduce leakages.
3. Fiscal Federalism: Strengthen state finances through higher devolution and grants.
4. Monitor Spending: Use technology for real-time tracking of expenditure outcomes.
5. Reform FRBM Act: Focus on debt-to-GDP targets and flexible deficit limits during crises.

Conclusion:

India's quality of public expenditure has improved significantly since 1991, driven by fiscal discipline and higher capex. However, challenges like revenue deficits and inefficient spending persist. By rationalizing subsidies, boosting capex, and strengthening fiscal federalism, India can ensure sustainable and inclusive growth.

Social Security Cover for Gig Workers

Context:

The 2025 Budget introduced health insurance and identity registration for gig workers to improve their social security. While this addresses basic welfare needs, challenges in enforcement and sustainability remain.

The Gig Economy: Growth and Challenges

- Rapid Expansion: The gig workforce constitutes 12% of the global labour market (World Bank) and is expected to reach 23.5 million in India by 2029-30 (NITI Aayog).

Advantages:

- Provides flexible employment and income opportunities, driving economic growth, especially in e-commerce and service industries.

Challenges:

- Income insecurity due to irregular earnings.
- Lack of legal protection as gig workers do not fall under traditional labour laws.
- No employer contributions to pensions, insurance, or other social benefits.

Existing Policy Framework

1. **Code on Social Security, 2020**
   - Recognizes gig workers as a distinct category and provides for insurance, health benefits, pensions, and a Social Security Fund.
2. **Budget 2025 Provisions**
   - Health Insurance: Coverage under PM Jan Arogya Yojana.
   - Identity Registration: e-Shram portal for tracking and integrating workers into social security schemes.
   - Aggregator Module: Launched to streamline registration of workers and platform companies.

Key Challenges in Social Security Implementation

1. Lack of Employer-Employee Relationship: Gig workers are independent contractors, making it difficult to enforce labour protections and ensure mandatory contributions.
2. Irregular Income & Financial Constraints: Unstable earnings limit workers' ability to contribute to social security funds, making purely contributory schemes impractical.
3. Gaps in Registration & Compliance: Many workers remain unregistered on the e-Shram portal, and platform aggregators have no legal obligation to provide social security.
4. Sustainable Financing Mechanism: Funding social security requires a balanced approach, involving government support, platform aggregator contributions, and worker participation.

Global Best Practices for Gig Worker Protection

Country	Social Security Measures
UK	Minimum wage, paid leave, and pension for gig workers.
Singapore	Mandates platform aggregators to contribute to social security.
Oman & Thailand	Co-funded social security models.
Indonesia	Government-subsidized accident and life insurance.

Way Forward: A Sustainable & Inclusive Approach

1. **Multi-Stakeholder Social Security Model**
   - Government: Policy framework and partial funding.
   - Platform Aggregators: Mandatory contributions to social security funds.
   - Workers: Opt-in contributory pension and insurance schemes.
2. **Expanding Benefits Beyond Health Insurance**
   - Pension & Retirement Plans: Small contributions pooled for old-age benefits.
   - Skill Development: Upskilling for better income stability.
   - Emergency Assistance: Financial aid for crisis situations.
3. **Strengthening Implementation & Compliance**
   - Mandatory Registration: e-Shram portal integration for better outreach.
   - Worker Grievance Redressal: Institutional mechanisms to address concerns.
4. **Leveraging Technology for Social Security**
   - Digital Payment Integration: Efficient contribution and benefit disbursal.
   - AI-driven Monitoring: Real-time tracking of worker participation and compliance.

Conclusion:

Ensuring long-term success requires strong enforcement, sustainable funding, and aggregator accountability. A multi-stakeholder approach can balance flexibility with essential worker protections.

Diversity, Equity, and Inclusion (DEI) Policies

Context:

The U.S. President Donald Trump revoked Diversity, Equity, and Inclusion (DEI) policies implemented under the Biden administration, citing them as discriminatory.

What Are DEI Policies?

Diversity, Equity, and Inclusion (DEI) policies refer to workplace and institutional measures aimed at ensuring fair representation and equal opportunities across race, gender, ethnicity, and socio-economic backgrounds.

Key Features of DEI Policies:

- Diversity: Encourages representation of different races, ethnicities, abilities, and cultural backgrounds.
- Equity: Ensures fair treatment, access, and opportunities for historically disadvantaged groups.

- Inclusion: Promotes a workplace environment where diverse individuals feel respected and valued.
- Accessibility: Ensures that workplaces, technology, and resources are available to people with disabilities.

Need for DEI Policies: Ethical & Non-Ethical Aspects

Ethical Justifications:

- Correcting Historical Injustices: Ensures fair opportunities for marginalized communities.
- Relational Ethics: Encourages workplaces to foster mutual respect, empathy, and inclusivity (Ethics of Care).
- Moral Virtue of Justice: Promotes fairness and ethical responsibility in corporate and social structures (Virtue Ethics).

Non-Ethical Aspects:

- Reverse Discrimination: Critics argue DEI creates bias against majority groups.
- Merit-Based Concerns: Some view DEI as prioritizing identity over merit in hiring and promotions.
- Financial Burden: High compliance costs for corporations and government agencies.

Why Did the U.S. Remove DEI Policies?

- Conservative Backlash: DEI was perceived as discriminatory against white Americans.
- Legal Challenges: The Supreme Court struck down affirmative action in college admissions.
- Economic Pressures: Companies faced shareholder scrutiny over the financial viability of DEI programs.
- Political Stance: Trump positioned DEI as "wasteful and radical", linking it to leftist ideology.

Potential Impact of DEI Rollback: Ethical & Non-Ethical Aspects

Ethical Impact:

- Reduced Workplace Diversity (Theory of Justice – John Rawls)
- Principle of Fairness: Undermines Rawls' distributive justice, reducing opportunities for marginalized groups.
- Difference Principal Violation: Reverses progress in social equity by removing policies benefiting the least advantaged.
- Social Repercussions (Ethics of Care – Carol Gilligan & Social Contract Theory – Rousseau)
- Loss of Moral Obligation: Weakens corporate responsibility toward underrepresented communities (Ethics of Care).
- Erosion of Social Contract: Undermines governmental duty to protect disadvantaged groups, leading to greater inequality (Rousseau's Social Contract).

Non-Ethical Impact:

- Corporate Realignment: Businesses may modify DEI branding to avoid political controversy.
- Cost Savings: Reducing DEI programs may lower corporate expenses.
- Merit-BasedHiring: Proponents argue that hiring will now be strictly performance-based.

India's Status on DEI Policies:

- No direct DEI framework, but India has long-standing affirmative action policies under the Constitution.
- Reservation System: SCs, STs, and OBCs benefit from educational and job quotas.
- Article 16: Guarantees equal employment opportunities regardless of caste, religion, gender, or birthplace.
- Private Sector Approach: Indian companies increasingly implement diversity hiring programs, especially for women and marginalized communities.

Conclusion:

The U.S. rollback may influence global corporate strategies, but India continues its social justice policies through reservations rather than direct DEI initiatives. The debate over balancing equity with meritocracy will shape future diversity policies worldwide.

Government Initiatives to Support Women Employees and Entrepreneurs

Context:

The Indian government has launched multiple initiatives to ensure a safe, secure, and non-discriminatory workplace for women while also supporting women entrepreneurs through financial and policy measures.

Government Initiatives to Support Women Employees and Entrepreneurs:

Workplace Safety and Gender Inclusivity:

- Mandatory Women Director: Listed and large public companies (100+ crore capital or 300+ crore turnover) must appoint at least one-woman director (Companies Act, 2013).
- Internal Complaints Committee (IC): Companies must comply with the Sexual Harassment of Women at Workplace (Prevention, Prohibition & Redressal) Act, 2013 (SH Act).
- SHe-Box (Sexual Harassment e-Box): A centralized online platform for women to register workplace harassment complaints.
- Creche Facility: Mandatory for establishments with 50+ employees under the Maternity Benefit (Amendment) Act, 2017.

Financial & Entrepreneurial Support:

- Credit Guarantee Scheme for Micro & Small Enterprises: Special incentives for women entrepreneurs.
- Prime Minister Employment Generation Programme (PMEGP): Higher subsidies for women in micro-enterprises.
- Stand-Up India (SUI) Scheme: Loans between 10 lakh – 1 crore for at least one-woman borrower per bank branch for greenfield enterprises.
- Yashasvini Initiative (2024): Capacity-building campaign for women entrepreneurs in Tier-II & III towns.
- 'Palna' Scheme (2022): Centrally sponsored day-care support for working mothers.

National Skill Development Corporation (NSDC)

Context:

The National Skill Development Corporation (NSDC) announced plans to establish 50 Future Skills Centres (FSCs) and 10 NSDC International Academies to boost skill development in India.

About National Skill Development Corporation (NSDC):

What is NSDC?

- A not-for-profit public limited company established to enhance skill development in India.
- Operates under the Ministry of Skill Development & Entrepreneurship (MSDE).

Established In:

- Founded on July 31, 2008, as a Public-Private Partnership (PPP) model under Section 25 of the Companies Act, 1956 (now Section 8 under the 2013 Act).

Shareholding Structure

- 49% government stake and 51% private sector participation, ensuring a collaborative skill development framework.

Aim of NSDC:

- To bridge the skill gap by providing industry-relevant training and enhancing workforce readiness.
- To support enterprises, start-ups, and training organizations through funding and concessional loans.

Key Functions of NSDC:

- Skill Development & Training: Provides vocational training and certification in emerging technologies to align with industry needs.
- Apprenticeship & Job Training: Implements NAPS with 5 million apprentices, disbursing 100,250 million for skill-based learning.
- Digital & Remote Skilling: Runs Skill India Digital Hub (SIDH) with 7,100 courses in 23 languages, reaching 30 crore candidates.
- Job & Career Support: NSDC JobX connects job seekers with employers, aiding resume building, career coaching, and placements for 4 million candidates.

Make the World Wear Khadi Campaign

Context:

The "Make the World Wear Khadi" campaign is part of the inaugural World Audio Visual & Entertainment Summit (WAVES) in Mumbai from 1 to 4 May 2025.

About Make the World Wear Khadi Campaign:

What is it?

- A global campaign to blend Khadi's heritage with modern fashion, positioning it as a desirable global brand.
- Launched by: Advertising Agencies Association of India (AAAI) & Ministry of Information and Broadcasting

Aim:

- Revitalize Khadi's global appeal through creative marketing.
- Encourage strategic branding efforts to increase Khadi's market presence.
- Promote Indian textile heritage at an international level.

Key Features:

- Part of the World Audio Visual & Entertainment Summit (WAVES).
- Open to advertising professionals and freelancers globally.
- Includes digital, print, video, and experiential marketing challenges.

Addressing Concerns of PwDs in the DPDP Act, 2023

Context:

Disability rights activists have raised concerns over Section 9(1) of the Digital Personal Data Protection (DPDP) Act, 2023, which mandates that PwDs with legal guardians must obtain consent from their guardian for data processing.

Understanding Concerns of PwDs in the DPDP Act, 2023:

1. What is Guardianship?

Governed by two laws:

- Rights of Persons with Disabilities (RPWD) Act, 2016: Provides for limited guardianship, allowing PwDs some decision-making rights.
- National Trust Act (NT Act), 1999: Grants full guardianship for PwDs with autism, cerebral palsy, and intellectual disabilities.
- Issue: DPDP Act does not differentiate between these laws, creating confusion over decision-making authority.

2. Who is a Data Fiduciary?

- Any entity that collects, processes, or stores personal data.
- Required to obtain consent before processing data and ensure compliance with privacy laws.

3. Who is a Data Principal?

- The individual whose data is being processed.
- For PwDs with legal guardians, the DPDP Act includes their guardian within the definition of Data Principal, raising concerns about autonomy and privacy.

Key Provisions of DPDP Rules & Their Impact on PwDs:

- Section 9(1): Mandates verifiable consent from a legal guardian before processing the personal data of a PwD with a guardian.
- Rule 10(2): Requires verification that the guardian is legally appointed under RPWD Act or NT Act.
- Definition of PwDs in the Act: Covers individuals with long-term disabilities who cannot take legally binding decisions.

Issues with DPDP Rules & PwD Concerns:

- Loss of Digital Autonomy: The law assumes PwDs cannot manage their data, reinforcing stereotypes and restricting their digital independence.
- Conflict Between Guardianship Laws & Digital Rights: The NT Act enforces full guardianship, while the RPWD Act allows limited guardianship, but DPDP fails to distinguish between the two.
- Data Privacy & Consent Issues: PwDs may be forced to disclose personal information to platforms, raising data security risks.
- Unclear whether guardians bear legal liability for data misuse.
- No Accessibility Measures in Digital Platforms: Many popular apps and websites remain inaccessible to PwDs, further limiting digital participation.
- Gender & Disability Intersectionality Ignored: Women with disabilities may face barriers in accessing essential online services (e.g., purchasing menstrual hygiene products).

Way Ahead:

- Remove Blanket Guardian Consent Requirement: Recognize PwDs' digital autonomy unless a court explicitly states full guardianship is needed.
- Differentiate Between Full & Limited Guardianship: Align DPDP Act with RPWD & NT Act to ensure legally sound consent mechanisms.
- Improve Accessibility & Digital Inclusion: Ensure government and private digital services comply with accessibility standards.
- Clarify Legal Liabilities for Guardians: Define data-related responsibilities and penalties for both PwDs and their guardians.

Conclusion:

The DPDP Act's consent clause for PwDs raises serious concerns about autonomy, privacy, and digital accessibility. While protecting vulnerable individuals is essential, the law must ensure inclusivity and respect for decision-making rights. Addressing ambiguities in guardianship roles and promoting digital accessibility will be key to ensuring fair implementation.

Kota Cares Initiative

Context:

The Kota district administration introduced student welfare reforms under the "Kota Cares" initiative to tackle stress, mental health concerns, and safety issues among coaching students.

About Kota Cares Initiative:

What is It?

- A student support initiative aimed at reducing stress, improving safety, and enhancing well-being for 1.25 lakh students in Kota's coaching centers.
- Aim: To create a safe, supportive, and student-friendly environment by addressing accommodation, safety, mental health, and recreation needs.

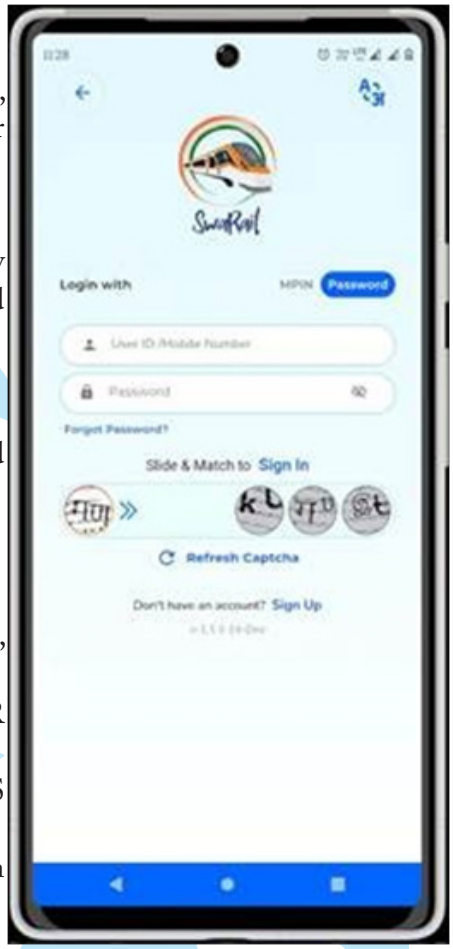
How It Works:

- Student Housing Reforms: Eliminates caution deposits, caps maintenance fees at 2,000, and mandates transparent payment systems with receipts.
- Enhanced Safety Measures: Implements CCTV surveillance, biometric access, fire safety NOCs, and suicide prevention devices in hostels.
- Mental Health & Recreation: Provides free access to recreational zones, mid-term food services, and sets up student support centers.
- 24/7 Emergency Services: Ensures round-the-clock medical aid, trained hostel staff, and dedicated help desks at transport hubs.

Impact:

- Reduces Student Stress: Enhances mental well-being and creates a safe, supportive environment for students.
- Prevents Suicides: Strengthens mental health interventions and suicide prevention mechanisms in hostels.
- Improves Living Conditions: Ensures better housing facilities, security, and emergency medical services.
- Boosts Kota's Reputation: Establishes Kota as a student-friendly city, attracting more aspirants with improved facilities.

SwaRail SuperApp



Context:

Indian Railways has launched the 'SwaRail' SuperApp in beta testing, integrating multiple railway services into a single platform to enhance user convenience and reduce app clutter.

About SuperApp 'SwaRail':

- What it is: A one-stop solution offering comprehensive railway services, including ticket booking, PNR enquiries, food ordering, and freight services.
- Ministry: Ministry of Railways.
- Developed by: Centre for Railway Information Systems (CRIS).
- Aim: To streamline railway services, improve user experience, and reduce the need for multiple apps.

Features:

- Single sign-on: Access all services with one set of credentials.
- All-in-One App: Combines reserved and unreserved ticket booking, train schedules, and PNR status.
- Integrated services: Provides cohesive information, such as PNR details with train information.
- Easy onboarding: Users can log in using existing RailConnect or UTS App credentials.
- Multiple login options: Supports m-PIN and biometric authentication for ease of access.

International Big Cat Alliance (IBCA)

Context:

The International Big Cat Alliance (IBCA) has officially come into force as a treaty-based intergovernmental organization with its headquarters in India.

- The alliance has received ratifications from India, Nicaragua, Eswatini, Somalia, and Liberia.

About International Big Cat Alliance (IBCA):

- Launched: April 9, 2023, by Prime Minister of India during Project Tiger's 50th anniversary.
- Headquarters: India (National Tiger Conservation Authority, MoEFCC).

Aim & Objectives:

- Global Conservation of seven big cats – Tiger, Lion, Leopard, Snow Leopard, Cheetah, Jaguar, and Puma.
- Prevent Illegal Wildlife Trade by strengthening anti-poaching laws and enforcement.
- Financial & Technical Support for conservation efforts in range and non-range countries.
- Climate Change Mitigation by integrating conservation with sustainability initiatives.

Species Covered:

- Seven Big Cats: Tiger, Lion, Leopard, Snow Leopard, Cheetah, Jaguar, Puma.
- India hosts five of these: Tiger, Lion, Leopard, Snow Leopard, and Cheetah (excluding Jaguar and Puma).

Functions & Operations:

- Collaborative Platform to share best conservation practices globally.
- Research & Monitoring through data sharing and ecological studies.
- Funding & Resource Mobilization for conservation projects and habitat protection.
- Policy Advocacy to align conservation strategies with the UN Sustainable Development Goals (SDGs).

Funding & Governance:

- Budget Allocation: 150 crore (2023-28) by the Union Cabinet.
- Inspired by International Solar Alliance (ISA) with a Director-General appointed by MoEFCC.

Household Consumption Expenditure Survey (HCES) 2023-24

Context:

The Ministry of Statistics and Programme Implementation (MoSPI) has released the Household Consumption Expenditure Survey (HCES) 2023-24, highlighting increasing MPCE (Monthly Per Capita Expenditure) and declining urban-rural consumption gaps.

About Household Consumption Expenditure Survey (HCES):

What is HCES?

- A nationwide survey conducted to assess household consumption patterns, living standards, and expenditure trends.
- Provides essential data for economic planning, poverty measurement, and updating the Consumer Price Index (CPI).

Survey Details:

- Conducted by: National Statistical Office (NSO) under MoSPI.
- Methodology: Multistage stratified sampling, covering both rural and urban areas.

Coverage:

- 2023-24 Sample: 2,61,953 households (1,54,357 rural, 1,07,596 urban).
- Conducted across all States and Union Territories, except a few remote villages in Andaman & Nicobar Islands.
- Survey Period: August 2023 – July 2024.

Key Findings of HCES 2023-24:

1. **Rising Household Consumption Expenditure**

- MPCE (Monthly Per Capita Expenditure) at Current Prices:
- Rural: 4,122 (2023-24) vs. 3,773 (2022-23).
- Urban: 6,996 (2023-24) vs. 6,459 (2022-23).

Urban-Rural Consumption Gap:

- Declined to 70% in 2023-24 from 71% in 2022-23 and 84% in 2011-12.

State-wise Trends:

- Odisha (14%) saw the highest increase in rural MPCE, while Punjab (13%) saw the highest rise in urban MPCE.
- Kerala recorded the lowest urban-rural MPCE gap (18%), while Jharkhand had the highest (83%).

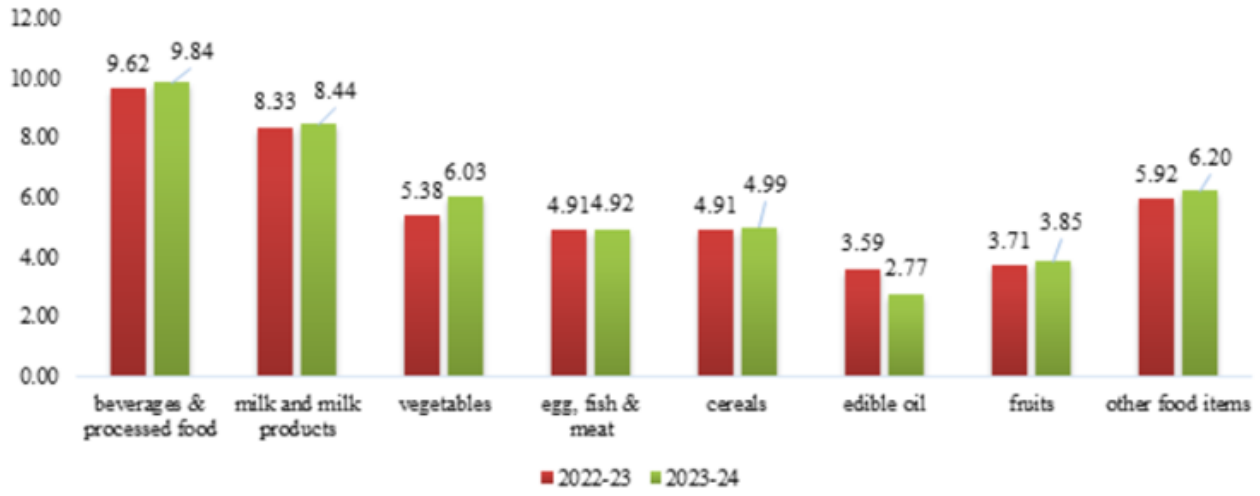
2. Decline in Consumption Inequality:

- Gini Coefficient (measure of consumption inequality) declined:
- Rural India: 0.237 (2023-24) vs. 0.266 (2022-23).
- Urban India: 0.284 (2023-24) vs. 0.314 (2022-23).
- All 18 major states recorded a decline in consumption inequality.

