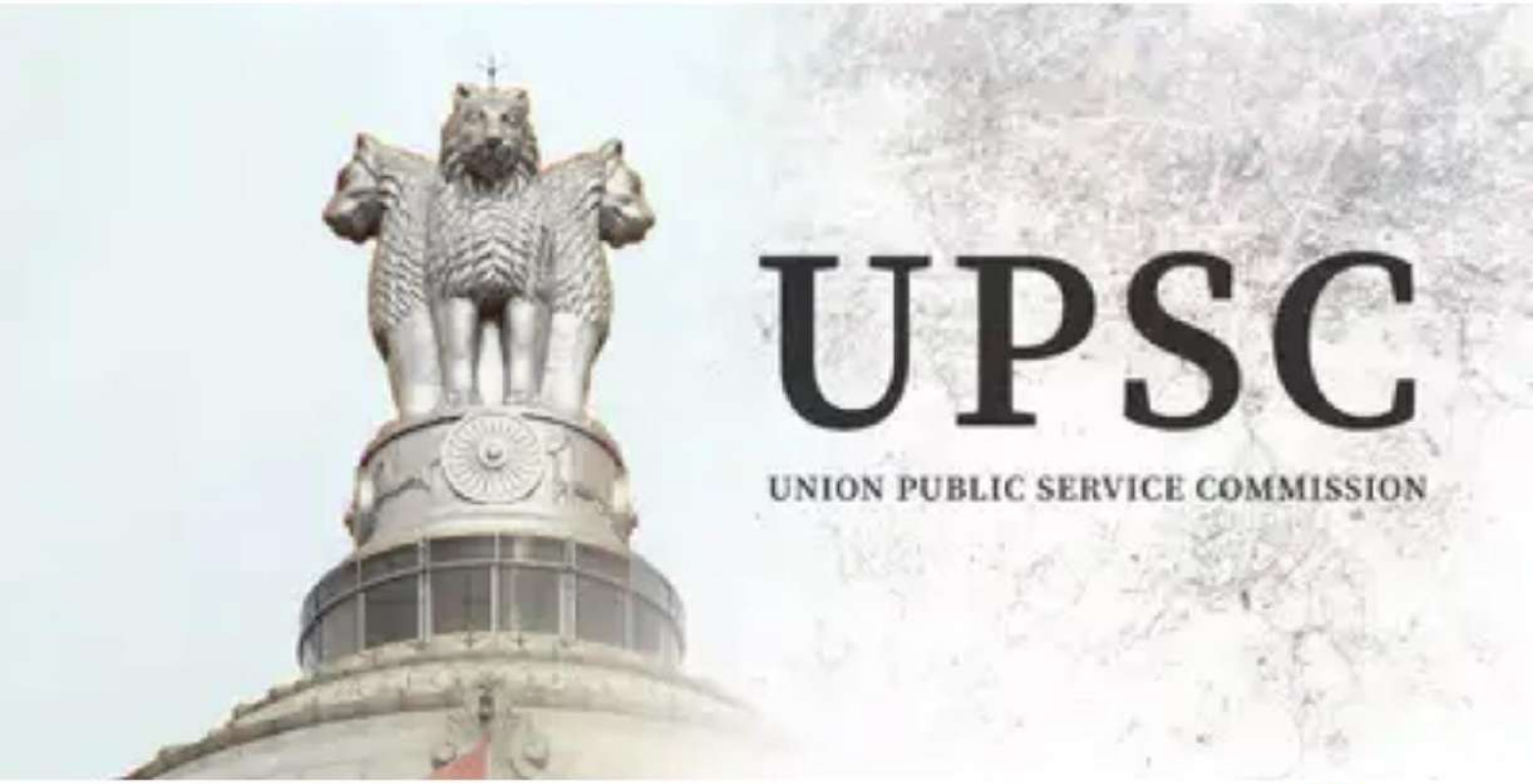
SHANKAR
IAS PARLIAMENT
Information is Empowering

CURRENT AFFAIRS MAGAZINE

MAY 2025

News Analysis



SINCE 2004

www.shankariasacademy.com
www.shankariasparliament.com

INDEX

May 2025

1. IMPORTANT TOPICS OF THE MONTH

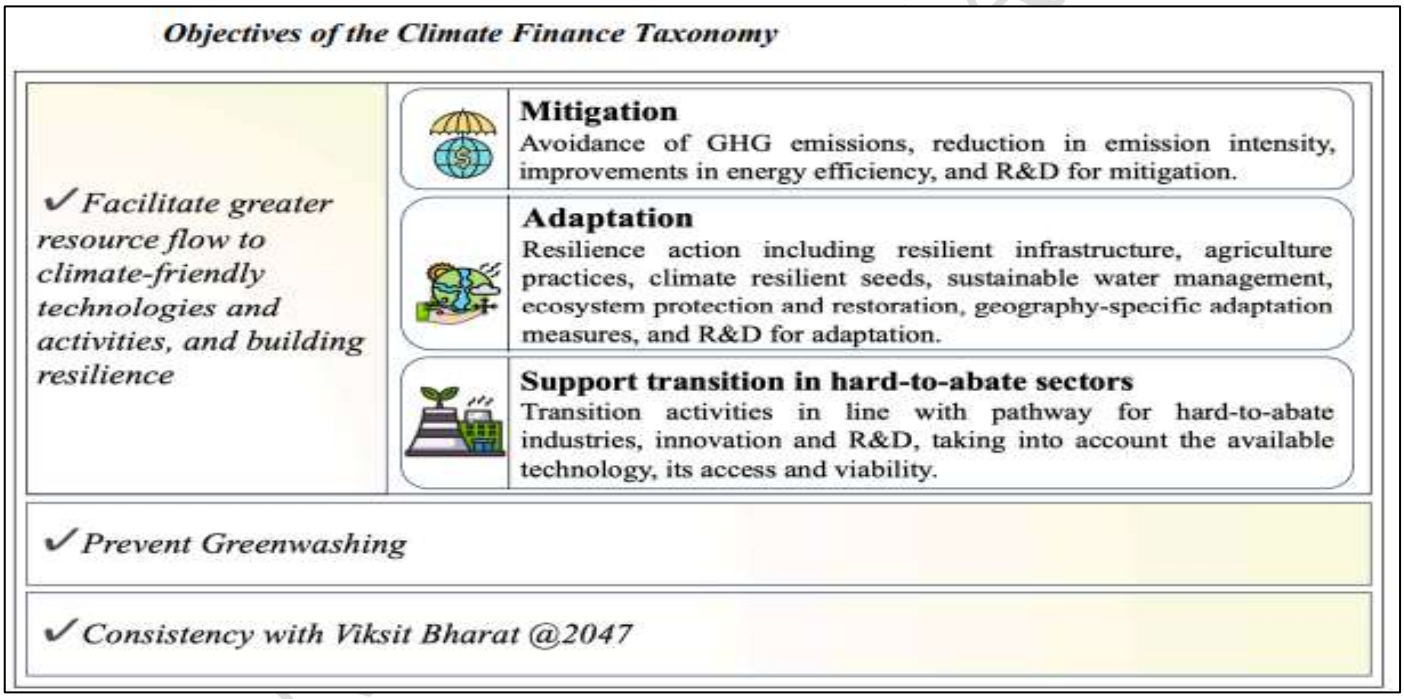
1.1 India's Climate Finance Taxonomy

Why in News?

Recently, the Finance Ministry has unveiled draft 'climate taxonomy' document to aid clean energy investment.

What is Climate Finance Taxonomy?

- It is a *tool to identify activities consistent with climate action goals* and transition pathway.
- **Objectives**
  - To facilitate greater resource flow to climate-friendly technologies and activities
  - To enable achievement of the country's vision to be Net Zero by 2070
  - To ensure long-term access to reliable and affordable energy.
  - To prevent green-washing.



What is the need for Climate Finance Taxonomy?

- **India's climate ambitions** - They are reflected through the Nationally Determined Contributions (NDCs) and the announcement of Net Zero emissions by 2070.
- India *requires around USD 2.5 trillion* (at 2014-15 prices) to meet the NDC targets till 2030.
  - As per *NITI Aayog's India Energy Security Scenarios (IESS) 2047*, a scenario-building tool, the total investment required for energy transition is estimated at ~USD 250 billion per year till 2047.
- **Adaptation action finance** - It is vital for addressing climate change impacts, building resilience and achieving India's development goals.
  - According to the *Initial Adaptation Communicatio*n submitted by India in 2023, the cumulative expenditure needed for adaptation in a Business as Usual (BAU) scenario is estimated to be Rs. 56.68 trillion till 2030.
- **Energy need** - The minimum level of per capita final energy requirement for India to become a developed country with an HDI of 0.9 must be in the range of 45.7 to 75 gigajoules / year, which was 16.7 gigajoules only in FY23.
  - At present, India's energy consumption per capita is about one-fifth of the developed countries.

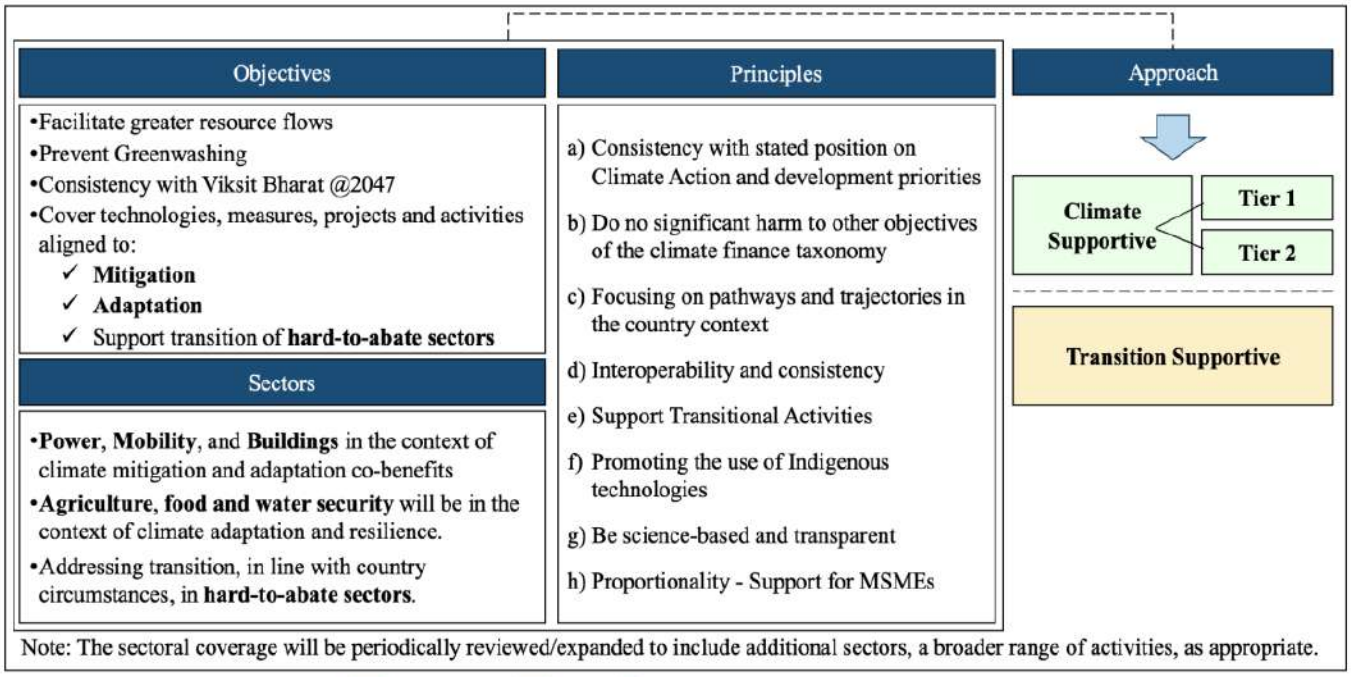
- **Lifestyle for Environment (LIFE)** – It is the mass movement to champion and cultivate a vibrant, sustainable lifestyle grounded in the rich traditions and core values of conservation and moderation.

Union Budget 2024-25 *announced that the taxonomy for Climate Finance would be developed for "enhancing the availability of capital for climate adaptation and mitigation.*

Historical Responsibility of Emissions
• **India's per capita GHG emissions** – It stood at approximately 2.9 tCO2e in 2023, significantly lower than the World average of 6.7 tCO2e. • In comparison, the per capita emissions of the European Union stood at 6.9 tCO2e, Japan at 8.3 tCO2e, the United States at 17.2 tCO2e and Canada at 20.4 tCO2e for the same year. • **High emission by developed countries** - Developed countries have been the predominant contributors to cumulative historical emissions and continue to have higher per capita emission levels. • Developed nations peaked their emissions decades ago, the EU in the 1970s and the US in the early 2000s.

What are the design features of India's climate finance taxonomy?

Structure of India's Climate Finance Taxonomy



- **Hybrid approach** – It *combines qualitative principles with quantitative metrics* ensures that the taxonomy remains inclusive, addressing India's diverse industrial structure and responding to new targets, regulatory changes, and policy dynamics while promoting a science-based trajectory for climate transition.

Aspects of Taxonomy Framework	
There are broadly two aspects to framing a taxonomy - qualitative and quantitative.	
Qualitative	**Quantitative**
It consists of exposition of the objectives and principles that guide the identification of activities and projects as being climate-relevant.	It is reflected in the form of performance thresholds like the expected extent of GHG savings, best-in-class performance, and improvements in emission intensity.
Qualitative elements can define the core principles guiding green activities and align with India's NDCs and SDGs.	Quantitative elements, such as GHG intensity reduction thresholds and sustainability performance metrics, can provide measurable targets for transparency and accountability.

- **Living document** - It will be periodically reviewed to capture the evolving requirements and to progressively cover sectors, projects and activities reflecting the dynamic landscape of investments for climate finance.
- **Phased implementation** – It will start with qualitative criteria to provide a broad framework that aligns with national priorities, such as inclusive growth, Net Zero goal by 2070, and sector-specific low-carbon pathways.
- Over time, quantitative thresholds and benchmarks will be incorporated, as appropriate, for greater precision.

8 Principles of India's Climate Finance Taxonomy

- **Consistency with climate action and development priorities** - INDC, Net Zero carbon emissions by 2070, India's Viksit Bharat@2047 and Energy Security for All are the bases to the climate finance framework.
- **No significant harm to other objectives** – Measures and projects that prevent or minimise adverse effects on other climate objectives.
- **Focusing on pathways and trajectories in the country context** – Recognition that immediate compliance with stringent standards may not be feasible in the short run or for all sectors.
- **Interoperability and consistency** - Aligning with international frameworks, the Indian taxonomy allow flexibility considering the country's context, development priorities and national climate goals.
- **Support Transition Activities** - Facilitate a dynamic and inclusive classification system that recognises and supports sectors crucial for transition, facilitating investment in critical sectors during transition phase.
- **Promoting the use of Indigenous technologies** - Enhancing investments in Indigenous technologies by incentivising the adoption of such technologies and Research and Development (R&D) on a preferred basis.
- **Be science-based and transparent** - The approach should be objective, supported by clearly defined and disclosed metrics, with transparent and robust methodologies to identify investment opportunities.
- **Support for MSMEs** – Incorporation of specific provisions to ensure that resource flows to MSMEs are not adversely impacted.

Reflection of India's Climate Finance Taxonomy Principles in Global Taxonomies

Consistency with Global Taxonomies

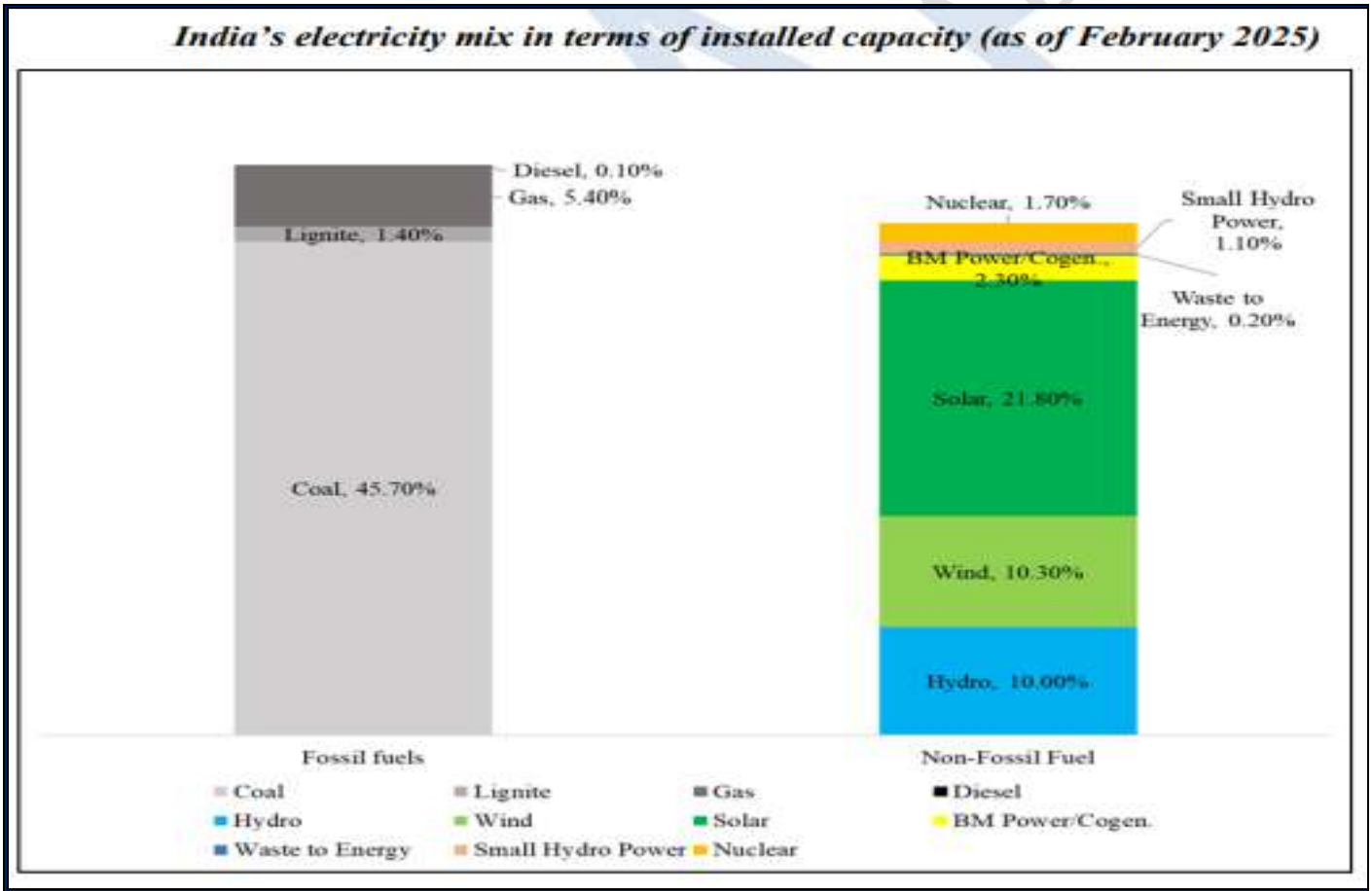
India's Principles	*Global Taxonomies reflecting consistency with India's principles*
Consistency with stated position on Climate Action and development priorities	EU, China, South Africa, ASEAN, Indonesia, Singapore, Egypt, Latin America, Malaysia, Sri Lanka, Brazil, EU-China Common Ground Taxonomy, IPSF-UNDESA G20 Sustainable Finance Working Group
Do no significant harm to other objectives of the climate finance taxonomy	EU, South Africa, ASEAN, Indonesia, Latin America, Malaysia, Sri Lanka, IPSF-UNDESA G20 Sustainable Finance Working Group
Focusing on pathways and trajectories in country context	EU, South Africa, ASEAN, Indonesia, Latin America, Malaysia, Sri Lanka, IPSF-UNDESA G20 Sustainable Finance Working Group
Interoperability and consistency	EU, ASEAN, Singapore, Indonesia, EU-China Common Ground Taxonomy
Support Transitional Activities	EU, ASEAN, Latin America, Malaysia, Singapore, Brazil
Promoting the use of Indigenous technologies	China, Brazil, Malaysia
Be science-based and transparent	EU, ASEAN, Indonesia, Malaysia, Sri Lanka, Brazil, IPSF-UNDESA G20 Sustainable Finance Working Group
Proportionality -Support for MSMEs	ASEAN, Indonesia, Malaysia, Brazil

To know more about Climate & Green Taxonomy, click here

Quick Facts

Present status of India's climate action

- **NDC** - India's Climate Action commitments made through the NDC was submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in 2016 and its subsequent update in 2022.
- The NDC is focused on
    - Reducing the emission intensity of the GDP
    - Enhancing the non-fossil energy installed capacities in electric power generation
    - Creating additional carbon sinks.
- **National Action Plan on Climate Change (NAPCC)** – It aims to enhance the sustainability of India's development by integrating high economic growth and building resilience to climate change.
- It encompasses *9 national missions*, addressing critical areas such as
    - Solar energy, water, energy efficiency, forests, sustainable habitat, sustainable agriculture, the Himalayan ecosystem, strategic climate knowledge, and, more recently, human health.
- **Advancing a Diversified Energy Mix** - India focusing on expanding renewable energy, bioenergy, nuclear, and storage solutions.
    - As of February 2025, non-fossil fuel sources account for 47.4% of the total installed electricity generation capacity. Among which solar comprises 21.8 %, wind 10.3%, hydro 10.0%, and nuclear 1.7%.



Energy Diversification Initiatives of India

- The Solar Parks Scheme and Ultra-Mega Solar Power Projects aim to establish 40,000 MW capacity.
- **PM KUSUM scheme** – It aims at decentralised solar deployment as
    - Solar power plants on barren/fallow/pasture/marshy/ cultivable land of farmers
    - Stand-alone solar pumps in off-grid areas
    - Solarisation of agriculture pumps through individual and feeder level solarisation
- **PM Surya Ghar Muft Bijli Yojana** – It aims at supplying solar power to one crore households by 2027.

- **Viability Gap Funding** – It aims to promote offshore wind.
- **National Bioenergy Programme** – It supports waste-to-energy, biomass cogeneration, and biogas plants.
- **Nuclear Energy Mission** – It aims to develop Small Modular Reactors (SMRs) indigenously and increase nuclear capacity to 100 GW by 2047.

Energy Efficiency Initiatives of India

- **Perform Achieve and Trade (PAT) Scheme** – A market-driven initiative, *launched in 2012*, to improve energy efficiency in energy-intensive industries by setting reduction targets for Designated Consumers (DCs).
    - As of March 2023, the scheme had saved approximately 26 million tonnes of oil equivalent (MTOE) and reduced over 70 million tonnes of CO_2 emissions.
- **Carbon Credit Trading Scheme (CCTS)** – It was *introduced in 2022* by amending the Energy Conservation Act and covers the energy-intensive sectors that were earlier covered under PAT.
    - 9 sectors, including Aluminium, Cement, and Steel, have been identified for inclusion under CCTS.
- **UJALA Scheme** - Unnat Jyoti by Affordable LEDs for All (UJALA) scheme has led to the widespread adoption of LED lighting and reduced household electricity consumption.
- **Energy efficiency in the building sector** - It is being driven by
    - Energy Conservation Sustainable Building Code (ECSBC) for commercial buildings
    - Eco Niwas Samhita for residential buildings
    - Star ratings for commercial buildings, energy-efficient homes, and net zero energy buildings (Shunya Labelling).
- **GRIHA Ratings -** It has become mandatory for all new Government buildings to adhere to the Green Rating for Integrated Habitat Assessment (GRIHA) ratings.
- **BEE Star Labelling Programme for appliances** - The Bureau of Energy Efficiency (BEE) encourages the use of energy-efficient electrical appliances across residential and commercial sectors.
- **Production-Linked Incentive (PLI) schemes** - They are designed to promote the manufacturing of high-efficiency solar PV modules and enhance the production of electric and hydrogen fuel cell vehicles.
    - **Faster Adoption and Manufacturing of Electric Vehicles (FAME) Scheme** – It encourages the adoption of electric 2-wheelers, 3-wheelers, 4-wheelers, and buses, along with the expansion of charging infrastructure.
    - **PM Electric Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) Scheme** – It was *launched in 2024* to accelerate EV adoption across various categories, including electric 2-wheelers, 3-wheelers, trucks, buses, and ambulances.

1.2 Strengthening Parliamentary Oversight in India

Why in News?

Opposition leaders have written to Prime Minister seeking a special session of Parliament to discuss the April 22 terror attack in Pahalgam.

What are the parliamentary oversight mechanisms available in India?

- **Question hour** - Legislators ask questions to ministers to scrutinize government functioning and policies.
- **Zero hour, calling attention motion, adjournment motion** - To raise urgent public issues and demand government explanations.
- **No-confidence and censure motions** - Formal means to express dissatisfaction with the government and hold it accountable.
- It is a powerful tool that empowers the parliament to remove the executive.
- **Parliamentary committees** – Public accounts committee and Department-related Standing Committees (DRSC), meet regularly and systematically evaluate the working of government, it's policy decisions and provide valuable suggestions.

- ***For example***, Committee on Public Undertakings addressing delays in National Highways Authority of India (NHAI)-managed highway projects, recommending that projects commence only after acquiring 80% of land and necessary clearances.

- Similarly, the Estimates Committee advised increasing domestic uranium production by opening new mines, reducing dependency on imports.
- On average, the PAC has made 180 recommendations every year in the past 8 years, out of which 80% were accepted by the government.
- **Ad Hoc committees** - Formed for specific purposes and dissolved after completing their tasks, such as inquiry committees or joint committees on particular bills or issues.
- These tools form the framework of accountability of executive to parliament.

What are the significances of parliamentary oversight?

- **Upholding democracy** - Constituent assembly adopted parliamentary from of government to ensure a democratic form of responsible government.
- **Ensuring executive Accountability** - Parliamentary oversight is a fundamental mechanism for holding the executive branch accountable for its actions.
    - ***For example***, Public Accounts Committee (PAC) exposed critical delays, opaque appointments, and corrupt practices during the Commonwealth Games in 2010.
- **Checks and balances** – It check on the accountability of executive, helps in maintaining the balance of power.
- **Promoting transparency** - It provides a transparent platform for scrutinizing government operations, which enhances public confidence in governance
- **Improving governance efficiency** - By *monitoring government spending and policy outcomes*, parliamentary oversight helps ensure that public resources are used efficiently and government programs achieve their intended results.
    - ***For example***, The Standing Committee on Railways recommended waiving dividend payments by Indian Railways in 2015 to improve its financial health, which was implemented in 2016.
- **Scrutinizing bills** – Bills can be sent to parliamentary committees for detailed evaluations and prevent hasty implementation and provide more inputs in enhancing the bill.
    - ***For example***, The Standing Committee on Transport influenced the Motor Vehicles Bill amendments in 2017, removing caps on third-party insurance and establishing a National Road Safety Board.
- **Budgetary oversight** - Parliament controls government finances through appropriation of grants and post-budgetary scrutiny by committees like the Public Accounts Committee, ensuring funds are used as intended.
- **Upholds rule of law** - It protects citizens' rights by investigating and addressing abuses of power, arbitrary or illegal conduct by government officials and public agencies.

What are the challenges in ensuring parliamentary oversight?

> *During the 17th Lok Sabha (2019-24),* ***Question Hour*** *functioned for 60% of its scheduled time in the Lok Sabha and 52% in Rajya Sabha, significantly reducing its effectiveness.*

- **Disruption in parliamentary functioning** - Question Hour, intended as a daily spotlight on government accountability, is *frequently disrupted by protests*, leading to adjournments where important issues remain unaddressed.
- **Ineffective scrutiny** - Even when question hour operates, individual MPs tend to *focus on isolated queries* rather than a systematic scrutiny of complex, cross-ministerial problems.
- **Inadequate diversity of parliamentary committees** - Despite their mandate for detailed scrutiny, committee consultations tend to engage a relatively small group of stakeholders, raising concerns about diversity and the breadth of input.
- **Lack of expertise support to parliament members** - MPs in India often operate without specialised staff or professional research support, making it harder to scrutinise complex policies or spending data.
- Faced with massive volumes of budget documents, audit reports, and policy reviews, they are at a disadvantage.
- Moreover, their inherently temporary structure limits the ability of members to develop both expertise and institutional standing.
- **Not discussing parliamentary reports** - The evaluations of policies and schemes by the parliamentary committee, their reports are often not taken up for discussion on the floor.

- **Lack of post legislative scrutiny** - India lacks a formal process to track whether laws are achieving their intended impact.

What lies ahead?

- Strengthening the role of Parliament can be done in scrutinising executive action.
- Parliament can adopt targeted reforms, beginning with *robust post-legislative scrutiny*.
- Subcommittees under each Standing Committee or a specialised body can be created to review implementation.
    - **For example**, in The United Kingdom, government departments submit reviews of major laws within 3 to 5 years, which are then examined by parliamentary committees thus enabling timely course correction.
- The oversight findings can be made accessible through translations in local languages, visual explainers, or short videos.
- Select DRSC reports can be brought to the floor for debate.
- Committees can also be strengthened with dedicated research and technical support.
- Technology offers a powerful opportunity to modernise and strengthen parliamentary oversight.
- Parliament can leverage AI and data analytics to help members swiftly flag irregularities, track policy trends,and frame sharper, evidence-based questions.

1.3 Heritage as climate strategy

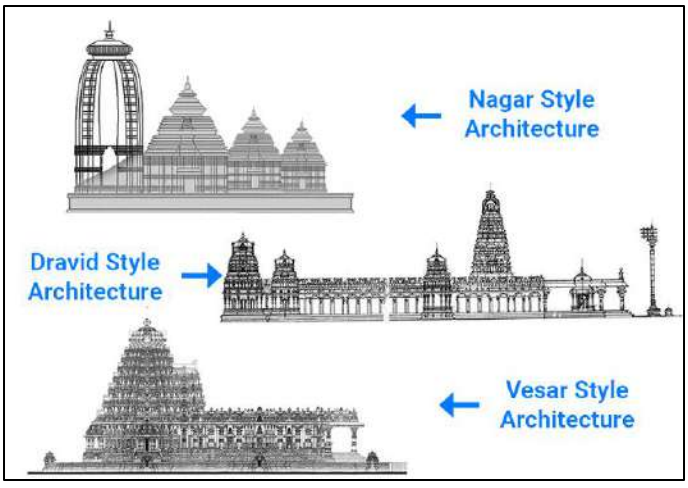
Why in News?

Significances of Indian heritage structures in climate adaptation have been recently emphasized.

What are the key features of India's architectural heritage?

*India boasts **43 UNESCO World Heritage Sites**, a blend of cultural and natural wonders.*

- India's architectural heritage is a vast and diverse tapestry, encompassing centuries of building traditions and cultural influences.
- **Characteristics** – It has a blend of ancient styles, including
    - Rock-cut architecture like the Ajanta and Ellora Caves, along with
    - Monumental structures like the Taj Mahal and the Red Fort, reflecting the influence of various dynasties and rulers.
- **Rock-cut Architecture** - The Ajanta and Ellora Caves in showcase Buddhist, Hindu, and Jain artistic traditions.
- **Temples** - Indian temples, Southern Dravidian style, Northern vihara style, Vesara mixed style have unique characteristics reflecting regional influences and traditions.
    - In the *Northern style*, the sikhara (rising tower in the Hindu temples) remained the prominent feature whereas, in the Southern style, the Gopurams (huge gateways that form the enclosure of the temple complex) were the highlight.
    - The Kandariya Mahadev Temple, Khajuraho in Madhya Pradesh are examples of the *Nagara Style* of temple architecture.
    - The towering Gopurams and the extensive Mandapas (porches) of the famous Thanjavur temple in Tamil Nadu are some of the finest examples of the *Dravidian style* of Architecture.



- **Mughal Architecture** - The Taj Mahal in Agra and the Red Fort in Delhi, known for their symmetrical designs, marble facades, and blend of Islamic and Indian elements.

- **Forts and Palaces** - Forts like Agra Fort and the Red Fort, and palaces like Mysore Palace, showcase the grandeur and power of various ruling dynasties.
- **Indo-Saracenic Style** - During the British colonial period, the amalgamation of Indo-Islamic and European styles resulted in the Indo-Saracenic style, seen in buildings like the Victoria Memorial in Kolkata.

What are the impacts of urbanization on heritage infrastructures?

- **Abandonment** - While newfound mobility and technology resulted in mega-cities, the medieval town, at its core, was often abandoned.
- **Loss of identity** - Large-scale constructions leads to the *erasure of historic precincts*.
- **Demolition and Encroachment** - Demolishing historical buildings and monuments to make way for new infrastructure leads to the *loss of cultural assets*.
- **Environmental Deterioration** - Urbanization can increase pollution, which accelerates the *deterioration of building materials and cultural artifact*s.
- **Social Displacement** – Disruption in traditional ways of life, undermines intangible cultural heritage tied to specific communities and places.
- **Changes to Heritage** - Urban expansion can alter the historical landscape of heritage sites and introduce modern infrastructures that may not be compatible with the historical context.
- **Climatically incompatible constructions** - Cities across climatic regions are beginning to look alike, resulting in a loss of climate-responsive and site-specific spatial identity.

How can the architectural heritage help in creating climatically resilient cities?

- In the face of adverse environmental conditions, cities across the world are recognising the value of heritage in a refreshingly new context.
- **Climate resilient buildings** - Medieval structures often reveal significant cultural and climatic features that hold lessons for responding to inclement weather patterns, whether urban heat or incessant monsoons.
- **Climatic features** - Most often, heritage buildings are uniform, hermetically-sealed and air-conditioned constructions, which rarely respond to climate.
- **Natural ventilation** - Vernacular architecture, with its shade and natural ventilation elements, creates a cooler micro-climate.
- **Thermal Comfort** - For instance, the *shaded thinnai* — a semi-open transitional space — subdues the harsh effect of the sun.
- In the past, it facilitated a communication between the street and home, embodying a spirit of hospitality for visitors and travellers.
- **Water Management Systems** - Historic buildings often incorporate water management systems like rainwater harvesting and greywater reuse, which can be adapted to modern contexts.
    - **For example**, Gujarat's 'Bhuj Historic Water Systems.
- **Flood Resilience** - Traditional building practices in flood-prone areas, such as elevated foundations and flood-resistant materials, can be adapted to modern construction.
- **Climate risk mitigation** - The revival of heritage precincts in Rajasthan's towns has demonstrated resilience, addressing natural disasters, heatwaves, and other risks with minimal investment.

Government Initiatives on Heritage Structure Rejuvenation

- **HRIDAY (Heritage City Development and Augmentation Yojana)** - This scheme aims to preserve and revitalize heritage cities by focusing on physical, institutional, economic, and social infrastructure.
- **Adopt a Heritage** - This initiative encourages individuals and organizations to take ownership of heritage sites by providing amenities and making them more visitor-friendly.
- **PRASAD (Pilgrimage Rejuvenation and Spiritual Augmentation Drive)** - This scheme focuses on developing and improving pilgrimage sites across the country, enhancing the spiritual experience of pilgrims and boosting tourism.

What lies ahead?

- A reimagination of heritage cities by planning authorities, in collaboration with civic society, could rejuvenate these derelict neighbourhoods.
- Transcending conventional notions of heritage, the Kochi-Muziris Biennale is an incredible example of how a medieval heritage town was transformed into a lively cultural art biennale with the support of the Kerala government.
- Metropolitan Development Authorities can evolve more appropriate heritage guidelines and regulations to revive heritage buildings for contemporary youth needs.
- Homestays in heritage homes can provide housing to visiting scholars and artists.
- Adaptive reuse of heritage buildings for new functions such as the Blue city of Jodhpur is an intuitive response to preserving heritage homes while meeting contemporaneous needs.
- Heritage-based solutions can integrate green spaces into urban landscapes to mitigate heat islands and improve air quality.

The 2030 Agenda by the United Nations recognises the role of heritage in sustainable development and its universal value.

The 2 aspects of 'celebrating urban life' and 'climate-friendly design' are intrinsically linked.

1.4 Evolution of Labour Laws in India

Why in News?

On May Day (1st May) this year, Karnataka has regularised services of more than 12,000 pourakarmikas and the Platform-based Gig Workers (Social Security and Welfare) Bill, 2024, was cleared by the state cabinet.

What are the pre-economic reform labour laws in India?

- **Factories Act in 1883** – It is the act by the British Parliament aimed to regulate the working conditions of labourers.
- This Act introduced regulations such as an 8-hour workday, overtime wages, the abolition of child labour and restrictions on women working at night.
- **The Trade Unions Act, 1926** – Provided legal recognition to trade unions and collective bargaining rights.
- **The Workmen's Compensation Act, 1923** – Ensured compensation for workplace injuries.
- **The Industrial Disputes Act, 1947** – Regulated industrial disputes, strikes, and layoffs.
- **The Minimum Wages Act, 1948** – Established minimum wage standards.
- **The Factories Act, 1948** – Set workplace safety and working hour regulations
- **Shops and Establishments Acts (various state laws)** - Regulated working hours, holidays, and conditions of employment in non-factory sectors like retail and services.

*Following World War I and the international discussions on labour reforms, India witnessed the introduction of the **Trade Union Act of 1923** and the **Industrial Disputes Act of 1929**.*

***First National Commission on Labour (1969)** and the **Second National Commission on Labour (2002),** along with judicial pronouncements on matters concerning minimum wages, bonded labour, child labour and contract labour, have further influenced labour legislation.*

What are the impacts of 1991 economic reforms on labour market?

- The new economic policy reforms of liberalisation, globalisation and privatisation marked a significant shift in labour laws, moving from rigid regulations to a more flexible framework.
- **Shift from Protectionism to Flexibility** – Labour laws were gradually relaxed to encourage private investment and ease hiring and firing processes
- **Rise of informal workforce** - While no reforms were introduced immediately through legislative acts, the pattern of employment in establishments drastically changed, giving rise to a large informal workforce.
- Workers in informal work arrangements are employed in big industries such as automobiles, manufacturing and so on, in the organised sector.
- In public sector also, since the 1990s, there is significant *drop in the number of permanent workers*, while there is a drastic increase in the number of workers in informal work arrangements.
- **Rise of Contractual Employment** – Companies increasingly relied on contract workers instead of permanent employees, reducing job security.

- **Dilution of Social Security Measures** – Some provisions of laws like the Factories Act and Industrial Disputes Act were modified to favour businesses.
- **Rise of State-Level Reforms** - States like Rajasthan, Gujarat, and Madhya Pradesh began to amend central labour laws (permitted under the Constitution).
    - **For example**, Rajasthan in 2014 raised thresholds for layoffs without government permission under the Industrial Disputes Act.

What is role of judiciary in labour regulations?

- **Right to Livelihood** – In Olga Tellis v. Bombay Municipal Corporation (1985) case, the Supreme Court expanded the Article 21 (Right to Life) to include the right to livelihood.
- **Curbing Arbitrary Dismissals** – In D.K. Yadav v. J.M.A. Industries Ltd. (1993) case, the court held that termination without due process violated Article 21—making procedural fairness mandatory in employment termination.
- **Equal pay** – In Randhir Singh v. Union of India (1982), it was held that Equal pay for equal work is a constitutional guarantee under Articles 14, 16, and 39(d).
- **Protection of Women Workers** – In Vishaka v. State of Rajasthan (1997) case, the court created binding guidelines to prevent sexual harassment at the workplace, later codified in law in 2013.

Judicial Protection of Labour Rights		
Principle Protected	**Key Case(s)**	**Judicial Outcome**
Right to Livelihood	Olga Tellis (1985)	Livelihood is part of Right to Life
Procedural Fairness	D.K. Yadav (1993)	Termination must follow due process
Equal Pay	Randhir Singh (1982)	Equal pay is constitutional
Natural Justice	DTC v. Mazdoor Congress (1991)	Arbitrary dismissals invalid
Sexual Harassment	Vishaka (1997)	Workplace safety for women
Contract Labour Protection	SAIL v. NUWW (2001)	Contracts must be genuine
Labour Welfare	Bhopal Gas Case (1989)	Industries accountable for safety

What is the change in judicial position affecting labour rights?

- Since 2000s, a discernible shift in judicial approach towards the issue also started becoming palpable.
- **Contract labour** - In the SAIL judgement 2001, the constitution bench of Supreme Court ruled that The Contract Labour (Regulation and Abolition) Act, 1970 did not mandate the automatic absorption of contract labour into the regular establishment when contract labour is prohibited.
- **Temporary labours** - The Secretary, State of Karnataka v. Umadevi (2006) judgement said that the employees appointed on a temporary basis do not have a fundamental right to claim permanent employment or equal pay with regular employees.
- While the judgment was aimed at preventing backdoor entries, the ruling has since then been misused widely
- **No right to strike for government employees** - In the T.K. Rangarajan vs. Government of Tamil Nadu case, it was ruled that government employees do not have the legal, fundamental, moral or equitable right to strike.

Comparison of Indian Labour Laws: Pre-1991 vs. Post-1991 Impact		
Aspect	**Pre-1991 (Before Economic Reforms)**	**Post-1991 (After Economic Reforms)**
Legal Framework	Fragmented – 40+ central laws, numerous state laws	Consolidation into 4 labour codes (2020)

Comparison of Indian Labour Laws: Pre-1991 vs. Post-1991 Impact		
Aspect	**Pre-1991 (Before Economic Reforms)**	**Post-1991 (After Economic Reforms)**
Hiring & Firing	Rigid – Government approval required for layoffs (ID Act Sec. 25K for 100+ workers)	Push for flexibility – States like Rajasthan raised threshold to 300; IR Code 2020 follows
Contract Labour	Heavily restricted by Contract Labour (Regulation and Abolition) Act, 1970	Widespread use of contract workers to bypass rigidities
Union Power	Strong – Recognized under Trade Unions Act, frequent strikes	Decline in union influence, move to decentralized negotiations
Wage Regulation	Sector-specific minimum wages, complex compliance	Code on Wages (2020) unifies minimum wage provisions and simplifies structure
Social Security	EPF and ESI Acts with multiple compliance hurdles	Social Security Code (2020) aims for universal coverage and ease of compliance
Workplace Safety	Multiple overlapping laws like Factories Act, Mines Act	Occupational Safety, Health & Working Conditions Code (2020) consolidates 13 laws
Labour Market Flexibility	Minimal – Focus on job security	Emphasis on balancing flexibility with protection
State Role	Centralized lawmaking	States granted more reform power (esp. post-2014)
Informal Sector	Less emphasized	Major employment generator; increased policy attention

What are changes brought by the new labour codes?

- **4 labour codes** - All the *29 existing labour laws were consolidated* under the 4 new codes.
    - Code of wages 2019
    - Code on occupational safety and health and working conditions of 2020
    - Code on social security 2020
    - Industrial regulations code 2020.
- While they have been passed by both houses of the parliament and notified by the president, they have *not yet come into force.*
- **Deciding minimum wages** – The code empowers the central and state governments to set minimum wages for all employees covered by the Code.
- This is different from the Minimum Wages Act of 1948, which listed minimum wages in the schedule of the Act.
- **Setting floor wages** – The Code mandates that the central government determines floor wages, considering working conditions.
- State governments cannot set minimum wages below the floor rates established by the central government.
- **Changes in industrial dispute matters** - The definition of industrial dispute was expanded under the industrial relations code to encompasses workers' discharge, dismissal, reduction or termination.
- **Social security to Gig workers** - Code expands its coverage to include gig, platform, and unorganised workers.
- It aims to protect gig workers who work in non-traditional employment arrangements, such as food and e-commerce delivery services.

What is the criticism on the new labour codes?

- **Increase in applicability threshold** - The industrial relations code, for example, imposes the requirement of framing standing orders only in industrial establishments with 300 or more workers employees (100 earlier).

- **Weakened Trade Union** - The codes make strikes harder to organize by mandating a 60-day notice for strikes in all sectors, not just public utilities.
- Only one trade union is recognized in an establishment, which could sideline minority or smaller unions.
- **Increased Informalization** - The greater ease of hiring fixed-term and contract workers could lead to a shift away from permanent employment.
- **Over delegation** - Much of the detail is left to executive rule-making rather than being spelled out in the law itself.

What lies ahead?

- Improving India's labour regulation requires balancing flexibility for employers with protection for workers, especially in a country where over 90% of the workforce is informal.
- Basic protections (minimum wage, working hours, safety) can be applied regardless of enterprise size.
- Plain language can be used in legal drafting to increase accessibility for workers and small employers.
- Sectoral-level bargaining can be encouraged in fragmented industries like construction, retail, and gig work.

1.5 Making Indian Steel Competitive

Why in News?

Despite the US-China trade deal in Geneva, the imposition of 55 % duties on Chinese steel exports to the US significantly increases the risk of large-scale steel dumping from China into India.

What is the recent change in US – China Steel trade?

- **US – China Trade Agreement** – It is a temporary agreement to reduce the tariff between the countries.
- The U.S. has agreed to temporarily lower, for 90 days, its overall tariffs on Chinese goods from 145% to 30%, while China will cut its tariffs on American imports from 125% to 10%.
- Despite the deal, the US imposed 55 % duties on Chinese steel exports.
- **Impact on India** – This increases the *risk of large-scale steel dumping from China into India*.
- **India's Proactive Measures** - India has swiftly set-up an import-surge monitoring group and has imposed safeguard duties on steel.

India's Steel Industry

- **Steel Production** - Crude steel production grew from 109.137 million tonnes (MT) in 2019-20 to 144.299 MT in 2023-24, registering a robust growth of 13.4% over the previous year (127.197 MT in 2022-23).
- **Capacity Utilization** – This rate has increased to 81% during the same period.
- **Steel Consumption** - Total finished steel consumption grew to 136.291 MT in 2023-24.
- *Steel is a deregulated sector*, So the Government acts as a facilitator by creating a conducive policy environment for the development of the steel sector.
- **National Steel Policy (NSP) 2017** - It set ambitious targets to achieve a crude steel capacity of 300 million tonnes by 2030-31, with an expected production of 255 million tonnes of crude steel and 230 million tonnes of finished steel.
- **PLI for Steel** – It is aimed at boosting domestic steel production through attracting capital investments and reducing imports.
- **DMI&SP Policy** - Domestically Manufactured Iron & Steel Products Policy promotes 'Made in India' steel for Government procurement.
- **Reduction of Basic Custom Duty** - To make the steel industry globally competitive, in Budget 2024, the Government reduced the Basic Customs Duty on ferro nickel, a raw material, and extended the duty exemption on ferrous scrap until March 2026.

Why is Chinese steel competitive than India's?

- **Large Scale of Economy** – A single Chinese steel company Baowu's produces 130 mtpa (metric tonne per annum) output, almost matching India's total steel production.

*China and India are the **world's top 2 steel producers** with 1,050 MT and 150 MT in 2024 respectively.*

- **High Productivity** - Chinese plants have achieved 3,000-4,000 tonnes per worker annually, compared to just 800-1,200 tonnes at Indian plants.
- **Technology Edge** – Chinese steel plants have adopted advanced technologies like Advanced automation, Industry 4.0 technologies, AI-driven operations, where India's Steel Inc. is lacking.
- **Efficient Resource Use** - Chinese plants maintain over 95% utilisation rates, supported by superior infrastructure and reliable power supply while Indian plants face frequent maintenance shutdowns, high industrial power tariffs, supply disruptions, and greater reliance on manual operations.
- **Superior Infrastructure** - Over 70% of China's bulk cargo, including iron ore, moves efficiently through inland waterways and rail, compared to less than 30% in India.
- **Integrated Supply-Chains** – China's dedicated freight corridors and port-centric clusters ensure seamless raw material flow while Indian plants sourcing from distant mines, like those in Odisha and Maharashtra, face higher costs and delays.
- **Strong Government Incentives & Cheap Financing** - Manufacturers enjoy subsidies, 13% export rebates, and loans at 3-5%, while Indian firms face borrowing costs of 8-12%.
- **Better Monetary System** - China's managed float of yuan, backed by large forex reserves, stabilises inflation and financing costs, keeping steel exports competitive.
- In contrast, India's floating exchange rate triggers currency volatility, inflating production costs despite protective duties and limited PLI schemes.
- **Quality Coal** - While India has abundant iron ore, it lacks coal with the required carbon-content, necessitating expensive imports.
- These structural disadvantages make Indian steel more expensive and vulnerable to cheaper Chinese dumping .

What are the impacts of Chinese steel dumping into India?

- **Cripples Indian industry** - China's relentless steel dumping depresses the consumption of domestic steel.
    - SMEs, in particular, have reported revenue declines of 15-20% due to import competition.
- This financial strain and depressed margin pushed several smaller players to the brink, while larger producers are deferring critical capacity additions.
- **Stalls Future Investments** - The influx of cheap Chinese steel erodes profit margins for Indian manufacturers, making the domestic market less attractive for new investments.
- **Limits Specialised Steel Initiatives under PLI** - Persistent dumping of low-priced Chinese steel restricts the success of these initiatives by making it difficult for Indian producers to compete .
- **Disrupts Supply-Chains** - Dumping creates volatility in the steel market by disrupting supply chains.
- **Harms Downstream Industries** – If domestic producers are forced to cut production or shut down, downstream industries like construction, engineering, and automotive face increased vulnerability to global price shocks and supply disruptions.
- **Reduces Employment** - The financial pressure from dumped imports can lead to job losses in the steel sector as companies cut costs, reduce production, or shut down operations.
- **Threatens Economy** - Steel is foundational to infrastructure, manufacturing, and defence sectors and so, a weakened steel industry undermines broader economic development goals.

What lies ahead?

- Surging imports of flat-rolled steel, stainless steel, and ferro-alloys have exposed deep-rooted structural vulnerabilities, contributing to a $7.33 billion trade deficit in the iron and steel sector.
- These imbalances call for an urgent review of trade provisions under existing FTAs.
- Simultaneously, structural reforms need to be launched to dismantle oligopolistic control, improve cost-efficiency, and attract credible foreign players.
- Safeguard measures must be matched with merit-based incentives to upgrade in specialty steel, improve quality, and enable sustainability.
- Protection is only meaningful if it drives long-term competitiveness, industrial sovereignty, and a fair, future-ready steel ecosystem.

1.6 Rising North East

Why in News?

Rising North East summit 2025 is held recently.

What is the geographical significance of North East India?

- **North Easter Region (NER)** – It encompasses a group of eight states, namely Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura.
- **Geographical Coverage** - NER covers 7.98% of India's total geographical the region and accounts for 3.78% of the total population.
- **Hills of NER** – The region is characterized by several mountain ranges and hills such as Patkai Bum, Naga Hills, and Mizo Hills, as well as the Garo, Khasi, and Jaintia Hills.
- **Strategic Significance** – It serves as a gateway to Southeast Asia, with each state sharing a border with at least one Southeast Asian nation.

Key Demographic Indicators

Indicators	Northeast India	India
Population (millions), 2011 Census	45.7	1210.9
Population density (per sq. km.)	175	368
Literacy Rate (Census 2011) (% age)	78.5	74.0
Life Expectancy (in Years)	71.8	68.3

What are the environmental and biological significance of NER?

- **Biodiversity Hotspot** – It is part of the Indo-Burma Biodiversity Hotspot, one of the world's richest in species diversity and endemism.
- **Rich Forest Cover** - One of India's most heavily forested regions — about 65-70% of the area is under forest cover, with tropical rainforests, alpine meadows, and bamboo forests.
- **Ecological Buffer Zone** – It acts as a climate regulator and ecological buffer between the Eastern Himalayas and South-East Asia.

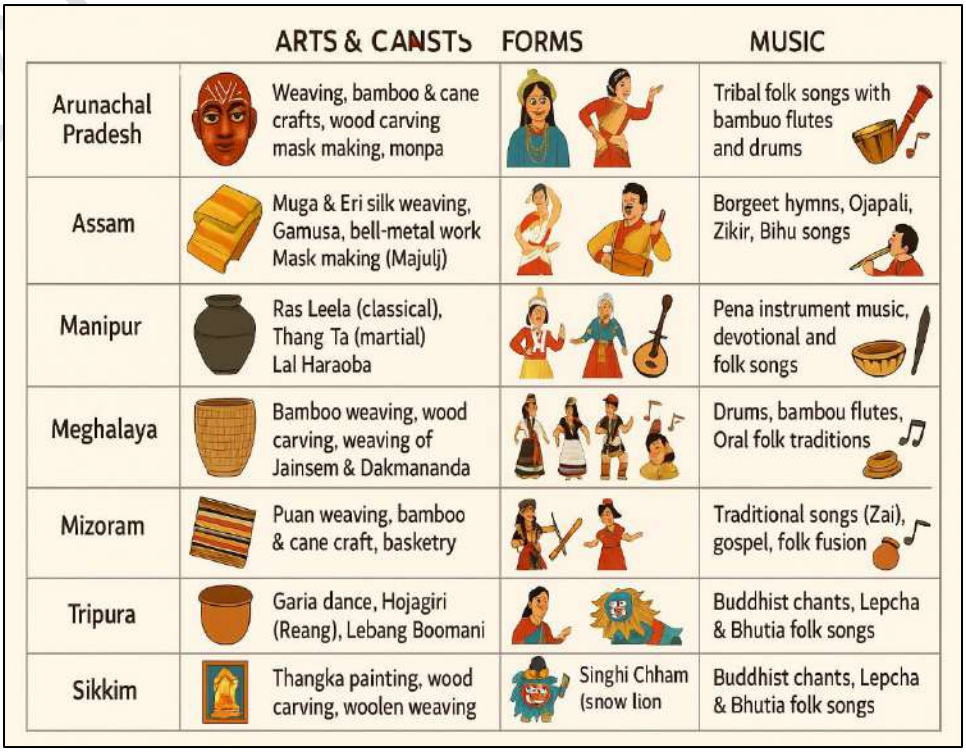
- **Floral Diversity** - Northeast India is often referred to as the "cradle of flowering plants" as it home to a vast array of plant species, including orchids, ferns, bamboos, and medicinal plants.
- **Wildlife Richness** – It is home to protected areas like Kaziranga National Park, Namdapha, and Manas.
- Arunachal Pradesh and Sikkim are particularly renowned for their high orchid species richness, with Arunachal Pradesh even dubbed the "Orchid Paradise" of India.
- It is home to numerous rare and endangered mammals, including the one-horned rhinoceros, Asian elephant, tiger, hoolock gibbon (India's only ape), clouded leopard, red panda.

What are the cultural significances of NER?

- It is a region of immense cultural significance, characterized by a vibrant tapestry of distinct ethnic groups, traditions, and languages.
- **Tribal Region** - Over 54% of the region's population, particularly in hilly areas, belong to tribal communities and is home to *approximately 135 Scheduled Tribe* groups out of a total of around 705 in India.

State	Major Tribes
Arunachal Pradesh	Nyishi, Adi, Apatani, Monpa, Mishmi, Galo, Tagin
Assam	Bodo, Mishing, Karbi, Rabha, Dimasa, Deori, Tiwa
Manipur	Tangkhul, Thadou, Paite, Hmar, Mao, Zeliangrong, Maram
Meghalaya	Khasi, Garo, Jaintia
Mizoram	Mizo (Lushai), Hmar, Lai, Mara, Chakma
Nagaland	Ao, Angami, Sumi, Lotha, Konyak, Phom, Chang, Yimchunger, Zeliang, Sangtam
Tripura	Tripuri (Debbarma, Jamatia, Reang/Bru), Chakma, Halam, Mog, Uchoi
Sikkim	Lepcha, Bhutia, Limbu

- **Religions** - The region is a mosaic of religious beliefs with the co-existence of Hinduism, Buddhism, Christianity, and indigenous belief systems.
- Christianity has a significant presence in states like Nagaland and Mizoram, where it has played a transformative role in the culture and way of life.
- **Rich Folklore and Mythology** - It is rich in oral traditions, folk stories, and mythical narratives that reflect the unique worldview of its people.
- **North East Festivals** - Hornbill Festival (Nagaland), Bihu (Assam), Ziro Festival (Arunachal Pradesh), Chapchar Kut (Mizoram), Cherry Blossom Festival (Meghalaya)
- **Art and Crafts** – North East has a vigorous craft tradition and every tribe excels in craftsmanship.



What are the economic significances of NER?

- **Productivity of the Region** - The Region's GSDP at current prices is INR 5.75 lakh crore in FY 2021-22.
- **Growth Rate** - Compounded Annual Growth Rate (CAGR) of GSDP of North-eastern States grew at 08.17% from FY2015 to FY2022.
- **Abundant Natural Resources** - An abundance of oil, gas, coal, minerals, timber, medicinal plants, bamboo, forest products, and an abundance of water for industries to exploit.
- **Gateway to Southeast Asia** – As a strategic location, it offers easy access to ASEAN markets.
- **Low-cost Manufacturing Hub** - Low labour costs compared to other parts of India and the world.
- **Skilled Workforce** - A young, educated, and skilled workforce that is proficient in English.
- **Emerging Consumer Market** - A growing consumer market with rising incomes and increased urbanization that offers immense potential for business.
- **Thriving Bio-economy** - It is the thriving region of bamboo industry, tea production and organic products.

What are the challenges in NER development?

- **Remoteness** - Its geographical location, connected to the rest of India by the narrow Siliguri Corridor (Chicken's Neck), creates a sense of remoteness and logistical challenges.
- **Limited Flat Land** - The mountainous nature of the region limits the availability of suitable land for urban expansion and industrial development.
- **Infrastructural challenges** - The region's mountainous terrain makes it difficult to build infrastructure and connect various parts of the region, hindering transportation and trade.
- **Natural Disasters** - The North East is prone to earthquakes and floods, landslide and other natural hazards further complicating development efforts.
- **Political Instability** -Insurgency and ethnic conflicts have disrupted social and economic development in some parts of the region.
- The recent Kuki and Meitei conflict in Manipur has severely hampered the development process in Northeast India.
- **Inter-State and Intra-State Conflicts** - Occasional border disputes between states and ethnic tensions within states can also impede cooperative development efforts.
- **Migration & Infiltration** - Large-scale migration from neighbouring countries, particularly Bangladesh, has created social and political tensions, and also poses challenges to resource allocation.
- **Limited Private Investment** - The challenging environment and perceived risks have deterred significant private sector investment, hindering job creation and economic diversification.

What are the government initiatives for the development of NER?

- **Bio- Transformation** - Since 2011, a network of 126 Biotech Hubs was established across NER to support and promote biological sciences / biotechnology education and research.
- **Funding Support** - Since 2010, Department of Bio-Technology DBT has consistently allocated 10% of its annual budget to specialized programmes in the NER, aiming to bridge the gap between potential and prosperity.
- **Infrastructure Development** - Government has taken the specific initiative for improvement of connectivity within the region by programs such as SARDP-NE, Bharatmala-I, etc. and with rest of India through East-West Corridor program.
    - The *Sela Tunnel* and mega projects like the Bhupen Hazarika Bridge have been completed recently.
- **Building Connectivity** - The India-Myanmar-Thailand Trilateral Highway will establish direct connectivity to Thailand through Myanmar.
    - *Kaladan Multimodal Transit Project* will connect the Kolkata Port to Sittwe Port in Myanmar, and further link the rest of the Northeast via Mizoram.
- **Sports Development** - Under the Khelo India program, projects worth hundreds of crores of rupees are underway in the Northeast.
    - There are 8 Khelo India Centres of Excellence and over 250 Khelo India Centres in the region alone.

- **Rising Northeast Summit** – The Ministry of DoNER, is organizing the summit to showcase the investment and trade potential of the Northeast Region of India.
- **Peace Efforts** – Several peace treaties are being made to address the conflicts in the region.
- Long-standing dispute for Karbianglong was solved having signed *Karbianglong agreement/accord in 2021*.

What lies ahead?

- The Northeast Region of India needs better infrastructure, including roads, railways, and digital access, to enhance connectivity and economic growth.
- Strengthening education, healthcare, and tourism can empower communities and create sustainable opportunities.
- Governance improvements and targeted social welfare programs will ensure stability and long-term development.