3. Share of Expenditure on Food and Non-Food Items:

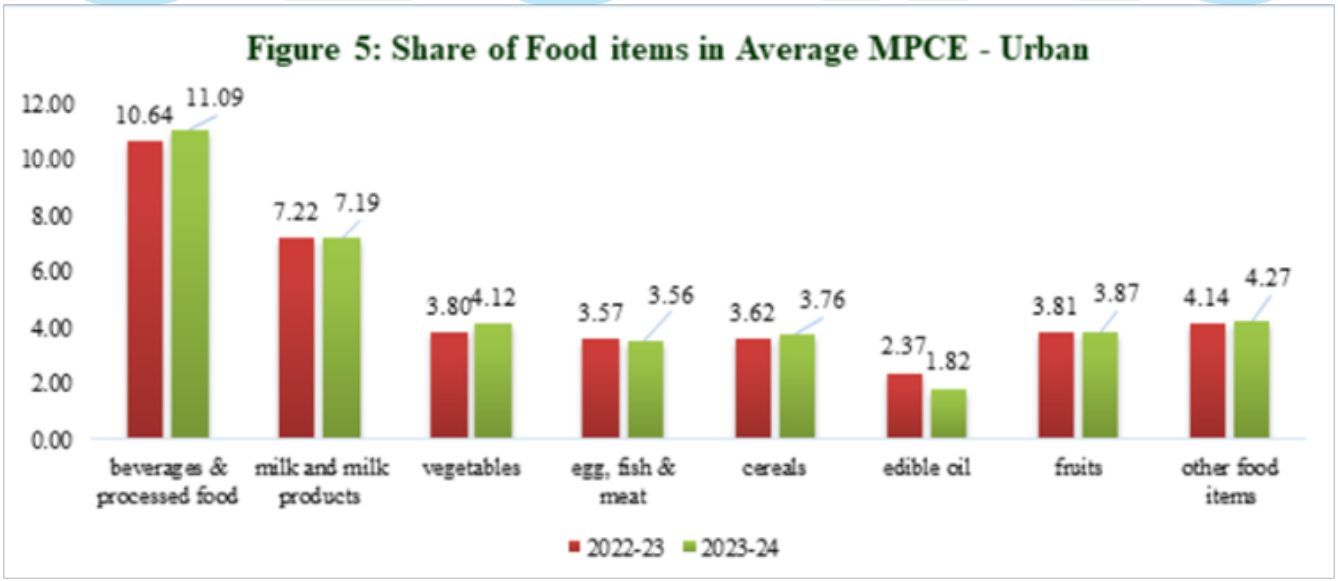
- Rural Areas: 47% of MPCE spent on food, with highest expenditure on beverages (9.84%), milk (8.44%), and vegetables (6.03%).

Figure 4: Share of Food items in Average MPCE - Rural



- Urban Areas: 40% of MPCE spent on food, highest on beverages (11.09%), milk (7.19%), and vegetables (4.12%).

Figure 5: Share of Food items in Average MPCE - Urban



- Non-food expenditure dominated by transport, medical expenses, durable goods, and rent.

4. Variation in MPCE Across Social Groups:

- Highest MPCE among 'Others' category, followed by OBCs, SCs, and STs.

- MPCE for STs increased from 3,016 (rural) and 5,414 (urban) in 2022-23 to 3,363 (rural) and 6,030 (urban) in 2023-24.

5. Variation in MPCE Across Occupations:

- Highest MPCE in rural areas: Salaried non-agricultural households (5,005).
- Highest MPCE in urban areas: 'Others' category (9,159).

Positive Outcomes from the Report:

- Rising Consumption Levels: Increased MPCE in all states, indicating improved living standards and economic activity.
- Reduction in Consumption Inequality: Declining Gini coefficient suggests better income distribution.
- Narrowing Urban-Rural Gap: Indicates rising rural purchasing power, reducing economic disparity.
- Stronger Impact of Social Welfare Programs: Higher imputed MPCE shows better access to subsidized goods and services.
- Better Policy Insights: Provides updated data for economic planning, poverty measurement, and CPI computation.

Negative Findings from the Report:

- Persisting Urban-Rural Gap: Though declining, rural MPCE remains significantly lower than urban MPCE.
- High Consumption Disparity Across States: States like Jharkhand and Chhattisgarh still show large urban-rural divides.
- Limited Growth in Maharashtra & Karnataka: Lowest increase in MPCE (rural: 3%, urban: 5%), indicating economic stagnation.
- High Share of Expenditure on Non-Essential Goods: Rising spending on processed foods and beverages over essential food grains.
- Vulnerable Social Groups Still Lagging: STs and SCs continue to have lower MPCE compared to OBCs and General category.

Way Ahead:

- Targeted Rural Economic Growth: Enhance employment opportunities, infrastructure, and digital connectivity to boost rural income.
- Bridging State-Level Disparities: State-specific interventions for states with high urban-rural MPCE gaps.
- Sustainable Consumption Pattern: Promote balanced spending on essentials, healthcare, and savings.
- Strengthening Social Welfare Programs: Expand direct benefit transfers (DBT) and rural livelihood missions to further reduce inequality.
- Data-Driven Policy Formulation: Utilize HCES data for poverty alleviation, inflation control, and inclusive economic growth.

Conclusion:

The Household Consumption Expenditure Survey 2023-24 reflects positive economic trends, including rising MPCE, declining consumption inequality, and narrowing urban-rural gaps. However, persistent regional and social disparities highlight the need for targeted policy interventions. Leveraging HCES insights can drive inclusive growth, ensuring equitable economic prosperity across India.

SARAT Version 2 Tool

Context:

Union Minister for Science and Technology announced the launch of SARAT Version 2, an advanced tool enhancing the efficiency of Indian search-and-rescue agencies with improved accuracy, faster response times, and better visualization capabilities.

About SARAT (Search and Rescue Aid Tool) Version 2:

- What it is: SARAT is a specialized tool developed to

assist search-and-rescue (SAR) operations, particularly in the Indian Ocean region.

- Ministry: Developed under the Ministry of Earth Sciences (MoES) and implemented by the Indian National Centre for Ocean Information Services (INCOIS).
- Aim: To improve the efficiency, accuracy, and success rates of SAR operations by providing precise search areas, exportable data, and enhanced visualization tools.

Key Features:

- Accurate Search Areas:Anchored to the Last Known Position (LKP) for precise search region computation.
- Exportable Data:Digital search area formats for seamless integration with rescue planning maps.
- Enhanced Visualization:Features like particle trajectory visualization, color-coded search regions, and LKP markers for clearer interpretation.
- Training Initiatives:INCOIS conducts workshops and training for SAR agencies like the Indian Coast Guard (ICG) and Airports Authority of India (AAI).
- Future Enhancements:Plans to improve accuracy by integrating high-frequency radar measurements and advanced ocean modeling techniques.

TROPEX-25

Context:

The Indian Navy's biennial Theatre Level Operational Exercise (TROPEX-25) is currently underway in the Indian Ocean Region (IOR) from January to March 2025.

About Theatre Level Operational Exercise (TROPEX-25):

What is TROPEX?

- Theatre Level Operational Readiness Exercise (TROPEX) is the Indian Navy's largest biennial maritime exercise, testing combat readiness and joint warfighting capabilities.
- Location: Hosted by India, the exercise is conducted across the Indian Ocean Region (IOR), including strategic maritime zones.

Participation:

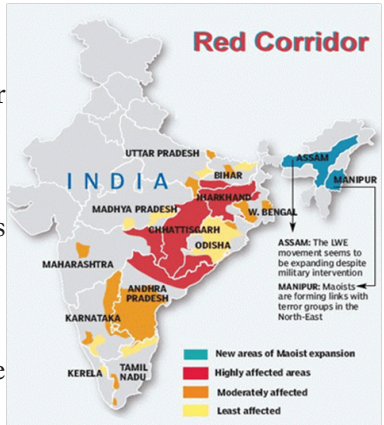
- Led by the Indian Navy, with substantial participation from the Indian Army, Air Force, and Coast Guard.

Key Features & Objectives:

- Focuses on maritime security, anti-submarine warfare, cyber and electronic warfare, and live weapon firings.
- Tests integrated response strategies against conventional, asymmetric, and hybrid threats.
- Includes joint work-up phases, amphibious exercises, and combat scenario simulations.

Naxalism

Context:



Security forces eliminated 31 Naxalites in Bijapur, Chhattisgarh, marking a major success in the government's mission to make India Naxal-free by March 31, 2026.

Understanding Naxalism:

- Definition: Naxalism refers to Left-Wing Extremist (LWE) movements inspired by Maoist ideology, advocating armed rebellion against the state.

Reasons Behind Naxalism:

- Land Disputes & Exploitation: Marginalized tribal communities face displacement due to mining, industrialization, and lack of land rights.

- Economic Inequality: Lack of basic infrastructure, employment, and access to education fuels discontent.
- Political Alienation: Weak governance and failure to integrate tribal areas into mainstream development policies.
- Weak Law Enforcement: Poor police presence in remote areas allows Naxals to establish control.
- External Support: Naxalite groups receive funding, arms, and training from sympathizers within and outside India.

Key Security Measures Taken So Far: (Source: Ministry of Home Affairs Annual Report)

1. Administrative Actions

- Ban on CPI (Maoist) under the Unlawful Activities (Prevention) Act (UAPA), 1967, restricting its operations and funding.
- Creation of NIA LWE Division to fast-track prosecution of Naxal cases.
- Strengthening Inter-State Coordination for intelligence sharing and joint operations.

2. Welfare & Development Initiatives

- Special Central Assistance (SCA): 3,450 crore allocated to develop critical infrastructure in 25 most-affected LWE districts.
- Road Connectivity Projects: Over 5,148 km of roads built to improve access to remote areas.
- Skill Development & Employment: Establishment of 48 Industrial Training Institutes (ITIs) and 68 Skill Development Centers (SDCs).
- Financial Inclusion: Opening of 2,796 bank branches and 4,903 post offices in LWE-affected districts.

3. Military & Strategic Countermeasures

- Deployment of Central Armed Police Forces (CAPFs) in high-risk zones.
- Fortification of 250 Police Stations in LWE-affected states to ensure better security.
- Counter-IED Operations to tackle landmine threats, reducing security force casualties.
- Use of UAVs and Helicopters to track and neutralize Maoist strongholds.

Progress and Impact

- Sharp Decline in Naxal Incidents: 48% reduction in violent incidents (from 1,136 in 2013 to 594 in 2023).
- Fewer Casualties: 65% decline in deaths (from 397 in 2013 to 138 in 2023).
- Shrinking Naxal Influence: Maoist violence is now limited to 25 districts, down from 76 districts in 2013.
- Increased Surrenders: A large number of Maoist cadres abandoning violence and reintegrating into society.

Challenges in Eliminating Naxalism:

- Guerrilla Warfare Tactics: Naxalites use forests, landmines, and surprise attacks, making counterinsurgency difficult.
- Tribal Distrust of Authorities: Decades of neglect have led to deep-rooted resentment, which Maoists exploit.
- Political & Ideological Support: Urban sympathizers continue to fund and justify the movement.
- Infrastructure Sabotage: Maoists target schools, roads, telecom towers, and other government projects to halt development.
- Limited Economic Alternatives: Lack of sustainable employment and education keeps Naxal ideology alive in affected regions.

Way Forward:

- Sustained Military Action: Security forces must continue targeted operations while improving intelligence networks.
- Community Engagement: Tribal populations should be involved in governance to build trust and cooperation.
- Focused Development Initiatives: Government should accelerate road, telecom, and employment projects to integrate remote areas.
- De-radicalization Programs: Skill training and education campaigns should be launched to prevent youth recruitment.

- Political Will & Coordination: Stronger inter-state and central-state collaboration will ensure a unified approach against LWE.

Conclusion:

A balanced approach of military action and socio-economic upliftment is necessary to completely eradicate Naxalism by 2026. The recent success in Bijapur, Chhattisgarh, signals a step closer to achieving a Naxal-free India while ensuring peace, security, and prosperity in the affected regions.

Revised Market Intervention Scheme (MIS) Guidelines

Context:

The Government has revised the Market Intervention Scheme (MIS) guidelines, increasing the procurement limit from 20% to 25% and expanding procurement agencies.

About Market Intervention Scheme (MIS):

What is Market Intervention Scheme (MIS)?

- A price support scheme under the Department of Agriculture & Farmers' Welfare.
- Part of the PM-AASHA scheme, ensuring remunerative prices for farmers.
- Covers perishable crops (horticultural & agricultural commodities) that do not have Minimum Support Price (MSP).
- Implemented on request of State/UT Governments when market prices drop by at least 10% compared to the previous season.

Key Features of MIS:

- Ad-hoc Scheme: Applied during market price crashes.
- State-Central Cost Sharing: 50:50 (75:25 for North-Eastern States).
- Operational by NAFED, NCCF & State Agencies.

Revised Market Intervention Scheme (MIS):

- Increased Procurement Limit: Procurement coverage raised from 20% to 25% of total production.
- Direct Benefit Transfer (DBT) Option: States can now pay farmers directly for the price difference between the Market Intervention Price (MIP) and market price.

Expanded Procurement Agencies:

- Farmer Producer Organizations (FPOs), Farmer Producer Companies (FPCs), State-nominated agencies, and Central Nodal Agencies (NAFED, NCCF) will procure TOP (Tomato, Onion, Potato) crops.

Reimbursement of Storage & Transport Costs:

- Central Nodal Agencies (CNA) will reimburse costs for transporting crops from producing to consuming States.

Sjanam Rig

Context:

Union Minister for Science & Technology launched India's first indigenous Automated Biomedical Waste Treatment Plant, named Sjanam, at AIIMS, New Delhi.

About Sjanam Rig:

What is Sjanam?

- Sjanam is an automated, eco-friendly biomedical waste treatment rig designed to disinfect pathogenic medical waste without incineration.

Location & Implementing Agencies:

- Location: AIIMS, New Delhi.
- Developed by: CSIR-NIIST (National Institute for Interdisciplinary Science and Technology), Thiruvananthapuram.
- Under Ministry: Ministry of Science & Technology.
- Implemented by: AIIMS in collaboration with CSIR.

How it Works?

- Uses non-incineration technology to disinfect biomedical waste such as blood, urine, lab disposables.
- Employs a specialized antimicrobial process to neutralize pathogens.
- Converts treated waste into safe organic material, reducing hazardous emissions.

Key Features of Sjanam Rig:

- Incineration-Free Technology: Reduces harmful emissions like dioxins and furans from medical waste burning.
- Capacity: Can treat 400 kg of waste per day, including 10 kg of degradable medical waste.
- Eco-Friendly: Produces fragrance-infused non-toxic waste, reducing foul odors.
- Safe & Efficient: Eliminates human exposure risks and prevents accidental spills.
- Sustainable Alternative: Validated for antimicrobial action, making treated waste safer than organic fertilizers.
- Aligns with CPCB Norms: Addresses India's biomedical waste crisis (743 tonnes/day as per CPCB).

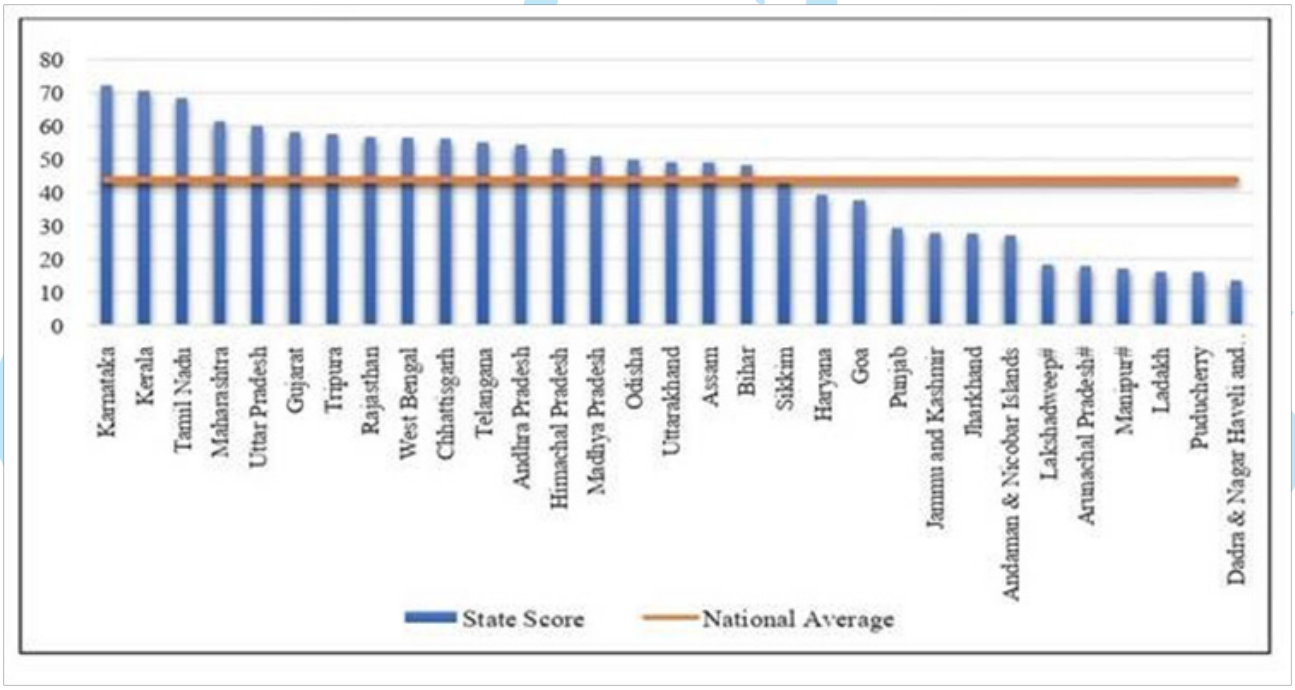
Status of Devolution to Panchayats in States

Context:

The Union Minister of State, released the "Status of Devolution to Panchayats in States" report in New Delhi, highlighting an increase in Panchayat devolution from 39.9% to 43.9% (2013-14 to 2021-22).

Key Data Insights on Present Panchayat Devolution:

- Karnataka secured the highest rank with a Devolution Index score of 72.23, followed by Kerala (70.59) and Tamil Nadu (68.38).
- Chhattisgarh, Gujarat, Maharashtra, Rajasthan, Telangana, Tripura, Uttar Pradesh, and West Bengal are categorized as high devolution states (>55 score).
- Andhra Pradesh, Himachal Pradesh, Madhya Pradesh, and Odisha fall under the medium devolution category (50-55 score).
- Assam, Bihar, Sikkim, and Uttarakhand scored between 43.89 and 50, indicating moderate devolution progress.
- 12 states and UTs, including Jharkhand, Punjab, Goa, and Arunachal Pradesh, ranked below the national average (43.89), marking them as low-performing states in panchayat empowerment.
- Financial devolution saw an improvement from 32.05 (2013-14) to 37.04 (2023-24), but functional devolution declined from 35.34 to 29.18 in the same period.
- Capacity enhancement index increased from 44.01 to 54.63, indicating a stronger push for training and institutional support.



Top Performers in Specific Dimensions:

- Finances & Accountability: Karnataka
- Functions: Tamil Nadu
- Framework & Institutional Setup: Kerala
- Training & Capacity Building: Telangana
- Role in Government Schemes: Uttar Pradesh

Positives in the Report:

- Strengthened Financial Support: Panchayats benefited from timely 15th Finance Commission grants, improving fiscal autonomy.
- Enhanced Panchayat Capacities: States such as Telangana, Tamil Nadu, and Gujarat led in training programs and institutional support for Panchayats.
- Improved Digital & Administrative Infrastructure: States like Chhattisgarh, Gujarat, and Assam advanced in e-Governance adoption, online audits, and record-keeping.

- Higher Role in Centrally Sponsored Schemes (CSSs): Panchayats showed greater engagement in key schemes like MGNREGA, PMAY, ICDS, and NHM.
- Increased Gender & Social Inclusion: Many states increased women's reservation to 50%, fostering better participation in local governance.

Challenges in Panchayat Devolution:

- Declining Functional Devolution: States are not transferring sufficient administrative powers to Panchayats despite financial devolution.
- Weak State Finance Commissions (SFCs): Several states delay SFC reports, affecting timely fund allocations and fiscal autonomy.
- Limited Own Revenue Generation: Panchayats rely heavily on state and central transfers due to weak taxation powers at the local level.
- Inadequate Human Resources: Shortage of Panchayat functionaries, with one secretary often managing multiple Panchayats, hinders efficient governance.
- Parallel Bodies Overlapping Panchayat Functions: Multiple line departments & parastatal bodies bypass Panchayats, weakening decentralization.
- Weak Transparency & Accountability: Inadequate social audits, low RTI compliance, and ineffective grievance redressal mechanisms undermine governance.

Way Forward:

- Strengthen Functional Devolution: Ensure activity mapping is completed, delegating real decision-making power to Panchayats.
- Revamp State Finance Commissions (SFCs): Institutionalize regular assessments, ensuring states implement SFC recommendations without delay.
- Enhance Own Revenue Mobilization: Empower Panchayats with property tax collection, ensuring financial self-sufficiency.
- Address Manpower Shortages: Establish Panchayat Service Commissions for structured hiring of skilled personnel.
- Improve Digital Infrastructure: Expand e-Governance, real-time audits, and digital public financial management systems (PFMS).
- Integrate Panchayats into CSSs: Amend guidelines to ensure Gram Panchayats manage and implement key welfare schemes.
- Strengthen Accountability Measures: Enhance RTI implementation, transparency in budgeting, and social audit mechanisms.

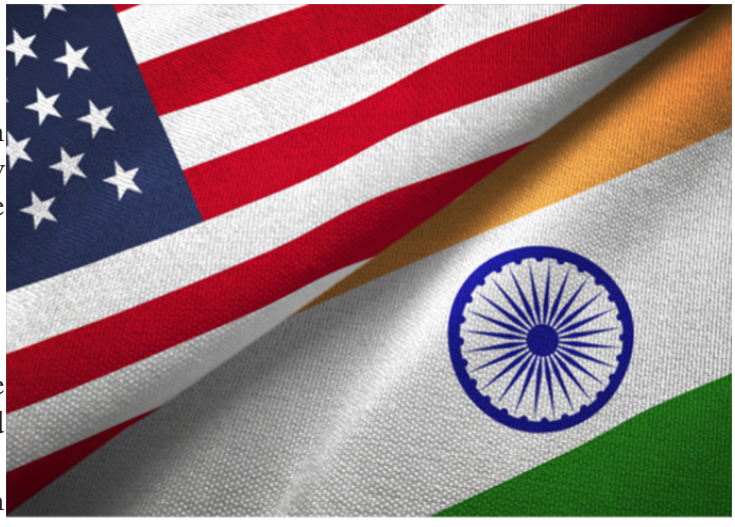
Conclusion:

Panchayat devolution has improved in financial transfers and capacity-building, but functional devolution remains a critical gap. Strengthening autonomy, financial independence, and governance mechanisms will be key to realizing true decentralized democracy. States must expedite structural reforms to ensure Panchayats function as genuine institutions of self-government.

India-U.S. Relations

Context:

Prime Minister of India met U.S. President during an official working visit to Washington, D.C., in February 2025, reaffirming the India-U.S. Comprehensive Global Strategic Partnership.



Key Outcomes of India-U.S. Summit:

1. **Defense & Security Cooperation:**

- New 10-Year Framework for Major Defense Partnership to enhance interoperability and co-production of defense systems.
- Expansion of defense sales, including Javelin

Anti-Tank Missiles, Stryker Infantry Combat Vehicles, and six additional P-8I maritime patrol aircraft.

- Autonomous Systems Industry Alliance (ASIA) launched to co-develop AI-based counter-UAS and maritime defense systems.
- Streamlining arms transfer regulations (ITAR) to improve technology exchange and joint production.
- Strengthening military exercises like "Tiger Triumph" and advancing logistics, intelligence sharing, and humanitarian assistance cooperation.

2. Trade & Economic Partnership

- Mission 500: Target set to double bilateral trade to $500 billion by 2030.
- Agreement to negotiate a Bilateral Trade Agreement (BTA) by late 2025 to reduce tariff and non-tariff barriers.
- Enhanced market access for U.S. agricultural goods and Indian labor-intensive exports.
- Increased U.S.-India investments in manufacturing, greenfield industries, and supply chain diversification.

3. Energy & Civil Nuclear Cooperation:

- Expansion of energy trade: U.S. to supply crude oil, LNG, and hydrocarbons to India for energy security.
- Nuclear Collaboration: U.S. and India to jointly develop U.S.-designed nuclear reactors, with India amending the Civil Liability for Nuclear Damage Act (CLNDA).

4. Technology & Innovation:

- Launch of U.S.-India TRUST initiative to advance AI, semiconductors, quantum computing, and space technology.
- Strengthening supply chains for critical minerals, pharmaceuticals, and advanced materials.
- NASA-ISRO collaboration: Plans for an Indian astronaut on ISS and the NISAR satellite mission.

5. Multilateral & Strategic Cooperation:

- Strengthened Indo-Pacific and Indian Ocean security cooperation through joint maritime patrols, airlift capacities, and military exercises.
- Terrorism and security cooperation: U.S. approved extradition of Tahawwur Rana and called on Pakistan to act against terror groups like LeT and JeM.
- India to take a leadership role in the Combined Maritime Forces naval task force for Arabian Sea security.

Significance of India-U.S. Summit

- Strengthened Defense Ties: Enhances India's role as a Major Defense Partner, enabling technology transfers and co-production for Indo-Pacific security.
- Economic & Trade Expansion: Mission 500 boosts trade, reduces reliance on China, and expands U.S. investments in semiconductors and pharma.
- Energy & Climate Cooperation: Strengthens energy security via U.S. crude, LNG, and nuclear power, supporting clean energy transition.
- Technology & Digital Growth: Advances AI, semiconductors, and space tech, while improving cybersecurity and digital infrastructure.
- Geopolitical Stability: Counters China's BRI, strengthens Indo-Pacific security, and reinforces counterterrorism efforts against Pakistan.

Challenges in India-U.S. Relations:

- Trade Barriers: High tariffs and delays in Bilateral Trade Agreement (BTA) impact market access and trade expansion.
- Technology Transfer Issues: Stringent U.S. export controls (ITAR) limit India's access to advanced defense and AI technologies.
- Nuclear Liability Concerns: CLNDA liability issues slow U.S.-India nuclear reactor collaborations, needing policy amendments.
- Visa & Mobility Restrictions: Work visa hurdles affect Indian professionals, requiring a mutually beneficial mobility framework.
- Geopolitical Constraints: U.S.-China tensions and India's strategic autonomy may create diplomatic friction in global conflicts.

Way Forward:

- Defense Technology Transfers: Streamline ITAR regulations and fast-track Reciprocal Defense Procurement (RDP) agreement.
- Trade & Economic Diversification: Finalize BTA by 2025, expand green energy and high-tech manufacturing ties.
- Nuclear & Energy Security: Amend CLNDA for nuclear projects and strengthen oil reserve collaborations.
- Technology & AI Cooperation: Enhance AI, semiconductors, and quantum research while expanding cybersecurity.
- Counterterrorism & Security: Strengthen Indo-Pacific naval patrols and enhance joint counterterrorism initiatives.

Conclusion:

The India-U.S. Comprehensive Strategic Partnership is evolving with deeper defense, trade, energy, and technology ties. Initiatives like COMPACT, TRUST, and Mission 500 enhance regional security and economic growth. Overcoming trade barriers, tech transfer limits, and visa issues is key to long-term success.

Animal Welfare Board of India (AWBI)

Context:

The Animal Welfare Board of India (AWBI) will host the Prani Mitra and Jeev Daya Award Ceremony at Vigyan Bhawan, New Delhi, to honor individuals and organizations for exceptional contributions to animal welfare.

About Animal Welfare Board of India (AWBI):

What is AWBI?

- AWBI is a statutory body established to promote animal welfare and prevent cruelty to animals in India.
- It serves as an advisory body to the Central and State Governments on animal welfare laws and enforcement measures.
- Headquarters: Ballabhgarh, Haryana.
- Established in: 1962 under Section 4 of the Prevention of Cruelty to Animals Act, 1960.
- Administered by: Ministry of Fisheries, Animal Husbandry, and Dairying, Government of India.

History & Evolution:

- Founded under the guidance of Rukmini Devi Arundale, a prominent animal rights activist.
- Has expanded its functions over the decades to include awareness programs, policy advisory roles, and financial aid for animal welfare organizations.

Powers & Functions:

- Advisory Role: Recommends amendments to animal welfare laws and advises the Central & State Governments on cruelty prevention measures.
- Animal Welfare Programs: Monitors shelters, rescue homes, and sanctuaries, provides financial aid to Animal Welfare Organizations (AWOs), and encourages Pinjarapoles for old and sick animals.
- Regulatory Compliance: Ensures adherence to the Prevention of Cruelty to Animals Act, 1960, oversees District SPCAs, and supervises animal treatment in slaughterhouses and transport.
- Legal Enforcement: Assists in prosecuting offenders, coordinates with State Animal Welfare Boards (SAWBs), and prevents illegal animal trade and abuse.
- Man-Animal Conflict Resolution: Monitors human-wildlife conflicts and promotes humane solutions to protect both animals and local communities.

Time Use Survey (TUS) 2024

Context:

The Time Use Survey (TUS) 2024, conducted by the Ministry of Statistics & Programme Implementation (MoSPI), revealed a rise in women's participation in paid employment and caregiving activities.

About Time Use Survey (TUS) 2024:

Key Data Insights & Important Findings from TUS 2024:

1. **Women's Participation in Employment & Unpaid Work:**
   - 25% of women aged 15-59 years participated in employment-related activities (up from 21.8% in 2019).
   - Men spent 132 minutes more than women on employment activities (473 minutes vs. 341 minutes).
   - Women spent 201 minutes more than men in unpaid domestic services (289 minutes vs. 88 minutes).
2. **Caregiving & Domestic Work:**
   - 41% of women participated in caregiving (vs. 21.4% of men).
   - Women spent 137 minutes/day on caregiving (men: 75 minutes/day).
   - Time spent on unpaid domestic work for women reduced from 315 minutes in 2019 to 305 minutes in 2024.
3. **Learning & Skill Development:**
   - 89.3% of children (6-14 years) participated in learning activities, spending 413 minutes/day.
   - Time spent on learning activities declined for both genders (males: 415 minutes, females: 413 minutes).
4. **Leisure, Mass Media & Social Activities:**
   - 11% of daily time was spent on culture, leisure, mass media, and sports (up from 9.9% in 2019).
   - Time spent on socializing and communication remained constant for women (139 minutes), while men's participation decreased from 147 minutes to 138 minutes.
5. **Self-Care & Maintenance:**
   - Individuals aged 6+ years spent 708 minutes/day on self-care activities.
   - Women spent 706 minutes/day, while men spent 710 minutes/day on self-care.

Analysis of the Report:

1. Positive Trends in the Report:

- Increase in Women's Workforce Participation: Women's employment rate rose to 25% from 8% in 2019, showing a shift towards paid work.
- Reduction in Unpaid Domestic Work for Women: Women's unpaid domestic workload decreased by 10 minutes/day, indicating progress towards gender balance.
- More Recognition of Caregiving Responsibilities: Both men and women saw higher participation in caregiving activities, acknowledging its importance within families.
- Rise in Cultural & Leisure Activities: Time spent on culture, mass media, and sports rose to 11% of daily time from 9% in 2019, improving work-life balance.
- Higher Participation in Learning Activities Among Children: 3% of children (6-14 years) engaged in learning activities, spending 413 minutes/day, showing strong educational engagement.

1. Negative Aspects & Challenges in the Report:

- Persistent Gender Disparity in Household Work: Women still spent 201 minutes more than men on unpaid domestic work, reflecting deep-rooted gender roles.
- Decline in Learning Time for Youth: Both men and women spent less time on learning activities (males: -11 minutes, females: -10 minutes), indicating possible educational setbacks.
- Limited Male Participation in Caregiving: Only 4% of men participated in caregiving (vs. 41% of women), reinforcing the burden of care on women.
- Rural-Urban Divide in Employment & Domestic Work: 8% of people in rural areas engaged in self-production activities (vs. 6.2% in urban areas), highlighting economic inequalities.
- Increase in Employment Not Equal to Gender Parity: Despite higher workforce participation, women still spent 132 minutes less than men in employment-related activities.

Way Ahead:

1. Promoting Gender Equality in Domestic Responsibilities: Encourage equal sharing of unpaid work through policy interventions and awareness programs.
2. Enhancing Women's Workforce Participation: Introduce flexible work policies, childcare support, and skill development programs to increase women's employment rate.

3. Revitalizing Learning & Skill Development: Strengthen educational infrastructure, promote vocational training, and boost digital learning to improve learning time.
4. Reducing Rural-Urban Economic Disparities: Implement rural employment schemes, digital literacy programs, and financial inclusion initiatives to bridge the economic gap.

Conclusion:

While women's workforce participation has improved, gender disparities in unpaid domestic work and caregiving remain a concern. Addressing these inequalities through policy interventions and social awareness will be key to achieving inclusive development and gender parity.

SWAYATT initiative

Context:

The SWAYATT initiative on the Government e-Marketplace (GeM) celebrated six years of empowering startups, women entrepreneurs, and youth in public procurement.

- The initiative has significantly boosted participation, with women entrepreneurs now comprising 8% of registered sellers on GeM.

About SWAYATT initiative:

What is SWAYATT?

- Full Form: Startups, Women & Youth Advantage Through e-Transactions.
- Launched On: 19th February 2019.
- Ministry: Ministry of Commerce and Industry, Government of India.
- Platform: Integrated with the Government e-Marketplace (GeM).

Aim of SWAYATT:

- Promote Inclusion: Enhance participation of women-led enterprises, startups, and youth in public procurement.
- Empower Marginalized Groups: Focus on Micro & Small Enterprises (MSEs), Self-Help Groups (SHGs), and backward sections of society.
- Facilitate Market Access: Provide direct market linkages to government buyers without intermediaries.
- Boost Economic Growth: Encourage hyper-local job creation and inclusive economic development.

Key Features:

- Dedicated Storefronts: Includes "Startup Runway" and "Womaniya" for startups and women entrepreneurs.
- Training and Onboarding: Focuses on capacity-building for last-mile sellers and women entrepreneurs.
- MoU with FICCI-FLO: Collaboration to empower 9,500+ women entrepreneurs through advocacy and training.
- Udyam-Verified Sellers: Over 1,77,786 women-led MSEs registered on GeM, fulfilling orders worth 46,615 crore.
- Startup Ecosystem: Supports 29,000+ startups, with cumulative orders worth 35,950 crore.

International Association of Aids to Marine Navigation (IALA)

Context:

India has been elected Vice President of the International Association of Aids to Marine Navigation (IALA) during its first General Assembly in Singapore.

- India is hosting the IALA Council meeting in December 2025 and the IALA Conference & General Assembly in September 2027 in Mumbai.

About International Association of Aids to Marine Navigation (IALA):

What is IALA?

- IALA is a global organization dedicated to harmonizing marine aids to navigation (AtoN), ensuring safe, efficient, and environmentally responsible maritime operations.

Establishment:

- Founded: 1957 as a non-governmental organization (NGO).
- Status Change: Became an Intergovernmental Organization (IGO) on August 22, 2024, after ratification by 34 states.
- Headquarters: Saint-Germain-en-Laye, France.

Aims & Objectives:

- Ensure safe and efficient vessel movement through marine navigation aids.
- Standardize global maritime navigation systems.
- Promote sustainable marine environment protection.
- Facilitate technology-driven solutions for better navigational safety.

Functions & Responsibilities:

- Develop Global Standards: IALA sets Standards, Guidelines, and Courses for uniform maritime safety. It promotes best practices to enhance navigation efficiency.
- Enhance Maritime Safety & Environmental Protection: It works to reduce marine accidents and protect ecosystems. It helps developing nations build reliable navigation systems.
- Technological Advancements: IALA forms technical committees for innovation in navigation. It fosters collaboration to integrate modern solutions.
- Promote International Cooperation: It provides training to harmonize AtoN systems. It organizes conferences for global maritime collaboration.

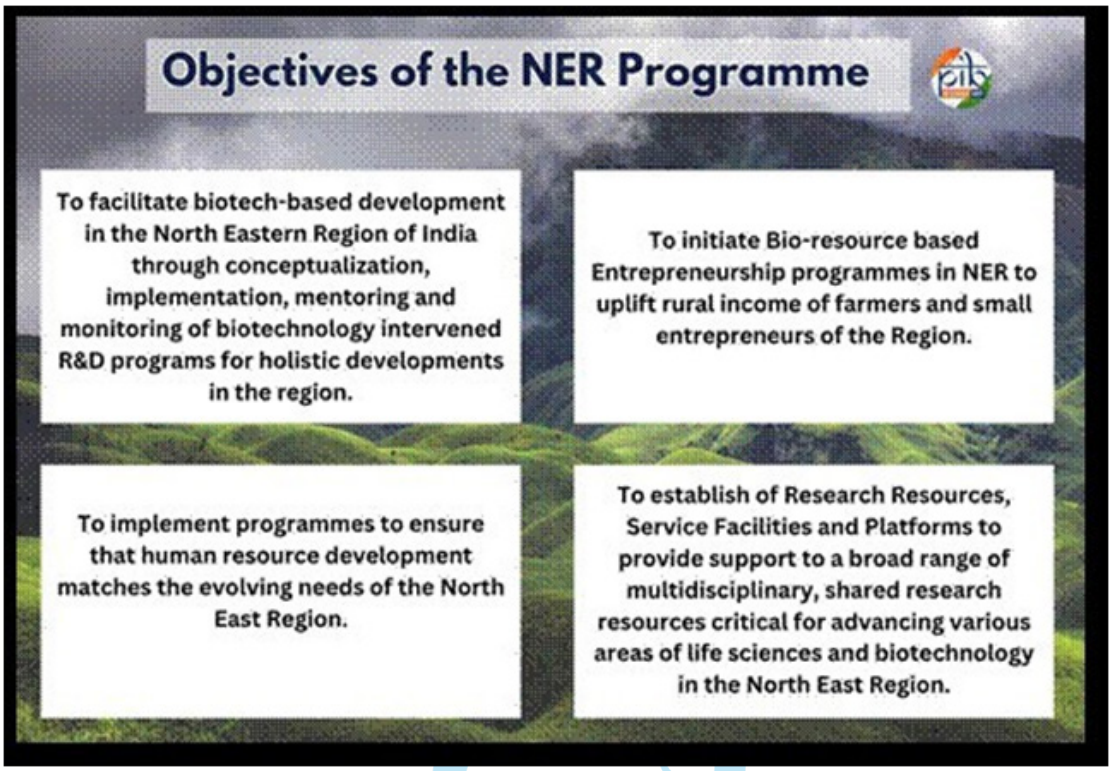
Organizational Structure:

- General Assembly: Supreme governing body, meets every four years.
- Council: Executive decision-making authority.
- Technical Committees: Experts from different nations work on standardization.

Biotechnology in North East India

Context:

The Department of Biotechnology (DBT) is driving bioeconomic transformation in North East India through innovation and research.



Understanding Biotechnology and Its Types:

What is Biotechnology?

- Biotechnology involves using biological systems, organisms, or derivatives to develop new technologies and products.
- It enhances healthcare, agriculture, industrial processes, and environmental sustainability.

Types of Biotechnology:

- Medical Biotechnology: Develops vaccines, gene therapy, and regenerative medicine.
- Agricultural Biotechnology: Improves crop yields, pest resistance, and soil health.
- Industrial Biotechnology: Creates biofuels, biodegradable plastics, and bio-based chemicals.
- Environmental Biotechnology: Focuses on waste management, pollution control, and bioremediation.

Potential of North East India in Harnessing Biotechnology:

- Rich Biodiversity: Home to 8,000+ plant species, 850+ medicinal plants, and vast agro-climatic diversity.
- Indigenous Knowledge: Tribal communities possess traditional expertise in herbal medicine and organic farming.
- Agri-Biotech Growth: Suitable for high-value medicinal crops, organic farming, and sustainable agriculture.
- Biotech-Based Industry: Potential for biofuels, essential oils, pharmaceuticals, and processed food industries.

Government Initiatives Driving Biotech Growth in North East India:

- DBT North Eastern Programme: Allocates 10% of DBT's budget to the region for biotech development.
- Twinning R&D Programme: Established 65+ collaborations benefiting 450+ researchers & 2000+ students.
- Biotech Hubs: Set up 126 Biotech Hubs in universities to promote research and training.
- BLiSS (Biotech Labs in Schools): Introduced biotechnology education at the secondary level since 2014.
- Agri-Biotech & Citrus Research: Developing disease-free crops, medicinal plants, and sustainable farming models.
- Mobile App for Livestock Management: Pig Disease Diagnosis Expert System (PDDES) launched for disease detection.
- Genomics Research in Human Health: Training scientists in genetics-based disease analysis.

Challenges in Implementing Biotechnology in North East:

- Limited Infrastructure: Insufficient biotech labs, R&D facilities, and industrial support.

- Funding Constraints: High costs of biotech research and commercial-scale production.
- Skilled Workforce Shortage: Lack of trained personnel in cutting-edge biotech fields.
- Climate Sensitivity: Erratic weather & environmental factors affect agricultural biotechnology projects.
- Connectivity Issues: Remote location hinders market access and tech adoption.

Way Forward for Biotech Growth in North East:

- Strengthen Research Infrastructure – Establish advanced biotech parks, incubators, and R&D centers.
- Enhance Skill Development – Train local researchers, students, and farmers in biotech applications.
- Public-Private Partnerships (PPP) – Encourage industry investment in biotech-based startups and innovation.
- Focus on Sustainable Biotech – Promote eco-friendly bio-based industries and conservation projects.
- Leverage Digital Platforms – Utilize AI and data-driven solutions for biotech advancements.

Conclusion:

With sustained government support, research collaborations, and skill-building programs, the region can emerge as a leading bioeconomy hub. By bridging the gap between tradition and technology, North East India is setting a model for sustainable and inclusive development.

Bharat Tech Triumph Program (TTP)

Context:

Bharat Tech Triumph Program (TTP) launched under the Create in India Challenge Season 1 to showcase India's gaming talent globally.

- Winners will present their innovations at the Game Developers Conference (GDC) 2025 in San Francisco and WAVES Summit in India.

About Bharat Tech Triumph Program (TTP):

- What is the Bharat Tech Triumph Program?
- A national initiative to promote India's gaming industry, innovation, and interactive entertainment sector.
- Provides global exposure to Indian game developers, startups, and tech companies.

Ministry & Organizers:

- Ministry of Information & Broadcasting (MIB) – Government body overseeing the initiative.
- Interactive Entertainment and Innovation Council (IEIC) – Organizing partner.

Aim of the Program:

- Identify and promote Indian gaming talent on global platforms.
- Support innovation in gaming, animation, and immersive technologies (Artificial Reality, Virtual Reality, Metaverse).
- Encourage startups and studios to develop world-class games under the 'Create in India' initiative.

Key Features of Bharat Tech Triumph Program:

- Open to developers, studios, startups, and tech firms with a working prototype.
- 3-stage selection process: Game submission, expert evaluation, and final showcase.
- Winners get fully sponsored opportunities to present at GDC 2025 and WAVES.
- Encourages cross-border collaborations, with 1,078 total registrations, including 12 international entries.

Chapter-
9

INTERNATIONAL RELATION

Deportation

Context:

The U.S. deported 104 Indian nationals for alleged immigration law violations, with deportees arriving in Amritsar on a U.S. military aircraft in shackles, prompting diplomatic concerns from India over their treatment and human rights violations.

Understanding Deportation:

What is Deportation?

- Deportation is the forced removal of foreign nationals from a country due to visa violations, illegal entry, criminal activity, or threats to public safety.
- It is governed by the U.S. Immigration and Customs Enforcement (ICE), which enforces immigration laws and removal processes.

Why is Deportation Happening?

- Stricter U.S. Immigration Policies: Recent crackdown on illegal migration under the Trump administration.
- Overstay & Visa Violations: Large numbers of Indian nationals overstay their visas or enter through unauthorized means.
- Final Removal List: The U.S. identified 487 Indians for deportation, citing national security concerns.
- Use of Military Aircraft: The latest deportation was classified as a "national security operation", unlike previous cases using commercial flights.

How Deportations are Carried Out?