1.7 Early Monsoon Arrival

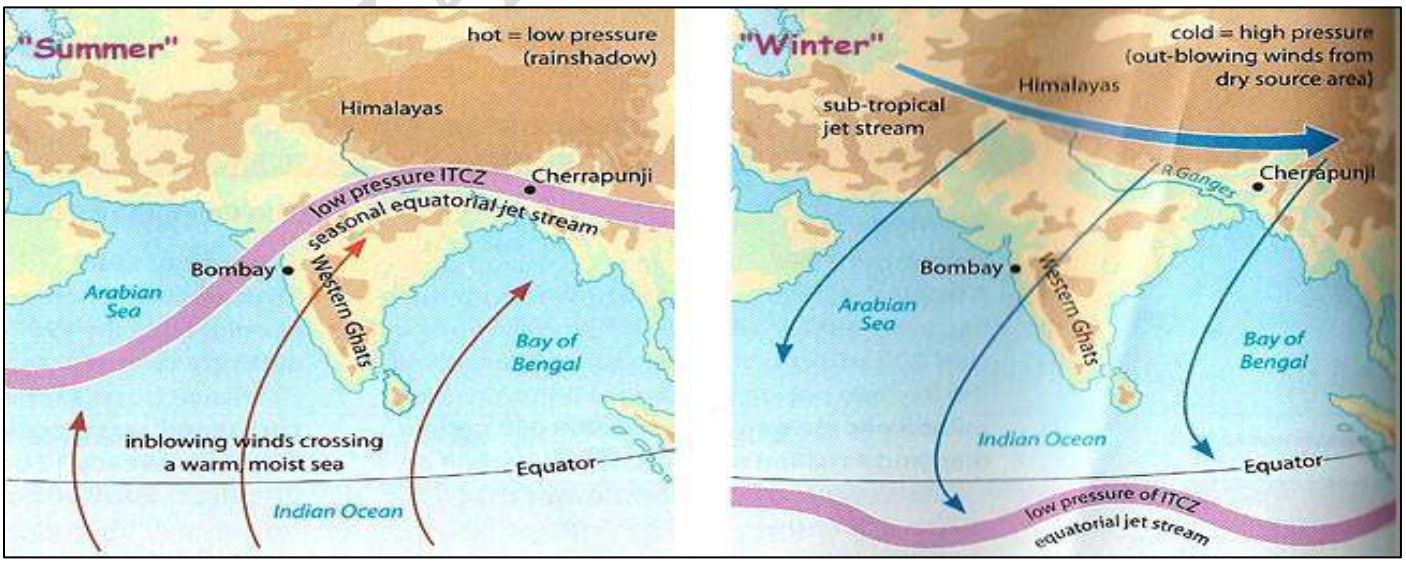
Why in News?

India Meteorological Department said the southwest monsoon set in over Kerala on May 24, a week ahead of its normal onset.

What are the various theories on monsoon onset?

> ***A monsoon*** *is a seasonal change in the direction of the prevailing, or strongest, winds of a region. Monsoons cause wet and dry seasons throughout much of the tropics.*

- **Monsoon Factors** - The onset of the monsoon is a complex phenomenon influenced by multiple atmospheric, oceanic, and terrestrial factors.
- **Tracking the Trough** - The march of the trough is watched carefully from its origin in the northwestern tropical Pacific into the Andaman Sea and the Bay of Bengal.
- **Different Theories** - There are many theories as to the science of monsoon onset, but there is no consensus on a complete understanding of the processes leading to the onset of monsoon.
- **Classical (Thermal) Theory** - Proposed by Sir Edmund Halley (1686), It attributes the monsoon to the differential heating of land and sea.
- During summer, the Asian landmass heats up much faster than the surrounding oceans, creating a low-pressure area over the land and a high-pressure area over the ocean.
    - **Limitations** - This theory cannot explain the sudden burst of monsoon, regional variations, or the intricacies of monsoon onset and withdrawal.

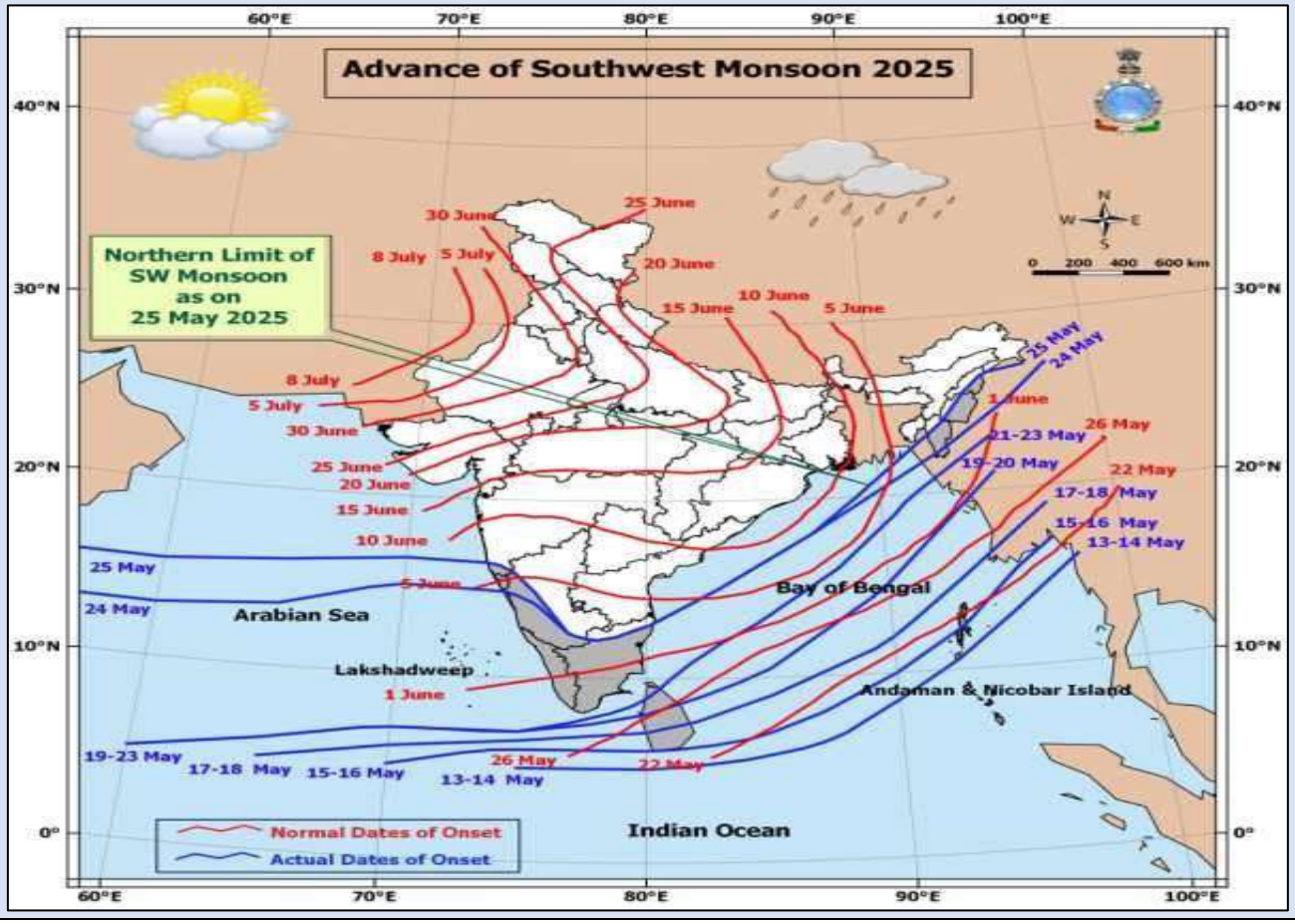


- **Dynamic Theory** - Developed by Flohn (1951), this theory focuses on the seasonal migration of planetary wind and pressure belts.
- The Inter-Tropical Convergence Zone (ITCZ), where trade winds from both hemispheres meet, shifts northward during the northern summer.

- The monsoon is seen as a result of this shift, with the equatorial westerlies (southwest monsoon) moving towards the Indian subcontinent as the ITCZ migrates.
- **Jet Stream Theory** - Modern research has highlighted the role of upper atmospheric circulation, particularly the jet streams.
- The subtropical westerly jet shifts northward in summer due to heating of the Tibetan Plateau, allowing the monsoon trough to develop over India.
- This theory helps explain the timing and sudden onset ("burst") of the monsoon over the Indian subcontinent.
- **Orographic and Surface Moist Static Energy (SMSE) Theory** - Recent studies using Atmospheric General Circulation Models (AGCMs) suggest that orography (mountains) and surface moist static energy play crucial roles in monsoon onset.
- The onset occurs when the SMSE crosses a threshold value and there is large-scale upward motion in the mid-troposphere.
- The presence and configuration of the Himalayas and Tibetan Plateau are particularly important in modulating the onset and strength of the monsoon.
- **Sea Surface Temperature (SST)** - Warmer SSTs near the equator and the Indian subcontinent increase atmospheric instability, favoring monsoon onset.

IMD's Meteorological Criteria on Monsoon Onset

- **Rainfall** - At least 60% of 14 southern meteorological stations record ≥2.5 mm rainfall for two consecutive days.
- **Wind field** - Westerly winds blow from West to East in the 30-to-60-degree latitudes, both in the northern and southern hemispheres.
- For the onset, the depth of westerly winds should be maintained at upto 600 hectoPascals or hPa wind speeds must range between 15-20 knots (27-37km/hr) at 925 hPa.
- **Outgoing Longwave Radiation (OLR)** – Its value falls below 200 W/m², indicating dense cloud cover and active convection.



What is the relation between past and present early onsets?

> *This year, there has been a **simultaneous onset** over the entire Lakshadweep, Mahe (Puducherry), many parts of the Arabian Sea and the Bay of Bengal, along with monsoon winds reaching parts of southern Karnataka and Mizoram in northeast India.*

- **Earliest Onset** - Since 1975, the earliest monsoon onset over Kerala occurred on May 19, 1990, 13 days ahead of schedule.
- **Previous Onset** – Before to this year's onset, it happened in 2009 with the early arrival occurred at May 23.
- **Unusual El Nino 2009** - 2008 was about 0.5°C warmer than the pre-industrial baseline and 2009 was a mild El Niño year.
- The summer of 2009 was noted to be warm across the tropical Pacific, which is unusual for an El Niño year and 2009 had a severe monsoon drought.
- **Current Global Warming Rate** - Global warming thus far in 2025 is already over 1.2°C with a strong El Niño in 2023, and a failed La Niña in 2024.

> *In an El Niño year, the east is expected to be warming in the summer and the west to be cooling.*

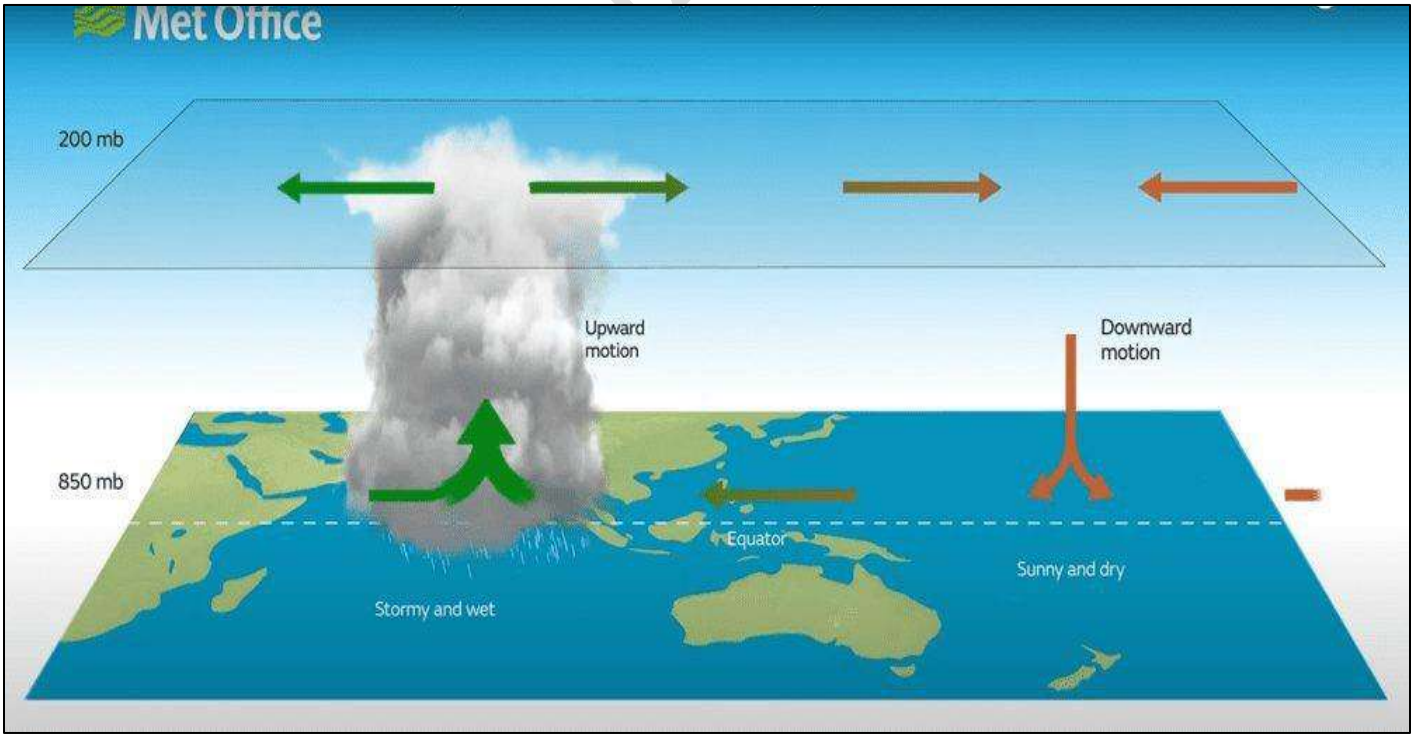
- **2024 Anomaly** - An unusual sea surface temperature anomaly pattern in the tropical Pacific occurred in 2024, with warm anomalies in the far east and far west but cooler anomalies in the centre.

What are the factors affecting monsoon arrival in India?

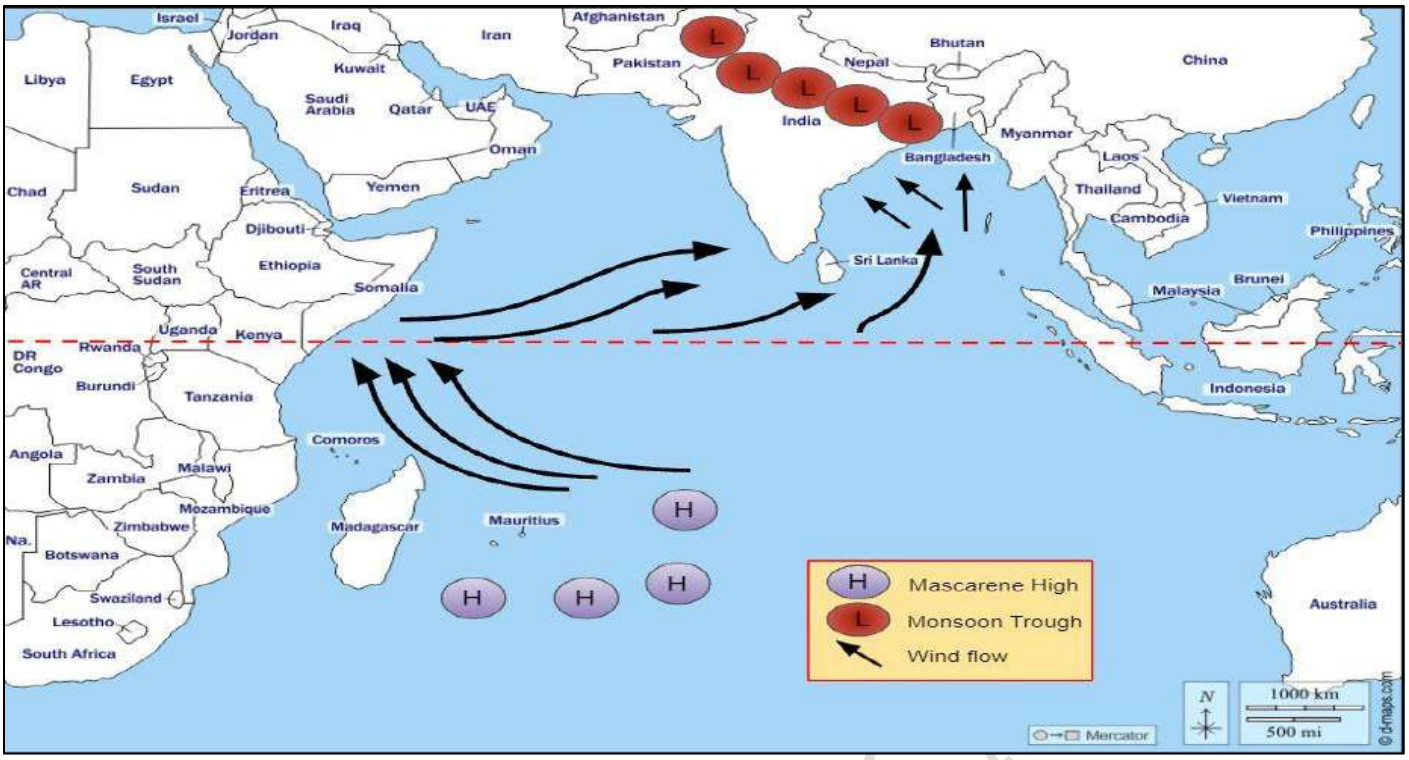
- Many external factors are now playing into the arrival of the monsoon trough to Kerala.
- **Pre-monsoon cyclone** - More cyclones are occurring late into the pre-monsoon cyclone season, that is, close to the monsoon onset and some pulls the trough forward to deliver an early onset.
- **Pacific Typhoons** - They also pull moisture away from the Indian Ocean during the onset phase to delay the onset.

> *The **pre-monsoon cyclone season** in the North Indian Ocean, particularly the Bay of Bengal, typically occurs between April and May, characterized by the formation and intensification of tropical cyclones.*

- **Madden-Julian Oscillation (MJO)** - The MJO is a significant, eastward-moving atmospheric disturbance originating in the Indian Ocean.
- When in a favorable phase, it enhances cloud formation, wind patterns, and rainfall over India, often accelerating monsoon onset.



- **Mascarene High** - This is a high-pressure system near the Mascarene Islands (south Indian Ocean).
- Its intensity influences the strength and direction of monsoon winds toward India, with a stronger Mascarene High promoting robust monsoon flow and early arrival.



- **Somali Jet**- It is a low-level, cross-equatorial wind originating near Mauritius and Madagascar.
- A strong Somali jet intensifies the southwest monsoon winds, aiding in the timely or early onset over Kerala.

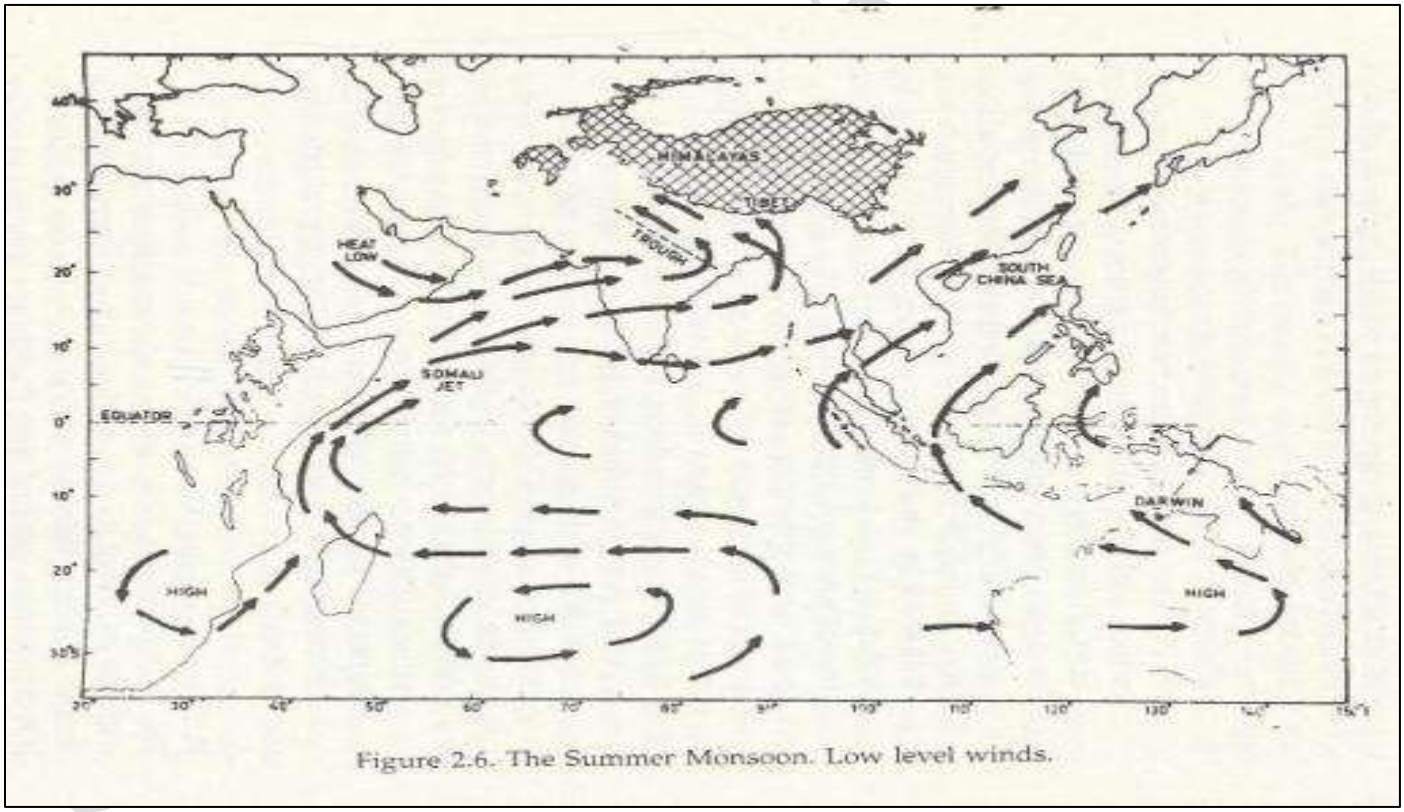


Figure 2.6. The Summer Monsoon. Low level winds.

What are the implications of early onset of monsoon?

- **Agricultural Impact** - Early rains can benefit farmers by enabling earlier sowing of summer (kharif) crops such as rice, cotton, and soybeans, potentially leading to a longer growing season and higher yields.
- However, if the early onset is followed by a prolonged dry spell or "break" in rainfall, it can damage newly sown crops or disrupt the cropping cycle, causing losses for farmers.
- **Relief from Heatwaves** - Early monsoon rains provide immediate relief from extreme heat, lowering temperatures and reducing the impact of heatwaves in affected regions.

- **Water Resource Replenishment** - Reservoirs, groundwater, and other water bodies benefit from early rainfall, improving water availability for irrigation, drinking, and industrial use.
- **Risk of Urban Flooding** - Intense early rainfall can overwhelm drainage systems, leading to waterlogging, flash floods, and disruptions in cities unprepared for early rains.
- **Economic Impacts** - The monsoon's timing is a critical economic indicator for India, influencing food prices, rural incomes, and overall economic stability.

What lies ahead?

- As India continues to grapple with the growing impacts of climate change, understanding the evolving behaviour of the monsoon is more critical than ever.
- Disaster response plans need to be activated ahead of the planned schedule.
- Early monsoon preparedness activities like dredging drainage network needs to be fastened.
- Health advisories on vector control to prevent outbreaks of diseases like dengue, malaria, and chikungunya, which spike during the monsoon can be released ahead.
- Timely advisories to farmers regarding sowing schedules, crop selection, and protection measures in light of the altered rainfall pattern needs to be issued.

G.S PAPER I

2. HISTORY

2.1 Tagore's Cosmopolitan Nationalism

Why in the News?

Rabindranath Tagore Jayanti is celebrated on May 7.

What is the view of Tagore on Nationalism?

- **Tagore on Nationalism** – Tagore's essays, especially in his *book Nationalism (1917),* present his thoughts on how nationalism, particularly Western-style nationalism, could be dangerous.
    - In it, he criticizes the way nationalism was practiced and argues for a society built on cooperation and universal values rather than competition and aggression.
- **Rejection of Aggressive Nationalism** -Tagore viewed narrow nationalism, which prioritizes a nation's territorial boundaries and power, as divisive and prone to conflict.
- He believed it neglected fundamental human values and hindered genuine societal progress.
    - In his work, *Ghare Baire, or The Home and the World*, he expressed apprehension over the anticolonial response to the British leading to Hindus and Muslims rigidly defining their identities.
- **Advocacy for Cosmopolitanism** - He championed a cosmopolitan perspective, emphasizing the interconnectedness of all humanity and the importance of cultural exchange and cooperation.
- He envisioned a world where individuals saw themselves as part of a global community, transcending parochial loyalties.
- **Focus on Humanity and Spirituality** - Tagore emphasized the importance of spiritual unity and understanding between individuals, guided by love, respect, and mutual trust.
- **Emphasis on Indian Culture and Traditions** – He also valued Indian culture, traditions, and humanity, promoting a more inclusive and spiritual understanding of nationalism.

What are the different types of nationalism advocated by Tagore?

- **Cultural Nationalism** - He emphasized the importance of preserving Indian culture, traditions, and heritage.
- **Spiritual Nationalism** - He believed in the spiritual unity of India, transcending religious & regional divisions.
- **Humanistic Nationalism** - He prioritized human values, such as love, compassion, and equality, over narrow nationalistic interests.

- **Anti-Colonial Nationalism** - He opposed British rule, advocating for Indian independence and self-rule.
- **Internationalism** - He envisioned a global community, where nations coexisted in harmony, sharing knowledge and culture.

What is the comparison between Gandhi and Tagore on Nationalism?

Difference Between Gandhi and Tagore on Nationalism	
Rabindranath Tagore	**Mahatma Gandhi**
Tagore believed in more inclusive and spiritual nationalism, emphasizing the importance of Indian culture and traditions	Gandhi's nationalism was rooted in politics and the struggle for Indian independence.
For Rabindranath Tagore, the view of nationalism and patriotism that the movement was taking on was too narrow.	Gandhi saw nationalism as a means to achieve Indian independence and self-rule.
Tagore envisioned a global community.	Gandhi advocated for Indian self-sufficiency and isolation from Western influences.
Similarities on Nationalism	
Humanistic Nationalism • Both Gandhi and Tagore believed in a form of nationalism rooted in respect for all humanity. • They argued that love for one's country should not breed hatred or contempt for others. • Gandhi's idea of Sarvodaya (welfare of all) and Tagore's advocacy for universal brotherhood reflected their shared view that nations should uplift humanity, not divide it	
Cultural and Spiritual Identity Over Political Identity • For both thinkers, the soul of a nation was not its political or military power but its cultural and spiritual values. • Gandhi's emphasis on Swaraj (self-rule) was not just political independence but also moral and cultural self-reliance. • Similarly, Tagore valued India's cultural heritage and believed it could enrich the world, emphasizing that true freedom comes from within.	
Non-violence and Ethical Means of Resistance • Gandhi and Tagore both rejected aggressive or violent forms of nationalism. • Gandhi's philosophy of Ahimsa (non-violence) was integral to his vision for a free India, while Tagore argued that nationalism rooted in aggression and hatred was harmful. • Both believed that a just and lasting independence must come through ethical means and mutual respect.	
Nationalism Beyond Materialism • Gandhi and Tagore were both wary of a nationalism driven by materialism or economic exploitation. • They advocated for a sustainable, self-sufficient society where people's needs were met without excessive consumption. • Gandhi's Swadeshi movement encouraged local production and self-sufficiency, while Tagore promoted a simple, sustainable life that respected natural resources.	

- In essence, Tagore's concept of nationalism was not an outright rejection of patriotism but a call for a more humane and spiritual understanding of national identity, one that prioritized universal values and global cooperation over narrow self-interest and territorial competition.

2.2 Buddhism in Modern India

Why in the News?

Buddha Purnima 2025 was observed on May 12, 2025, celebrating Gautam Buddha's 2587th birth anniversary.

How was Buddhism revived in modern India?

- **Rediscovery of Buddhist Monuments** – The efforts of the British archaeologists and explorers in the 19th century commenced the rediscovery of Buddhism by bringing to light the rich Buddhist heritage.
    - Ashokan pillars and rock edicts in the 18th and 19th century.
    - The Great Sanchi Stupa, 1st Buddhist shrine discovered in modern India in 1818 by *General Taylor*.
- *Alexander Cunnigham* in 1851 made an important discovery at Sanchi in 1851 when he unsealed the Sanchi Stupas for the first time and unearthed the well-preserved gateways, or Torana's, which were adorned with elaborate carvings illustrating Buddhist stories and teachings.
- **Entrepreneurial Patronage** - J.K. Birla financed major Buddhist constructions in pilgrimage centres like Rajgir, Sarnath, Bodh Gaya, and also in new centres of *"urban Buddhist activity"*, including Calcutta, Bombay, and New Delhi.
- **Buddha Gaya Maha Bodhi Society** - Anagarika Dharmapala, a Sri Lankan Buddhist reformer, played a crucial role in reviving interest in Buddhism in India.
- **Theosophical society** - Colonel Henry Steel Olcott, Madame Helena Blavatsky led the revival of Buddhism in India through the society.
- **Role of Social Reformers** - Social reformers like *Jyotirao Phule, Iyotheedasa Pandithar and B.R Ambedkar* in the late 19th and early 20th centuries advocated for Buddhism as a means of challenging caste oppression and social inequality.
- **Tibetan Buddhism** - After the *Tibetan uprising in 1959*, the Dalai Lama and thousands of Tibetan refugees settled in India.
- This brought Tibetan Buddhist traditions into India, creating monasteries and communities in places like Dharamshala and Ladakh.