- Immigration Detention Centers: Violators are detained before deportation.
- Legal Proceedings: They may apply for asylum or face expedited removal if found without proper documentation.
- Transport Mechanism: The U.S. covers deportation costs, using commercial or military aircraft in extreme cases.

Issues Surrounding Mass Deportations

- Human Rights Violations: Shackling of deportees, including women and children, raised concerns over inhumane treatment.
- Diplomatic Implications: India, Brazil, and Colombia raised formal objections over unfair deportation practices.
- Lack of Legal Assistance & Due Process: Deportees face limited legal aid, with expedited removals bypassing judicial review.
- Socioeconomic & Psychological Impact: Deportees return to economic hardship, social stigma, and financial instability.
- Rising Trend of Immigration Crackdowns: Strict U.S. border enforcement threatens 7.25 lakh undocumented Indians with removal.

Way Ahead:

- Diplomatic Engagement & Bilateral Dialogue: India must push for humane deportation processes through diplomatic negotiations.
- Rehabilitation & Reintegration Programs: Employment, legal aid, and psychological support should be provided to deportees.
- Stronger Immigration Awareness Programs: Campaigns on legal migration pathways are needed to prevent visa fraud and trafficking.

- Monitoring of Immigration Agents: Strict regulations are required to curb fraudulent agents misleading migrants.
- Global Legal Framework for Ethical Deportations: India should push for humane deportation protocols at UN forums.

Conclusion:

The mass deportation of 104 Indians raises serious humanitarian concerns, demanding a more structured diplomatic and legal approach. India must ensure fair treatment of its nationals while strengthening legal migration frameworks to prevent future deportations and safeguard citizen rights.

BIMSTEC Youth Summit

Context:

The Union Minister for Youth Affairs and Sports officially inaugurated the first BIMSTEC Youth Summit in Gandhinagar, Gujarat, focused on promoting cooperation and developing leadership abilities among the youth from BIMSTEC nations.

About BIMSTEC Youth Summit 2025:

- Origin: BIMSTEC Youth Summit 2025 was conceptualized or proposed during the 4th BIMSTEC Summit (Held in Nepal).

Host: Gandhinagar, Gujarat

- Organised by: The Ministry of Youth Affairs & Sports and the Ministry of External Affairs, with the Confederation of Indian Industry's Young Indians (CII YI) as the knowledge partner.
- Theme: 'Youth as a bridge for intra-BIMSTEC exchange'
- Aim: The Summit provides a platform for young leaders from BIMSTEC nations to engage in discussions on regional cooperation and emerging challenges.

Key Features & Functions:

- Leadership & Skill Development: Focus on training youth in AI, robotics, cybersecurity, and digital technologies.
- Innovation & Entrepreneurship: Proposal to create a regional startup network within BIMSTEC nations.
- Youth Policy & Governance: Sessions on policy discussions for regional youth empowerment.
- Cultural & Heritage Exchange: Promoting mutual cooperation through cultural engagements and visits like Dandi Kutir.
- Sustainable Development & Digital Growth: Discussions on technology, climate resilience, and economic sustainability.

- Viksit Bharat @2047: India's vision of a developed nation by 2047, chaired by Raksha Khadse.

About BIMSTEC:

- Established: 6 June 1997 (Formed under the Bangkok Declaration as BIST-EC)
- Headquarters: Dhaka, Bangladesh (Permanent Secretariat since 2014)
- Founding Declaration: BIMSTEC Declaration (2004)
- Member Countries: Bangladesh, Bhutan, India, Myanmar, Nepal, Sri Lanka, Thailand
- Current Secretary-General: Ambassador Indra Mani Pandey (India)

International Criminal Court (ICC)

Context:

The International Criminal Court (ICC) is in the spotlight after U.S. President imposed sanctions for investigations that threaten the 'national security' of Washington and its allies, which include Israel.

About International Criminal Court (ICC):

- Established: It was established in 2002 under the Rome Statute.
- Headquarters: The Hague, Netherlands
- Jurisdiction: Prosecutes individuals for genocide, crimes against humanity, war crimes, and crimes of aggression
- Members: 125 countries; major non-members include the U.S., China, Russia, India, and Israel

Working Procedure:

- Referral Mechanisms: Cases can be referred by member states, the UN Security Council, or initiated by the ICC Prosecutor
- Complementarity Principle: Acts only when national courts are unwilling or unable to prosecute

Investigation & Trial Process:

- The Office of the Prosecutor (OTP) examines referrals, gathers evidence, and initiates prosecutions
- Judicial Divisions oversee pre-trial, trial, and appeals proceedings
- Registry handles administrative functions

Functions & Powers:

- Prosecutes individuals for grave international crimes.
- Issues arrest warrants for those responsible for human rights violations.

- Cooperates with nations and organizations for legal assistance and enforcement.
- Ensures justice when national courts fail to act.

Paris AI Summit 2025

Context:

India, co-chairing the Paris AI Action Summit (Feb 10-11, 2025), seeks to amplify the Global South's voice on AI governance, innovation, and equitable AI access.

About Paris AI Summit:

What is the Paris AI Summit?

- The third global AI safety summit, following UK (2023) and South Korea (2024) meetings.
- Organized by France, focusing on AI safety, ethics, governance, innovation, and economic impact.
- Attended by world leaders (US, EU, China, Germany), tech CEOs (OpenAI, Google), and policymakers.

Significance of the Summit:

- AI Safety & Governance: Establishes norms and risk management frameworks for AI development.
- Equitable AI Access: Addresses global AI divide, advocating for open-source AI and cross-border collaboration.
- Economic & Strategic Impact: Shapes future of AI-driven industries, trade policies, and international regulations.
- Geopolitical Balancing: Counterbalances US-China AI dominance, promoting multilateral cooperation.

Challenges in Global AI Governance:

- Corporate Monopoly: AI development remains concentrated in a few tech giants (OpenAI, Google, DeepSeek).
- Regulatory Divergence: The US, EU, and China have conflicting AI policies, delaying a unified framework.
- Ethical Concerns: AI models risk cultural biases, misinformation, and economic displacement.
- Security & Deepfakes: AI misuse in cyber warfare, deepfake propaganda, and surveillance raises global concerns.

Opportunities for India at the AI Summit:

- Advocacy for Global South: Push for AI democratization, equitable data access, and AI infrastructure support.
- Building AI Partnerships: Expand tech collaboration with EU, France, and emerging AI economies.
- Strategic Leadership: Strengthen India's role as a bridge between AI superpowers (US-China) and developing nations.
- AI Research & Innovation: Promote India's AI Safety Institute, indigenous AI models, and public-interest AI.

Conclusion:

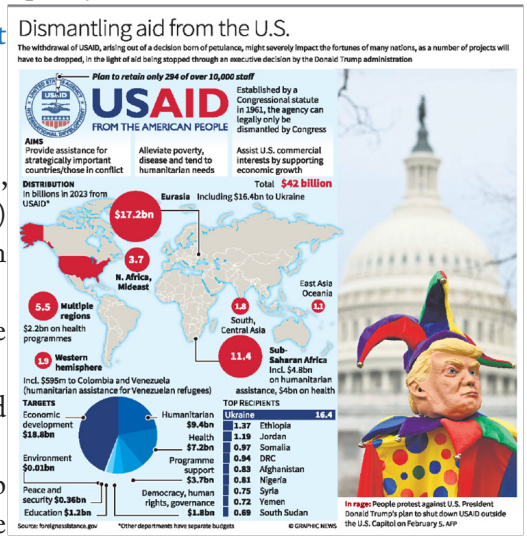
India's co-chairing of the Paris AI Summit is a strategic opportunity to shape global AI governance, foster innovation, and secure AI leadership for the Global South. By advocating for equitable AI access and regulatory frameworks, India strengthens its global AI diplomacy while preparing to host future AI summits.

USAID Freeze

Context:

Recently, U.S. President Donald Trump, on his first day of his second term, imposed a 90-day freeze on foreign assistance to reassess program efficiency and alignment with U.S. foreign policy.

About the United States Agency for International Development (USAID):



What is USAID?

- Formation: Established in 1961 under an Act of Congress, USAID (United States Agency for International Development) is an independent agency responsible for administering civilian foreign aid and development assistance.
- Mission: To promote democratic values, advance global peace and prosperity, and align with U.S. national security interests.
- Key Sectors: Economic development, health, education, food security, humanitarian aid, climate change, and governance.
- Global Reach: Operates in over 100 countries, with flagship programs like PEPFAR (HIV/AIDS relief), Feed the Future (food security), and Power Africa (energy access).

Why the Freeze?

- Executive Order: On January 20, 2023, President Donald Trump issued a 90-day freeze on foreign assistance to reassess program efficiency and alignment with U.S. foreign policy.
- Political Motivations: Critics argue the freeze targets Biden-era programs, driven by political vendetta rather than strategic reassessment.
- Statements: Elon Musk (DOGE head) called USAID a "criminal organization," while Secretary of State Marco Rubio emphasized restructuring to serve U.S. national interests.

Impacts:

Global Impact:

- Humanitarian Crisis: Withdrawal of funds could disrupt critical programs, risking millions of lives, especially in HIV/AIDS treatment, food security, and disaster relief.
- Affected Countries: Top recipients like Ukraine, Ethiopia, Somalia, and Yemen face severe setbacks in development and humanitarian projects.
- UN Concerns: The UN warns that halting HIV/AIDS funding could lead to over 6 million deaths in the next four years.

Impact on India:

- Reduced Dependency: India's reliance on USAID has decreased over the years, with funding now constituting only 0.2%-0.4% of USAID's global budget.
- Key Sectors: Health (HIV/AIDS, TB, maternal health), energy, water, sanitation, and environmental health.
- Current Status: USAID has suspended operations in India, but the impact may be limited due to India's growing self-reliance and alternative funding mechanisms.

Alternatives and Way Forward:

- Domestic Funding: Indian government and state agencies can step in to fund critical projects.
- Multilateral Partnerships: Strengthen collaborations with organizations like the World Bank, WHO, and UN agencies.
- Private Sector Engagement: Encourage CSR initiatives and public-private partnerships to fill funding gaps.
- Global Solidarity: Other donor nations and NGOs can increase contributions to mitigate the impact of USAID's withdrawal.

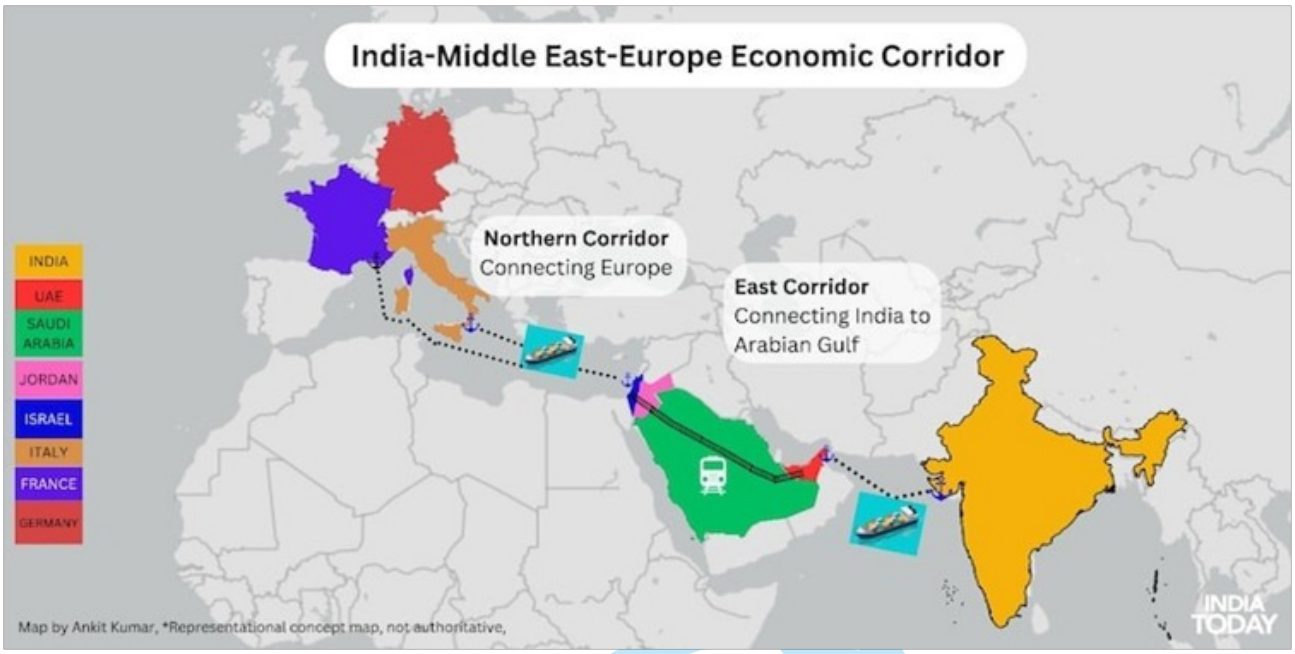
Conclusion:

The USAID freeze poses significant challenges to global development and humanitarian efforts, particularly in vulnerable nations. While India may weather the storm due to reduced dependency, the Global South faces heightened risks. The way forward lies in diversifying funding sources, enhancing domestic capacities, and fostering international cooperation to ensure continuity in critical development projects.

India-Middle East-Europe Corridor (IMEEC)

Context:

India and France reaffirmed commitment to implementing the India-Middle East-Europe Economic Corridor (IMEC) during Prime Minister visit to France.



About India-Middle East-Europe Economic Corridor (IMEEC):

What is IMEEC?

- A multimodal connectivity initiative linking India, the Middle East, and Europe through sea and land routes.
- Alternative trade route bypassing the Suez Canal and reducing dependency on China's Belt and Road Initiative (BRI).
- Participating Nations: India, UAE, Saudi Arabia, Jordan, Israel, France, Germany, Italy, and the European Union.

Launched In:

- Announced during the G20 Summit in New Delhi in September, 2023.
- Intergovernmental Framework Agreement (IGFA) signed between India and UAE on February, 2024.

Aim & Objectives:

- Boost trade efficiency by reducing transport time between Asia and Europe.
- Enhance connectivity across key economic hubs in the Middle East and Europe.
- Strengthen supply chain security by offering an alternative route to global trade.
- Support clean energy initiatives by facilitating green hydrogen and renewable energy trade.
- Promote digital integration through secure high-speed data connectivity.

Key Features & Functions:

Two Corridors:

- Eastern Corridor: Connects India to the Gulf (UAE & Saudi Arabia) via sea.
- Northern Corridor: Links the Gulf to Europe (France, Germany, Italy) via rail and sea.
- Digital & Logistics Integration: A logistics platform will manage trade, containers, bulk cargo, and digital transactions.
- $600 Billion Mobilization: Target by 2027 to address infrastructure gaps.
- Trade Route Diversification: Bypasses geopolitical risks, including conflicts affecting the Suez Canal and Red Sea region.

U.S.-India COMPACT Initiative

Context:

India and the U.S. launched the U.S.-India COMPACT initiative to strengthen defense, trade, and technology cooperation, marking a new milestone in bilateral relations.

About U.S.-India COMPACT Initiative:

- What is the U.S.-India COMPACT Initiative?
- The S.-India COMPACT (Catalyzing Opportunities for Military Partnership, Accelerated Commerce & Technology) for the 21st Century is a strategic framework launched to enhance defense, trade, and technology cooperation between India and the United States.
- Nations Involved: India & United States of America (USA)

Aim of the Initiative:

- To strengthen the U.S.-India Comprehensive Global Strategic Partnership across key sectors.
- To deepen defense collaboration, co-production, and technology exchange.
- To expand bilateral trade, aiming for $500 billion by 2030 (Mission-500).
- To advance innovation and technological cooperation, especially in AI, cybersecurity, semiconductors, and space exploration.

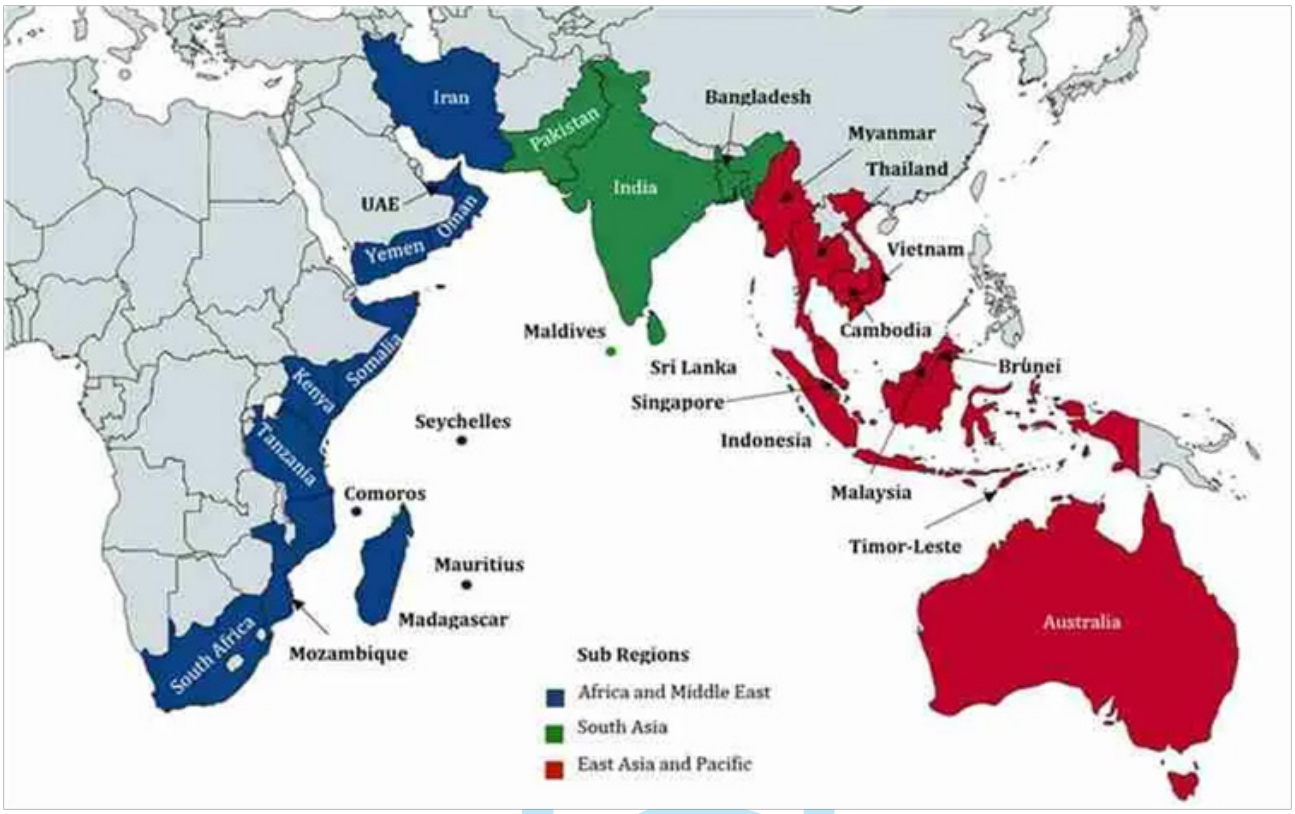
Key Features & Functions:

- Defense & Security Cooperation: Establishes a 10-year U.S.-India Defense Partnership Framework (2025-2035), including reciprocal defense procurement, technology transfer, and military exercises.
- Economic & Trade Expansion: Mission-500 aims to double bilateral trade to $500 billion by 2030, supported by a multi-sector trade agreement by 2025.
- Technology & Innovation: Launch of the TRUST Initiative to boost AI, space, quantum computing, and semiconductor manufacturing.
- Energy & Climate Action: Collaboration in nuclear energy, LNG trade, and clean hydrogen projects to enhance energy security.
- Strategic Geopolitical Engagement: Enhances Indo-Pacific security, counterterrorism efforts, and economic corridors like IMEEC.

India in Indian Ocean Region

Context:

India, along with Singapore and Oman, is hosting the 8th Indian Ocean Conference (IOC) in Muscat, where foreign ministers from 30 nations are discussing regional security and economic cooperation.



What is the Indian Ocean Region (IOR)?

- The third-largest ocean in the world, covering 70.56 million sq km and connecting Asia, Africa, and Australia.
- A natural trade corridor historically influenced by Indian civilization and maritime networks.

Nations Surrounding IOR:

- 26 coastal nations, including India, Sri Lanka, Maldives, Oman, Indonesia, Australia, South Africa, and Somalia.
- Landlocked countries like Nepal and Bhutan also depend on IOR trade routes.

Importance of the Indian Ocean Region (IOR):

- Global Trade Hub: Facilitates 70% of global container traffic and 90% of India's energy imports, making it a key economic corridor.
- Maritime Security: Critical sea lanes like the Strait of Malacca, Hormuz, and Bab el Mandeb ensure uninterrupted global trade.
- Resource-Rich Waters: Contains vast fisheries, oil, gas, and mineral deposits, crucial for regional economies.
- Strategic Significance: Hosts naval bases of major powers (US, UK, China, France), influencing global security dynamics.

India's Role in Managing the Indian Ocean Region:

- SAGAR Initiative (2015): Launched by PM Modi to promote Security and Growth for All in the Region, ensuring maritime stability.
- Naval Capabilities & Regional Security: Indian Navy conducts joint exercises (MILAN, Malabar, Varuna) to strengthen regional defense cooperation.
- Economic & Trade Leadership: India develops ports via Sagarmala and promotes the Blue Economy for sustainable ocean resource utilization.
- Disaster Relief & Humanitarian Assistance: Plays a leading role in HADR operations, assisting countries during natural disasters and emergencies.
- Diplomatic & Strategic Alliances: Strengthens regional partnerships through IORA, BIMSTEC, and QUAD for collective maritime governance.

Challenges in the Indian Ocean Region:

- China's Expanding Influence: String of Pearls strategy and growing naval presence challenge regional stability and India's interests.
- Piracy & Maritime Crimes: Somali piracy, illegal fishing, and arms smuggling disrupt trade and security operations.
- Climate Change & Rising Sea Levels: Small Island nations face existential threats due to coastal erosion and submergence risks.
- Undersea Surveillance & Cyber Threats: Chinese control over subsea cables poses risks to data security and regional communications.
- Maritime Terrorism & Trafficking: Drug smuggling, human trafficking, and sea-based terrorism remain persistent security threats.

Way Ahead:

- Strengthening Maritime Infrastructure: Invest in port modernization, naval expansion, and undersea surveillance systems.
- Enhancing Regional Cooperation: Deepen partnerships with IORA, QUAD, and bilateral maritime security agreements.
- Boosting Blue Economy & Sustainable Development: Promote fisheries, ocean industries, and clean energy solutions for long-term sustainability.
- Countering External Influence: Protect regional communication networks and prevent foreign dominance in key maritime sectors.
- Disaster Preparedness & Climate Action: Develop early warning systems, climate resilience plans, and disaster relief infrastructure.

Conclusion:

The Indian Ocean Region is a vital geopolitical and economic hub, influencing global trade, security, and regional stability. India's proactive leadership through SAGAR and IORA is crucial in maintaining peace and prosperity. Strengthening maritime security, infrastructure, and regional alliances will ensure India's prominence in the global maritime order.

India-US TRUST Initiative

Context:

India and the United States launched the TRUST Initiative to strengthen supply chains for critical minerals, pharmaceuticals, and advanced materials.

About India-US TRUST Initiative:

What is the TRUST Initiative?

- Transforming Relationship Utilizing Strategic Technology (TRUST) is a bilateral agreement to enhance cooperation in critical minerals, pharmaceuticals, and advanced materials.
- Builds on India's participation in the Minerals Security Partnership (MSP) and the Minerals Security Finance Network (MSFN).
- Aims to diversify supply chains, reduce dependence on China, and facilitate technology transfer.

How Will the TRUST Initiative Work?

Strengthening Critical Minerals Supply Chains:

- Focus on lithium, rare earth elements (REEs), and advanced materials for sectors like defense, semiconductors, and energy storage.
- India to increase mineral exploration and processing capacity.

- US to facilitate investments and technology transfers.

Boosting Pharma Sector & API Production:

- Collaboration to reduce India's dependence on China for Active Pharmaceutical Ingredients (APIs).
- Development of alternative supply chains for critical minerals used in pharmaceuticals.

Technology Transfer & Export Control Reduction:

- Removing barriers in technology transfer between India and the US.
- Addressing export restrictions on high-tech materials and components.

Innovation Across Strategic Sectors:

- Catalyzing R&D in defense, AI, quantum computing, semiconductors, space, and energy.
- Engaging governments, academia, and private industries to drive innovation.
- Significance of the TRUST Initiative:
- Reducing Dependence on China: Ensures a diversified supply chain for India and the US, reducing reliance on China's 70% control over REE production.
- Strengthening Atmanirbhar Bharat: Boosts domestic production and recycling of critical minerals, aligning with India's National Critical Minerals Mission (2024-31).
- Enhancing Pharma & Defense Sectors: Supports API self-sufficiency in pharmaceuticals and strengthens defense manufacturing with secure access to critical materials.
- Boosting Clean Energy & EV Manufacturing: Secures lithium and cobalt for EV batteries and expands processing of minerals needed for renewable energy technologies.
- Expanding High-Tech Trade & Investment: Encourages US investments in India's mineral and tech sectors, fostering growth in AI, semiconductors, and space research.

India – EU Relations

Context:

A high-level delegation of the European Commission's College of Commissioners, led by President Ursula von der Leyen, is in New Delhi for a two-day visit to strengthen India-EU relations.

About India-EU Relations:

Historical Relationship

- Diplomatic ties since 1962 with the European Economic Community (EEC), evolving into the EU-India Strategic Partnership in 2004.
- The India-EU Joint Political Statement (1993) and Cooperation Agreement (1994) strengthened bilateral engagement.
- 15 India-EU Summits have been held, with the first in Lisbon (2000) and the most recent in 2021.

Present Status of India-EU Relations:

- The EU is India's largest trading partner in goods, with bilateral trade at $135 billion (FY 2023-24).
- EU FDI in India stands at $117.4 billion (16.6% of total FDI) since 2000.
- Strategic cooperation in trade, technology, climate action, and security has deepened through the India-EU Trade and Technology Council (TTC).

Key Fields of Cooperation:

1. **Trade & Investments:**
   - Negotiations on a Free Trade Agreement (FTA) and Geographical Indications Agreement are ongoing.
   - India is concerned about the EU's Carbon Border Adjustment Mechanism (CBAM) impacting exports.
2. **Technology & Innovation:**
   - Science & Technology Cooperation Agreement (2007) guides bilateral research partnerships.
   - India-EU Semiconductor MoU (2023) strengthens cooperation in chip manufacturing and AI.
3. **Green Energy & Climate Action:**
   - The EU has committed €1 billion for India's green hydrogen projects.

- Collaboration on renewables, circular economy, and sustainable urbanization.

4. **Defence & Security:**
   - India-EU Security & Defence Consultations (2022) focus on maritime security, counter-terrorism, and cyber threats.
   - First India-EU joint naval exercise (2023) in the Gulf of Guinea.
5. **Space Cooperation:**
   - India's ISRO and the European Space Agency (ESA) are collaborating on Gaganyaan, Chandrayaan-3, and Aditya-L1 missions.
   - EU's PROBA-3 mission was launched by ISRO's PSLV in December 2024.

Challenges & Differences:

Trade Barriers & CBAM:

- India opposes the EU's Carbon Border Tax, which could impact steel and aluminum exports.
- Regulatory differences in data protection and digital trade remain contentious.
- Slow Progress on FTA: The India-EU FTA negotiations have been ongoing since 2007, facing hurdles over tariffs and market access.
- Ukraine War & Geopolitical Divergence: India's neutral stance on Russia-Ukraine conflict contrasts with EU's strong opposition to Russia.
- Mobility & Visa Policies: Indian professionals received over 20% of EU Blue Cards (2023-24), but strict EU visa policies remain a challenge for Indian workers.
- Human Rights & Democratic Values: EU concerns over India's internet restrictions, freedom of expression, and human rights create periodic friction in diplomatic engagements.

Way Ahead:

- Fast-track India-EU FTA Negotiations: Prioritize resolving trade barriers and conclude an FTA by 2025.
- Strengthen Technology & Digital Partnerships: Expand collaboration on AI, quantum computing, and cyber security.
- Enhance Security & Defence Ties: Deepen maritime cooperation in the Indo-Pacific under ESIWA+ security program.
- Resolve Trade & Environmental Disputes: Negotiate a pragmatic approach to EU's CBAM, balancing trade and climate goals.
- Expand People-to-People Ties: Simplify visa policies and student exchange programs to enhance mobility.

Conclusion:

India-EU relations are at a crucial turning point, with deepening cooperation in trade, technology, and security. Despite challenges in FTA negotiations and CBAM policies, strategic engagement in green energy, digital economy, and defence will strengthen their partnership for global stability and economic growth.

Japan-India-Africa Forum

Context:

External Affairs Minister emphasized India's commitment to Africa through capacity-building, skill development, and infrastructure investment, unlike extractive economic models.

About Japan-India-Africa Forum:

What is the Japan-India-Africa Forum?

- A trilateral economic and strategic platform promoting investment, trade, and development projects across Africa.
- Facilitates collaboration between India, Japan, and African nations to drive

infrastructure, digital transformation, and human capital development.

Established In:

- The initiative evolved from India-Africa Forum Summit (IAFS) and Japan's TICAD (Tokyo International Conference on African Development).
- Gained momentum in 2021 with the Japan-India-Africa Growth Corridor discussions.

Aim:

- Strengthen economic partnerships among India, Japan, and Africa.
- Foster infrastructure development, digital transformation, and skill-building.
- Enhance Africa's global trade integration through investment and knowledge transfer.

Key Functions

- Infrastructure & Connectivity: Investments in railways, ports, and power generation.
- Skill Development & Technology Transfer: Programs like ITEC, e-VidyaBharti, and e-ArogyaBharti.
- Sustainable Development & Green Energy: Support for solar electrification, climate finance, and circular economy.
- Economic Growth & Trade Expansion: Enhancing supply chain resilience and financial inclusion.

Potential of the Forum:

- Boosts Africa's Industrial Growth: Promotes manufacturing hubs, special economic zones (SEZs), and digital startups.
- Enhances Strategic Connectivity: Strengthens infrastructure linkages in East Africa and the Indian Ocean Region.
- Leverages Japan-India Expertise: Combines Japan's investment & technology with India's digital ecosystem & industrial strength.
- Strengthens South-South Cooperation: Positions Africa as the next economic growth driver, ensuring sustainable partnerships.
- Counterbalances Chinese Influence: Provides an alternative to China's Belt & Road Initiative (BRI) with a transparent, non-debt-driven approach.

Issues and Challenges:

- Geopolitical Competition: China's dominance in African infrastructure poses economic and strategic challenges.
- Limited Private Sector Engagement: Indian and Japanese companies are hesitant to invest due to regulatory risks and uncertain returns.
- Financing Constraints: Africa's high debt burden limits its ability to attract large-scale investment.
- Logistical & Connectivity Barriers: Inadequate transport infrastructure affects the flow of goods and trade integration.
- Political Instability & Governance Issues: Corruption, conflicts, and weak policy frameworks hinder long-term collaboration.

Way Ahead:

- Expand Institutional & Policy Frameworks: Establish joint economic councils to streamline investments and policy coordination.
- Encourage Private Sector Investments: Provide financial incentives and risk-mitigation tools to attract corporate participation.
- Strengthen Digital & Green Energy Collaboration: Enhance Africa's digital economy and renewable energy capacity through joint ventures.
- Develop Inclusive Trade Partnerships: Promote local capacity-building to ensure African industries gain long-term benefits.

Conclusion:

Overcoming geopolitical, financial, and policy challenges will be key to realizing its full potential. By leveraging

Japan's technology, India's industrial strength, and Africa's growing markets, the trilateral partnership can create a mutually beneficial, resilient economic framework for the future.

India – UK Free Trade Agreement

Context:

India and the UK have resumed negotiations for a Free Trade Agreement (FTA) after an eight-month gap, with 14 rounds of talks completed since January 2022.

- India has signed 13 FTAs and 6 preferential trade agreements, with a recent focus on western partners like the UK, EU, and US to expand exports and enhance trade relations.

What is a Free Trade Agreement (FTA)?

- An FTA is a pact between two or more countries to reduce or eliminate import duties on a majority of traded goods.
- It also aims to minimize non-tariff barriers, facilitate trade in services, and enhance bilateral investments.

Benefits of FTAs:

- Boosts Exports & Market Access: Eliminates tariffs, making Indian goods more competitive.
- Enhances Foreign Investment: Encourages FDI inflows and technology transfer.
- Diversifies Trade Relations: Reduces over-reliance on specific markets.
- Creates Jobs & Economic Growth: Expands industries and employment opportunities.
- Strengthens Strategic Partnerships: Builds diplomatic and economic cooperation.

India's Signed FTAs:

- Signed FTAs: Sri Lanka, Bhutan, Thailand, Singapore, Malaysia, Korea, Japan, Australia, UAE, Mauritius, ASEAN, and EFTA.
- Upcoming FTAs: India is negotiating FTAs with the UK, EU, and US to strengthen trade with western economies.

India-UK Free Trade Agreement (FTA)

Aim of the India-UK FTA

- Boost trade & investment by reducing tariff and non-tariff barriers.
- Expand opportunities in technology, healthcare, and education.
- Facilitate easier movement of students and professionals.

India's Gains from the FTA:

- Merchandise Trade: Exports to the UK were $12.9 billion (FY24), with gains in textiles, apparel, footwear, cars, marine products, grapes, and mangoes.
- Tariff Reduction Benefits: India will gain from duty cuts on $6.1 billion worth of goods.
- Market Access in Services: Indian IT, education, and healthcare sectors will benefit.
- Increased Investments: The Bilateral Investment Treaty (BIT) will promote UK investments in India.

UK's Gains from the FTA:

- Tariff Reductions in India: The UK exports $8.4 billion to India, with 91% of products facing tariffs (e.g., cars – 100%, whisky – 150%).
- Better Access to Indian Markets: UK products such as precious metals, make-up items, machinery, and scotch whisky will benefit from lower duties.

Challenges to the India-UK FTA:

- Tariff Negotiations: India is reluctant to reduce tariffs on UK goods like whisky, automobiles, and meat.
- Visa & Mobility Issues: India demands greater access for students and professionals, while the UK has tight visa policies.
- Bilateral Investment Treaty (BIT) Dispute Resolution: India wants foreign firms to exhaust local remedies before arbitration, which the UK opposes.
- Regulatory Barriers: The UK demands liberalization in India's legal and financial sectors, which faces resistance.

- Geopolitical Factors: Domestic political changes and economic uncertainties can delay agreements.

Way Ahead:

- Balanced Tariff Reductions: Both nations must negotiate fair duty cuts while protecting domestic industries.
- Enhancing Market Access: Address visa and mobility concerns for professionals and students.
- Finalizing Investment Protections: Ensure a mutually beneficial Bilateral Investment Treaty (BIT).
- Sector-Specific Cooperation: Strengthen technology, digital trade, and green energy collaborations.

Conclusion:

The India-UK FTA can be a game-changer for trade and investment, boosting bilateral economic ties. Addressing tariff concerns, investment protection, and market access will be key to finalizing the deal. A balanced agreement will strengthen economic growth for both nations while enhancing India's global trade standing.

Global Infrastructure Resilience Report

Context:

The Coalition for Disaster Resilient Infrastructure (CDRI) published the Global Infrastructure Resilience Report, evaluating infrastructure preparedness and resilience in disaster scenarios.

About CDRI:

- **Established in:** 2019
- **By:** Government of India, launched at the UN Climate Action Summit.
- **Headquarters:** New Delhi, India.
- **Aim:** To promote the resilience of infrastructure systems to climate and disaster risks.
- **Functions:**
  - Develop global frameworks for disaster-resilient infrastructure.
  - Facilitate risk-informed investment decisions.
  - Provide technical assistance to member countries.
  - Promote knowledge sharing on disaster resilience and infrastructure sustainability.

About Global Infrastructure Resilience Report:

Summary & Key Findings from CDRI Report

- Global Infrastructure Risk Model and Resilience Index (GIRI): Provides financial risk metrics for major infrastructure sectors like transport, energy, telecom, water, and health.
- Investment Gap: To address global infrastructure deficits and climate change resilience, $9.2 trillion in annual investment is needed by 2050.
- Climate Risks: Infrastructure remains vulnerable to hazards like earthquakes, tsunamis, cyclones, floods, and droughts.
- Governance Challenges: Many Low- and Middle-Income Countries (LMICs) struggle with weak infrastructure governance, limiting resilience efforts.

Positive Outcomes from the Report:

1. Data-Driven Insights: The GIRI model provides the first-ever publicly available risk assessment for infrastructure resilience.
2. Economic Case for Resilience: Investing in resilient infrastructure leads to reduced asset loss, fewer service disruptions, and long-term economic growth.
3. Nature-Based Solutions (NbIS): The report highlights NbIS as a sustainable approach to enhance infrastructure resilience.
4. Increased Awareness: Policymakers and investors now have access to critical data for informed decision-making.
5. Global Collaboration: The report fosters global cooperation by engaging governments, financial institutions, and multilateral agencies.

Challenges Identified:

1. Financial Constraints: LMICs lack sufficient funding to invest in disaster-resilient infrastructure.
2. Slow Policy Implementation: Despite guidelines, governments struggle to integrate resilience measures into infrastructure planning.
3. Lack of Data Standardization: Many countries do not have consistent metrics to assess infrastructure risks.
4. Private Sector Hesitancy: Investors view resilience measures as additional costs rather than opportunities.
5. Climate Adaptation Gap: Developing countries face challenges in transitioning to low-carbon and climate-resilient infrastructure.

Way Ahead:

1. Scaling Up Investments: Increased public and private funding is needed to bridge the resilience investment gap.
2. Improved Risk Governance: Countries must adopt data-driven policies to ensure resilient infrastructure planning.
3. Technology-Driven Solutions: AI, big data, and remote sensing should be leveraged for real-time infrastructure risk assessment.
4. Enhanced Private Sector Engagement: Governments must incentivize businesses to invest in resilience measures.
5. Global Partnerships: Strengthening international cooperation will help share best practices and technical expertise.

Conclusion:

The CDRI report underscores the urgent need for resilient infrastructure to combat climate risks and disaster vulnerabilities. By fostering global cooperation, leveraging data-driven solutions, and increasing investment, nations can ensure sustainable and resilient infrastructure for future generations.

India China Ministerial Meet

Context:

External Affairs Minister S. Jaishankar met Chinese Foreign Minister Wang Yi on the sidelines of the G-20 Foreign Ministers' meeting in Johannesburg.

About India-China Foreign Ministers Meeting:

Issues Discussed:

1. Border Management: Discussions focused on maintaining peace and tranquillity along the Line of Actual Control (LAC). Both sides emphasized the need for stability in border areas.
2. Kailash Mansarovar Yatra: Resumption of the pilgrimage was a key agenda item. India sought China's cooperation to facilitate the yatra.
3. Connectivity: Talks included improving flight connectivity and travel facilitation. Enhanced connectivity was seen as vital for bilateral ties.
4. Trans-Border Rivers: Both sides addressed issues related to shared river waters. India raised concerns over China's dam-building activities.
5. Multilateral Cooperation: Emphasis was placed on collaboration in G-20, SCO, and BRICS. Both nations agreed to strengthen multilateral platforms.

Successful Coordination:

1. G-20 Preservation: Both nations worked together to protect the G-20 as a key multilateral platform. This highlighted their commitment to global cooperation.
2. Diplomatic Engagements: Regular high-level talks, including visits by India's NSA and Foreign Secretary to China, were held. These visits aimed to address bilateral issues.
3. Disengagement: Successful troop disengagement in eastern Ladakh in November 2024 was achieved. This marked a significant step toward reducing tensions.
4. Regional Stability: Joint efforts were made to address global challenges like climate change and food security. Both nations recognized the need for collective action.
5. Plurilateralism: Advocacy for inclusive international cooperation beyond unilateralism was emphasized. This reflected a shared vision for a multipolar world.

India-China Differences:

1. Border Tensions: Persistent issues along the LAC, especially post-Galwan clashes in 2020, remain unresolved. These tensions continue to strain bilateral relations.
2. Strategic Rivalry: Competing interests in the Indo-Pacific region create friction. Both nations seek to expand their influence in the region.
3. Trade Imbalance: India's significant trade deficit with China is a major concern. India seeks to reduce dependency on Chinese imports.
4. Trust Deficit: Lack of mutual trust due to China's aggressive posturing hampers relations. Confidence-building measures are needed to bridge this gap.
5. Global Influence: Differing approaches to multilateralism and global governance create divergence. India advocates for inclusive global institutions.

Way Ahead:

1. Dialogue Continuation: Regular diplomatic engagements are essential to address bilateral issues. Sustained dialogue can help build mutual understanding.
2. Confidence-Building Measures: Strengthening mechanisms to prevent border skirmishes is crucial. These measures can reduce the risk of escalation.
3. Economic Cooperation: Addressing trade imbalances and enhancing economic ties is vital. Both nations can benefit from balanced trade relations.
4. Multilateral Collaboration: Leveraging platforms like BRICS and SCO for mutual benefits is important. These platforms offer opportunities for cooperation.
5. Regional Stability: Joint efforts to ensure peace and stability in Asia are necessary. Collaborative approaches can address regional challenges effectively.

Conclusion:

The India-China meeting in Johannesburg underscored the importance of dialogue in resolving bilateral issues and preserving multilateralism. While challenges like border tensions persist, both nations have shown a commitment to cooperation. Sustained engagement and confidence-building measures are crucial for long-term stability and mutual growth.

Chapter-
10

INTERNAL SECURITY

Man Portable Air Defence System (MANPAD)

Context:

The Defence Research and Development Organisation (DRDO) successfully conducted three flight trials of the indigenously developed Very Short-Range Air Defence System (VSHORADS), a Man Portable Air Defence System (MANPAD).

About Man Portable Air Defence System (MANPAD):

What is MANPAD?

- A lightweight, shoulder-fired missile system designed to target low-altitude aerial threats like drones, helicopters, and aircraft.
- Provides mobility and flexibility to ground forces for air defence in combat zones.

Developed By:

- Designed and developed by DRDO's Research Centre Imarat (RCI), Hyderabad.

Aim:

- To provide the Indian armed forces with an indigenous, advanced air defence system capable of neutralizing modern aerial threats.
- To replace ageing systems like the Russian Igla MANPADS.

Features:

- Portability: Weighs 20.5 kg and can be shoulder-fired or mounted on a tripod.
- Range: Effective range of 250 meters to 6 kilometres.
- Speed: Maximum speed of Mach 1.5 (1,850 km/h).

- Warhead: Equipped with a 2 kg adaptive proximity fuze for precise target destruction.
- Target Engagement: Capable of intercepting low-flying drones and aircraft with reduced thermal signatures.
- Operational Flexibility: Can be deployed in various combat scenarios, including mountainous and urban terrains.

Stryker Infantry Combat Vehicle

Context:

India-U.S. defence cooperation advances with progress in the Stryker Infantry Combat Vehicle (ICV) deal, with a plan for co-production in India.

About Stryker Infantry Combat Vehicle (ICV):

What is Stryker?

- Eight-wheeled armoured infantry combat vehicle (ICV) designed for rapid deployment and enhanced battlefield mobility.
- Developed by General Dynamics Land Systems (GDLS) Canada and U.S.

Purpose of Stryker ICV:

- Designed for quick response in counter-insurgency and war-like situations.
- Provides better survivability against IEDs compared to other light-armoured vehicles.
- Supports infantry squads with firepower, protection, and mobility in high-threat environments.

Features of Stryker ICV:

- V-hull structure for enhanced mine and blast protection.
- Equipped with 30 mm cannon and 105 mm mobile gun for combat effectiveness.
- Composite armour with ceramic tiles for enhanced protection.
- Manned by two crew members and carries a nine-member infantry squad.
- Top speed: 100 km/h, Range: 483 km.
- Can be airlifted by Chinook helicopters, improving mobility in difficult terrains.

Significance for India:

- Enhances infantry mobility and firepower in high-altitude warfare.
- Provides better protection for troops against IEDs and small arms fire.
- Strengthens India's border security in sensitive regions like Ladakh and Arunachal Pradesh.
- Supports 'Make in India' initiative with a potential co-production agreement involving Bharat Earth Movers Limited (BEML).
- Boosts India-U.S. defence ties, expanding military collaboration beyond aircraft and missile systems.

Pinaka Ammunition

Context:

The Defence Ministry signed 10,147 crore contracts with EEL, MIL, and BEL to enhance Pinaka MRLS firepower, improve range, precision, and modernize artillery systems under Aatmanirbhar Bharat.