On October 14, 1956, Dr. B. R. Ambedkar, publicly converted to Buddhism in Nagpur along with over 400,000 of his followers, primarily from Scheduled Castes (Dalits).

What are the effects of revival of Buddhism in colonial and post-colonial India?

- **Revival of Buddhist Philosophy** - The revival of Buddhist archaeological heritage sites helped in connecting its monumental past with its philosophy.
- **Hindu Reform Movements** - The revival of Buddhism challenged Hindu orthodoxy, particularly the caste system, prompting Hindu reformers to introspect and adapt.
- **Dalit and anti-caste activism** – Anti-caste leaders like Jyotirao Phule, B.R. Ambedkar have used Buddhism as socio religious tool to find against caste oppression and for equality.
- The threat of conversion to Buddhism (and other religions) encouraged reformist Hindus to become more inclusive of lower castes, at least rhetorically.
- **Making of Hindu Nationalism** - Hindu nationalists responded to the Buddhist revival, especially Ambedkar's movement, by reasserting a unified Hindu identity that downplayed internal divisions.
- **Nehruvian Secular Democracy** – Buddhism was an important cornerstone for building India a secular democracy post-independence.

What are the importances of Buddhist monuments?

- **Reflecting Years of History** - Lives of the monuments resonated with the people and communities around them, including monks, laity, kings, traders, guilds, landlords, agriculturalists, and villagers.
- **Deciphering the Past** - Inscriptions, sculptures, and iconography provide key evidence for reconstructing ancient Indian history, society, and art.
- **Capture the Changing Times** - The buildings are "complex ecosystems" which capture the changing times and give an idea about belief systems, rituals, stories, and folklore.
    - For instance, the sculptured panels on the gateways of Sanchi not only depict events from the life of the Buddha but also the Jataka tales and the mythical bodhisattvas.
- **Preservation of Texts** - Many caves and monasteries were repositories of Buddhist manuscripts and teachings.
- **Social Cultural Interactions** - Over time, the monumental structures have acquired different forms and meanings, and have also become important sites of social and cultural interactions.

- **Places of Pilgrimage** - Sites like Bodh Gaya, Sarnath, Kushinagar, and Lumbini (in Nepal) are sacred places associated with the life of the Buddha—his birth, enlightenment, 1st sermon, and death.
- **Spiritual Legacy** - They preserve the teachings of the Buddha in a visual and symbolic form, inspiring faith and practice.
- **Inspirations to Art and Architecture** - Sites like Ajanta Caves (with murals), Sanchi Stupa, and Borobudur (Indonesia) display exquisite artistic achievement.

What are the significances of Buddhism in contemporary India?

- **Recovering from Self Obsession** - In an era of social media obsession, the world is increasingly getting obsessed with self-promotion.
- Often, a 'perfect' identity is carefully curated on social media with a focus on the self.
- The teachings of the Buddha said thousands of years ago that the self is an illusion and that our belief in it is the cause of most, if not all, of our sufferings.
- **Promotion of Peace, Non-Violence, and Compassion** - Buddhism's core teachings—non-violence, compassion, mindfulness, and the Middle Path—remain influential in shaping India's moral and ethical landscape.
- These principles are celebrated during festivals like Buddha Purnima and are increasingly recognized as universal values relevant to India's pluralistic society.
- **Interfaith Harmony** - Buddhism promotes tolerance and compassion, helping to build bridges in a religiously diverse society.
- **Soft Power** - India leverages its Buddhist heritage as a cornerstone of its soft power and diplomatic outreach, especially within Asia.
    - Initiatives such as the *International Buddhist Circuit*, restoration of Buddhist sites, and the exposition of holy relics serve to strengthen spiritual and cultural ties with Buddhist-majority countries.
- In essence, Buddhism in contemporary India is both a spiritual tradition and a dynamic force for social change, cultural identity, and international engagement.

3. GEOGRAPHY

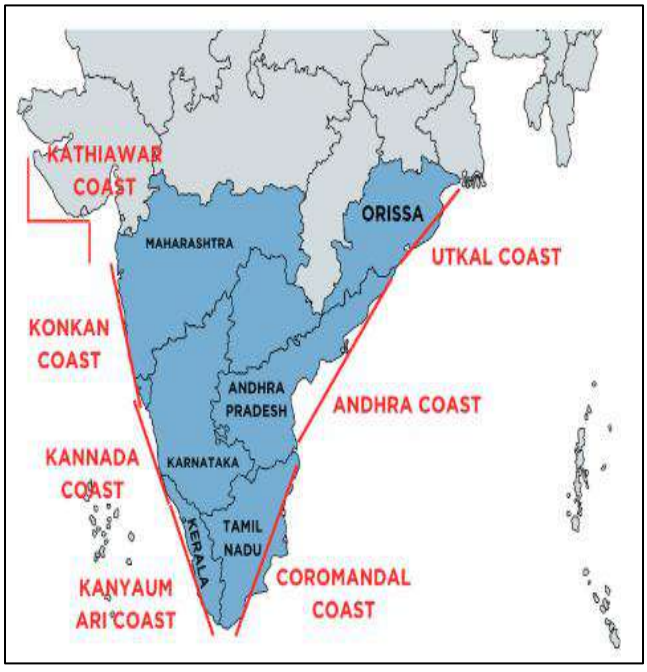
3.1 India's Coastline Increase

Why in News?

India's coastline has been *recalculated as 11,098.81 km from 7,561.60 km*, up by 3,537.21 km or nearly 50 %.

What are geographical indicators of India's Coast?

- **Length of Coastline of India** – As per Ministry of Home Affairs website, it is ***7516.60 Km***.
- **Coastal states of India** – There are 9 coastal states and 4 coastal union territories.
    - **9 coastal states** - Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamilnadu, Andhra Pradesh, Odisha and West Bengal.
    - **4 coastal union territories** - Puducherry, Andaman and Nicobar Islands, Dadra and Nagar Haveli and Daman and Diu and Lakshadweep.
- Gujarat has the largest coastline followed by Tamilnadu and Andhra Pradesh.



What are the challenges in measuring coastal length?

- **Coastline Paradox** - The British mathematician and physicist Lewis Fry Richardson first identified the coastline paradox in the early 1950s.

- **Fractals** - French peer Benoît Mandelbrot examined the problem mathematically in 1967 and found that coastlines exhibit properties similar to fractals.
- **Ruler Dependency** – Measurement of the coastal length depends on the length of the measuring stick.
    - **For example**, measuring a coastline with a 200-km-long ruler would smooth over most inlets and bends — but a 50-km ruler would detect them.
- At 1 km, the measurement will capture every estuary, tidal flat, and creek and so the more one refines the scale of the ruler, the longer the total coast becomes.

> ***Coastlines are not true fractals*** *in the pure mathematical sense but display fractal-like properties.*

State/Union Territory	Onshore Islands	Onshore Islets	Offshore Islands	Offshore Islets	Total
Gujarat	95	13	33	3	144
Maharashtra	88	17	14	1	120
Goa	38	1	2	0	41
Karantaka	86	2	12	0	100
Kerala	7	0	0	0	7
Tamil Nadu	24	2	1	1	28
Andhra Pradesh	12	8	2	10	32
Odisha	13	0	1	2	16
West Bengal	14	0	9	0	23
Daman and Diu	5	4	0	0	9
Lakshwadeep	28	5	0	0	33
Andaman and Nicobar	649	187	0	0	836
Total	1,059	239	74	17	1,389

Why was India's coastal length increased?

Change in Calculation Method - Earlier measurements have relied on simplified straight-line distances, whereas the current approach, *uses the fractal method* that captures every curve and contour, resulting in a more accurate and longer coastline measurement.

- **Change in the Scale**- The previous estimate of 7516 km from the 1970s banked on maps that displayed India's coastline at a 1:4,500,000 resolution.
- The more recent updated measurement, performed by the National Hydrographic Office (NHO) and the Survey of India, used electronic navigation charts at a much finer scale of 1:250,000.

NEW PARAMETERS

- While earlier method relied on straight-line distance, new one **factors in complex coastal formations such as bays, estuaries and inlets**
- Tamil Nadu's coast, with a revised length of 1,068km, has overtaken Andhra (1,053km)
- **Puducherry's coastline shrinks** 4.9km, a departure from general upward revision

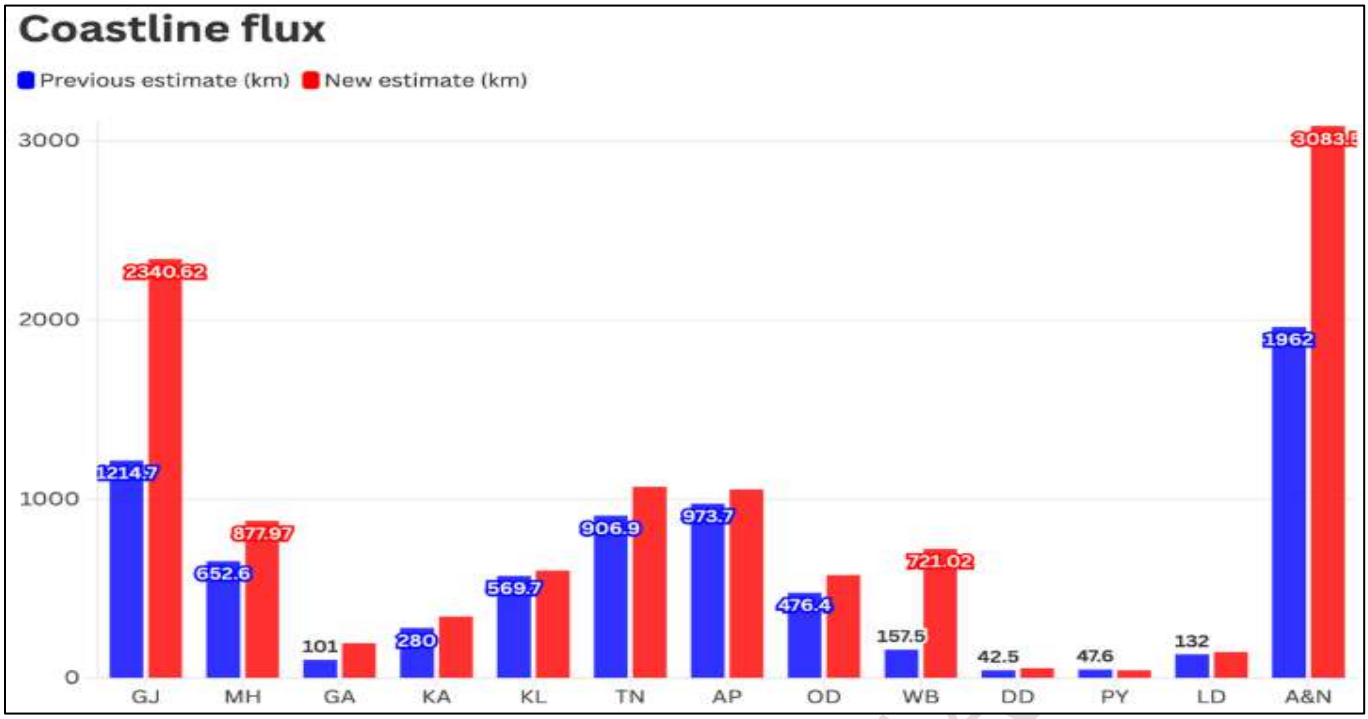
The larger the scale of the map, the greater the length's outcome, because larger-scale data capture more intricate details like bays, inlets, and minor irregularities that are smoothed out at smaller-scale data.

- **Updated High Waterlines** - The Survey of India used highwater lines prepared by the NHO based on 2011 data on electronic navigation charts to measure the coastline.
- The highwater line was used as the base reference and river mouths and creeks were closed off at a fixed threshold inland.
- **Addition of Coastline of Individual Offshore Islands** - Peripheral coastline (high-water line) of individual offshore islands has been used to calculate coastline length.
- **Inclusion of new islands** - About 1,389 islands/islets which were not included when the survey was done in 1970 were added to the list, to define the coastal boundaries of all Indian states and Union territories.

> *The revised coastline will be* ***reviewed every 10 years*** *using updated datasets.*

LENGTH OF COASTLINE OF INDIA (AS PER SOI IN KM)

State/Union Territory	Coastline Length
Gujarat	2340.62
Maharashtra	877.97
Goa	193.95
Karnataka	343.30
Kerala	600.15
Tamil Nadu	1,068.69
Andhra Pradesh	1,053.07
Odisha	574.71
West Bengal	721.02
Daman and Diu	54.38
Pondicherry	42.65
Lakshwadeep	144.80
Andaman and Nicobar	3,083.50
Total	11,098.81



What are the implications of updated coastal length?

- **Maritime Security** - A longer coastline means a longer length to protect and recalibrate its maritime security framework.
- **Disaster Preparedness** - India has 11 coastal States and two large island groups, faces regular cyclones, and is especially vulnerable to sea-level rise.
- Understanding the true extent of the national coast can thus help refine climate models, coastal zoning regulations, and disaster response strategies.
- **Updating the Economic Zone** - The revision impacts the calculation of India's Exclusive Economic Zone (EEZ), potentially expanding rights over marine resources, including fisheries, oil, gas, and minerals.
- **Coastal Regulation** – Changes in coastal length requires updating Coastal Regulation Zone (CRZ) norms and coastal zone management plans, which govern construction, development, and conservation along the coast.
- **Better Planning and Policy Making** - The revised measurements inform better planning for coastal infrastructure, including ports, industrial zones, and tourism projects.
- **Updating Learning Materials** – The official announcement of the updated length needs to be updated in all the relevant books.

4. SOCIAL ISSUES

4.1 Regional Variation of TFR

Why in News?

The Sample Registration System (SRS) Statistical Report of 2021 reveals a wide regional variation in Total TFR data for States and Union Territories (UTs).

What is the status of TFR across India?

- **Total Fertility Rate (TFR)** – It represents the average number of children a woman is expected to have during her reproductive age between 15 and 49 years.
- **National TFR** - It has remained at 2.0 in both 2020 and 2021, according to SRS 2021 report.
    - Highest TFR - It was recorded in Bihar at 3.0
    - Lowest TFR – It was reported for West Bengal and Delhi at 1.4.

- **Overall Change** - In the decade between 2009-11 and 2019-21, TFR has been on an overall decline, in States,and nationally, albeit at different rates.
- **Below Replacement Rate** – The TFR of India at 2.0 has *come down below the replacement level of 2.1*.
- According to the TFR data for 2021, just 6 States had TFR above the replacement level of 2.1.
    - Bihar (3.0), Madhya Pradesh (2.6), Jharkhand (2.3), Uttar Pradesh (2.7), Chhattisgarh (2.2), and Rajasthan (2.4).
- All other States had reported a TFR at or below the replacement level.
- **Changes in Crude Birth Rate** - India's CBR is at 19.3 for 2021, which has declined at a rate of 1.12% every year from 2016 onwards.
    - Among the States and UTs, the rate of decline in CBR is highest for Kerala, Tamil Nadu, and Delhi, where the CBR is declining at almost twice the rate of the national average.

> *The **replacement level TFR** is measured as the number of children each woman should have for each generation to replace the previous generation's population.*

What are the causes of regional variations of TFR?

- **Socioeconomic Development** - Regions with higher levels of education, especially female literacy, and greater economic prosperity tend to have lower fertility rates.
- **Educational Attainment** - Higher educational attainment is associated with delayed marriage, increased workforce participation, and a preference for smaller families, leading to lower fertility rates
- Variation in literacy rate, higher education enrolment has consequent effect on fertility level.
- **Cultural and Social Norms** - Traditional norms and beliefs about family size, gender roles, and early marriage are more prevalent in certain regions, particularly in less developed or rural areas, contributing to higher fertility rates.
- In contrast, regions such as Tamil Nadu, Kerala with progressive attitudes toward women's roles and family planning see lower fertility
- **Variations in Public Health Systems** - States with robust health systems and easy access to contraception experience lower rates of unintended births and overall fertility.

What are the potential effects of regional TFR variation?

- **Demographic Impacts** - Regions with higher TFRs tend to have younger populations, while those with lower TFRs face population aging.
- It can lead to uneven age structures across India, affecting dependency ratios and long-term demographic stability
- **Economic Consequences**
    - High fertility regions - They may experience greater pressure on resources, public services, and infrastructure, potentially slowing economic development and exacerbating poverty
    - Low TFRs regions – They may face labour shortages, reduced workforce growth, and challenges in sustaining economic productivity as their populations age.
- **Policy and Governance Challenges** - Regional TFR differences can complicate national policy planning, especially in federal systems where resource allocation and representation may be linked to population size.
    - For example, finance commission fund allocation and delimitation exercises.
- **Internal Migration** - Uneven fertility decline can exacerbate regional inequalities in development, health outcomes, and opportunities.
- This may lead to migration from high-fertility, less developed regions to low-fertility, more prosperous areas, further influencing regional demographics and economies.

What lies ahead?

- Quality reproductive health services, contraception access, and maternal care can be strengthened in northern and central states (e.g., Bihar, Uttar Pradesh, Madhya Pradesh), where fertility remains above replacement level.
- Policies can be updated to target infrastructure, employment, and social welfare in less developed regions to address root causes of high fertility.

- Southern and western states with TFRs below replacement need to strengthen social security, healthcare, and pension systems to support an aging population.

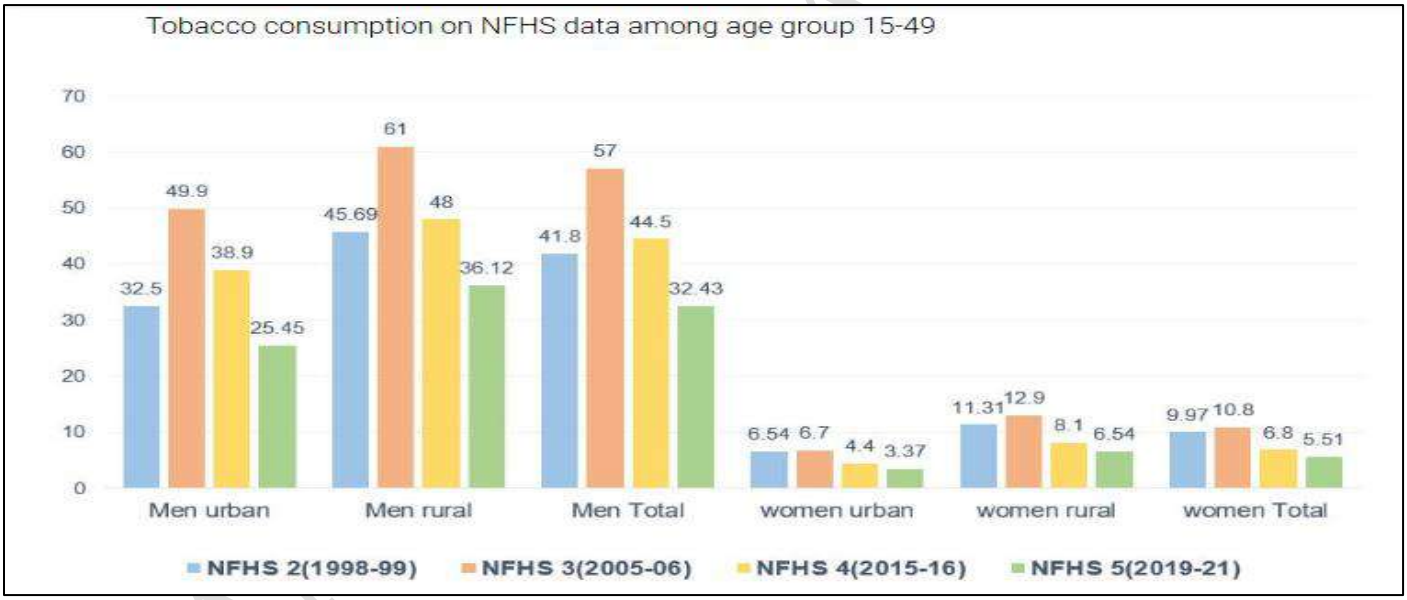
4.2 Tobacco Menace

Why in News?

World No Tobacco Day is observed around the world every year *on 31 May*.

What is the status of tobacco usage in India?

- **Tobacco Usage** - India has one of the highest numbers of tobacco users globally, with 28.6% –29% of all adults in the country.
- **High Male Users** - According to Global Adult Tobacco Survey (GATS) data, nearly 42% of men and 14% of women in India use tobacco.
- Prevalence is highest among men aged 50–64 (52.8%) and among women aged 65+ (18.6%).
- **Smokeless Tobacco Usage** (SLT) – *Home to 70% of the world's smokeless tobacco (SLT)* users, SLT is preferred over smoked tobacco.
- **Smoked Tobacco** - In smoked tobacco, the *bidi is favoured over cigarettes*, especially in rural and low-income groups.
- **Increase in Usage of Cigarettes** - Despite the preference for bidis, India has seen the largest increase in the market share of cigarettes globally.
- **Regional Usage** - Most Indian states have seen a decline in the NFHS-5 survey in male tobacco use, except for Sikkim, Goa, Bihar, Gujarat, Himachal Pradesh, and Mizoram.



What are the impacts of tobacco usage?

- **Common Health Risk Factor** - Smoking is the most common risk factor for the 5 of the top 10 causes of mortality in the world.
- According to the World Health Organization, these include ischemic heart disease, stroke, chronic obstructive pulmonary disease (COPD), lower respiratory infections and trachea, bronchus and lung cancers.
- **Cancer** - Both SLT and smoked tobacco drastically increase cancer risk, particularly for lung, head, neck, stomach, and pancreatic cancers.
- India ranks first globally in male cancer incidence and mortality rates.
- Among tobacco-related cancers in males, lung cancer leads globally, while in India, lip and oral cancers top the list, followed by lung cancer.

> ***Smoked tobacco products*** *contain over 7,000 chemicals including at least 250 known to be toxic or to cause cancer, the WHO states.*

- **Affects Body Function** – Smoking also causes skin damage, hearing and vision loss, impact fertility and cause erectile dysfunction.

- **Reduction in Life Expectancy** - 1 cigarette can steal 20 minutes of your life expectancy, researchers in the U.K. estimate.
- **Loss of Productive Years** - Smoking primarily eats into the relatively healthy middle years rather than shortening the period at the end of life, which is often marked by chronic illness or disability.
- So, a 60-year-old smoker will typically have the health profile of a 70-year-old non-smoker.

Over 1.3 million lives are lost every year to cancers caused by smoking tobacco across 7 countries, including India, according to 'The Lancet's eClinical Medicine' journal.

- **Economic Burden** - Along with the health burden, tobacco use imposed an economic cost of 1.04% of India's GDP (₹1.77 lakh crore) in 2017-2018.
- Smoking accounted for 74% of these costs, while SLT use made up 26%.

Government Initiatives on Tobacco Control

- **COPTA Act** - Cigarettes and Other Tobacco Products Act (COTPA) 2003, which is applicable in all states, prohibits smoking in public areas, around educational institutions, and in advertisements for tobacco products.
- **National Tobacco Control Programme (NTCP)** – It was introduced in 2007–2008 intended to improve the implementation of tobacco control policies under the COTPA.
- **mCessation Programme** - A digital initiative offering help to quit tobacco via mobile phones by sending an SMS (QUIT to 56161).
- **Tobacco-Free Educational Institutions (ToFEI) Guidelines** - Issued by the Ministry of Health and Family Welfare, it prohibits the sale and use of tobacco products within 100 yards of educational institutions.
- **FSSAI Regulation** - The use of tobacco and nicotine in food items is also prohibited by Regulation under Food Safety and Standards (Prohibition and Restrictions on Sales) Regulations 2011, which means that gutka is prohibited.
- **Prohibition of Electronic Cigarettes** - The production, manufacture, import, export, transport, sale, distribution, storage, and advertisement of electronic cigarettes has been prohibited under the Prohibition of Electronic Cigarettes Act, 2019.
- **Pictorial Health Warnings** - India mandates 85% of the packaging space must include graphic and text warnings on all tobacco product packages.
- **Media Health Warnings** - Films, including those released on OTT platforms, must include anti-tobacco health spots of at least 30 seconds at the beginning and middle of the film.
- On 31 May 2023, the Ministry of Health and Family Welfare (MOHFW) notified amendments to COTPA 2023, updated tobacco control guidelines to issue disclaimers and warnings in online content.
- **Periodic Survey** - Global Adult Tobacco Survey (GATS) & NFHS Survey are conducted to monitor the usage trend of tobacco in the country.
- **MPOWER measures** - The WHO Framework Convention on Tobacco Control (WHO FCTC) and its guidelines provide the foundation for countries to implement and manage tobacco control.
- MPOWER measures are intended to assist in the country-level implementation of effective interventions to reduce the demand for tobacco, contained in the WHO FCTC.

What are the challenges in controlling tobacco menace?

- **Lack of Enforcement** - Implementation of ban on public smoking remains patchy and so the public smoking has been rising.
- **Availability of variety of Forms** – The widespread availability of tobacco in various forms makes them easily accessible and normalize their use, particularly among young people and vulnerable populations.
- **Illegal Sale** – Despite the various ban tobacco products, the illegal manufacturing, distribution and sales of electronic cigarettes and smokeless tobacco are flourishing.
- **Tobacco Industry's Influence** — Through policy interference, pricing tactics to maintain affordability, targeted marketing, dense tobacco shop networks ensure widespread tobacco accessibility.
- **Ineffectiveness of Price Deterrence** - Unlike in other countries where higher prices have deterred smoking, rising disposable incomes in India, particularly among the 450 million middle class have outpaced tax increases.

- With increased purchasing power, tobacco products continue to be affordable.
- **Under Shifting of Taxes** - Tobacco industry absorbs a portion of a tax increase instead of fully passing the increase on the prices to consumers to keep it affordable.
- **Unit Sales** - To enhance affordability, cigarettes are often sold as single sticks - a practice banned in 88 countries but not in India.
- Tobacco affordability undermines the government efforts in reducing tobacco usage.
- **Cultural Normalization** - Tobacco use has become socially acceptable as a result of cultural normalisation, with urban regions having higher cigarette smoking rates (5 %) than rural areas (3 %).

What needs to be done to control the tobacco usage?

- India faces a dual challenge of significant health and economic burdens from tobacco-related cancers and the complexities of lung cancer screening in a TB-endemic country.
- This underscores the urgent need for evidence-based anti-tobacco policies as a primary prevention strategy.
- **Reducing the Affordability** - Regular tax hikes that outpace income growth can make tobacco products unaffordable, discouraging their use
    - As recommended by World Health Organization, all tobacco products *can be taxed at 75% of its MRP* to effectively deter use.
- **Price Fixation** - Along with tax increase, a minimum retail price can also be set and increased to prevent the under shifting tactics of tobacco industries.
- **Banning Loose Sales** - Banning single-stick sales can reinforce health warnings and curb impulse purchases.
- **Packaging Control** - Enforcing plain packaging with prominent health warnings can also reduce tobacco's appeal.
- **Robust Enforcement** - Sales near tea stalls needs to be restricted through regular inspections and penalties to help break the 'chai-sutta' association.
- **Public Outreach** - Prioritising cancer screening, tobacco-cessation programmes can further bolster tobacco control efforts, ultimately creating a comprehensive approach to tackle tobacco use.

The Tobacco GST rate for all types of its products is 28%, except for tobacco leaves which is taxed at 5%.

G. S. PAPER II

5. INDIAN POLITY

5.1 Reforms for India's District Courts

Why in News?

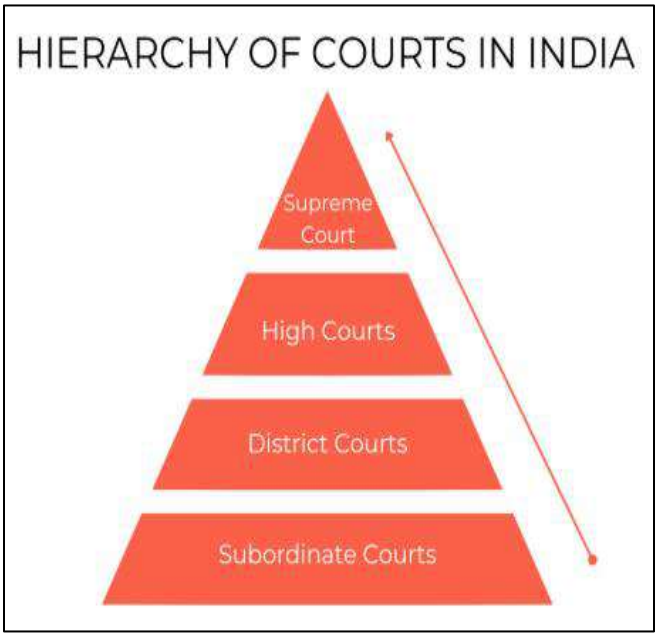
Recently a book on judicial reform "Tareekh Pe Justice: Reforms for India's District Courts (Simon & Schuster)" by Prashant Reddy T. and Chitrakshi Jain was released.

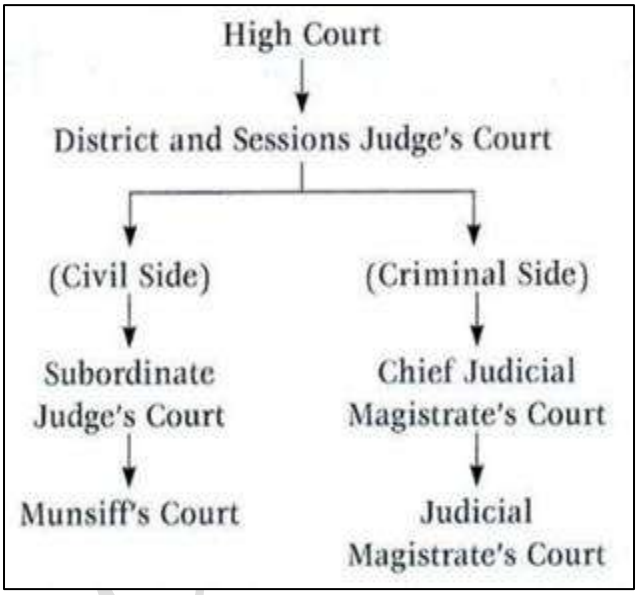
What is role and position of lower courts in India?

- The Indian Constitution establishes a judicial system that is integrated as well as independent.
- This single system of courts, adopted from the Government of India Act of 1935, enforces both Central laws as well as the state laws.
- **Hierarchy of Indian courts** – The Supreme Court stands at the top of the integrated judicial system in the country.
- Below it, there are high courts at the state level.
- Under a high court, there is a hierarchy of subordinate courts, that is, district courts and other lower courts.
- **The state judiciary** – It consists of a high court and a *hierarchy of subordinate courts, also known as lower courts*.

- **The subordinate courts** – They arc so-called because of their subordination to the state high court.
- They function below and under the high court at district and lower levels.

Articles 233 to 237 in Part VI *of the Constitution make the provisions to regulate the organisation of subordinate courts and to ensure their independence from the executive.*





What are the significances of district and lower courts?

- District and lower courts are indispensable for delivering justice at the grassroots, maintaining the rule of law, and ensuring the judicial system functions efficiently and equitably across India.
- **First point of justice** – They are the first and often the only point of contact for most Indian litigants.
- **Backbone of the judiciary** – They adjudicate the vast majority of civil and criminal cases across the country.
    - District courts manage a substantial caseload, approximately 1.13 million cases daily.
- **Decentralized justice delivery** – They make justice more accessible and affordable for ordinary citizens, especially those in rural and remote areas.
- **Constitutional recognition and independence** - The independence of district judges is constitutionally protected, and the Supreme Court has emphasized their importance, rejecting the term "subordinate judiciary" to highlight their vital constitutional role.

What are the issues in lower judicial system?

- **Dilapidated facilities** - *Over 40% of district and subordinate courts lack basic facilities* such as modern computers, reliable internet, and video-conferencing equipment.
- Poor infrastructure is a major bottleneck affecting court efficiency and access to justice
- **Burgeoning case backlogs** - A significant backlog exists, with approximately 4.14 to 4.5 crore (41-45 million) cases pending in district and subordinate courts across India.
    - Some cases have been *pending for over 30 years*, severely delaying justice delivery.
- **Shortage of judicial personnel** - Around 30% of judicial posts in these courts remain vacant.
- **Procedural delays** - Frequent adjournments, stay orders from higher courts, and difficulties in securing witness presence cause additional delays.
- **Threat of retribution** - Former Chief Justice of India D.Y. Chandrachud said that district judges operate under the looming threat of retribution, acutely aware that delivering a verdict perceived as unpalatable to the ruling dispensation could invite disciplinary proceedings.
- **Culture of opacity** - Lack of transparency and accountability in its functioning leads to concerns about public trust and the integrity of the system.
- **Data unreliability** - National Judicial Data Grid (NJDG) disclaimer states that the data displayed is for informational purposes and should not be considered legal evidence.

- It also states that data may contain errors or omissions due to various reasons, including data transmission issues.

What lies ahead?

- Meaningful judicial reforms can begin at the level of the district courts.
- Jury trials can be reintroduced to foster civic engagement.
- Procedural law can be strengthened in ensuring fairness and predictability in adjudication.
- Re-engineering court procedures can simplify court procedures, improve case management, and reduce delays in case disposal.
- Court infrastructure, including better facilities for courtrooms and judicial staff can be improved.
- Use of virtual courts for certain types of cases (like traffic violations) can reduce the need for physical court appearances.

5.2 Presidential Reference

Why in News?

Recently President of India has invoked the Supreme Court's advisory jurisdiction on whether timelines could be set for the President and Governors to act on Bills passed by state Assemblies.

What is the Presidential reference?

- **Article 143** – The President may refer a "question of law or fact" to the Supreme Court for its opinion.
- It is part of the Supreme Court's advisory jurisdiction, exclusively dedicated to the President of India.

Origin of Article 143
• The concept of advisory jurisdiction in India arose from the Government of India Act, 1935. • The Government of India Act, 1935 under section 213 stated that if the Governor- General thinks that a situation has arisen or may arise where a question of fact or question of law may come up, he may refer such a matter for advice to the federal court. • The federal court was empowered to conduct proceeding on such matters as it deems fit, and furnish advice to the governor- general.

- **Article 145(3)** - It requires any such reference to be heard by 5 judges, after which the SC returns the reference to the President with the majority opinion.
- **Non-Adversarial Nature** - It is consultative, not a dispute between parties — focused on advice rather than judgment.
- **Discretion of Supreme Court** – Under article 143(2) of Constitution of India, the Court is under an obligation to advise the President on issues relating to matters mentioned under the proviso of article 131.
- The Court may also decline to give opinion on the references.
    - In Ayodhya case of 1992, Supreme Court declined to give an opinion, stating it was not a question of law.
- **No binding on President**- The advises given by the supreme courts is not binding on the President.
- **Advisory but Influential** - Though opinion is not legally binding but is treated with high moral and legal respect.

> ***Article 131*** *establishes the Supreme Court's original jurisdiction on legal disputes, particularly those between the Union government and states, or between states themselves.*

- **Exclusion of Settled Questions** - The President cannot refer matters that have been conclusively resolved by the Supreme Court in its adjudicatory role.

President's 14 Questions to Supreme Court	
1. What are the constitutional options before a Governor when a Bill is presented to him under **Article 200** of the Constitution of India?	9. Are the decisions of the Governor and the President under Article 200 and Article 201 of the Constitution of India, respectively, justiciable at a stage anterior into the law coming into force? Is it permissible for

2. Is the Governor bound by the **aid & advice tendered by the Council of Ministers** while exercising all the options available with him when a Bill is presented before him under Article 200 of the Constitution of India? 3. Is the exercise of **constitutional discretion by the Governor** under Article 200 of the Constitution of India justiciable? 4. Is **Article 361** of the Constitution of India an absolute bar to the judicial review in relation to the actions of a Governor under Article 200 of the Constitution of India? 5. In the absence of a constitutionally prescribed time limit, and the manner of exercise of powers by the Governor, can timelines be imposed and the manner of exercise be prescribed through judicial orders for the exercise of all powers under Article 200 of the Constitution of India by the Governor? 6. Is the exercise of constitutional discretion by the President under Article 201 of the Constitution of India justiciable? 7. In the absence of a constitutionally prescribed timeline and the manner of exercise of powers by the President, can timelines be imposed and the manner of exercise be prescribed through judicial orders for the exercise of discretion by the President under Article 201 of the Constitution of India? 8. In light of the constitutional scheme governing the powers of the President, is the President required to seek advice of the Supreme Court by way of a reference under **Article 143** of the Constitution of India and take the opinion of the Supreme Court when the Governor reserves a Bill for the President's assent or otherwise?	the Courts to undertake judicial adjudication over the contents of a Bill, in any manner, before it becomes law? 10. Can the exercise of constitutional powers and the orders of/by the President / Governor be substituted in any manner under **Article 142** of the Constitution of India? 11. Is a law made by the State legislature a law in force without the assent of the Governor granted under Article 200 of the Constitution of India? 12. In view of the proviso to **Article 145(3)** of the Constitution of India, is it not mandatory for any bench of this Hon'ble Court to first decide as to whether the question involved in the proceedings before it is of such a nature which involves substantial questions of law as to the interpretation of constitution and to refer it to a bench of minimum five Judges? 13. Do the powers of the Supreme Court under Article 142 of the Constitution of India limited to matters of procedural law or Article 142 of the Constitution of India extends to issuing directions /passing orders which are contrary to or inconsistent with existing substantive or procedural provisions of the Constitution or law in force? 14. Does the Constitution bar any other jurisdiction of the Supreme Court to resolve disputes between the Union Government and the State Governments except by way of a suit under **Article 131** of the Constitution of India?

What were previous usages of presidential references?

- **First Usage** - In 1951, India's first President Rajendra Prasad made the first reference to the Supreme Court in relation to provisions of Delhi Laws Act, 1912, the Ajmer-Merwara (Extension of Laws) Act, 1947 and Part C of the States (Laws) Act of 1950.
- The questions on which the opinion was sought related to delegation of legislative powers to the executive.
- **Rights of Minority Institutions** - In 1958, the Supreme Court answered a reference on certain provisions of Kerala Education Bill, 1957, particularly whether the provisions of the proposed law infringed upon the rights of minority institutions.
- **Berubari Union Case** – In 1961, the President sought advice on the implementation of an agreement made by India and Pakistan over transfer of a portion of Indian territory (Berubari Union) to then East Pakistan.
- **Interpretation of Article 289** - In 1963, the Supreme Court answered a reference on the scope and interpretation of Article 289 of the Constitution, relating to the immunity of states from Union taxation.
- **2G Case** - The President sought clarity on various matters such as permissible methods of allocating natural resources like spectrum and the extent of judicial review of policy decisions.

What are the significances of Presidential references?

- **Constitutional Clarity** - Helps the President seek the Supreme Court's opinion on complex legal or constitutional questions.
- **Prevents Legal Uncertainty** - Used to avoid constitutional crises or confusion in interpreting laws before implementation.

- **Strengthens Rule of Law** -Shows that the executive values and respects the judiciary's role in governance.
- **Bridges Executive and Judiciary** - Facilitates coordination between the Executive and the Judiciary within a democratic framework.
- **Guides Government Action** -Helps the government take constitutionally sound decisions, especially on sensitive national issues.
- **Protects Constitutional Morality** - Reinforces the President's role as a constitutional head, upholding neutrality and legality.

What are issues associated with the Presidential reference?

- **Use as Appellate Mechanism** – Often advisory jurisdiction of the Supreme Court is converted into appellate or review jurisdiction, where the court is made to advice on issues already decided by it.
- **Limitation on Supreme Court** - The court cannot check the validity and truthfulness of the facts so mentioned in the reference.
- The court under a reference application cannot go beyond the scope of issues referred to the court, i.e. the court cannot inquire about the matter which is not mentioned in the reference.
- **Politicization Risk** – The provision may be misused to legitimize political or controversial actions.
    - The Ayodhya Reference (1993) attempted to involve judiciary in a religious/political matter.
- **Undermines Parliamentary Debate** - Overuse of Article 143 might bypass the Parliament, where public issues should ideally be debated and resolved democratically.

What lies ahead?

- Presidential reference should not be used to circumvent or overturn the Court's settled judgments.

5.3 Principled Criminalization

Why in News?

The recent Supreme Court of India ruling, in Imran Pratapgarhi vs State of Gujarat, highlighted that principled criminalisation is contingent on the adherence of the police to India's criminal procedure law, the Bharatiya Nagarik Suraksha Sanhita (BNSS).

What is Criminalization?

- **Criminalization** – It is about the state's power to name a wrong/harm as 'crime' and impose 'punishment'.
- It is, equally, about the state's duty to address wrongdoing by holding individuals accountable publicly and administering appropriate penalties.
- **Criminal law** - In a constitutional democracy, Criminal law seeks to ensure that this enormous authority and responsibility is exercised properly.
- **Duty/Power of the State** - Legal philosopher Victor Tadros suggests that the state's duty/power to criminalise wrongful conduct is part of a larger complex duty/power to criminalise, prosecute, convict, publicly condemn and punish the conduct.
- **Social Institution** - Within the broader normative context, criminalisation exists as part of social institutions and practices that address wrongdoing, such as families and private law.
- **Effectiveness of Criminal System** - The full force of criminalisation depends on criminal law and the workings of the criminal justice system.
- **Principles of Criminalization** - Tatjana Hörnle makes a cogent case for three principles that conduct should be criminalised only if
    - It is incompatible with important collective interests.
    - It constitutes a violent attack against other persons.
    - It violates another person's right to non-intervention.
- These principles can be seen at the core of criminalisation under India's substantive criminal law, the Bharatiya Nyaya Sanhita (BNS).

What is the role of police in criminal justice system?

- **Performing functions** - Police spearhead the process of criminalisation by detecting, registering, investigating crime, and, most conspicuously, by arresting suspects.
- **Performance of the system** - The nature and the extent of criminalisation is largely shaped by the regulation and use of police.
- **Crime Prevention** - Police patrol areas to deter crime and maintain public order and they collect and analyse information to anticipate and prevent crime.
- **Investigation and Law Enforcement** - Police investigate crimes, collect evidence, identify suspects and arrest individuals suspected of committing crimes.
- **Maintenance of Law and Order** - Police manage crowds and ensure public safety during events and gatherings and traffic.

What are the problems with over criminalization?

- **Unjust and Excessive Punishments** - Overcriminalization often leads to punishments that are excessive or imposed for conduct that arguably should not be criminalized at all.
- **Overlapping and Duplicative Offenses** - Multiple statutes may criminalize the same conduct, leading to harsher sentences and confusion in the legal system.
- **Erosion of Civil Liberties and Rights** - The expansion of criminal law can restrict freedom of movement, take away civil and political rights, and even result in life-altering consequences for actions that may not warrant such severe responses.
- **Overburdened Justice System** - Overcriminalization contributes directly to prison overcrowding and strains the criminal justice system.
- **Resource Misallocation** - Significant government resources are diverted to policing and prosecuting minor offenses, such as gambling or drug use, rather than focusing on serious crimes.

What lies ahead?

- Principled criminalisation is central to the legitimacy of the state's power to criminalise.
- It is as crucial for substantive law to be defined by judicious principles as it is for procedural law to be able to control the actual effects of criminalisation.

6. GOVERNMENT POLICIES AND INTERVENTIONS

6.1 New Education Policy 2020 on Employment and Educational Competitiveness

Why in the News?

Recently, Union Education Minister emphasised the importance of fully implementing the National Education Policy (NEP) 2020 for India to become a developed nation.

How does the National Education Policy 2020 improve employability?

- **Skill Development** - NEP 2020 emphasizes the *integration of vocational education and skill development* at the school and college levels.
- **Strengthening Industry-Academia Collaboration** - It promotes mechanisms like internships, vocational training, and *joint research initiatives* to bridge the gap between academia and industry.
- **Practical Learning** – Strong *industry-academia linkages* enable students learn hands on directly from industries and enhances their employability outcome.
- The *apprenticeship programs* provide on-the-job training at industry establishments and include a stipend, partially funded by the government.
- **Research Internship Programme** - To enable an original and innovative research universe, a vibrant research internship programme for undergraduate and postgraduate students has evolved in higher education institutions.
- **Reduces Drop-Out Rate** – ***National Credit Framework (NCrF)*** to allow for multiple entry and exit points in higher education, enabling students to pursue their careers while simultaneously earning credits and completing their degrees.
- It enables them to pursue diverse career trajectories with tangible credentials.

- **Holistic Development** - NEP 2020 emphasizes a holistic approach to education, ensuring students develop not only academic knowledge but also soft skills, leadership qualities, and ethical understanding, which are important for career success.

Employment Progress After NEP 2020

- **Increase in Employment Rate** - From 2018-19 on, there has been *constant growth in the employment rate* of educated youth.
- By 2023-24, the overall employment rate increased to 38.6% and the employment rate of men was 53.4% and that of women at 22.7%, approaching 2004-05 levels.
- For all age groups, also, employment grew after 2017-18, touching 43.7% in 2023-24.
- **Increase in Formal Work** - The *proportion of regular workers has grown*, particularly for men from 17.2% in 2004-05 to 24.88% in 2023-24.
- **Decline in casual labour** – It has *decreased for females* (30.31% to 16.68%) and overall (28.85% to 19.83%) as per NSS employment and unemployment and Periodic Labour Force Survey (PLFS) data.

How have NEP 2020 enhanced the global competitiveness of Indian education?

- **Global Rankings** - *11 Indian universities feature in the QS 500 listing* and India also has the highest representation in the QS Asia Rankings 2025.
- 10 higher education institutions (including six Indian Institutes of Technology, and two Indian Institutes of Management) placed in the global top 50 across various disciplines.
- **Improvement in Performance** - Under subject-specific performance, Indian institutions recorded a 25.7% jump in total entries (533).
- **Increase in Patents** - Patents filed by Indian higher education institutions have grown from 7,405 in 2021-22 to 19,155 in 2022-23, which is a *158% increase*.
- **Moving Up in Innovation** - India's performance in the Global Innovation Index has moved up to 39th, which is an exponential improvement from a decade ago, when India was 76.
- **Fostering Research** - Anusandhan National Research Foundation (ANRF), All India Council for Technical Education's (AICTE), Idea Development, Evaluation and Application (IDEA) labs have all contributed in giving depth to the Indian research universe.
- **Strengthening International Collaboration** - Scheme for Promotion of Academic and Research Collaboration (SPARC) has been instrumental in *fostering a culture of research and innovation* by facilitating collaborative projects between Indian and foreign educational institutions.
- It has identified educational partners from 28 countries, which include the United States, the United Kingdom, Germany, Australia and France to advance joint research efforts.
- **Promoting Grassroot Innovations-** Initiatives such as the Smart India Hackathon are nurturing innovation at the grass-root level.
- Since inception, it has empowered over 13.9 lakh students, with idea submissions growing sevenfold since 2017.

What lies ahead?

- NEP 2020 is a significant step towards modernizing India's education system and enhancing its competitiveness in the global landscape.
- While it offers a comprehensive framework for educational reform, its successful implementation requires significant resources, infrastructure, and policy changes.
- Ensuring equitable access to quality education for all students, including those from disadvantaged backgrounds, is a major challenge that needs to be addressed.

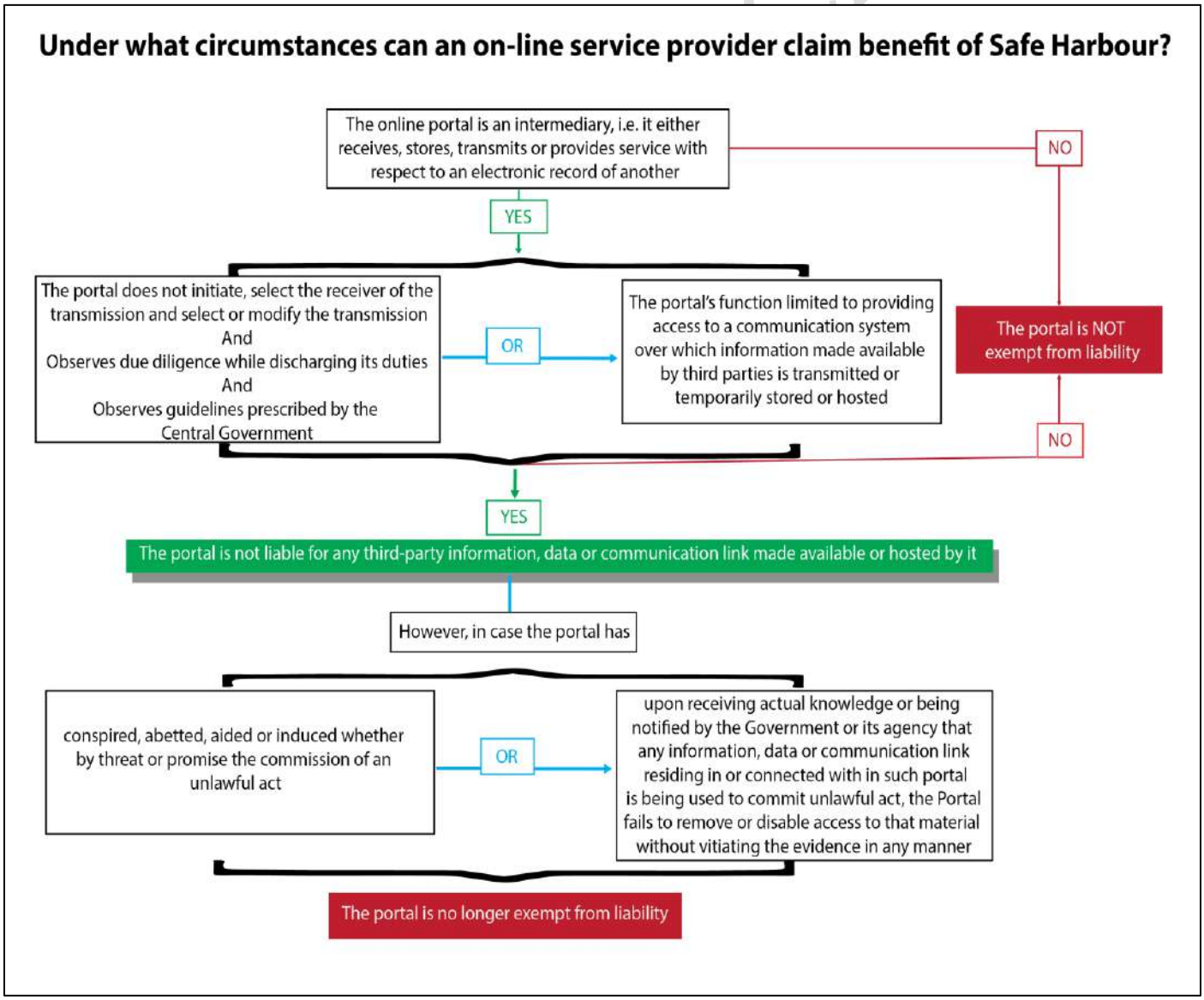
6.2 Safe Harbour for Social Media

Why in News?

Union Ministry of Information and Broadcasting is reconsidering the concept of safe harbour for social media platforms, to combat the issue of "fake news" online.

What is safe harbour?

- **Safe harbour** – It is a legal concept that *protects individual websites* that allow third party users to share content from legal liability for any unlawful posts.
- Safe harbour *protects sites, by default, from any criminal action* for content hosted by them.
- **Objective** – It acts as a safeguard to encourage innovation online and prevent website owners from being unfairly hounded for content they had no hand in publishing.
- **Intermediary liability** - The concept of a middleman being responsible for third party content is known as intermediary liability.
- **Safe Harbour in US** - It is enshrined in Section 230 of the Communications Act of 1934, inserted into the decades-old law in 1996.
- **Safe Harbour in India** ***– Section 79 of the Information Technology Act, 2000***, grants intermediaries' similar protections.
- **Conditional liability** - In India, if an intermediary receives "actual knowledge" of illegal content on their website, they lose liability protections under Section 79 if they don't work to take the content down within a certain time period.
- The Supreme Court has read down "actual knowledge" to mean a court order or government notification.
- **Effect of liability** - Without safe harbour protections, online intermediaries could face tremendous consequences for illegal content.
    - For instance, in 2004, the then head of the website eBay in India was arrested because of a user listing of a disk containing child sex abuse material for sale.



How are intermediary liability protections regulated in India?

- **IT Rules Condition** - The Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021 has put in place additional conditions for platforms to retain protection from intermediary liability.
- **Grievance Redressal Mechanism** - Social media firms need to have a nodal officer, a grievance officer resident in India.
- **Periodic Reporting** – Social media firms need to periodically submit reports of complaints they receive on content, and action taken against them for this.
- **Fake News** - IT (Intermediary Guidelines and Digital Media Ethics Code) Amendment Rules, 2023, provides for removal of safe harbour from sites for content that has been notified as "fake news" by the Press Information Bureau's fact check unit.

What is the need for amending the safe harbour clause?

- **Prevent Violation of Laws** - The government has accused foreign social media platforms of flouting Indian laws and acting too slowly on takedown notices.
    - X platform had public confrontations with the Union government regarding orders to hide users' content.
- **Resistance to Remove Contents** – Platforms have been fighting the government's right to issue blocking and takedown orders without notice to users.
- **Proactive Governance** - To get platforms to be more proactive in governing their sites, not just for what they deem to be misinformation, but for AI-generated deepfakes, cyberfraud and so on.
- **Prevent Evasion of Responsibility** - Safe harbour clause allows social media platforms to evade accountability for harmful or illegal content, including misinformation, hate speech, and explicit material
- **Insufficient Grievance Redressal** - There are concerns that platforms have not been effective in addressing user grievances related to objectionable or harmful content.
- These issues prompt the government to consider stricter oversight and the formation of grievance appellate committees.

What are the potential consequences of repealing safe harbour clause?

- **Increased Legal Liability** - Without safe harbour protection, social media platforms would face direct civil and criminal liability for any unlawful or problematic content posted by users.
- **Mass Censorship** - To avoid legal risk, platforms would likely over-censor content, removing or restricting posts pre-emptively even those that are lawful or merely controversial15.
- This could lead to a chilling effect on free expression and undermine the open, participatory nature of the internet
- **Threat to Platform Viability** - If repealed, the operational and legal risks could be so high that many platforms may find it unsustainable to operate in India or would drastically curtail their services
- **Impediments to Innovation** - The fear of liability would discourage investment and innovation in the digital ecosystem, as new entrants and startups may not have the resources to manage the legal risks associated with hosting user content.
- **Burden of Content Moderation** - Platforms would be forced to monitor and vet every piece of content before publication, an impossible task at scale, leading to delays, errors, and increased operational costs.
- **Risk of Government Overreach** - In the absence of safe harbour, governments could exert more control over what content is allowed online, potentially leading to arbitrary censorship and suppression of dissenting voices

What lies ahead?

- Safe harbour laws are essential for the functioning and openness of social media platforms, supporting free speech and innovation.
- However, they require careful regulation and periodic updating to ensure platforms do not evade responsibility for harmful content.
- A balanced approach-retaining safe harbour with clear, enforceable obligations for content moderation and transparency-is widely seen as the most effective way forward.

7. EDUCATION

7.1 Changing Educational Landscape

Why in the News?

Recently UGC has released the draft UGC (Minimum Qualifications for Appointment and Promotion of Teachers and Academic Staff in Universities and Colleges and Measures for the Maintenance of Standards in Higher Education) Regulations, 2025.

Why is education the cornerstone of societal advancement?

- **Pursuit of Knowledge** - Education should not be limited to memorizing facts but should encourage students to actively seek knowledge and understand the world around them.
- **Critical Thinking** – It is a higher-order skill that goes beyond memorization, requiring students to analyse, evaluate, and synthesize information.
- **Free Inquiry** - It fosters a culture of intellectual curiosity and independent exploration.
- It encourages students to ask questions, explore different ideas, and challenge traditional assumptions to promote deeper understanding and a more nuanced perspective on various topics.
- **Intellectual Independence** – Education creates the ability and willingness to form one's own opinions and judgments based on critical thinking and independent reasoning, without being unduly influenced by external sources or societal pressures.
- **Nurtured Dissent** – Dissent is important because it's a cornerstone of democracy, ensuring a healthy public discourse, safeguarding minority rights, and preventing the rise of majoritarianism.
- **Progress across Disciplines and Societies** - The boundaries of human understanding were continually pushed through unfettered dialogue and academic exploration.
- **Social Change** - Campuses have played a vital role in catalysing social change such as anti-colonial movements, civil rights struggles, or pro-democracy uprisings.

What are the challenges faced by the educational landscape?

- **Erosion of Academic Freedom** - Bureaucratic controls, External mandates and Ideological gatekeeping creates engines of conformity which affects academic intellectualness.
- **Prioritising Managerial Efficiency** - University leadership, it is now proposed, can comprise administrators drawn from corporate backgrounds rather than only academic.
- These individuals will, understandably, bring with them a managerial mindset that privileges efficiency, quantifiable outputs, and brand visibility over scholarly rigour and pedagogical richness.
- **Corporatisation of Higher Education** – Treating education as businesses and expecting it to generate profit, attract investment.
- This market governance of education increasingly affects what is being taught and why it is taught.
- **Centralisation of Academic Curricula** - Centralised agencies such as the University Grants Commission (UGC) or frameworks such as the National Education Policy (NEP) — increasingly dictate the structure and content of academic programmes.
- An institution that is stripped of autonomy in faculty selection, research direction, and protection of dissent ceases to be a university in any meaningful sense.
- **Performance Pressures** - Academic faculty are increasingly subject to performative pressures, evaluated through metrics such as publication counts and student satisfaction ratings.
- **Standardized Metrics** - The proliferation of global university rankings exacerbates this issue, prioritising conformity to western norms and standardised metrics over indigenous intellectual traditions and context-specific inquiry.

What are the consequences of these challenges on education system?

- **Monolithic Education Ecosystem** - When syllabi are standardised across regions and institutions, the intellectual ecosystem becomes monolithic — devoid of diversity, nuance, or radical innovation.
- **Marginalises Alternative Perspectives** - A narrow focus in education can marginalize alternative perspectives, leading to limited learning experiences and a skewed understanding of the world.
- **Discourages Innovation** - This intellectual flattening not only stifles creativity but also discourages the interrogation of dominant narratives and received assumptions.

- **Decline of Public Intellectuals** - Smothering intellectual climate where fear of dissent trumps inquiry, and conformity is mistaken for collective wisdom, resulting in the decline of public intellectuals.
- **Decline of Value Education** - Disciplines that promise immediate financial returns — such as technology, business, and engineering — receive substantial funding and institutional support.
- Meanwhile, fields that emphasise critical thought, ethical reflection and historical understanding — such as philosophy, literature, and the arts — are sidelined as unproductive or irrelevant.

What lies ahead?

- Universities at all costs should be preserved as a sanctuary of intellectual freedom, where merit is not the casualty.
- Universities can have considerable autonomy to craft syllabi tailored to their students' needs, faculty expertise, and the shifting contours of intellectual inquiry.
- Universities could prioritise appointments grounded in the intellectual ethos of liberal arts and sciences, ensuring that selection procedures are rigorous and objective.

8. GOVERNANCE

8.1 Caste Census

Why in News?

The Cabinet Committee on Political Affairs (CCPA) has approved the enumeration of castes in the upcoming Census.

What is the historical context of caste census?

- **British India (1881–1931)** - The British administration included caste in decadal censuses to categorise the population by caste, religion, and occupation.