Key Features of the Procurement:

Enhanced Firepower:

- ADM Type-1 Rockets: Disperse sub-munitions over a large area; effective against mechanized forces.
- HEPF Mk-1 (Enhanced) Rockets: Extended range, higher lethality, designed for deep-strike.

Increased Range & Precision:

- Pinaka MRLS as India's long-range artillery backbone.
- DRDO-tested guided rockets (38- 75 km range); plans for 120 km and 300 km.

Indigenous Defence Boost:

- Supports Aatmanirbhar Bharat, promotes MSMEs, reduces foreign dependency.

Operational Strengthening:

- Modernizes artillery; Shakti software upgrade enhances targeting & coordination.

About Pinaka Rocket Missile System:

- Type: Multi-Barrel Rocket Launcher (MBRL) designed by DRDO's Armament Research and Development Establishment (ARDE).
- First Use: Played a crucial role in neutralizing enemy positions during the Kargil War.

Features:

- The launcher system includes a multi-tube launcher vehicle, command post vehicle, and replenishment vehicles.
- Can fire 12 rockets in 48 seconds, covering an area of 700 × 500 square meters.
- Mounted on a Tatra truck for mobility with hydraulically actuated outriggers for stability during firing.

Su-57 Fighter Jet

Context:

Russia has offered India a partnership for the joint production of the Su-57 fighter jet at Hindustan Aeronautics Limited (HAL), aiming to localize fifth-generation fighter aircraft (FGFA) technology.

About Su-57 Fighter Jet:

What is Su-57?

- A fifth-generation stealth fighter developed by Russia's United Aircraft Corporation (UAC).
- Designed for air superiority and ground attack roles with advanced stealth, agility, and multi-role combat capabilities.

Nation of Origin:

- Developed by Russia, primarily for the Russian Air Force.

Key Features of Su-57:

- Stealth Design: Low radar cross-section (RCS) with composite materials and radar-absorbing coating.
- AESA Radar: Multi-band active electronically scanned array (AESA) radar for enhanced situational awareness.
- Supermaneuverability: Thrust-vectoring engines allow superior dogfight agility.
- Supersonic Cruising (Supercruise): Can sustain supersonic speeds without afterburners.
- AI-Integrated Systems: AI-assisted avionics for advanced combat decision-making.
- Advanced Weaponry: Carries hypersonic missiles, air-to-air and air-to-ground precision-guided weapons.

Differences Between Su-57 and F-35:

Feature	Su-57 (Russia)	F-35 (USA)
Design Objective	Air superiority & interception with ground attack capability	Multi-role strike fighter with advanced stealth
Stealth Capability	Front-aspect stealth, moderate all-round stealth	Full-spectrum stealth, ultra-low radar signature
Radar & Sensors	AESA multi-band radar with additional L-band radars (better for stealth detection)	Advanced AESA radar optimized for electronic warfare & precision strikes
Manoeuvrability	Highly manoeuvrable (thrust-vectoring engines)	Less agile, optimized for stealth penetration
Speed & Range	Max Speed: Mach 2	Max Speed: Mach 1.6
Super cruise	Yes (can cruise at supersonic speeds without afterburners)	Limited (requires afterburners)
Weapons Load	Larger payload, internal & external weapons bay	Smaller internal payload (due to stealth), larger payload in non-stealth mode
Production Cost	Lower cost (~$70 million per unit)	Expensive (~$100-110 million per unit)
Operational Cost	Lower maintenance and operating cost	Higher sustainment costs due to stealth coating and advanced avionics
Strategic Suitability for India	Ideal for border defense and air superiority	Best for precision strikes & offensive penetration

Chapter-
11

Yojana March 2025

1: PM-KUSUM: Empowering Farmers with Solar Energy Solutions

Introduction

The Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) was launched by the Ministry of New and Renewable Energy (MNRE) in 2019 to promote the installation of off-grid solar pumps in rural areas and reduce dependence on conventional grid electricity.

- The scheme also facilitates grid-connected solar energy solutions for agricultural purposes.

Components

Component A: Decentralized Solar Power Plants

- Target: 10,000 MW of solar capacity through small solar power plants (up to 2 MW each).
- Location: Preferably within 5 km radius of notified substations to minimize transmission losses and costs.
- Power Purchase: Local DISCOMs will procure electricity at pre-fixed tariffs set by the State Electricity Regulatory Commission (SERC).

Component B: Standalone Solar Agriculture Pumps

- Target: 20 lakh standalone solar-powered agricultural pumps.
- Capacity: Individual farmers can install solar pumps of up to 7.5 HP to replace diesel-based irrigation systems in off-grid areas.

Financial Support:

- 30% subsidy by the State Government.
- The remaining cost to be borne by the farmer.

Component C: Solarization of Grid-Connected Pumps

- Target: Solarizing 15 lakh grid-connected agricultural pumps.
- Usage: Farmers can use the solar power for irrigation and sell excess energy to DISCOMs at pre-fixed tariffs.

Objectives:

- Enable farmers to set up solar power generation on arid lands and sell surplus electricity to the grid.
- Enhance farmers' income by allowing them to trade excess solar energy.

Significance of the Scheme:

1. Enhancing Energy Access:

- Encourages farmers to sell surplus solar power to the state, thereby supplementing their income.
- Expands rural electricity access, ensuring a reliable energy source for agricultural and allied activities.

2. Climate Change Mitigation:

- Promotes sustainable irrigation by reducing reliance on polluting diesel pumps.
- Encourages efficient groundwater utilization by incentivizing farmers to save energy.
- Expected to reduce carbon emissions by 32 million tonnes of CO2 annually.

3. Employment Generation & Rural Empowerment:

- Creates job opportunities in the installation, maintenance, and operation of solar projects.
- Strengthens energy security by enabling decentralized power generation.

Challenges in Implementation:

1. Financial and Logistical Constraints:

- High initial investment costs may limit access to solar power solutions for small farmers.
- Domestic availability of solar equipment, especially pumps, remains a concern.

2. Water Table Depletion:

- Power subsidies encourage excessive groundwater extraction, leading to a declining water table.
- Upgrading to higher-capacity pumps in case of falling water tables requires additional solar panels, increasing costs.

3. Regulatory and Technical Challenges:

- Regulatory restrictions may hinder seamless integration of solar power with the grid.
- Decentralized solar projects pose grid stability and technical integration issues.

2: National Solar Mission: Progress, Challenges, and the Path for Renewable Energy by 2030

The National Solar Mission (NSM), launched in 2010 as part of India's National Action Plan on Climate Change, aims to establish India as a global leader in solar energy.

- With ambitious targets set for solar power generation, the mission has made significant strides but faces numerous challenges that must be addressed to achieve its goals by 2030.

Progress of the National Solar Mission

- Increase in Installed Capacity: India's solar power capacity has seen remarkable growth. As of December 2023, India's total renewable energy capacity stood at approximately 180 GW, with solar energy contributing about 70 GW. The initial target of 20 GW by 2022 was surpassed, and the nation is now working towards achieving 500 GW of non-fossil fuel capacity by 2030 as part of a broader renewable energy strategy.
- Development of Solar Parks: The establishment of solar parks has been a cornerstone of the NSM. These parks facilitate large-scale solar power generation and have attracted substantial investments. Notable projects include the Bhadla Solar Park in Rajasthan (2.25 GW), one of the largest in the world, and the Rewa Ultra Mega Solar Park (750 MW) in Madhya Pradesh.
- Growth of Rooftop Solar Installations: Rooftop solar installations have gained traction due to government incentives and subsidies. This decentralization of solar power generation helps alleviate stress on the national grid and promotes energy independence at the household and commercial levels.
- Technological Advancements: The mission has spurred innovation in solar technologies, leading to improved efficiency and reduced costs. India is now one of the largest manufacturers of solar panels globally, contributing to both domestic needs and export markets. Advances in solar panel efficiency, perovskite solar cells, and bifacial modules are enhancing power generation capabilities.
- International Collaboration: India's commitment to global solar initiatives is evident through its leadership in the International Solar Alliance (ISA), aimed at promoting solar energy worldwide and facilitating technology transfer among member countries.

Challenges Faced by the National Solar Mission

- Land Acquisition Issues: Acquiring land for solar projects remains a significant barrier. The process is often hampered by regulatory complexities and local opposition, particularly in densely populated and agricultural regions.
- Financial Constraint: High initial capital costs for solar installations pose a challenge, especially for smallscale projects. While government subsidies exist, financing mechanisms such as viability gap funding (VGF), green bonds, and interest subvention schemes need further strengthening.
- Policy and Regulatory Uncertainty: Inconsistent policies and regulatory frameworks create uncertainty for investors. Frequent changes in tariffs, import duties on solar panels, and delays in power purchase agreements (PPAs) affect project timelines and financial viability.
- Grid Integration Challenges: Integrating intermittent solar power into the national grid requires advanced grid management systems and energy storage solutions. Battery storage technologies, pumped hydro storage, and hybrid solar-wind projects are being explored but require further scaling.

- Skilled Workforce Shortage: The lack of trained professionals in the renewable energy sector hampers growth. Vocational training programs and skill development initiatives are essential to build a workforce capable of supporting the growing solar industry.

Way Forward

To meet its ambitious target of fulfilling 50% of its energy needs from renewable sources by 2030, India must adopt a multi-faceted approach:

- Strengthening Policy Frameworks: Establishing stable and transparent policies that encourage longterm investments in renewable energy.
- Enhancing Infrastructure: Investing significantly in smart grids, advanced energy storage, and transmission infrastructure to accommodate increased renewable capacity.
- Promoting Public-Private Partnerships: Encouraging collaboration between government entities and private companies to mobilize resources effectively.
- Redirecting Subsidies: Shifting financial support from fossil fuels to renewables will enhance cost competitiveness and drive adoption.
- Investing in R&D: Continuous innovation in solar technology, including high-efficiency solar cells, energy storage solutions, and grid management systems, will be crucial for improving efficiency and reducing costs.

Conclusion

In conclusion, while India's National Solar Mission has made impressive progress since its inception, overcoming existing challenges will be vital for achieving its renewable energy targets by 2030. A concerted effort involving policy reform, financial investment, infrastructure development, and workforce training will pave the way for a sustainable energy future in India.

Table 1 : Salient features of PM-KUSUM

Aspect	PM-KUSUM
Coverage	All India
Year of Initiation	March 2019
Architecture/ Institutional set-up	• **Two tier** • **National Level:** Screening Committee under the chairmanship of Secretary, MNRE • **State level:** State Implementing Agency (SIA)
Planning	• SIA assesses the demand of solar pumps and submits the proposal to MNRE. • MNRE after the approval from Screening Committee sanctions and allocates the number of pumps to SIA • SIA installs pumps through empaneled vendors, and monitors the progress till at least five years
Nodal Department	• **National level**: MNRE • **State level**: DISCOMS/ State specific Renewable Energy Development Agency/ Agriculture department/Any other department identified by the state government
Beneficiaries	• Individual farmers/SHGs/JLGs forming groups of farmers/Co-operatives/ Panchayats/FPO, WUA.
Financial assistance (Subsidy)	**Component B&C:** • 60 per cent of the benchmark or tender cost whichever is less, in all states except North Eastern states, J&K, Himachal Pradesh, Uttarakhand, Lakshadweep and A&N Islands where subsidy assistance is 80 per cent. • In case the state government provides top up subsidy, farmers' share can be reduced. • Priority is given to marginal and small farmers, and those with micro-irrigation system
Ceiling	• Central Financial Assistance (CFA) is restricted to 7.5 Hp pumps. However, more than 7.5 Hp pumps may be allowed without CFA. • CFA is available for pumps up to 15 Hp capacity in J&K, Ladakh, Uttarakhand, Himachal Pradesh, and the A&N and Lakshadweep Islands, as well as for cluster/ community irrigation projects in high water table areas.
Funding pattern	**Component B&C:** • 100 per cent central government assistance for all UTs • 50:50: Central & state government sharing for all other states (60 per cent subsidy of benchmark cost) • 62.5: 37.5: Central & state government sharing for all other states in NE & Himalayan states, Lakshadweep and A&N Islands (80 per cent subsidy of benchmark cost) • Farmers share: 20 per cent in special category states and 40 per cent in other states. • Bank finance may be available upto 10 per cent to 30 per cent of farmers' share.
Installation and maintenance	• Empaneled vendors are responsible for design, supply, installation and commissioning of solar agricultural pumps under the close real-time monitoring of SIA. • Annual maintenance charges for a period of 5 years, including insurance coverage for the installed system against natural calamity and theft.
Convergence possibility	• The guidelines of PM-KUSUM encourage convergence with PDMC. New solar pumps shall not be installed in dark zones. Existing pumps in dark zones can be replaced with solar provided they use micro-irrigation techniques to save water.

Conclusion

PM-KUSUM has the potential to revolutionize rural energy access, promote sustainable agriculture, and mitigate climate change. However, addressing financial, regulatory, and technical challenges is essential for the scheme's effective implementation and long-term success.

3: Perform, Achieve, and Trade (PAT) Scheme

Introduction

India's economic growth, under the and initiatives, is closely linked to energy consumption.

- However, rising energy demand, climate change, and pollution necessitate a shift towards energy efficiency and renewable energy sources.
- The scheme, under the , aims to reduce energy consumption in industrial sectors through energy-saving targets and trading of .

India's Energy Scenario and Challenges

- India aims to reduce energy intensity by 45% by 2030 (compared to 2005 levels) and achieve net-zero emissions by 2070.
- Energy-intensive industries like steel, cement, fertilisers, and power generation require efficiency improvements.
- Transitioning to energy-efficient technologies (e.g., LEDs, efficient industrial processes) is crucial to managing growing energy demand while mitigating pollution and climate risks.

PAT Scheme: Design and Implementation

- Objective: Improve energy efficiency in high-energy-consuming industries by setting specific energy consumption (SEC) reduction targets.

Implementation:

- Designated Consumers (DCs): Identified industrial plants mandated to participate.
- Baseline Calculation: Accredited energy auditors assess SEC for each DC.
- Energy-Saving Targets: Assigned based on industry benchmarks.
- Energy Efficiency Measures: DCs implement recommended improvements, ranging from low-cost interventions to high-investment structural changes.

Trading Mechanism:

- DCs achieving savings beyond targets receive.
- These can be sold to underperforming DCs, allowing flexibility in compliance.

Sector-Specific Challenges and Solutions

- Iron & Steel Industry: Variability in raw materials (iron ore, coal), energy-intensive processes.
- Solutions: Improved coal quality, waste heat recovery, increased scrap utilisation.
- Other Sectors: Variability in technology, process efficiency, and resource availability impact energy efficiency goals.

Impact and Achievements

- PAT Cycle I (2012-15): 8.67 million tonnes of oil equivalent (MTOE) saved (target: 6.86 MTOE), reducing 31 million tonnes of CO_2 emissions.
- Subsequent PAT cycles: Expanded to new sectors, achieving cumulative savings of over 14 MTOE in Cycle II (2016-19).
- Flexibility and Market Approach: The trading of ESCerts allows industries to optimise energy efficiency investments.

Conclusion

The PAT scheme has proven to be an effective mechanism in reducing India's industrial energy consumption while aligning with global climate commitments. By integrating technical, financial, and market-based solutions, PAT fosters sustainable industrial growth and contributes significantly to India's energy efficiency and carbon reduction goals.

4: Smart Cities Mission (SCM) and the Role of Energy Efficiency in Urban Development

Introduction

India's Smart Cities Mission (SCM), launched in 2015, aims to integrate technology and infrastructure to improve urban living standards. Given that cities contribute 50-60% of global greenhouse gas (GHG) emissions, energy efficiency has become a key pillar of sustainable urbanization.

Energy Efficiency in Urban Development

- Rising Energy Demand: Urbanization has made India the third-largest energy consumer, with 80% of its energy coming from conventional sources like coal, which contributes 70% of emissions.
- Government Initiatives: India's Nationally Determined Contributions (NDCs) and Long-Term LowEmissions Development Strategy (LT-LEDS) focus on energy-efficient and climate-resilient urban infrastructure.

Key Sectors for Energy Efficiency in Smart Cities

Energy-Efficient Buildings:

1. Buildings account for over one-third of India's total energy consumption.
2. Retrofitting HVAC, lighting, and water supply can reduce energy demand.
3. Green building standards such as GRIHA and LEED promote sustainable construction.

Energy-Efficient Water Management:

1. The Climate Smart Cities Assessment Framework (CSCAF) promotes energyefficient water supply networks.
2. SCADA automation, solar energy integration, and hydraulic modeling can improve efficiency.

Energy-Efficient Waste Management:

1. Urban waste is growing at 5% annually, requiring sensor-based waste collection, AI-driven waste processing, and waste-toenergy conversion.

Energy-Efficient Transportation:

1. The transport sector contributes 14% of CO_2 emissions.
2. Electric vehicles (EVs), AI-driven traffic management, and multimodal transport networks can help reduce the energy footprint.

Policy and Regulatory Framework

- The transition from Energy Conservation Act (2001) to more consumer-oriented policies reflects a shift towards sustainability.
- NAPCC (National Action Plan on Climate Change) and NMEEE (National Mission on Enhanced Energy Efficiency) should be integrated into urban planning.

Way Forward

- Stakeholder Collaboration: Coordination among think tanks, academia, businesses, and local governance can enhance policy impact.
- Technological Advancements: Adoption of smart grids, AI-driven energy systems, IoT-enabled sensors, and blockchain energy trading can revolutionize energy efficiency.

- Decentralized Energy Governance: Strengthening urban local bodies can lead to better energy management.

Table 1: Transforming policy environment with direct & indirect contribution to energy efficiency in cities

Policy/Programme	Year	Emphasis
Energy Conservation Act (EC Act)	2001, Amended 2010	Establish energy efficiency standards, promote energy conservation, regulate high energy-use industries.
National Mission on Enhanced Energy Efficiency (NMEEE)	2010	Enhance industrial energy efficiency through Perform, Achieve & Trade (PAT), and financial instruments like Energy Savings Certificates.
National Mission for Sustainable Habitat (NMSH)	2010	Promote sustainable urban development, energy-efficient buildings, and urban waste management.
National Solar Mission (NSM)	2010	Scale up solar power generation with targets for grid-connected and off-grid solar installations.
Perform, Achieve, and Trade (PAT) Scheme	2012	Market-based mechanism for enhancing energy efficiency in industries
National Electric Mobility Mission Plan (NEMMP)	2013	Development and promotion of electric vehicles that contribute to net zero emissions by reducing vehicular pollution
Smart Cities Mission (SCM)	2015	Foster energy-efficient, sustainable urban development with integrated technologies and green infrastructure.
National Smart Grid Mission	2015	Modernises India's power distribution network using smart grids and enables grid decarbonisation for net zero carbon goals.
Unnat Jyoti by Affordable LEDs for All (UJALA)	2015	Encourages the production and use of energy-saving LED lights and appliances. Lowers the amount of electricity used in homes and businesses.
Energy Conservation Building Code (ECBC)	2017 (Updated)	Sets energy efficiency standards for commercial buildings to boost climate resilience in Urban Development.
Draft National Energy Policy (NEP)	2017	Provide universal energy access, reduce fossil fuel dependency, and promote low-carbon development.
Draft National Cooling Action Plan (NCAP)	2018	Manage cooling demand, reduce carbon footprint, and increase energy-efficient cooling technologies.
National Program for Climate Change & Human Health (NPCCHH)	2019	Ensuring environmentally sustainable and climate-resilient health services
Steel Scrap Recycling Policy (SSRP)	2019	Promotes the use of scrap steel in manufacturing to lessen the emissions and effects of mining. Encourages the steel sector to use sustainable manufacturing practices.

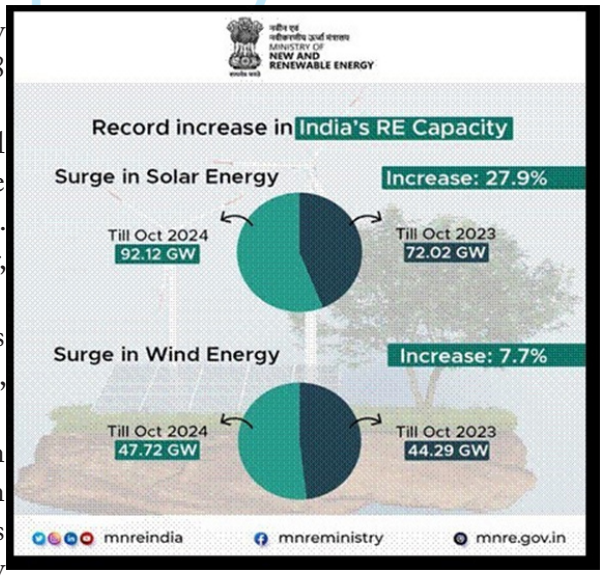
Conclusion

Energy efficiency is a cornerstone of smart urbanization. India must scale up its energy-efficient initiatives in buildings, transport, water, and waste management to achieve sustainable, low-carbon, and climate-resilient urban development.

5: Scope and Opportunities for Renewable Energy in Rural India

Introduction

India has witnessed a remarkable growth in its renewable energy capacity, expanding by 165% over the past decade—from 76.38 GW in 2014 to 203.1 GW in 2024.



- Given that rural India constitutes about 67% of the total population and contributes 37% of GDP, renewable energy can play a transformative role in its development. The government has identified energy as a priority sector, allocating Rs 68,769 crores towards its enhancement.
- The Pradhan Mantri Surya Ghar: Muft Bijli Yojana aims to install rooftop solar plants in one crore households, providing up to 300 units of free electricity per month.
- Additionally, the National Green Hydrogen Mission seeks to achieve 5 million metric tonnes of annual green hydrogen production capacity by 2030. These initiatives align with India's commitment to sustainable energy solutions.

Need for Renewable Energy in Rural India

Despite India's rapid economic growth, rural areas still face significant infrastructure deficits, particularly in electricity access.

- Around 300 million people in rural India lack access to grid-connected power, relying instead on traditional and polluting sources such as kerosene, diesel, and wood-fired chulhas. These not only contribute to environmental degradation but also impose health hazards and economic burdens.

Solar Power: A Key Solution

Solar energy emerges as a viable alternative due to declining costs and its ability to provide decentralized power solutions. Key advantages include:

- Decentralized Electrification: Solar energy enables cost-effective electrification of remote areas where grid extension is not feasible.
- Multi-purpose Applications: Solar power benefits productivity, safety, healthcare, clean water access, and livelihoods.
- Improving Rural Productivity: Solar lighting can extend working hours and increase household incomes.
- Solar-Powered Agricultural Pumps: These enhance irrigation efficiency, reducing dependence on fossil fuel-based pumps that consume nearly 20% of India's installed power capacity.
- Water Purification: Solar energy can be harnessed for water treatment, addressing the pressing need for clean drinking water in rural India.