> *The most recent caste data available is from the Census of 1931 which put the numbers of **Other Backward Classes (OBC)** at 52% of the then total 271 million population of the country. It became the basis of the Mandal Commission's recommendation in 1980 to grant 27% reservations to OBCs in education and government jobs, which was implemented only in 1990.*

- **Post-independence (1951)** - The newly independent Indian government, led by Prime Minister Jawaharlal Nehru, stopped caste enumeration to avoid reinforcing social divisions.
- The data collected in Censuses since 1951 include the numbers of individuals belonging to the Scheduled Castes (SCs) and Scheduled Tribes (STs), and of various religious denominations.
- But the members of caste groups other than SCs and STs have not been counted.
- **1961 directive** - The central government allowed states to compile OBC lists based on their own surveys, but no national caste census was conducted.
- **Mandal commission (1980)** - The recommendation for 27% OBC reservation brought caste data into sharp political focus.
- The absence of updated caste figures made implementation difficult and contentious.
- **SECC 2011** - Though this UPA-era effort collected caste data, the findings were never fully released or utilised, prompting criticism.
- **State-level surveys** - In recent years, states like Bihar, Telangana, and Karnataka conducted their own caste surveys to guide welfare schemes and reservations.
- Bihar's 2023 survey found that OBCs and Extremely Backward Classes made up more than 63% of its population.

What are the significances of Caste census?

- It could help redesign affirmative action policies, improve representation, and address entrenched inequalities.
- **Evidence-based policy making** – It enables the government to craft targeted and effective welfare schemes.
- **Resource allocation** - A better understanding of caste-based economic disparities can lead to more equitable distribution of government funds, welfare programs, and development efforts.

- **Redesign affirmative action policies** – A caste census is critical to uncover any intersectional disparities and to design policies and programs that are truly equitable and inclusive.
- Much of access to essential services in India—education, healthcare, nutrition, and social protection—is shaped by structural inequalities of caste, region, religion, and economic status.
- **Improving effectiveness and efficiency of Social Welfare Schemes** - It helps identify and target beneficiaries accurately, ensuring that welfare programs reach those who need them most.
- **Rationalizing reservation policies** – It can provide a factual basis for affirmative action, helping evaluate whether current reservation policies are adequately serving marginalized groups or need to be revised.

- **Facilitate sub-categorisation** – It will also be helpful in sub-categorization of caste particularly among the OBCs for reservation in government jobs and education.
- **Social justice and inclusion** – It will empower marginalized communities by bringing visibility to their socio-economic challenges.
- **Implementing women reservation** - The reservation for women in legislatures announced by the government is also dependent on the Census and delimitation.

What are the implementation challenges in Caste census?

- **Deciding the OBC list** - A central OBC list maintained by the National Commission for Backward Classes (NCBC) is used for reservations in central government jobs and educational institutions.
- Separately, each state maintains its own OBC list, which often differs from the central list — and in many cases, includes many more communities.

*In the last **Census for SCs and STs**, the proforma relied on the official lists notified under the Constitution (Scheduled Castes) Order, 1950, and the Constitution (Scheduled Tribes) Order, 1950. These lists — currently comprising 1,170 castes under SC and 890 communities under ST are periodically updated.*

- With the inclusion of caste data, the software will now need to be updated to include a new field for OBCs, along with a drop-down menu of sub-categories.
- **Training the enumerators** - Enumerators will also need to be retrained, especially since many of those identified for the postponed 2020 exercise may have moved on or retired.
- **Complex data handling** - Managing accurate data from thousands of caste categories (many with regional variations) is a huge logistical task.

What challenges may arise after the caste census?

- **Social tension** – While the census aims at social justice, it could also reinforce caste identities, potentially deepening social divides.
- Public access to detailed caste data may lead to resentment or rivalry among groups, especially in the competition for limited resources or reservation benefits
- **Shift in power dynamics** - Detailed caste data can shift the balance of political influence by revealing the true population sizes of caste groups, potentially changing how political parties allocate tickets and build coalitions.
- **Political exploitation** - Caste census data can significantly reshape political discourse, especially in states where caste identity is a primary factor in elections and can be exploited for vote bank politics.
- **Privacy concerns** - Improper handling of caste-related data can breach privacy or expose individuals to discrimination.

What lies ahead?

- Advanced technology can be adapted to significantly reduce the manual effort required to tabulate data, which earlier took months—sometimes years.
- State and Union OBC list could be consolidated and this exercise could then be used as an opportunity to remove the differences between the them.
- Difficulties going to be faced by enumerators can be addressed through proper training and rigorous piloting.
- A pilot exercise could be conducted to understand the challenges and ground realities which can be then extended to national level, based on the learnings from the pilot exercise.
- It must be handled with sensitivity, neutrality, and robust safeguards to avoid worsening social divisions.

9. INTERNATIONAL RELATIONS

9.1 Global Fight Against Terrorism

Why in News?

The Pahalgam terror attack of April 22 has exposed, yet again, the fragmentation in the global fight against terror.

What is the international framework against terrorism?

- **UN Security Council** – It is the principal international organ dealing with international peace and security and has also long been involved in the fight against terrorism.
- Its resolutions are legally binding on member states to combat terrorism.

UNSC Resolutions Against Terrorism
• **Resolution 1373 (2001):** Requires states to prevent and suppress financing of terrorism, criminalize terrorist acts, and improve international cooperation. • **Resolution 1540 (2004):** Aims to prevent non-state actors from acquiring weapons of mass destruction. • **Resolution 2178 (2014):** Focuses on foreign terrorist fighters.

- **United Nations Global Counter-Terrorism Strategy** – It aims to enhance national, regional and international efforts to counter terrorism.
- It was *adopted by consensus in 2006*, thereby all UN Member States agreed to a common strategic and operational approach to fighting terrorism.
- It reaffirms that the members have the primary responsibility to implement this strategy and in preventing and countering terrorism and violent extremism conducive to terrorism.
- **United Nations Office of Counter-Terrorism** – It is responsible for promoting international cooperation in counterterrorism efforts, examining the causes and effects of terrorism and organizing efforts to prevent terrorism and extremism.
- **International Legal Instruments** – There are *19 international legal instruments* that address various aspects of terrorism, such as hijacking, hostage-taking, bombings, and financing terrorist activities.
    - 1970 Hague Convention (Aircraft hijacking).
    - 1997 International Convention for the Suppression of Terrorist Bombings.
    - 1999 International Convention for the Suppression of the Financing of Terrorism.
    - 2005 Nuclear Terrorism Convention.
- **INTERPOL** - It plays a crucial role in counter-terrorism by facilitating international police cooperation, sharing intelligence on terrorist networks, and providing technical support and training to member countries.
- **Financial Action Task Force (FATF)** – It is the global money laundering and terrorist financing watchdog and sets global standards to combat terrorist financing.
- **Global Counterterrorism Forum** – It is an informal, apolitical, multilateral counter-terrorism platform that was launched officially in 2011.
- **Regional Mechanisms** - Many regions have developed their own frameworks such as
    - **European Union** - EU Counter-Terrorism Strategy, Europol, and Eurojust.

- **African Union** - 1999 Algiers Convention on the Prevention and Combating of Terrorism.
- **ASEAN** - Convention on Counter-Terrorism and regional cooperation.

What are the challenges in collective fight against terrorism?

- **Fragmentation in Global Response** - Countries often prioritize their own security concerns, leading to inconsistent approaches to counter-terrorism.
  - Europe is focused on "its" terrorists — right-wing extremism and terror.
  - The U.S., was focused on REMVE, or racially and ethnically motivated violent extremism.
- **Lack of co-operation among countries** - Canada has told India that "*your" terrorists are not "my" terrorists* and that any terrorist threat against India from its soil is covered under its freedom of expression.
- **Geo political constraints** - Geopolitical interests sometimes prevent nations from taking decisive action against terrorism.
- Certain countries block efforts to blacklist terrorists due to strategic alliances.
  - China has blocked proposals submitted by India in 2022 to "black-list", under the UN Security Council 1267 sanctions regime, terrorists operating against India from Pakistani soil.
- **Lack of Strong International Coordination** – Despite many resolutions and conventions by the UNs and Interpol work to combat terrorism, enforcement remains weak due to differing national policies.
- **Emerging Threats** - Terrorist groups increasingly use cyber warfare, social media, and encrypted communication to evade detection.
- **Escapism of responsible organizations** - The Organisation of Islamic Cooperation (OIC) is keen only to use Islamophobia as an excuse to condone terror.
- **State-sponsored terrorism** - India, which is the biggest victim of state-sponsored terror from Pakistan.

What lies ahead?

- Strengthening international efforts against terrorism requires greater cooperation, intelligence sharing, and decisive action.
- Strengthening multilateral frameworks like the UN Global Counter-Terrorism Strategy.
- Diversifying UN Security Council can strengthen the collective effort by strong decisive decisions and actions.
- Regional platforms like SAARC, BIMSTEC can be effectively used to create and enforce regional counter terrorism efforts.

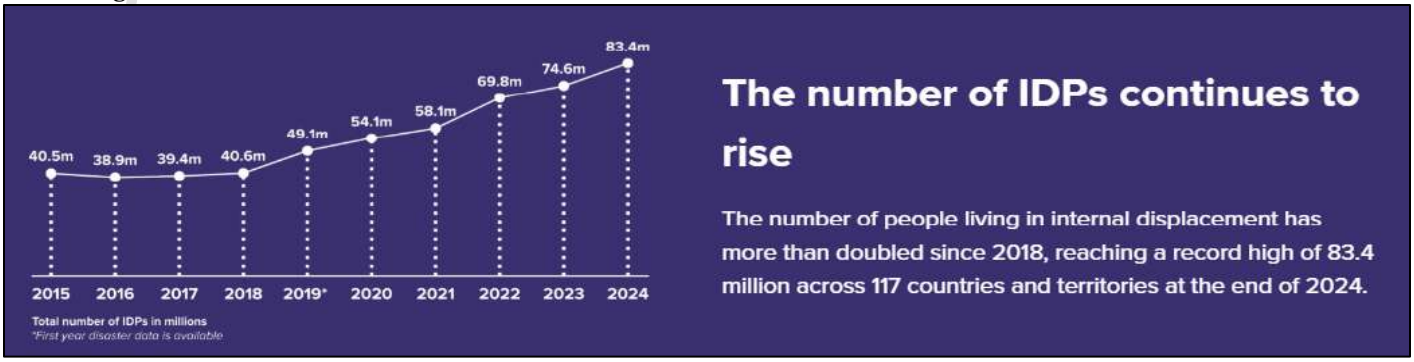
9.2 Internal Displacement

Why in the News?

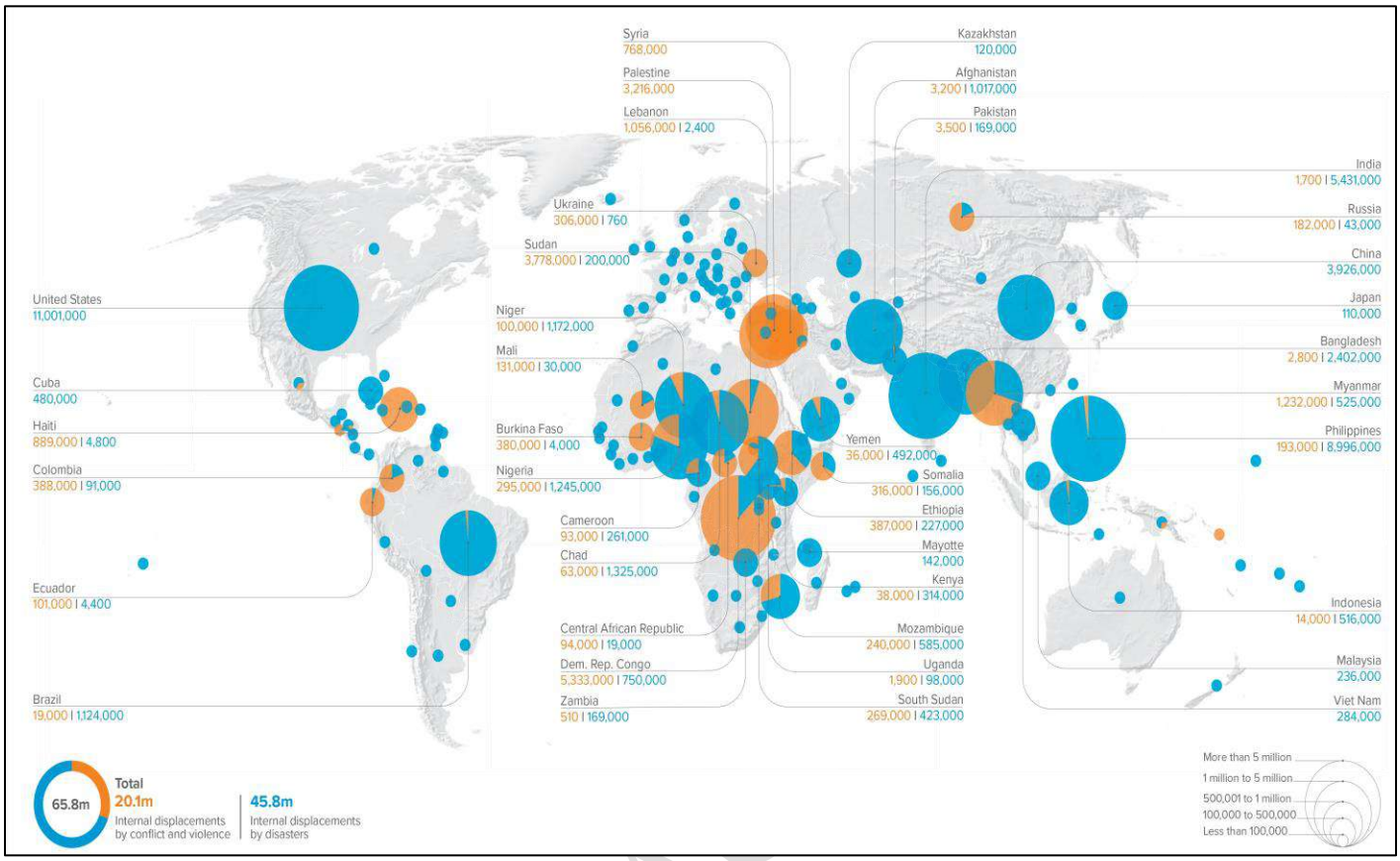
Recently, Global Report on Internal Displacement 2025 was released by the Internal Displacement Monitoring Centre (IDMC) and the Norwegian Refugee Council (NRC).

What is the global displacement crisis?

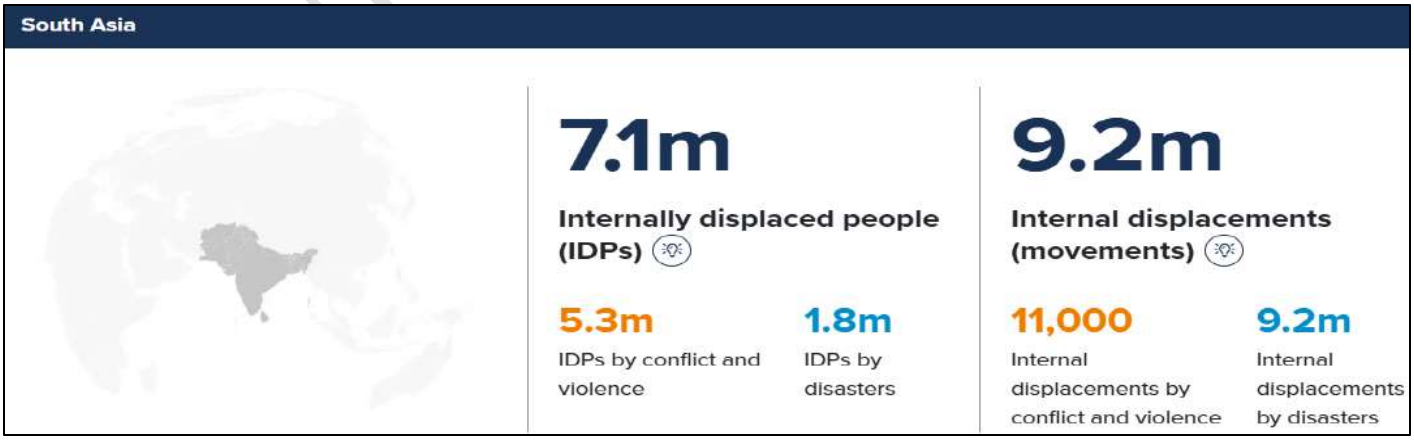
- **Internally displaced people** – It includes those who have been forced to flee their homes as a result of conflict, violence, or disasters and who have ***not crossed an internationally recognized State border***.
- **Internal Displacement Rate** - According to the Global Report on Internal Displacement 2025, the number of people internally displaced within their own countries soared to 83.4 million by the end of 2024—the highest figure ever recorded.



- **Rapidly Worsening Crisis** – The 2024 migration rate marks a doubling of the total figure in just six years highlighting a rapidly worsening global emergency.
- At least ten countries had more than three million conflict-displaced individuals by the end of 2024, double the number from just four years ago.

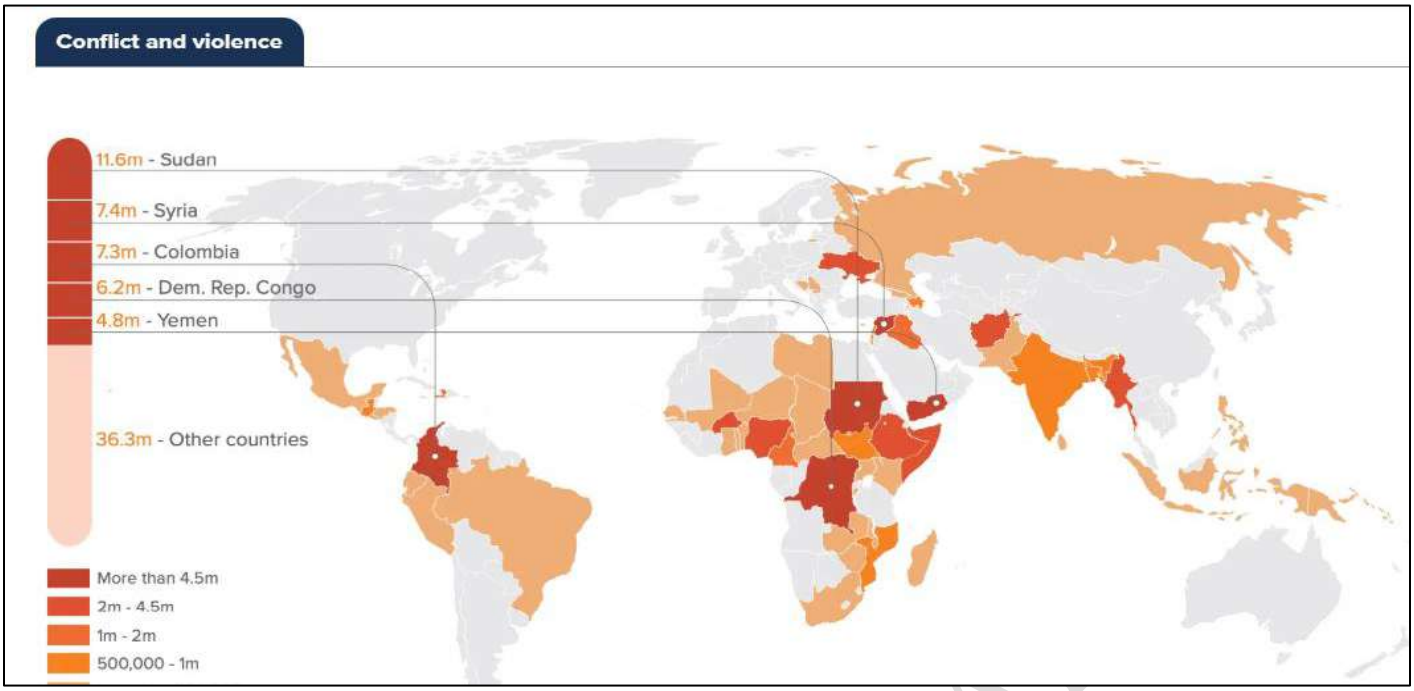


- **Most Affected Region** – Conflict displacement remained high in Africa and the Middle East, and in both regions, disasters added to the number of displacements and prolonged the plight of many of those already displaced.
- At the end of 2024, 11.6 million people remained displaced within Sudan's borders, the highest figure ever recorded in a single country.
- In the Gaza Strip, nearly two million people—essentially the territory's entire population—were internally displaced by the end of 2024.
- **Displacement in South Asia** - After drier conditions associated with El Niño in 2023, the number of disaster displacements in South Asia nearly tripled in 2024 to reach 9.2 million.

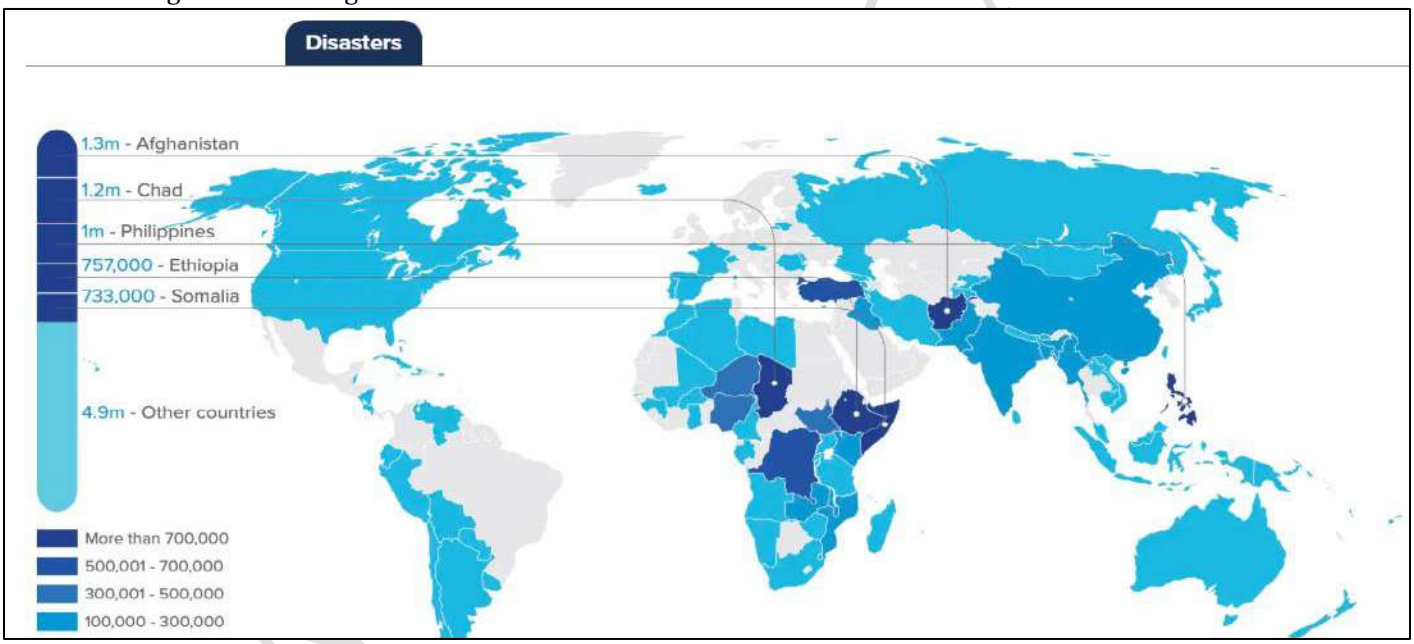


What are the causes of internal displacement?

- **Violent Conflicts** – It remained the leading cause of internal displacement in 2024, forcing nearly 90% of displaced individuals to flee within their own countries.
- An estimated 73.5 million people were forced to flee their homes due to armed violence, ethnic strife, civil war or other forms of conflict—a staggering 80% increase since 2018.



- **Climate-related Disasters** - In 2024, disasters triggered 45.8 million new internal displacements marking the highest annual figure ever recorded.



- **Weather-related Events** - Especially those intensified by climate change were responsible for 99.5% of disaster-related displacements in 2024.
- This total represents more than double the annual average of the past decade.
- **Floods** - Flooding was the second-most common cause of disaster displacement, responsible for 42% of such movements.
- Countries like Chad, Afghanistan, Brazil, the Philippines and regions across Europe all experienced severe flood events that displaced millions.
- **Typhoons** - In East Asia, Typhoon Yagi alone triggered mass evacuations and displacement across several nations.
- **Overlapping Crises** - The convergence of conflict and disaster-driven displacement in the same countries.
- Since 2009, the number of nations experiencing both has tripled.

> ***Hurricanes Helene and Milton*** *were particularly destructive in the United States, leading to 11 million internal displacements—nearly a quarter of the global total for disaster-related movement.*

- In these areas, overlapping crises not only erode resilience but also *strain already limited governmental resources*.

What are the challenges in addressing internal displacement?

- **Vulnerable Destinations** - According to the report, over three-quarters of people displaced by conflict in 2024 were living in countries deemed highly or very highly vulnerable to climate change.
- **Compounding Impacts** - The intersectionality of violent conflicts and climate change exacerbates the difficulty of recovery, stretches the capacity of humanitarian response systems, and heightens the likelihood of secondary or repeated displacements.
- **Governance Failure** – The displacement situation is particularly dire in fragile states and regions with limited governance.
- **Humanitarian Response under Pressure** - The alarming rise in internal displacement comes at a time when humanitarian organisations are under immense financial strain, especially with the new US government.
    - The new US government has significantly reduced global support (U.S. foreign aid funding) for displaced populations.

What lies ahead?

- The global community needs to treat internal displacement not just as a humanitarian issue, but also as a development and political challenge that requires sustained leadership, accountability and investment.
- As a long-term solution to displacement, which include addressing the root causes of conflict and poverty, adapting to climate risks and ensuring displaced people are need to be included in national development plans.
- Without a substantial shift in political will, policy innovation and financial investment, the number of displaced people will continue to rise—along with human suffering.

9.3 Water: A Geopolitical Weapon

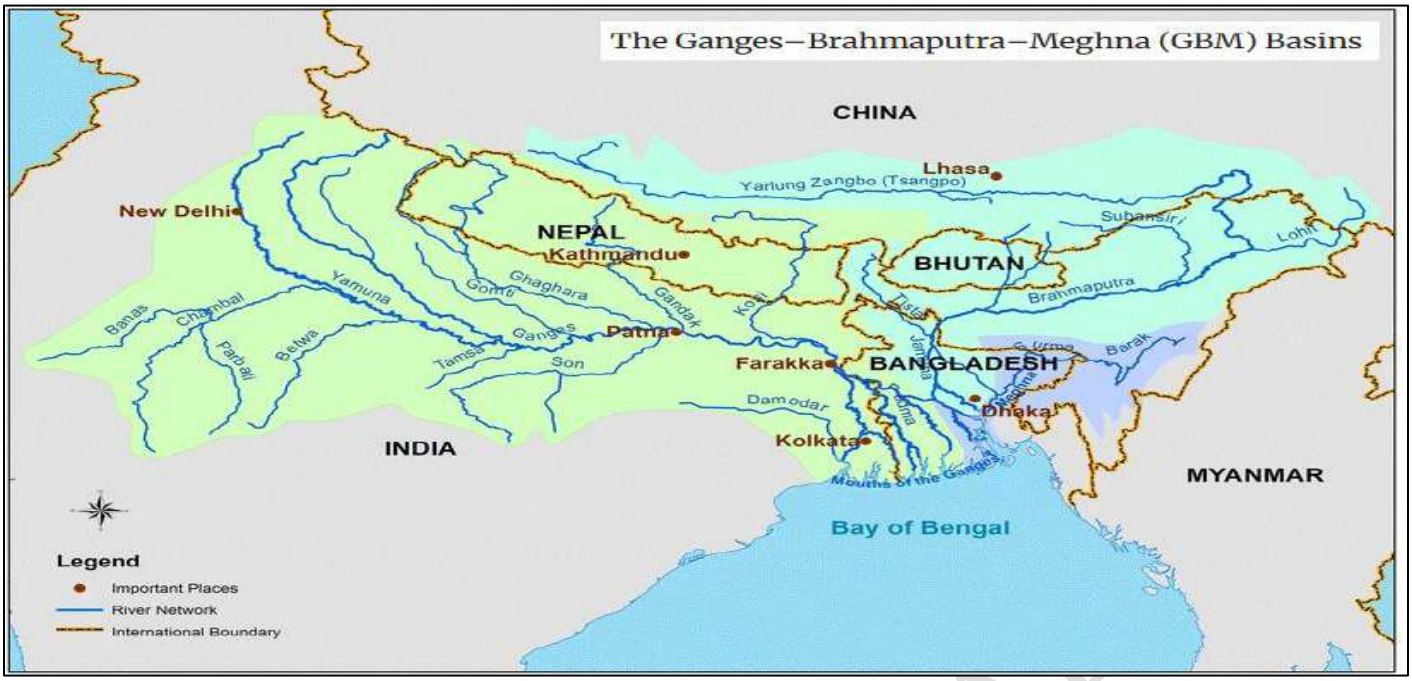
Why in News?

After the recent Pahalgam attack, India has temporarily suspended Indus water treaty.

What are the transboundary waters of India?

- **Transboundary Waters** – They are the *aquifers, lake and river basins* shared by two or more countries.
- Transboundary waters *account for 60% of the world's freshwater flows*.

Transboundary Rivers of India		
Neighbouring Country	**Major Shared Rivers**	**Notable Features/Agreements**
Pakistan	Indus, Jhelum, Chenab, Ravi, Beas, Sutlej	Indus Waters Treaty (1960)
Bangladesh	Ganges, Brahmaputra, Teesta, Barak, Feni, etc.	Ganga Water Treaty (1996), Teesta negotiations
Nepal	Kosi, Gandak, Mahakali (Sharda), Ghaghara	• Sarada Agreement (1920) • Kosi Agreement (1954) • Gandak Agreement (1959) • Mahakali Treaty (1996)
China	Indus, Sutlej, Brahmaputra (Yarlung Tsangpo)	• Hydrological data-sharing agreements for the Sutlej and Brahmaputra rivers, signed between 2002 and 2018. • There is no formal water-sharing treaty between the two nations
Bhutan	Manas, Sankosh, Torsa, Amo Chu	Hydropower cooperation
Myanmar	Barak	• Limited cooperation, mainly regional. • There is no formal "water treaty" specifically between India and Myanmar.



What is China's capability to influence India's water?

- **Tibet Factor** - China's control over Tibet, where key rivers like the Indus and Sutlej originate.

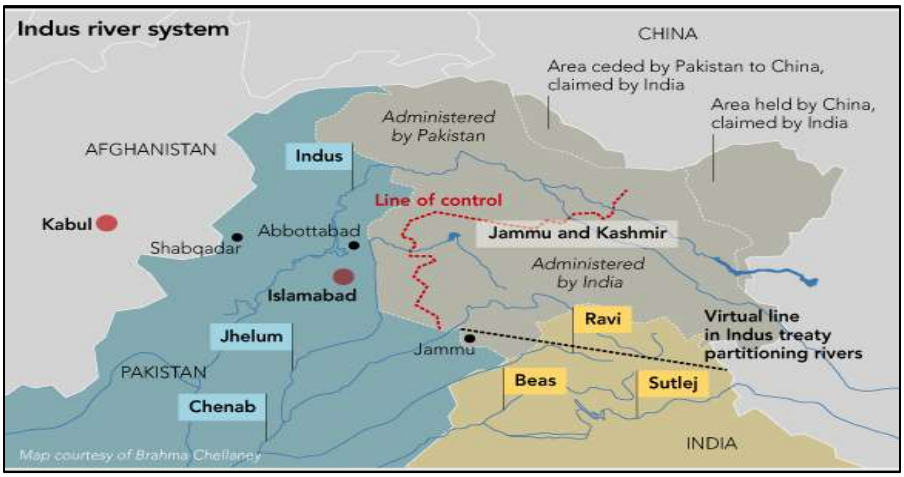
Indus

- **Origin** - It originates from the Seng Khabab glacier near Mansarovar Lake and Mount Kailash in Tibet, at an altitude of around 5,500 metres.
- **Flow Route** - It flows through Tibet into Ladakh, where it meets tributaries like the Zanskar and Shyok, before entering Pakistan and eventually emptying into the Arabian Sea.
- **Significance** - Spanning approximately 3,180 kilometres, the Indus was the lifeline of the ancient Indus Valley Civilization and remains vital for agriculture and hydroelectric power in both India and Pakistan.

Sutlej

- **Origin** – It originates from the Longchen Khabab glacier near Rakshas Tal in Tibet, at an altitude of approximately 4,600 to 5,000 metres.
- **Flow Route** - In Tibet, the Sutlej merges with streams like the Spiti River before entering India's Himachal Pradesh near the Shipki La pass.
- It then flows through the Kinnar Kailash region and continues into Punjab, where it supports the crucial Bhakra Dam hydroelectric and irrigation project.
- **Significance** - Finally, the Sutlej joins the Indus River in Pakistan. Stretching about 1,450 kilometres, the Sutlej is vital for Punjab's agriculture and India's hydroelectric power generation.

- **Indus Water Treaty** - Signed in 1960 to manage shared water resources, the Indus Water Treaty lets India use the eastern rivers (Sutlej, Beas, Ravi) and Pakistan the western rivers (Indus, Jhelum, Chenab).
- **China's Capability** - Technically, China has the capability to stop the water flow of these rivers since they originate in Tibet.



- **Hydroelectric Plants** - China has built hydroelectric plants like Senge Tsangpo and Ngari Shiquanhe near the Indus' source, and a barrage at Zada Gorge on the Sutlej.
- In 2016, China halted the flow of the Shiyaku, a Brahmaputra tributary, for a hydroelectric project, sending a geopolitical message to India.
- These structures can control water flow, potentially reducing, stopping, or altering it.
- **Dams** - These dams have the potential to regulate water flow, impacting India and Pakistan, especially during dry and rainy seasons.
- After the Galwan Valley conflict in 2020, China blocked the Galwan River, an Indus tributary, causing water shortages in India.
- **Water Diversion** - Additionally, China could divert water for its own use, similar to its South-North Water Transfer Project, though this has not been implemented on the Indus or Sutlej rivers.
- **Data Blockage** - If China withholds water-flow data—as it did for the Brahmaputra in 2017—it could hinder India's ability to predict floods or droughts, complicating water management and disaster preparedness.
- **Water Bomb** - In 2004, China created an artificial lake on the Parechu River, a tributary of the Sutlej, raising fears in India of a potential 'water bomb'.

What are the limitations on China's ability to control Indian Waters?

- **Limited Source Control** - Only a small percentage of the water in the Indus (10-15%) and Sutlej (20%) originates from Tibet, making it difficult to stop entirely.
- **Vulnerable Himalayan Terrain** - Building large dams in the earthquake-prone region of Tibet is risky, and stopping water could affect the local ecology and communities.
- **International Water Laws** - Stopping water flow can be considered a violation of *international water laws, such as the Helsinki Rules*, which could lead to global criticism of China.

Helsinki Rules

• **Helsinki Rules** – These are international guidelines for the *use of waters in international drainage basins*, adopted by the International Law Association (ILA) in 1966.
• **Objective** - The rules aim to establish a legal framework *for the equitable sharing and utilization of international water resources*, ensuring that all riparian states (states sharing a watercourse) can benefit from their use without causing undue harm to others.
• **Core Principles** – It emphasize the principle of equitable utilization and the prohibition of causing significant harm to other riparian states.
• **Factors Considered** - The rules outline several factors that should be considered when assessing the fairness of a water usage plan, including:
  ○ The social and economic needs of each state.
  ○ The extent of the drainage area of the river.
  ○ The availability of other water resources.
  ○ The cost of alternative means of satisfying the needs of each state
• **Application** - The Helsinki Rules are not a legally binding treaty but rather a set of guidelines that are widely recognized and used in international water law.

- **Affects downstream** – Any move by China to stop Indian waters will also affect water to Pakistan and Bangladesh.
- This will create negative responses from these south east Asian countries against China.

Quick Facts

UN Watercourses Convention
• **UN Watercourses Convention** - Officially named, the Convention on the Law of the Non-Navigational Uses of International Watercourses, is a treaty adopted by the United Nations in 1997.

- **Objective** - It aims to ensure equitable and reasonable use of shared water resources, prevent harm to other riparian states, and promote sustainable management for present and future generations.
- **Entry into Force** - The convention entered into force on August 17, 2014, after being ratified by 35 states.
- **Principles** – It outlines principles for managing and conserving international water resources, including both surface water and groundwater.
- **Non-Navigational Uses** - The convention focuses on the use of water for purposes other than navigation, such as irrigation, domestic use, industrial use, and hydropower.
- **Obligations of Watercourse States** - The convention obligates states sharing an international watercourse to:
    - Utilize the watercourse in an equitable and reasonable manner.
    - Exercise due diligence to prevent significant harm to other riparian states.
    - Protect and conserve the watercourse's ecosystem.

UN Water Convention

- **Water Convention** – It is the Convention on the Protection and Use of Transboundary Watercourses and International Lakes adopted in Helsinki in 1992 and entered into force in 1996.
- **About** – It is a unique international legal instrument and intergovernmental platform to ensure the sustainable use of transboundary water resources by facilitating cooperation.
- **Scope** - Initially negotiated as a regional instrument for European region, it has been opened up for accession to all UN Member States in 2016.
- **Objective** - The Convention is a unique ***legally binding*** instrument promoting
    - The sustainable management of shared water resources
    - The implementation of the Sustainable Development Goals
    - The prevention of conflicts
    - Promotion of peace and regional integration
- **India** - It is *not a party to this convention*.
- **Obligation of the Parties** - The Water Convention requires Parties to prevent, control and reduce transboundary impact, use transboundary waters in a reasonable and equitable way and ensure their sustainable management.
- **Co-operation** - Parties bordering the same transboundary waters have to cooperate by entering into specific agreements and establishing joint bodies.
- As a framework agreement, the Convention does not replace bilateral and multilateral agreements for specific basins or aquifers.

9.4 India's Digital Development Diplomacy for Africa

Why in News?

Africa Day is celebrated in May 25.

What are the contributions of India for the development of Africa?

- **State-led Financing** - India has provided over US$ 13 billion in concessional aid and grants to African countries between 2010 and 2024.
- **Lines of Credit** - India is the second-largest issuer of credit to Africa, after China.

India is Africa's third-largest trading partner, with bilateral trade valued at approximately US$ 82.1 billion.

- **Capacity-building** – Various Indian educational institutions have signed MoUs with African countries to train their human resources on emerging technologies.
- Indian Institute of Technology Madras has established its first overseas campus in Zanzibar.
- **Market Access** - India offers duty-free and preferential market access to several African nations, primarily through its Duty-Free Tariff Preference (DFTP) Scheme for Least Developed Countries (LDCs)

- **Renewable Energy** - Through the International Solar Alliance, India has committed US$ 2 billion towards solar projects in Africa, advancing sustainable electrification and energy security.

What is the digital development approach of India to Africa?

- **Support for African Union Digital Strategy** - India aligns its digital cooperation with the African Union's Digital Transformation Strategy (2020–2030).
- **Pan-African e-Network** - It is a satellite-based network launched by India for connecting countries in Africa for tele-medicine, tele-education, and satellite connectivity.
- **Open-Source** - India's digital solutions are promoted as open-source digital public goods, distinct from proprietary or surveillance-heavy models offered by other countries.
- This ensures affordability, adaptability, and sovereignty for African nations in their digital transformation.
- **Digital Financial Inclusion** - India has contributed $2 million to the Africa Digital Financial Inclusion Facility (ADFI), supporting digital financial solutions for underserved populations and sharing expertise in digital payments and financial inclusion.

How is India's Digital Public Infrastructure (DPI) transforming Africa's development?

- **Digital Public Infrastructure (DPI)** –It is a set of technology building blocks that drive innovation, inclusion, and competition at scale, operating under open, transparent and participatory governance.
    - **Examples** – Internet, powered by common protocols like HTTP, HTML, and SMTP
- **India's DPIs for other nations** – India has been sharing it's DPIs such as Aadhaar, UPI, CoWIN, and DIKSHA and co-creating digital solutions to tackle fundamental governance and service delivery challenges.
- Initiatives such as the *One Future Alliance* (under India's G20 presidency) have emerged to build capacity, provide technical assistance and adequate funding to support DPI rollout in developing countries.
- **In Africa** - In 2023, *Zambia signed an MoU* with the Centre for Digital Public Infrastructure at International Institute of Information Technology Bangalore (IIIT-B) to advance digital transformation across government services.

> *The **"One Future Alliance" (OFA)** is a voluntary initiative proposed by the G20 India Presidency to bring together governments, private sector, academic institutions, and other stakeholders to synergize global efforts in the field of Digital Public Infrastructure (DPI).*

- **Digital ID Systems in Africa** - Approximately 85% of African countries have national ID systems with digital capabilities.
- Africa's Modular Open-Source Identity Platform (MOSIP) which enables national foundational IDs to be built on open source, is inspired by India's Aadhaar.
    - In 2021, *Togo's National Agency for Identification signed an MoU* with the IIIT-B to implement the Modular Open-Source Identification Platform as the foundation for its national digital ID system.
- **Digital Payments** - DPI-enabled digital payments are envisioned to be low-cost and frictionless.
- India's DPI approach to digital payments, the UPI, is influencing African countries' payments infrastructure.
    - In 2024, the *Bank of Namibia signed a pact with the National Payments Corporation of India* for developing a UPI-like instant payment system.

What lies ahead?

- A new India-Africa digital compact, anchored in mutual respect, co-development, and long-term institutional partnerships, could serve as a scalable framework for advancing digital inclusion.

G.S PAPER III

10. ECONOMY

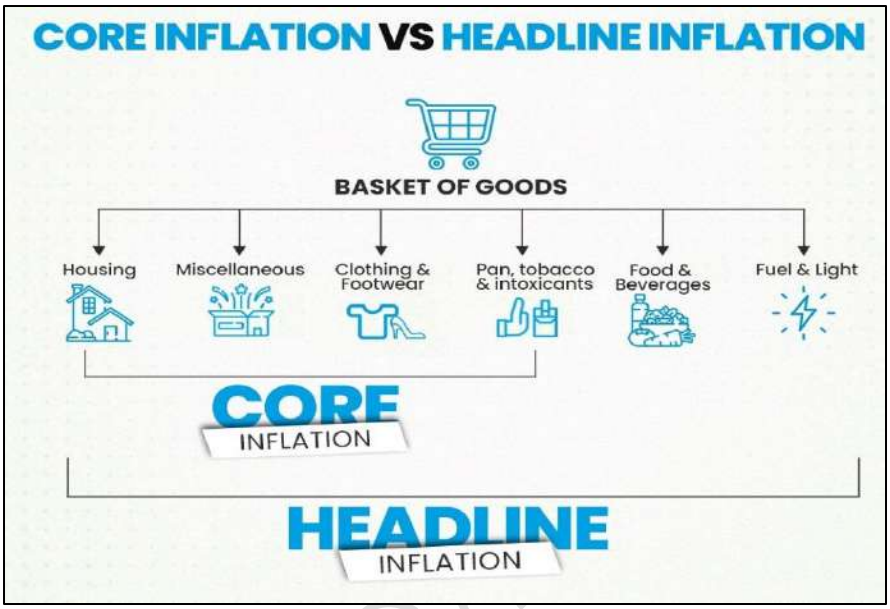
10.1 Inflation Change

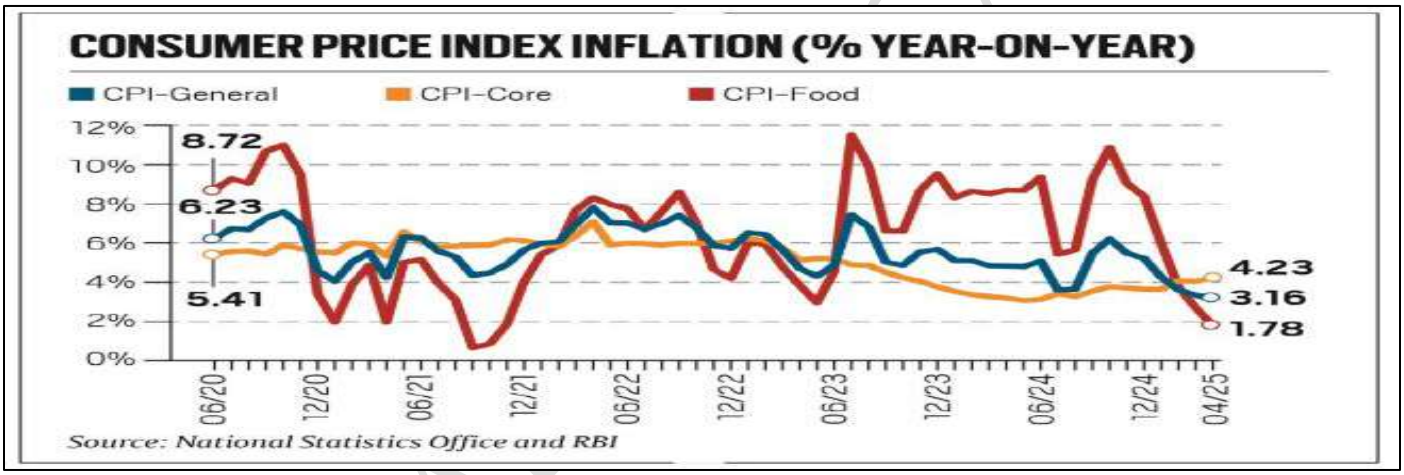
Why in News?

For the past 2 months India's inflation indices were making turnaround from the past 2-year trend.

What is the recent trend in inflation movement?

- **Past 2 Years Average Inflation** - Between February 2023 and January 2025, the average inflation based on the official consumer price index (CPI) was 5.2% year-on-year.
- **Core Inflation Trend** - Core inflation rate which excludes food and fuel energy items from the CPI to compute the annual price increase – was only 4.1%.
- **Food Inflation Trend** - It was even higher, at 7.6%, for the consumer food price index (CFPI).
- **Recent Turnaround of Indices** - CFPI inflation has declined to 1.8% in April 2025, lowest since October 2021 and the headline inflation to 3.2%, the lowest since July 2019.
- On the other hand, core inflation, at 4.2% has increased to its highest since September 2023.





Components of CPI

Food and beverages

1.1.01	Cereals and products
1.1.02	Meat and fish
1.1.03	Egg
1.1.04	Milk and products
1.1.05	Oils and fats
1.1.06	Fruits
1.1.07	Vegetables
1.1.08	Pulses and products
1.1.09	Sugar and Confectionery
1.1.10	Spices
1.2.11	Non-alcoholic beverages
1.1.12	Prepared meals, snacks, sweets etc.

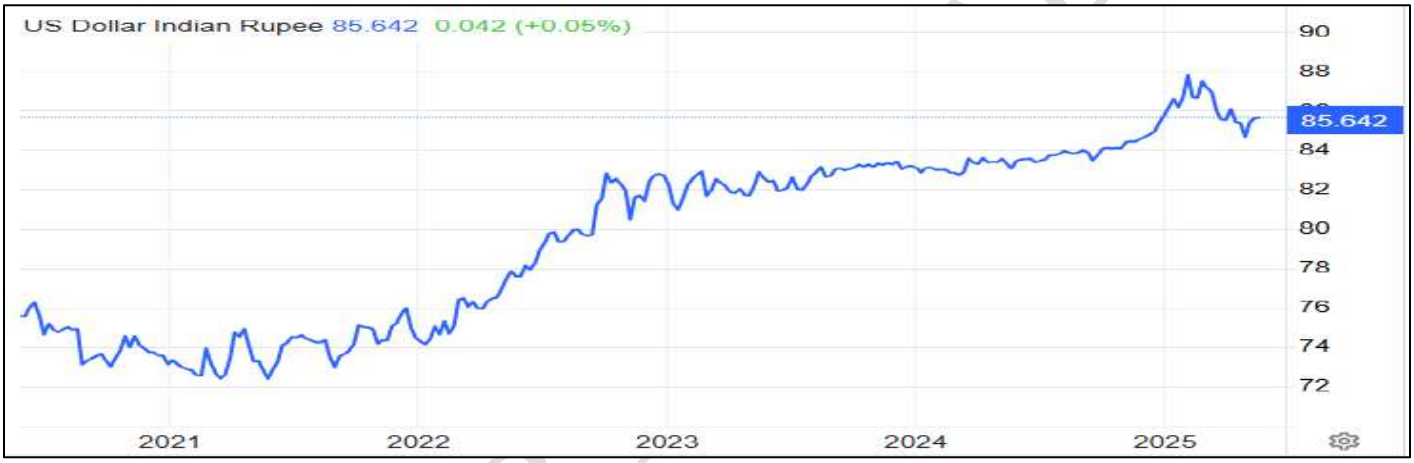
- Pan, tobacco and intoxicants
- Clothing and footwear
- Housing
- Fuel & Light
- Miscellaneous

6.1.01	Household goods and services
6.1.02	Health
6.1.03	Transport and communication
6.1.04	Recreation and amusement
6.1.05	Education
6.1.06	Personal care and effects

- **Consumer Food Prices Inflation (CFPI)** - Out of 12 sub-groups contained in 'Food and Beverages' group, CFPI is based on ten sub-groups, excluding 'Non-alcoholic beverages' and 'Prepared meals, snacks, sweets etc.'.

What are the reasons for the recent trend in inflation movement?

- **Geopolitical developments** - Russia's invasion of Ukraine in late-February 2022 pushed up international Agri-commodity prices.
- The UN Food and Agriculture Organization's (FAO) world food price index (base value: 2014-16=100) soared to an all-time-high of 160.2 points in March 2022.
- **El Nino** - The long and strong El Niño of 2023-24 did translate into subpar monsoon, post-monsoon and winter rains that was accompanied by a delayed and short winter, culminating in heat waves from the second half of March to June 2024.
- The effects, in terms of *lower crop production and elevated food prices*, were felt from July 2023 through the whole of 2024.
- **Oil Prices –** The brent crude is trading at just over $65 per dollar, as against $75 three months ago and $83 last year at this time.
- **Value of Rupee** - 3 months back, the rupee was in free fall, touching an all-time-low of 87.99 to the dollar on February 10.



- **Changes in Forex** - India's official foreign exchange reserves plunged from $704.89 billion to $623.98 billion between September 27 and January 17.
- **Outgoing FDI –** The recent government change in the USA caused a net pullout of about $22 billion by foreign portfolio investors (FPI) from India's equity and debt markets during October 2024-February 2025.
- The sweeping "reciprocal tariff" actions of US led to further outflows of $2.34 billion in April.

What are the challenges in controlling inflation?

- **Volatile Nature of Food & Fuel Inflation** – Food and fuel inflation are largely driven by supply-side factors – such as rainfall, temperature and other weather-related phenomena affecting crop output.
- Due to the volatile nature, monetary policy cannot effectively address, as interest rates primarily work by influencing borrowing costs and aggregate demand in the economy.
- **Balancing Economic Growth** - Tightening monetary policy to curb inflation can hinder economic growth and investment.
- **Supply Chain Disruptions** - Frequent interruptions in supply chains due to geopolitical conflicts, natural disasters, or pandemics can lead to supply-side inflation.
- **Climate Forecasting Challenges** - Accurately forecasting inflation is difficult, and errors in forecasting can lead to inappropriate monetary policy decisions.

What lies ahead?

- A stable rupee, disinflationary pressures from Chinese imports, soft global oil and commodity prices, and the improved domestic food supply position should make it easy for the RBI to further cut rates in its upcoming monetary policy reviews.

10.2 District Led Growth Approach

Why in the News?

Recent district domestic product (DDP) data from States reveal striking inequalities.

What are the consequences of unequal growth at district level?

District Level Growth Pattern of GDP

- **District Inequality** – India's *economic activity is driven disproportionately by a handful of districts*, while vast regions remain economically marginalised.
- Across States, the *top 10% of districts typically drive a disproportionate share* of 50-60 % of the State's economic output.
    - **In Uttar Pradesh** – 3 districts (Haridwar, Udham Singh Nagar, and Dehradun) collectively generate 71 % of GSDP.
    - **In Karnataka** – *Bengaluru alone generates 38% of the State's GSDP*, while the next highest contributor, Dakshina Kannada, contributes merely 5.5%.
- These disparities highlight that hundreds of rural and semi-urban districts contribute only marginally to the State's output and growth.

- **Concentration of Wealth** - Prosperity concentrated in a few districts creates "islands of prosperity in a sea of poverty," which limits the spread of economic benefits.
- **Large-scale migration** – These disparities in development drives large scale migration form 60% of the districts towards 10% of the developed districts.
- **Housing Shortages** – These migrations and consequent unsustainable urban expansion results in housing shortages and pressure on resources.
- **Infrastructure Deficits** – While underdeveloped regions suffer from lack of transportation, banking, healthcare, and educational facilities, the same is overburdened in developed regions due to migration.
- **Social Unrest and Tensions** - Inequality fuels resentment, sometimes erupting in violent conflicts, social unrest, and movements demanding separate states or special status (e.g., Telangana, Gorkhaland)
- **Environmental Consequences** - Developed regions can lead to overexploitation of resources (e.g., water table depletion, air pollution), while underdeveloped areas remain resource-rich but unutilized.

What are the significances of the district-led growth approach?

- **Addresses Intra-State Inequality** - A district-led growth approach recognizes that states are heterogeneous and that economic activity is often concentrated in a few districts.
- By focusing on districts as the operational units of development, this approach seeks to bridge the gap between high-performing and underperforming areas, promoting more inclusive and equitable growth.
- **Local Based Development** - District-led strategies are grounded in sector-specific plans that leverage local resources, demographic trends, and economic endowments
- **Reduces Migration** - By creating economic opportunities closer to where people live, district-led growth can reduce the pressure on major cities and stem the tide of rural-to-urban migration.
- **Strengthens Local Governance** - This approach encourages capacity-building at the district and municipal levels, fostering better coordination, monitoring, and evaluation of development initiatives.

Aspirational Districts Programme (ADP) *is an effective district led development approach.*

What are the significances of measuring DDP?

District domestic product (DDP) *is an indicator used to measure the economic disparity among district of a Region/State. It also helps in improving the standard of living by the filling the gap between a better performing district and underperforming district, thus ensuring a balanced growth among districts.*

- **Reveals Regional Economic Disparities** - DDP is a critical indicator for measuring economic disparities among districts within a state or region.

- **Localized Planning and Policy Making** - Accurate DDP data allows for the design of district-specific development programs.
- This granular approach supports more effective resource allocation, tailored strategies, and better utilization of local assets, as opposed to one-size-fits-all state or national policies.
- **Grass Root Development Measurement** - DDP, along with district-level per capita income, serves as a key indicator of the standard of living at the grassroots.
- **Supports Fiscal Federalism** - District-level economic data strengthens fiscal federalism by empowering local administrations to argue for a fair share of resources based on actual economic performance.
- **Enables Monitoring and Evaluation** - Regular measurement of DDP facilitates ongoing monitoring of growth dynamics, employment trends, and productivity at the district level.
- This supports evidence-based policymaking and timely course corrections.

What are the challenges in district led development approach?

- **Institutional and Capacity Constraints** - Many districts lack dedicated Local Economic Development (LED) units or committees, for planning, implementation, and monitoring of development initiatives.
- **Resource Limitations** - Persistent shortages of financial, human, and technical resources hinder effective district-level planning and project execution.
- **Data Deficiency** - In many States, the district-level economic data is not directly measured.
- Instead, State GDP is divided among districts using outdated estimates and in rural or less developed districts a lot of informal work, like small scale manufacturing or local services, is not counted due to lack of regular surveys for these areas.

What lies ahead?

- District-level economic measurement could be made an annual, systematic exercise, grounded in robust primary data collection.
- Regular surveys of unincorporated enterprises and labour force participation at the district level are essential to measure the contribution of this unincorporated sector.
- District-led development strategies need to be grounded in sector-specific growth plans tailored to local endowments, resource bases, and demographic trends.

AGRICULTURE

10.3 Irrigation Problems of India

Why in the News?

Recently, the 2020 Young Farmer Award recipient farmer, from Maharashtra, died by suicide, citing unaddressed irrigation demands.

What are the irrigation problems of India?

The agricultural sector accounts for almost 80% of the water withdrawal in India.

- **Accessibility Issue** - While India reports the highest water usage in agriculture globally, access to water for irrigation remains a contentious issue.
- **Inequitable Access** - The problem of water scarcity in India is multifaceted, indicating the co-existence of actual physical shortage with economic scarcity due to inequitable access and management.
- **Inequity in Distribution** - while inequity has declined in canal, tank, and well irrigated systems, it has increased in the tube well irrigated system.
- **Regional Disparities** - States like Punjab have high irrigation coverage (around 98%), while eastern and southern states have less developed infrastructure, leading to unequal access to water.
- **Social Inequalities** - Marginalised groups do not have adequate irrigation access for their crops.
- **Water Intensive Crops** - The majority of the area under water-guzzling crops such as rice, wheat, and sugarcane is currently in the water-scarce north-west and sub-tropical belts of the country.

- **Unsustainable Irrigation Expansion** - According to a study published in Nature Water (2024), India alone accounted for 36% of global unsustainable irrigation expansion that happened between 2000 and 2015.
- **Sub-optimal Water Use Efficiency** - While irrigation systems in India report an operating efficiency of 38%, in developed countries it is 55%.
- **Low Irrigation Water Productivity (IWP)** - Coupled with misaligned cropping patterns and inefficient water use practices, irrigation water productivity (IWP) has also remained low in the major irrigation belts of the country.
    - **For example**, Punjab, which claims the highest land productivity in rice, has one of the lowest IWPs for the crop.
- Similarly, in sugar cane, Tamil Nadu records the highest land productivity with IWP being dismally low.
- **Decline of Groundwater Tables** – It is both the cause and consequences of unsustainable irrigation system.
- **Unpredictable Monsoons** - Indian agriculture heavily relies on the monsoon, which is becoming increasingly unpredictable and prone to delays due to climate change, affecting water availability for irrigation.
- **Inter-state Conflicts** - Irrigation in India is a state subject, leading to disputes between states over the sharing of river water, which can affect the planning and implementation of irrigation projects.

What are the impacts of irrigation issues?

- **Reinforces Existing Inequalities** - Even as irrigation has been proven to drive economic prosperity, various studies have reported that uneven progress has reinforced existing inequalities, between and within States.
- **Decline in Groundwater Table** - Due to over extraction, almost 17% of India's groundwater assessment units are deemed 'over-exploited' while 3.9% are in a 'critical' state.
- **GHG Emission** - Intensive pumping has also resulted in massive energy consumption resulting in excessive carbon emissions.
    - As per the latest data, 45.3–62.3 MMT of annual carbon emissions is attributed to groundwater irrigation, which constitutes 8-11% of India's total carbon emissions.
- **Cropland Emissions** - With continuous flooding of rice as the major water management practice, paddy rice is the biggest contributor to global cropland emissions.
- **Soil Degradation due to Irrigation** - Improper irrigation practices can contribute to soil erosion, leading to the loss of fertile topsoil.

What lies ahead?

- Efforts can be taken on efficient water-saving technologies, improved irrigation efficiency, and alternative sources of irrigation.
- Advancing irrigation technologies and practices based on sustainable intensification can be prioritised.
- Alternative water management technologies such as alternate wetting and drying can be popularised.
- Micro-irrigation systems such as drip irrigation, with minimal application losses, can be followed in crops such as sugar cane.
- Solar-powered irrigation and/or bundling solar pumps with micro-irrigation systems can be promoted.
- Rain water harvesting structures and tail water storage pits may be popularised as supplementary irrigation sources.

INDUSTRIES, INFRASTRUCTURE & INVESTMENTS

10.4 Survey on Private Sector CAPEX Investment

Why in News?

The Ministry of Statistics and Programme Implementation (MoSPI) has released the first ever "Forward-Looking Survey on Private Sector CAPEX Investment Intentions".

What is the Forward-Looking Survey on Private Sector CAPEX Investment Intentions?