Government Initiatives for Renewable Energy Promotion

The Government of India has launched several initiatives to enhance renewable energy capacity, including:

- 100% FDI in Renewable Energy: Permitted under the automatic route to attract global investment.
- National Green Hydrogen Mission (2023): Targets 5 MMT of annual green hydrogen production by 2030.
- Waiver of Inter-State Transmission Charges: Encourages inter-state sale of renewable power.
- Ultra Mega Renewable Energy Parks: Provides land and transmission infrastructure for large-scale RE projects.
- PM-KUSUM Scheme: Supports solar-powered agriculture and energy security.
- PM Surya Ghar: Muft Bijli Yojana: Plans to install rooftop solar in one crore households with a financial outlay of Rs 75,021 crore until FY27.
- Green Energy Corridor Scheme: Expanding transmission lines for renewable energy evacuation.
- Project Development Cell: Established to attract private investment.
- Offshore Wind Energy Development: Plans to install 1 GW offshore wind energy capacity along Gujarat and Tamil Nadu coasts.
- Standard Bidding Guidelines: Streamlining tariff-based competitive bidding for solar and wind power projects.

Challenges in Renewable Energy Deployment

Despite significant progress, India's RE sector faces various challenges:

- High Land Acquisition Costs: Finding suitable land, converting its use, and obtaining necessary clearances remain time-consuming.
- Trust Deficit in Solar Power Solutions: Despite government incentives, consumer skepticism about performance persists.
- Lower Efficiency of Domestic Solar Panels: Indian solar panels often lag behind international competitors in efficiency.
- Environmental Challenges: Dust accumulation on solar PV cells reduces efficiency, impacting energy generation.
- Intermittency Issues: Renewable sources depend on weather conditions, causing fluctuations in power generation.
- Grid Balancing Constraints: Sudden surges or drops in renewable generation can strain grid stability.
- Impact on Wildlife: Wind turbines pose risks to birds and bats, particularly during migration seasons.
- High Water Requirement for Hydrogen Production: Large-scale hydrogen production demands significant water resources.

- DISCOM Limitations: Power Purchase Agreements for thermal energy limit DISCOMs' ability to procure solar power.
- Economic Viability of Nuclear Power: Small modular reactors are expected to be expensive and may not be commercially viable before 2030.

Conclusion

Renewable energy, especially solar, can drive rural India's growth and sustainability. Addressing manufacturing, grid, and consumer challenges through policy, investment, and technology will ensure inclusive development and global leadership.

6: Green Hydrogen: India's Path to a Sustainable Energy Future

Introduction

India's National Green Hydrogen Mission (NGHM) aims to establish the country as a global hub for Green Hydrogen production, usage, and export.

- The mission advances India's energy self-sufficiency by promoting clean energy solutions and reducing dependence on fossil fuels.
- The mission targets a production capacity of at least 5 Million Metric Tonnes (MMT) of Green Hydrogen annually by 2030, with potential growth to 10 MMT per year as export markets expand. It is expected to decarbonize key industrial sectors and lay the groundwork for emerging sectors such as steel, shipping, energy storage, and long-haul mobility.
- These initiatives are projected to avert around 50 MMT of CO2 emissions annually, significantly contributing to India's Net Zero goals.
- Government interventions and a phased approach aim to accelerate the development of Green Hydrogen technologies, reduce production costs, and create economies of scale.

India's Commitment to Sustainable Development

India, a recognized global leader in climate action, has surpassed its Paris Agreement targets and now focuses on achieving energy independence by 2047 and Net Zero emissions by 2070.

- Green Hydrogen plays a crucial role in this vision by revolutionizing India's energy landscape and positioning it as a leader in renewable energy production.
- With one of the world's fastest-growing renewable energy sectors, India has abundant resources to meet domestic energy needs and supply Green Hydrogen to global markets.
- The NGHM is a comprehensive initiative designed to build a robust Green Hydrogen ecosystem, addressing opportunities and challenges in this emerging sector.

The Global Transition to Clean Energy

As countries strive to combat climate change, ensure energy security, and drive economic growth, Green Hydrogen is gaining prominence as a clean energy alternative. Produced from renewable sources like solar and wind, it holds vast potential to decarbonize hard-to-abate sectors such as industry, transport, and power generation while creating sustainable economic and employment opportunities.

Through the NGHM, India contributes to global sustainability while advancing its own energy security and economic development.

Advancing Energy Independence and Sustainable Development

With India's energy demand projected to grow by 25% by 2030, over 40% of its primary energy needs are currently met through imports. Transitioning to Green Hydrogen can significantly reduce fossil fuel dependence and improve energy self-sufficiency. It can replace fossil fuels in industries such as:

- Petroleum refining
- Steel production
- Fertilizers
- Long-haul transport (including automobiles and ships)

Global Opportunities

Growing global demand for Green Hydrogen, coupled with disruptions in fossil fuel supply chains, presents a significant opportunity for India to capitalize on its renewable energy resources.

- This can position the country as a leading producer and exporter of Green Hydrogen and its derivatives, such as Green Ammonia and Green Methanol.

Overcoming Challenges

Despite challenges such as high production costs and the lack of harmonized standards, advancements in technology and the declining costs of renewable energy and electrolysers will make Green Hydrogen cost-competitive across various sectors.

Objectives of the National Green Hydrogen Mission (NGHM)

Launched in January 2023, the NGHM aims to establish India as a global hub for Green Hydrogen production, usage, and export, helping to:

- Decarbonize the economy
- Reduce dependence on fossil fuel imports
- Strengthen India's leadership in Green Hydrogen technology and markets
- Contribute to the global clean energy transition

Key Targets

- At least 5 MMT of Green Hydrogen production annually by 2030, with potential growth to 10 MMT
- Replacement of fossil fuels with Green Hydrogen-based alternatives in sectors like ammonia production, petroleum refining, and city gas distribution
- Promotion of Green Hydrogen-based synthetic fuels, including Green Ammonia and Green Methanol, in mobility, shipping, and aviation
- Strengthening India's electrolyser manufacturing industry

Scaling Green Hydrogen Production: Leveraging Renewable Resources

India currently consumes about 5 MMT of Hydrogen annually, primarily sourced from fossil fuels (Grey Hydrogen). However, pilot projects have begun producing Green Hydrogen using water electrolysis powered by renewable energy and biomass-based thermochemical methods.

The NGHM seeks to scale these technologies by:

- Reducing costs associated with electrolysers, renewable energy inputs, and infrastructure
- Expanding electrolyser manufacturing to enhance domestic production and reduce imports
- Exploring decentralized models, such as rooftop solar and small hydro plants, to optimize land and water use
- Developing hydrogen refueling stations linked to renewable energy plants

Additionally, for remote regions and islands, decentralized Green Hydrogen production can support local energy needs and economic development.

Phased Implementation: Laying the Foundation for Growth

Phase I (2022-23 to 2025-26)

- Focus on creating demand and boosting domestic electrolyser manufacturing
- Introduction of incentives to promote indigenization
- Initial deployment in refineries, fertilizers, and city gas sectors

- Pilot projects in steel, long-haul transport, and shipping
- Development of regulations and standards

Phase II (2026-27 to 2029-30)

- Green Hydrogen expected to become cost-competitive in key sectors
- Commercial-scale projects in steel, mobility, and shipping
- Pilot projects in railways and aviation
- Expansion of R&D efforts to drive technological advancements and sector-wide decarbonization

Multi-Ministry Coordination for Success

The success of the NGHM requires coordination across multiple ministries and institutions. The key stakeholders include:

- Ministry of New and Renewable Energy (MNRE) – Lead agency overseeing policy formulation, incentives, and international collaborations
- Ministry of Power (MoP) – Policy support for cost-effective renewable energy production
- Ministry of Petroleum and Natural Gas (MoPNG) – Integration of Green Hydrogen in refineries and city gas distribution
- Ministry of Chemicals and Fertilisers – Adoption of Green Ammonia-based fertilizers to reduce imports
- Ministry of Road Transport and Highways (MoRTH) – Promotion of hydrogen adoption in heavy transport
- Ministry of Steel – Development of green steel production projects
- Ministry of Ports, Shipping and Waterways (MoPSW) – Infrastructure development for hydrogenpowered ships and exports
- Ministry of Finance – Establishment of financial frameworks and incentives

Conclusion

The National Green Hydrogen Mission is a pivotal initiative that will transform India's energy sector, making it self-reliant and sustainable. By leveraging its abundant renewable energy resources and fostering technological advancements, India is well-positioned to become a global leader in Green Hydrogen production and export. Through coordinated efforts, phased implementation, and international collaboration, the mission will accelerate India's transition to a low-carbon economy, ensuring a cleaner, greener, and energy-secure future.

7: Biofuels as a Promising Substitute for High-Carbon Energy Sources

Introduction

The rising demand for energy, coupled with the environmental and economic challenges of fossil fuels, has necessitated a shift towards renewable energy sources.

- While wind and solar power have gained prominence in India's renewable energy portfolio, biofuels offer a strategic advantage for sustainable development and energy security.
- The National Policy on Biofuels (NPB) 2018 aims to enhance biofuel production and establish a sustainable ecosystem.

The Need for Alternative Energy Sources

Conventional energy sources, primarily fossil fuels, are responsible for significant environmental degradation, including climate change, biodiversity loss, and pollution.

- The need for alternative energy sources is pressing, especially in large and developing countries like India, which face challenges such as energy insecurity, climate change, population growth, and poverty.
- Sustainable and clean energy solutions are essential for economic growth, social well-being, and environmental preservation.

Biofuels:

Biofuels are renewable fuels derived from biological sources such as plants, algae, and organic waste. They serve as an alternative to fossil fuels and help reduce carbon emissions. Biofuels are categorized into different generations based on their source and production methods:

Types of Biofuels

First-Generation Biofuels:

1. Derived from food crops like sugarcane, corn, and vegetable oils.
2. Examples: Ethanol (from sugarcane, corn), Biodiesel (from vegetable oils).

Second-Generation Biofuels:

1. Produced from non-food biomass like agricultural waste, wood, and algae.
2. Example: Cellulosic ethanol (from crop residues, wood chips).

Third-Generation Biofuels:

1. Made from specially cultivated energy sources like algae, which produce high oil yields.
2. Example: Algal biofuel.

Fourth-Generation Biofuels:

1. Involves advanced techniques like synthetic biology and carbon capture to enhance fuel production.

Examples of Biofuels

- Ethanol: Blended with petrol to reduce emissions.
- Biodiesel: Used as an alternative to diesel.
- Biogas: Generated from organic waste decomposition.
- Green Hydrogen: Produced using bio-based processes.

India's Biofuel Initiatives

India's biofuel initiative began in 2003, distinguishing itself by using molasses for bioethanol and non-edible oils for biodiesel. However, challenges such as the cyclic nature of sugar and ethanol production, high costs, and land availability have hindered consistent biofuel development.

- A coherent and long-term policy can drive India's biofuel efforts, ensuring energy security, economic growth, and environmental sustainability.

SOME FACTS ABOUT BIOFUELS

Biofuels	Liquid or gaseous fuels produced from biomass resources and used in place of, or in addition to, diesel, petrol or other fossil fuels for transport, stationary, portable and other applications;
Biomass resources	The biodegradable fraction of products, wastes and residues from agriculture, forestry and related industries as well as the biodegradable fraction of industrial and municipal wastes.
Bio-ethanol	Ethanol produced from biomass such as sugar-containing materials, like sugarcane, sugar beet, sweet sorghum, etc.; starch-containing materials such as corn, cassava, algae, etc.; and cellulosic materials such as bagasse, wood waste, agricultural and forestry residues, etc.
Biodiesel	A methyl or ethyl ester of fatty acids produced from vegetable oils, both edible and non-edible, or animal fat of diesel quality.

Strategic Role of Biofuels in India

The Ministry of Petroleum and Natural Gas has emphasized reducing dependence on fossil fuel imports by promoting alternative fuels. Biofuels, derived from agriculture and forest residues, municipal solid waste, and animal waste, offer multiple benefits:

- Reduction in fossil fuel imports leading to foreign exchange savings.
- Better financial incentives for farmers, aligning with the goal of doubling farmers' income.

- Waste management solutions, supporting the Swachh Bharat Abhiyan.
- Support for the 'Make in India' campaign by promoting indigenous energy solutions.
- Reduction in greenhouse gas emissions, improving air and water quality.

Environmental and Socioeconomic Benefits

Biofuels provide several advantages beyond energy security:

- Social Benefits: Biofuels can improve rural livelihoods by creating job opportunities and supporting sustainable agricultural practices.
- Environmental Benefits: They help in reducing air pollution and mitigating climate change by lowering carbon emissions compared to fossil fuels.
- Economic Benefits: A shift towards biofuels can reduce India's energy import bill, enhance local industry, and stimulate economic growth.

Challenges and the Way Forward

Despite their promise, biofuels face significant challenges:

- Land availability: Expanding biofuel crop cultivation must not compete with food production.
- High production costs: Large-scale production remains expensive compared to fossil fuels.
- Infrastructure and technology: Advanced biofuel technologies require substantial investment and development.

To overcome these challenges, India must focus on:

- Investment in research and development to improve biofuel efficiency and production.
- Incentives and subsidies to make biofuels economically viable.
- Public-private partnerships to drive innovation and commercialization.
- Sustainable land use policies to balance food security and biofuel production.

Conclusion

Biofuels represent a viable alternative to high-carbon energy sources, aligning with India's goals of sustainable development, energy security, and environmental conservation. While challenges persist, a well-structured policy framework, technological advancements, and strategic investments can position biofuels as a cornerstone of India's clean energy future. As the country progresses towards energy self-sufficiency, biofuels will play a crucial role in shaping a sustainable and resilient economy.

8: PRAGATI: Driving India's Development with Purpose

Introduction

India's governance landscape has witnessed a paradigm shift with the introduction of the PRAGATI (Pro-Active Governance and Timely Implementation) initiative.

- Launched on 25 March 2015, PRAGATI embodies the 'Minimum Government, Maximum Governance' approach, leveraging technology, transparency, and accountability to expedite stalled infrastructure projects and policy implementation.

Background

PRAGATI integrates multiple digital platforms like PARIVESH, PM Gati Shakti, and the Project Management Group (PMG) to enhance decision-making and implementation efficiency.

- The initiative draws inspiration from SWAGAT (State-Wide Attention on Grievances by Application of Technology), a grievance resolution platform launched in 2003, evolving it into a broader mechanism for nation-building, project execution, and grievance redressal.

Key Achievements of PRAGATI

- Project Unblocking: Since its inception, PRAGATI has reviewed 340 stalled projects worth Rs 17.05 lakh crore ($205 billion), ensuring their timely execution.
- Reduced Delays: Structured monthly reviews and digital interventions have transformed project delays from 3 to 20 years into completion within months.
- Faster Environmental Clearances: Approval timelines reduced to 70-75 days from 600 days previously.

- Forest Clearances: Approval time reduced to 20-29 days from 300 days.
- CPGRAMS Efficiency: Citizen grievances redressal time reduced from 32 days in 2014 to 20 days by 2023.
- Passport Issuance: Reduced from 16 days in 2014 to 7 days in 2023.

Striking Outcomes in Key Projects

- Bogibeel Rail and Road Bridge: Completed in 3 years after two decades of delays.
- Jammu-Srinagar Baramulla Rail Link: Overcoming stagnation, now set for completion by 2025.
- Navi Mumbai Airport: Resolved 15+ years of land acquisition hurdles, expected launch by December 2024.
- Bengaluru Metro Rail: Expedited land acquisition facilitated the opening of the 42 km, 40-station metro network since 2017.
- Haridaspur-Paradeep Rail Connection: Addressed investor-contractual deadlocks, leading to its inauguration in 2020.
- National Highways 8 & 2 (Dahisar-Surat, Varanasi-Aurangabad Sections): PRAGATI reviews accelerated progress, ensuring project completion.
- Jal Jeevan Mission: Increased tap water access in rural households from 17% in 2019 to 74% in February 2024.

National Leadership and Governance Model

Prime Minister direct oversight of PRAGATI meetings highlights the initiative's strategic importance. His leadership has facilitated:

- Swift course corrections for stalled projects.
- Real-time decision-making by deploying senior officials on the ground.
- Enhanced connectivity by expediting mobile tower installations in remote areas.
- Improved bureaucratic efficiency, shifting governance from delays and inefficiencies to real-time execution and transparency.
- Cooperative federalism, ensuring effective collaboration between the Central and State Governments.

PRAGATI's Influence on Other Government Schemes

The technological success of PRAGATI has paved the way for digitization in flagship schemes, improving their outcomes:

- Swachh Bharat Mission: Over 12 crore toilets constructed, transforming rural sanitation.
- Jal Jeevan Mission: Tap water access increased from 17% (2019) to 74% (2024).
- Saubhagya Scheme: Achieved universal household electrification.
- Vibrant Villages Programme (VVP): 46 remote Northeast villages developed as 'First Villages' of India.
- Light House Projects (MoHUA): 1,100 houses constructed using digital innovations in just 12 months in a single city.
- SVAMITVA Initiative: Drone-based land record digitization, ensuring land security in rural areas.

PRAGATI as a Global Benchmark for Governance

PRAGATI has established itself as a model of governance for developing nations, demonstrating the transformative power of digital tools, transparency, and decisive leadership. Key global benchmarks include:

- Tech-driven transparency: Real-time monitoring using drone feeds, GPS tracking, and digital dashboards.
- Combatting corruption: Reducing red tape, enhancing efficient resource allocation.
- Citizen participation: A robust feedback mechanism integrates public inputs into high-level policy decisions.
- Citizen participation: A robust feedback mechanism integrates public inputs into high-level policy decisions.
- Infrastructure's GDP impact: RBI and NIPFP studies affirm that each rupee spent on infrastructure generates a GDP gain of Rs 2.5-3.5, showcasing PRAGATI's multiplier effect.

Conclusion

PRAGATI embodies India's commitment to efficient governance by leveraging technology, cooperative federalism, and decisive leadership. It has accelerated project execution and improved public service delivery, showcasing digital leadership as a catalyst for national progress.

Chapter-
12

Kurukshetra March 2025

1- Fruit-Based Farming Systems for Improved Income and Livelihood

Introduction

Agriculture remains the backbone of India's economy, employing nearly 50% of the workforce and contributing around 18% to the Gross Value Added (GVA).

- Within this sector, fruit-based farming systems have emerged as a viable model for enhancing income, ensuring nutritional security, and promoting environmental sustainability.

India's Position in Global Fruit Production

- Top global producer of mango, banana, citrus fruits, and grapes.
- Production (2023-24): 112.73 million tonnes (MoA&FW, 2024).
- Annual growth rate: 2.29% in the horticulture sector.
- Vision 2047 Target: 244 million tonnes (Viksit Bharat).

Key contributors to fruit production include:

- Mango: India is the world's largest mango producer, with Uttar Pradesh, Andhra Pradesh, and Maharashtra leading production.
- Banana: Tamil Nadu, Maharashtra, and Andhra Pradesh dominate banana cultivation, contributing significantly to both domestic consumption and exports.
- Grapes: Maharashtra's grape industry has flourished due to technological advancements in cold storage and export-oriented production.
- Emerging Crops: Fruits like dragon fruit, kiwi, avocado, and passion fruit are gaining prominence due to increasing demand in both domestic and international markets.

Government Initiatives

- National Horticulture Mission (NHM): Financial & technical support.
- Pradhan Mantri Kisan Sampada Yojana: Post-harvest infrastructure development.
- Improved irrigation facilities & subsidies have boosted production.

Economic and Nutritional Benefits

Economic Growth and Export Potential

Fruit-based farming contributes significantly to farmers' income by offering high-value crops with substantial market demand. According to the Ministry of Commerce & Industry (MoC&I, 2024):

- India's mango exports grew by 19% in 2023, reaching $47.98 million between April and August.
- The country expanded its fruit export destinations to 41 countries, including the USA, Iran, Mauritius, and Nigeria.

The integration of fruit cultivation with value addition (e.g., processing into jams, juices, and dried fruits) enhances profitability and reduces wastage. Furthermore, horticulture-based enterprises generate employment opportunities in harvesting, processing, packaging, and marketing, particularly benefiting rural women and youth.

Nutritional Security

Fruits are rich sources of vitamins, minerals, and antioxidants, playing a crucial role in combating malnutrition and micronutrient deficiencies in India. By promoting local fruit cultivation, communities can access fresh and affordable nutrition, thereby strengthening food security and public health outcomes.

Environmental Sustainability

Fruit-based farming systems promote sustainable agricultural practices through:

- Soil Conservation: Techniques like mulching, contour farming, and agroforestry prevent soil erosion and enhance soil fertility.

- Water Efficiency: Drip irrigation and rainwater harvesting improve water-use efficiency in fruit cultivation.
- Biodiversity Enhancement: Growing diverse fruit crops supports ecological balance by fostering beneficial insect populations and reducing pest outbreaks.
- Carbon Sequestration: Fruit orchards contribute to climate mitigation by acting as carbon sinks, reducing the impact of greenhouse gas emissions.

Livelihood Diversification and Rural Development

1. Reducing Farmer Vulnerability

Diversifying agricultural income sources through fruit-based farming reduces dependency on traditional cereal crops, which are more susceptible to market fluctuations and climate shocks. Fruits provide year-round employment and revenue, ensuring economic resilience.

2. Value Addition and Agri-Tourism

- Processing & Value Addition: Establishing food processing units for dried fruits, juices, and jams enhances farmer profits and reduces post-harvest losses.
- Horti-Tourism: Fruit farms can serve as tourism destinations, boosting rural incomes through farm visits, agri-tours, and direct sales.

Challenges and Gaps

Despite its potential, fruit-based farming systems face several challenges:

1. Land Fragmentation: Small landholdings hinder large-scale fruit farming and mechanization.
2. Post-Harvest Losses: 30-40% of fruit production is lost due to inadequate cold storage and inefficient supply chains.
3. Market Instability: Fluctuating prices and the absence of Minimum Support Price (MSP) for fruits create income uncertainty.
4. Climate Vulnerability: Droughts, floods, and erratic weather affect fruit yields and quality.
5. Lack of Awareness and Training: Many farmers lack knowledge of modern high-density planting, integrated pest management (IPM), and organic farming techniques.
6. High Initial Investment: Establishing fruit orchards requires long-term investment, making it challenging for small farmers.

Way Forward

To maximize the potential of fruit-based farming systems, a multi-pronged strategy is required:

1. Policy Reforms and Financial Support

- Expanding subsidies under Mission for Integrated Development of Horticulture (MIDH).
- Facilitating easy credit access for small farmers through NABARD schemes.

2. Infrastructure Development

- Strengthening cold storage chains, pack houses, and processing units.
- Promoting digital marketing platforms for direct farmer-consumer linkages.

3. Climate-Resilient Agriculture

- Encouraging drought-resistant and high-yield fruit varieties.
- Training farmers in climate-smart practices, such as agroforestry and rainwater harvesting.

Conclusion

Fruit-based farming can boost economic growth, sustainability, and food security. Overcoming post-harvest losses, market instability, and climate challenges requires government support, private investment, and farmer innovation, crucial for achieving Viksit Bharat 2047.

2- Beekeeping: Generating Employment Opportunities in India

Introduction

Beekeeping, or apiculture, is a vital agro-based activity that boosts livelihoods, agricultural productivity, and environmental conservation.

- It aligns with the UN's Sustainable Development Goals (SDGs) by fostering economic growth and ecosystem health.
- With rising global honey demand and India's rich biodiversity, the country holds significant potential in apiculture.
- Government initiatives like the National Beekeeping & Honey Mission (NBHM) and the Sweet Revolution aim to enhance employment, especially for rural communities, women, and marginalized groups.

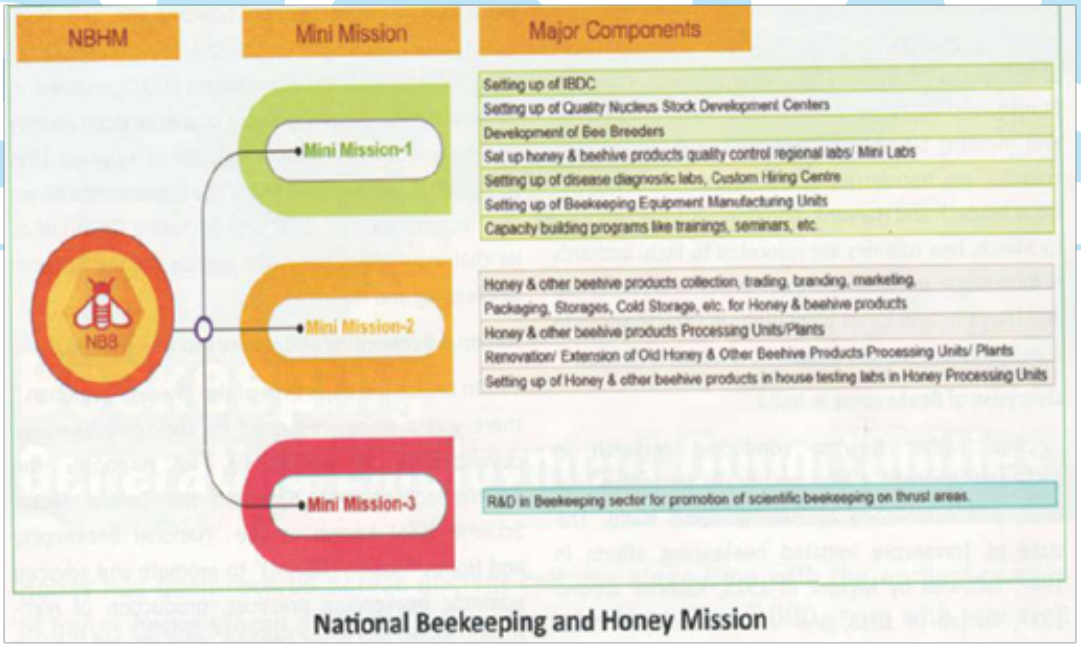
Current Status of Beekeeping in India

- Production and Export: India is the 8th largest honey producer globally, with an annual output of 1.33 lakh metric tonnes (2022-23). Exports surged to 74,413 MT valued at 1,543 crore in 2022-23, driven by demand from the US, UAE, and Saudi Arabia (APEDA).
- Key States: Punjab, West Bengal, Uttar Pradesh, Bihar, and Maharashtra lead in honey production. The Sundarbans (West Bengal) and Coorg (Karnataka) are renowned for niche products like mangrove and organic honey.
- Employment: Over 3 lakh rural households are engaged in beekeeping, with 80% being small and marginal farmers. The sector supports 15-20 lakh people directly and indirectly.

Global Context

- Countries like China, Argentina, and New Zealand have successfully leveraged beekeeping to boost employment and exports.
- China dominates global honey production with advanced R&D in disease-resistant bee species. Argentina focuses on organic honey production, while New Zealand's Manuka honey commands high global prices due to its medicinal properties. India can learn from these models by improving quality control, branding, and market linkages.

Government Initiatives Promoting Beekeeping



National Beekeeping and Honey Mission

National Beekeeping & Honey Mission (NBHM):

- Launched in 2020 under Atmanirbhar Bharat, NBHM aims to boost honey production, create employment, and enhance pollination services.

Components:

- Distribution of bee colonies and modern equipment (e.g., bee boxes, honey extractors).

- Training programs for farmers, especially women and tribal communities.
- Establishment of infrastructure like honey testing labs, processing units, and collection centers.

MSME Schemes:

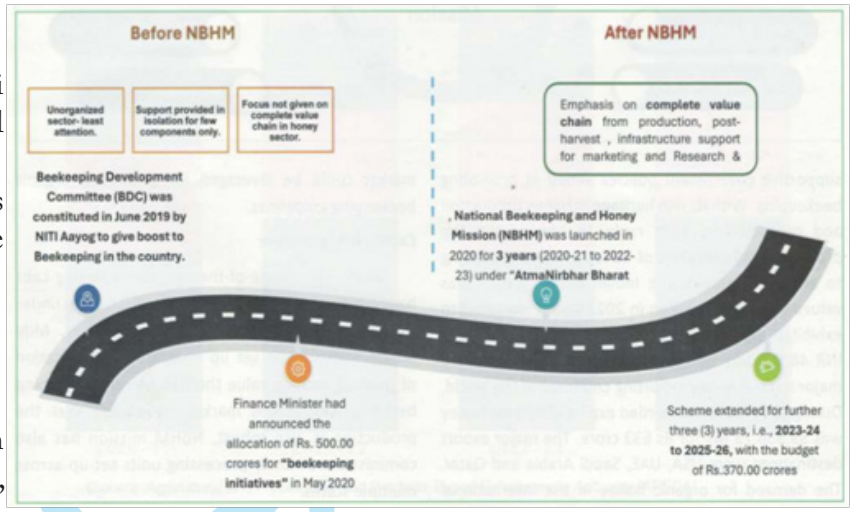
- Beekeeping is classified as an agro-based MSME, enabling access to subsidies, credit, and skill development under PM Formalization of Micro Food Processing Enterprises (PM FME).

Farmer Producer Organizations (FPOs):

- Formation of FPOs for honey producers to ensure better market linkages and fair prices.
- Example: Madhya Pradesh's Khadi and Village Industries Commission (KVIC)-supported FPOs.

State-Level Programs:

- West Bengal's Mukhymantri Madhu Vikas Yojana trains tribal communities in apiculture.
- Himachal Pradesh promotes beekeeping as part of its horticulture diversification strategy.



Employment Generation Potential

Direct Employment:

- Beekeepers: Training rural youth and women in colony management, honey extraction, and quality control.
- Processing Units: Jobs in honey filtration, packaging, and value-added products (beeswax, propolis, royal jelly).

Indirect Employment:

- Equipment Manufacturing: Production of bee boxes, protective gear, and honey extractors.
- Export and Marketing: Roles in logistics, branding, and e-commerce platforms (e.g., Amazon, Flipkart).
- Pollination Services: Beekeeping enhances crop yields by 15-30%, benefiting farmers and creating demand for migratory beekeeping services.

Women Empowerment:

- Over 30% of beekeepers in Kerala and Uttarakhand are women.
- Initiatives like KVIC's Honey Mission train women Self-Help Groups (SHGs) in apiculture.

Challenges in Scaling Beekeeping

- Lack of Awareness: Limited knowledge of scientific beekeeping practices.
- Climate Vulnerability: Erratic weather and pesticide use threaten bee populations.
- Market Access: Middlemen often exploit small beekeepers, reducing profit margins.
- Disease and Pests: Threats like Varroa mites and colony collapse disorder.
- Infrastructure Gaps: Insufficient processing units and cold storage facilities.

Technological Interventions

- AI-based Hive Monitoring: Sensors for temperature, humidity, and disease detection.
- Blockchain for Traceability: Ensuring quality and authenticity in global markets.

Case Studies: Success Stories

Sundarbans, West Bengal:

- Over 5,000 families practice mangrove honey production.
- NGOs like WWF-India provide training and market linkages, doubling incomes to 15,000/month.

Maharashtra's Tribal Belt:

- The Tribal Development Department trains Adivasi communities in beekeeping, linking them to urban markets through FPOs.

Policy Recommendations

- Expand Training Programs: Integrate apiculture into Skill India Mission and agricultural universities.
- Climate-Resilient Beekeeping: Promote indigenous species like Apis cerana indica and organic farming.
- Strengthen Market Linkages: Use e-NAM and GeM Portal to connect beekeepers with buyers.
- Research & Development: Invest in disease-resistant bee breeds and IoT-based hive monitoring systems.
- Promote FPOs and Cooperatives: Ensure economies of scale and collective bargaining power.
- Incentivize Beekeeping: Tax breaks, insurance schemes, and subsidies to encourage participation.

Conclusion

Beekeeping is a low-cost, high-reward enterprise that boosts rural economies and sustainability. With India's biodiversity and initiatives like the Sweet Revolution, it can create 10 lakh jobs by 2030 (NITI Aayog). A collaborative approach is key to making it a model of green entrepreneurship, balancing economic growth with environmental care.

3- Food Processing of Horticulture Crops

Food Processing refers to the transformation of raw horticultural produce into value-added products to enhance shelf life, improve safety, and reduce post-harvest losses.

India's Position:

- 2nd largest producer of fruits (11.7%) and vegetables (17.8%) globally.
- Horticulture production stood at 355.48 million MT (2022-23), surpassing food grains.

Challenges:

- High post-harvest losses: 6.7–15.8% in fruits, 4.5–12.4% in vegetables (~ 1.52 lakh crore annually).
- Poor storage, inefficient logistics, and unorganized sector dominance (85%).

Importance and Growth Potential

Economic Contribution

- Market Size: The global food processing market is projected to grow from $194.1 billion (2023) to $286.8 billion by 2030 (CAGR 5.7%).

India's Share:

- Food processing contributes 32% to India's food industry, which is expected to reach $1.27 trillion by 2027.
- Despite high production, only <10% of agri-output is processed (2% in fruits & vegetables).
- Exports of processed foods reached $48.9 billion (2023–24), with the USA, EU, and Japan as key markets.
- Employment Generation: The sector employs 20.05 lakh people, with southern states (Andhra, Tamil Nadu, Telangana) leading in exports (48% share).

Technological Interventions in Food Processing

1. Non-Thermal Processing Technologies

- High-Pressure Processing (HPP): Preserves nutrition and extends shelf life without heat.
- Cold Plasma Technology (CPT): Inactivates microbes in high-moisture foods.
- Pulsed Electric Field (PEF): Reduces energy consumption by 90% in potato processing.

2. AI & Automation

- AI-based Supply Chain Management: Predicts shelf life and monitors cold chains.
- Robotics & IoT: Ensures precision in sorting, grading, and packaging.

3. Smart Packaging & Fortification

- Smart Sensors: Track freshness and reduce food wastage.
- Fortified Foods: Micronutrient-enriched staples (e.g., fortified wheat, rice, and dairy) to tackle malnutrition.

Government Initiatives

1. Infrastructure & Credit Support

- PMKSY (SAMPADA): 6,000 crore for food processing infra, including 41 Mega Food Parks & 399 Cold Chains.
- PMFME Scheme: 10,000 crore (2020–25) to formalize micro-enterprises under "One District One Product".
- Mega Food Parks: Encourage cluster-based food processing with common facilities.

2. Financial & Export Incentives

- PLI Scheme: 10,900 crore to boost manufacturing, exports, and create global food brands.

FDI & GST Benefits:

- 100% FDI under automatic route.
- 71.7% of processed food items taxed at 0–5% GST slab.
- Priority Sector Lending for food processing and cold storage.

Case Studies & Success Stories

- Amul: Expanded into horticulture-based dairy products; 80,000 crore revenue (2023–24).
- PepsiCo India: Supports 24,000+ farmers and employs 75,000 indirectly via Tropicana, Lays.
- HPMC (Himachal Pradesh): Processed 2,000 MT apple juice (2024); Mega Food Park in Shimla boosting apple exports.
- ITC (B Natural), MTR Foods, Mother Dairy, and regional clusters like Cremica Park contribute significantly.

Challenges & Way Forward

Key Challenges

- Infrastructure Deficit: Lack of cold chains (India has <11,000 cold storage units vs. 35,000 needed).
- Unorganized Sector: 85% of processing units are unorganized, with poor hygiene and tech adoption.
- Export Bottlenecks: Only <15% of processed food exports vs. China's 49% share.
- Quality & Standards: Need for globally recognized certifications like HACCP, ISO 22000.

Policy Recommendations

- Cluster-Based Growth: Develop "Food Valleys" (like the Netherlands) for R&D and industry collaboration.
- Tech Adoption: Expand non-thermal processing, blockchain for traceability, and AI-driven logistics.
- Formalization of MSMEs: Improve credit access, skill development, and infrastructure for 23 lakh informal units.
- Export Focus: Incentivize value-added processing, reduce tariff/non-tariff barriers, and improve compliance with global standards.

Conclusion

The food processing sector is crucial for India's food security, employment, and economic growth. Addressing post-harvest losses, leveraging technology, and strengthening policy frameworks can help India emerge as a global agri-processing hub. With strategic interventions, the sector can significantly contribute to the goal of doubling farmers' income and reducing food wastage.

4- Nutritional and Health Security through Horticulture

Malnutrition remains a critical challenge in India, with one in three children stunted and 15% of the population undernourished (Global Hunger Index).

- While food security traditionally focused on grain production, nutrition security emphasizes access to safe, nutritious diets alongside adequate sanitation and healthcare.
- India's shift towards 'food and nutrition security' aims to tackle micronutrient deficiencies rather than just caloric intake.
- Horticulture plays a vital role, with total production reaching 353.19 million tonnes in 2023-24, a 3.17% rise from the previous year. However, per capita fruit and vegetable consumption remains low, despite dietary recommendations of 400 g vegetables and 100 g fruits daily (ICMR-NIN, 2024).

Enhancing horticultural production and accessibility can significantly improve nutrition security, reducing malnutrition and ensuring better public health outcomes.

Table 1: Horticultural source of energy and proteins

Protein	Cashew nut, almond, walnut	Pea, cowpea, lima bean, broad bean, mustard, pumpkin, pointed gourd drumstick, celery, garlic, Brussels spout.
Fat	Walnut, almond, cashew nut, avocado	Bengal gram leaf, small bitter gourd, chili, brinjal, brussels sprout, snake gourd, pointed gourd, lettuce, pink radish, sweet corn hyacinth bean, cluster bean, spinach, globe artichoke
Carbohydrate	Dry apricot, date fig, dry karonda, banana, bael, custard apple, cashew nut, jamun, jack fruit	Tapioca, potato, sweet potato elephant foot yam, taro, garlic, pea, onion bitter gourd, brussels sprout, carrot

Challenges in Horticulture Production and Distribution

India's horticulture production in 2023-24 is estimated at 353.19 million tonnes, surpassing foodgrain production for the fifth consecutive year. While record yields are expected in fruits, vegetables, spices, and plantation crops (e.g., areca nut, cashew, cocoa, coconut), higher production does not always lead to increased farmer income.

- The primary challenge lies in the lack of cold storage and inefficient supply chains. Farmers often face losses by selling perishable items such as onions, potatoes, and tomatoes at low prices due to spoilage.
- Addressing these logistical barriers is critical to maximizing the potential of horticulture in promoting nutrition security and improving farmer livelihoods.

Horticulture Crops for Nutritional Security

- Horticultural crops are rich sources of essential bioactive compounds, vitamins, minerals, antioxidants, folic acid, and dietary fibers. These crops provide cost-effective solutions to malnutrition and hidden hunger.
- Dietary Fiber: Found in plant cell walls, dietary fiber helps delay glucose and fat absorption, increases fecal bulk, and improves digestion. Leafy vegetables such as celery, cabbage, spinach, lettuce, and amaranth, along with fruits like figs, guava, and nuts, are excellent sources.
- Proteins and Energy: Though vegetables generally contain lower protein levels compared to pulses, protein-rich options include peas, lima beans, drumstick leaves, and French beans. Other sources include potatoes, cauliflower, okra, and onions.
- Vitamins and Minerals: Fruits and vegetables are considered 'protective foods' due to their rich content of vitamins C, A, B6, thiamine, niacin, and E, as well as minerals like calcium, potassium, iron, and phosphorus. Legume vegetables, potatoes, and tree nuts contribute significantly to per capita protein availability.

Addressing Micronutrient Deficiencies through Horticulture

India faces significant micronutrient deficiencies due to inadequate intake of essential nutrients like iron, iodine, vitamin A, and calcium. As a result:

- Iron deficiency anemia (IDA) affects over 75% of preschool children.
- Sub-clinical vitamin A deficiency (VAD) affects 57% of the population.
- Iodine deficiency remains endemic in 85% of districts.

These deficiencies contribute to 43% of child malnutrition cases and 22% of India's overall disease burden. Fresh fruits, vegetables, and nuts—key horticultural products—offer vital sources of micronutrients and provide a sustainable solution to these issues.

Nutraceutical Value of Horticultural Crops

Fruits and vegetables have long been recognized as rich sources of essential micronutrients and fibers. More recently, they have been identified as important suppliers of phytochemicals, which offer numerous health benefits. This has led to their classification as 'functional foods.'

- Antioxidants: Vegetables contain powerful antioxidants such as carotene, vitamin C, vitamin E, selenium, and flavonoids, which reduce the risk of chronic diseases like cancer, heart disease, and stroke. Research suggests that consuming whole foods is more beneficial than isolated supplements.
- Cancer and Chronic Disease Prevention: Some components of fruits and vegetables modify the metabolic activation and detoxification of carcinogens and influence processes that alter tumor development. A diet rich in carotenoid-rich fruits and vegetables is more effective than carotenoid supplements in reducing oxidative stress and DNA damage.

Conclusion

Horticulture is key to India's nutrition security, but challenges like poor cold storage, inefficient supply chains, and low consumption hinder its potential. A focused approach with improved infrastructure, policy support for farmers, and nutrition awareness is crucial to combat malnutrition and achieve long-term nutrition security.

5- Sustaining Rural Livelihoods Through Horticulture

Horticulture has emerged as a critical component of rural economies, contributing not only to nutrition and food security but also to the economic sustainability of rural areas.

- By diversifying agricultural practices towards horticulture, rural livelihoods can be enhanced, thereby mitigating the challenges of economic deprivation and out-migration.
- Economic Importance: Horticulture offers diversification from traditional agriculture, enhancing rural incomes, especially for small and marginal farmers.
- Poverty Reduction: Provides income stability and risk management by reducing dependence on unpredictable weather.
- Growth of Sector: Since the 1991 reforms, India's horticulture sector has expanded, making it the secondlargest global producer of fruits and vegetables.
- Export Potential: Horticulture exports surpassed Rs. 4 lakh crores in 2023, boosting India's presence in global trade.
- Rural Livelihoods: Linked to rural tourism, particularly in ecologically sensitive areas like the Himalayas, creating sustainable economic opportunities.
- Mitigating Urban Migration: Horticulture offers economic opportunities in rural areas, reducing pressures of rural-to-urban migration.

Challenges in the Horticulture Sector

Despite its potential, the horticulture sector in India faces several challenges:

- Insufficient Post-Harvest Infrastructure: Cold storage and warehousing infrastructure are inadequate, leading to high post-harvest losses.
- Limited Access to Quality Seeds and Irrigation: Small-scale farmers struggle with access to high-quality seeds and reliable irrigation systems.
- Low Mechanization: Lack of farm mechanization limits productivity and efficiency.
- Climate Change: Extreme weather events and changing climatic conditions require adaptive measures to protect horticulture crops.
- Market and Supply Chain Issues: There is a lack of robust market information, effective supply chain management, and price stability, which affects farmers' ability to maximize profits.

These challenges necessitate targeted interventions, especially in improving infrastructure, ensuring quality standards, and enhancing market linkages.

Government Support for Horticulture

- Government Initiatives: The government supports horticulture through programs like Mission for Integrated Development of Horticulture (MIDH), National Horticulture Mission (NHM), and National Horticulture Board (NHB), providing financial and technical assistance.
- Focus Areas: These initiatives aim to promote commercial horticulture, improve post-harvest infrastructure, and enhance market access.
- Warehouse Infrastructure Fund: Created under NABARD, it facilitates the development of cold storage and warehousing to reduce post-harvest losses.
- Research and Development: Centers of Excellence for fruits and vegetables have been established to promote horticulture R&D.

Way Forward: Enhancing Rural Livelihoods

While the government has made strides in promoting horticulture, more needs to be done to realize the full potential of the sector. A comprehensive national horticulture policy is essential to streamline efforts across states, considering the regional variations in climate, soil, and infrastructure. A bottom-up approach is crucial for tailoring strategies to local needs, thereby optimizing resource use and enhancing productivity.

- The private sector must also play a pivotal role in enhancing the horticulture sector's growth. PublicPrivate Partnerships (PPPs) and industry support can help in creating more integrated supply chains, leading to improved market access, value addition, and export potential.
- Additionally, quality control measures, capacity building for farmers, and better extension services are essential to ensure the sector's sustainability. Investment in research and innovation in horticulture can further contribute to improving productivity and income generation.

Conclusion

Horticulture has the potential to significantly improve rural livelihoods, enhance food security, and contribute to the overall economic development of rural India. By addressing the challenges related to infrastructure, access to resources, and market linkages, the sector can be a powerful tool for sustainable rural development. With continued government support and private sector involvement, horticulture can become a key driver of rural economic prosperity, preventing out-migration and fostering inclusive growth.