- **Survey background** - In 2022–23, the Parliamentary Standing Committee recommended that the Ministry of Statistics and Programme Implementation (MoSPI) to develop a comprehensive methodology to capture capital expenditure (CAPEX) data from the private sector.
- **Objective of the CAPEX survey** - To *estimate the CAPEX trends of private corporate sector* enterprises
    - From the past 3 financial years (2021-22, 2022-23 & 2023-24)
    - Anticipated capital expenditure for the current year (2024-25) and upcoming financial years (2025-26).
    - The breakdown of investments by asset type.
- **Survey period** - National Statistical Office (NSO) conducted it between November 2024 and January 2025.
- This marked the first initiative of MoSPI to engage the corporate sector through a self-administered, web-based survey platform to collect structured CAPEX data.
- **Coverage**
    - Manufacturing enterprises with an annual turnover of Rs.400 crore or more
    - Trade enterprises with an annual turnover of Rs.300 crore or more
    - Other enterprises with an annual turnover of Rs.100 crore or more
- Based on these criteria, the final survey frame consisted of 16,025 enterprises.

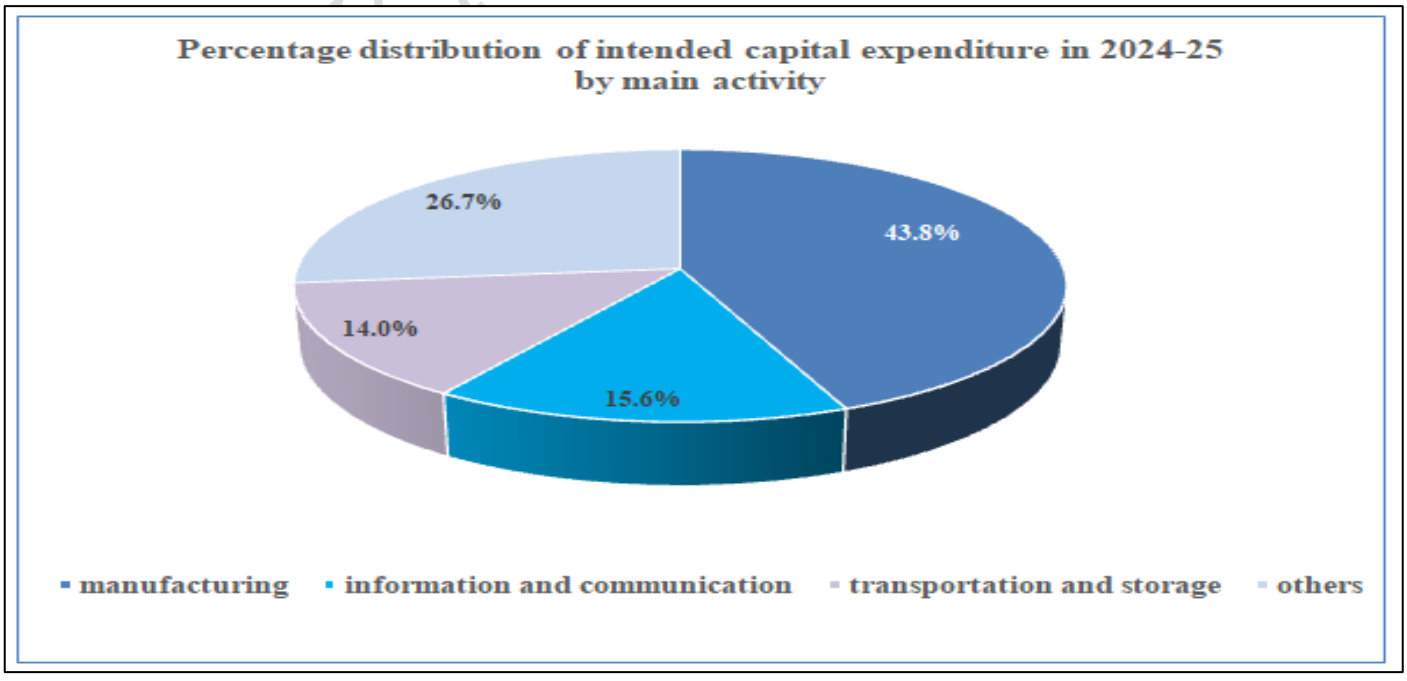
Capital expenditures (CapEx) are funds used by a company to acquire, upgrade, and maintain physical assets such as property, plants, buildings, technology, or equipment.

What are the significances of the survey?

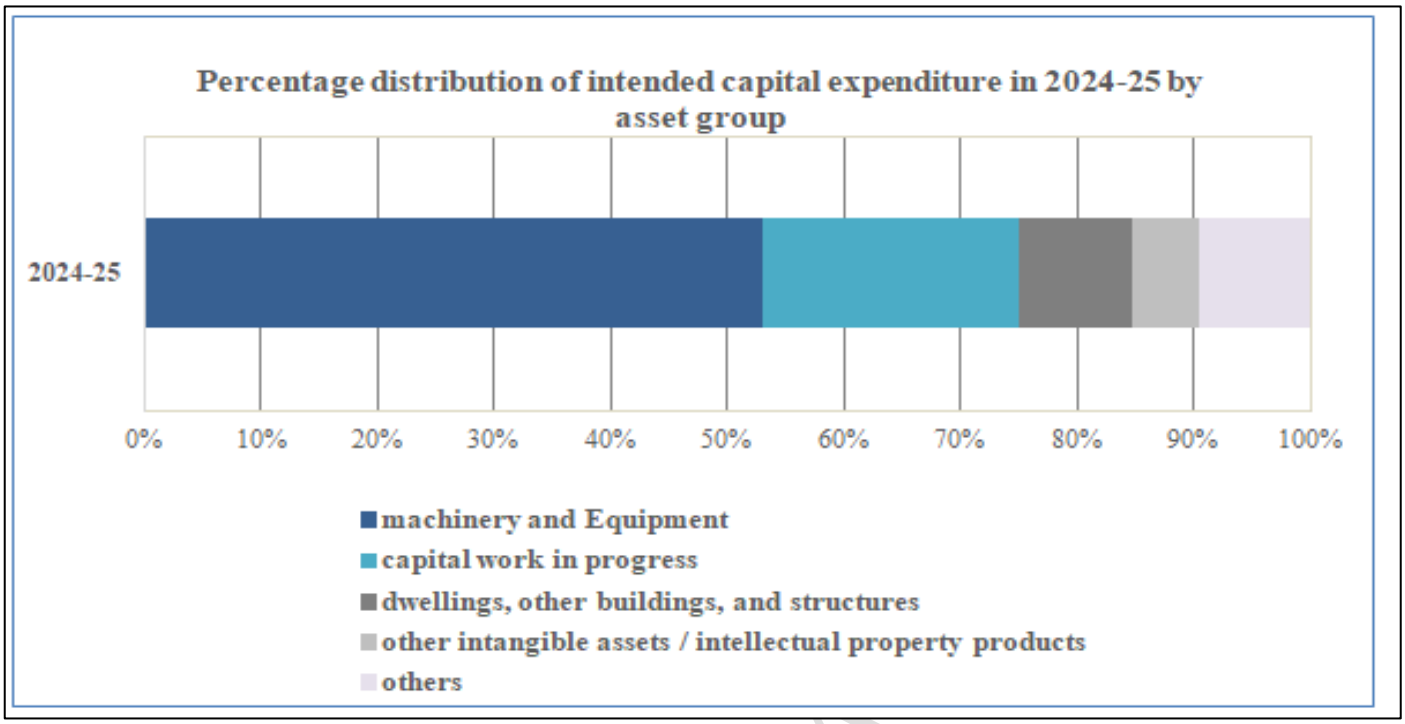
- **Valuabe data asset** – It will be a valuable asset for a wide range of stakeholders, including government departments, private enterprises, trade associations, researchers, and other relevant entities.
- **Evidence-based policy formulation** - It will enable evidence-based policy formulation through the analysis of trends in future investments.
- **Data-driven investment decisions** - A clear understanding of CAPEX patterns and scale can assist enterprises in making strategic and data-driven investment decisions.

What are the key findings of the survey?

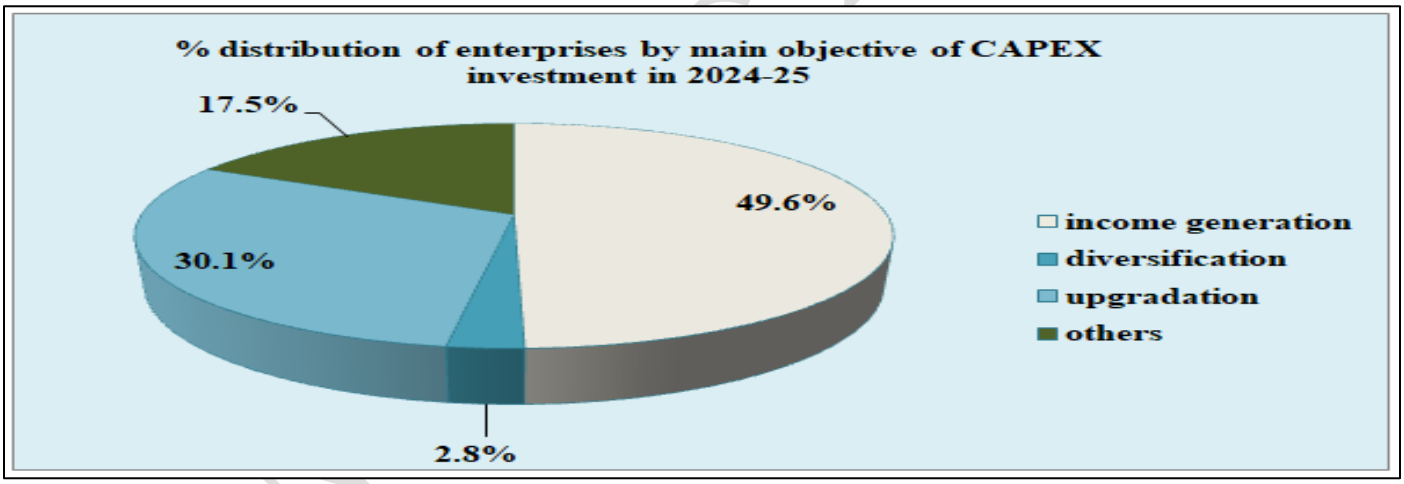
- **Average Gross Fixed Assets per enterprise** - It had a growth of 4% from 2021-22 to 2022-23, and further to Rs.4,183.3 crore *in 2023–24, reflecting a significant 27.5% growth* in the private corporate sector.
- Overall increase of 66.3% in aggregate CAPEX (unweighted) over the 4-year period from 2021-22 to 2024-25.
- **Asset wise investment** - Nearly 53.1% were utilized for purchasing machinery & equipment.



- **Sectoral investment** - Among the sectors, manufacturing enterprises account for the largest share at 43.8%, followed by those in 'Information and Communication Activities' and 'Transportation and Storage Activities'.

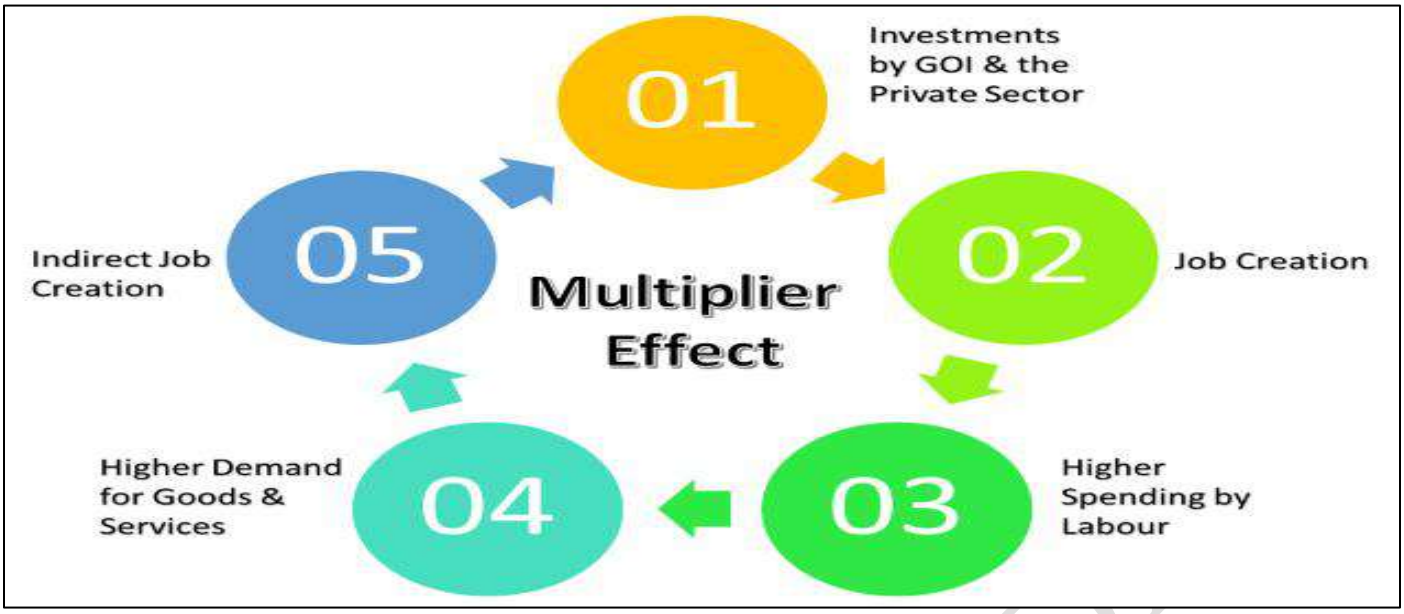


- **Objectives of investment** - The survey estimates indicate that nearly 49.6% of private corporate sector enterprises undertook CAPEX in 2024–25 primarily for income generation.



What are the significances of capital expenditure?

- **Enhances the stock of physical assets** - Capital expenditure (CAPEX) plays a crucial role in contributing to national investment and enhances the stock of physical assets within the economy.
- **Improves the operational efficiency of economic activities** - It leads to the *creation of long-term assets*, thereby generate revenue for many years and improve the overall operational efficiency of economic activities.
- **Accelerates economic growth** - CAPEX is fundamental to expanding production capacity, thereby serving as a catalyst for accelerated economic growth.
- **Creates livelihood** – This economic growth, in turn, supports job creation and enhances labour productivity.
- **Innovation** - Private enterprises drive innovation and entrepreneurship, which are essential for sustained economic progress.
- They often lead in research and development spending, collaborating with universities and institutions to bring new technologies and business models to market.
- **Infrastructure development** - Private investments provide necessary infrastructure that is sustainable, reliable, and technologically advanced, supporting modern economic activities.



What are the challenges in private sector capital investment?

- **Geopolitical uncertainties** - Global economic instability, geopolitical risks, and market volatility create apprehension among private investors, leading to cautious investment behaviour.
    - **For example**, the current tariff war among the countries after the government change in USA.
- **Financial risks** - Corporate prudence has increased due to high-profile bankruptcies, making firms prioritize financial stability over expansion.
- **Financial accessibility barrier** - Access to finance remains a significant barrier, with high interest rates, short loan tenors, and lack of concessional finance limiting investment capacity.
- **Falling household savings rate** – It affects private sector investment primarily by reducing the availability of domestic capital for investment and increasing reliance on external borrowing, which can raise financing costs and dampen investment growth.
- **Market limitations** - Market barriers such as incomplete or asymmetric information reduce investor confidence.
- **Technological limitations** - Availability, cost of new technologies and high gestation period pose challenges for private investments in innovative sectors.

What lies ahead?

- Strategic measures and policy actions can be taken to enhance efficiency, align investments with long-term goals, and to create a conducive environment for sustained private investment growth.
- Governments (National and State) can stimulate private investment by offering incentives such as Production Linked Incentive (PLI) schemes, improving ease of doing business, and ensuring policy stability.
- Access to affordable finance need to be improved by developing long-term credit facilities, reducing interest rates, and expanding venture capital availability.
- Transparency and information flow could be enhanced to reduce market asymmetries and build investor confidence.

10.5 Safe Roads

Why in the News?

Recently Union Ministry of Road Transport and Highway announced the setting up of driving training centres and vehicle fitness centres in every district.

What is the need for improving road safety in India?

- **High Burden of Road Traffic Mortalities** - With one of the world's largest road networks, India also carries the burden of having among the highest number of road traffic fatalities globally.
    - In 2022, India recorded 1.68 lakh road accident fatalities which translates to approximately 12.2 deaths per 1 lakh population.

- Japan and the U.K. have road traffic death rates of 2.57 and 2.61, respectively.

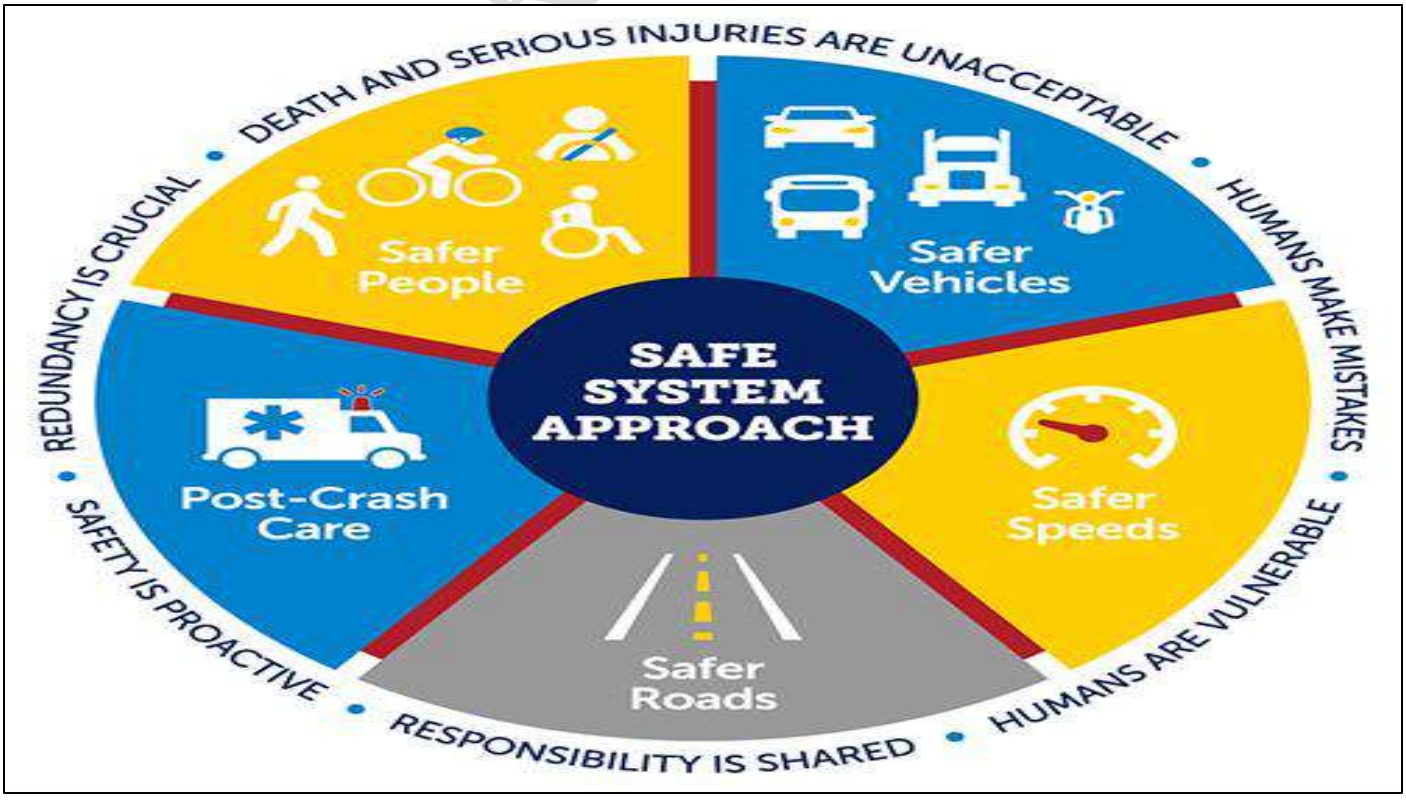
- **Economic Repercussions** - Road crashes cost India an estimated 3% of its GDP annually.
- **Urbanization** - By 2047, the urban population is expected to account for about 50% of the total population.
- This rapid urbanisation will be accompanied by a substantial rise in vehicle ownership.
- **Right to Life** - The right to safe road travel is an essential component of the right to life under Article 21 of the Constitution.
- Every citizen, whether a pedestrian, cyclist, or driver, has the right to move through public spaces without fear of injury or death.
- **Duty of the State** – It is the moral and legal duty of the state and society to treat road safety not as a privilege or technical matter, but as a human right and public good.

What are the causes of road accidents?

- **Drivers** - Over-speeding, rash driving, violation of rules, failure to understand signs, fatigue, alcohol.
- **Pedestrian** - Carelessness, illiteracy, crossing at wrong places moving on carriageway, Jaywalkers.
- **Passengers** - Projecting their body outside vehicle, by talking to drivers, alighting and boarding vehicle from wrong side travelling on footboards, catching a running bus etc.
- **Vehicles** - Failure of brakes or steering, tyre burst, insufficient headlights, overloading, projecting loads.
- **Road Conditions** - Potholes, damaged road, eroded road merging of rural roads with highways, diversions, illegal speed breakers.
- **Weather conditions** - Fog, snow, heavy rainfall, wind storms, hail storms.

What is the Safe System Approach?

- **Safe System Approach** - It is the heart of future-ready urban mobility lies and places human vulnerability and error at the centre of road design.
- **Philosophy** – It acknowledges that people will make mistakes, but those mistakes should not result in fatalities or serious injuries.
- **Safety** - Prioritising pedestrian safety is fundamental under this approach.
- **Resilience** - This system moves away from blaming individual road users and instead emphasises creating a forgiving and resilient road environment.



Key principles of the Safe System approach

- **Human Fallibility -** It acknowledges that people will make mistakes, and the system should be designed to accommodate these mistakes.
- **Human Vulnerability -** It recognizes that humans are fragile and cannot withstand impacts above a certain speed (typically 30 km/h).
- **Systemic Approach** - It considers the interaction between road infrastructure, vehicles, road users, and speeds to create a holistic and integrated safety system.
- **Focus on Prevention and Mitigation** - It aims to prevent crashes in the first place and, if they do occur, to reduce the severity of injuries.
- **Prioritizing Safety** - It makes safety the primary consideration when designing and managing roads.

Four Key Elements of a Safe System

1. **Safe Roads -** Designing roads that are predictable, forgiving of errors, and encourage safe speeds.
2. **Safe Speeds** - Setting appropriate speed limits and ensuring compliance to avoid excessive speeds.
3. **Safe Vehicles -** Building vehicles that prevent crashes and protect occupants, pedestrians, and cyclists in the event of a crash.
4. **Safe Road Users-Encouraging Road** users to be alert, compliant with rules, and to take responsibility for their own safety.

Government Measures on Road Safety

- **Rectification of Black Spots** – Recently government has identified over 13,795 black spots on India's National Highways (NHs) based on accident reports with fatality and major injury.

> *"**Black spots"** refer to specific locations on a road where road accidents, particularly those involving fatalities or serious injuries, occur with higher frequency than other comparable sections.*

- **Mandatory Road Safety Audits** - Road safety audit of all National Highways projects has been made mandatory at all stages of design, construction, operation & maintenance through third party auditors/experts.
- **Stricter Safety Norms** - Central Motor Vehicles (Tenth Amendment) Rules, 2024 mandates IS certified safety belts and restraint system.
- **Stringent Monitoring** - Electronic enforcement mechanisms such as speed cameras and CCTV surveillance have also been rolled out to improve compliance.
- **Training Centres** - To ensure safer driving practices and reduce accidents caused by unskilled driving, it has been announced to set up driving training centres and vehicle fitness centres in every district.

What lies ahead?

- People-centric interventions are needed to ensure that streets remain safe, especially for vulnerable road users such as pedestrians, cyclists, the elderly, and public transport commuters.
- Urban streets can be redesigned with wider footpaths, dedicated cycling tracks, well-marked crossings, pedestrian refuge islands, reduced speed limits, and calming measures such as raised intersections.
- Innovative funding models can be explored to meet the financial requirements of road safety improvements,
- Automobile manufacturers can be required to channel their entire Corporate Social Responsibility funds towards road safety initiatives for the next 20-25 years.
- Efforts can be taken to support black spot elimination, public awareness campaigns, emergency trauma care, driver training, and road safety research.

10.6 Aviation Turbine Fuel

Why in the News?

Recently in a meeting with Civil aviation minister, the airlines' representatives requested tax relief on Aviation Turbine Fuel.

What is Aviation Turbine Fuel (ATF)?

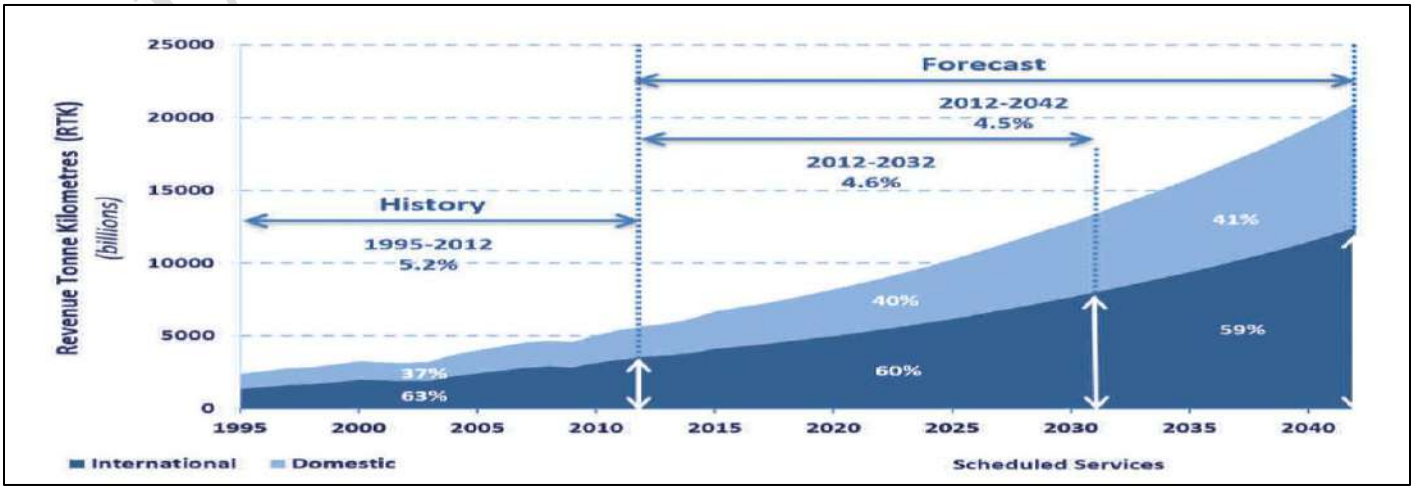
- **Aviation Turbine Fuel** – Also known as jet fuel, it is a specialized petroleum-based fuel used to power aircraft, particularly those with gas-turbine engines.
- It's a *refined kerosene or a blend of kerosene and gasoline* to meet stringent quality and safety standards.
- **Types** - The 2 primary types are *Jet A and Jet A-1,* with Jet A-1 being the global standard due to its exceptional cold-weather performance.
- **Testing Standards** - These fuels are rigorously tested to meet international standards set by leading organisations such as ASTM (American Society for Testing and Materials) and DEF STAN (the UK Ministry of Defence Standard).
- **Specialized Characteristics** - Formulated with advanced additives, jet fuel effectively prevents static discharge, corrosion, and microbial growth, ensuring safety and reliability even in the most demanding conditions at 35,000 feet.
- **Production** – ATF is primarily derived from crude oil refining and the process starts in petroleum refineries, where crude oil is distilled into various fractions.
- **Purifying Kerosene** - One of these fractions is kerosene, which is then hydrotreated to remove impurities like sulphur.
- **Blending** - The resulting jet fuel is blended to meet performance requirements.

What is sustainable aviation fuel (SAF)?

- **SAF** – It is a liquid fuel and a bio-based alternative to traditional jet fuel which *reduces CO_2 emissions by up to 80%.*
- **Sources** - It can be produced from a number of sources (feedstock) including *waste oil and fats, green and municipal waste and non-food crops*.
- **Blending** - It can be blended with traditional jet fuel at various levels, allowing for gradual adoption and compatibility with existing infrastructure.
- **Examples of SAF** - Types of SAF include HEFA-SPK (produced from hydro processed esters and fatty acids), FT-SPK (synthesized from Fischer-Tropsch technology), and ATJ-SPK (produced from alcohols).
- **ICAO Framework** - The International Civil Aviation Organization (ICAO) has established a Global Framework for Sustainable Aviation Fuels, aiming to reduce CO_2 emissions in international aviation.

What is the need for SAF?

- **Energy Intensive Aviation Sector** - The aviation industry's reliance on aviation turbine fuel makes it one of the most energy-intensive sectors in the world.
- **Reduce Carbon Footprint** - In 2023***, aviation accounted for 2.5% of global energy-related CO_2 emissions***, having grown faster between 2000 and 2019 than rail, road or shipping.
- As the world shifts toward sustainability, the aviation industry is under pressure to reduce its carbon footprint.
- **Increasing Aviation Demand** - The aviation sector is growing fast and will continue to grow.
- The most recent estimates suggest that demand for air transport will increase by an average of 4.3% per annum over the next 20 years.



What are the challenges faced by sustainable aviation fuel production?

- **High Production Costs** - Depending on the production method, SAF can cost 50% to 200% more than traditional jet fuel.
- **Limited Feedstock Availability** - SAF relies on feedstocks such as used cooking oil, plant oils, animal fats, agricultural residues, and other waste materials.
- The supply of these feedstocks is limited and often competes with other industries like food, agriculture, and cosmetics
- **Supply Chain Challenges** - Developing robust supply chains and logistics for collecting and processing diverse feedstocks is complex and capital-intensive.
- **Inadequate Production Capacity** - Current global SAF production capacity is insufficient to meet the ambitious targets set by governments and industry.
- **Regulatory Barriers** - Lack of harmonized global standards and regulations creates uncertainty and can hinder cross-border SAF production and adoption.

What lies ahead?

- Steps can be taken to overcome challenges like high production costs, limited feedstock availability, infrastructure and supply chain challenges, insufficient production capacity, and regulatory barriers for widespread adoption.
- Coordinated efforts can be initiated from industry, governments, and technology providers, along with significant investment and policy support.

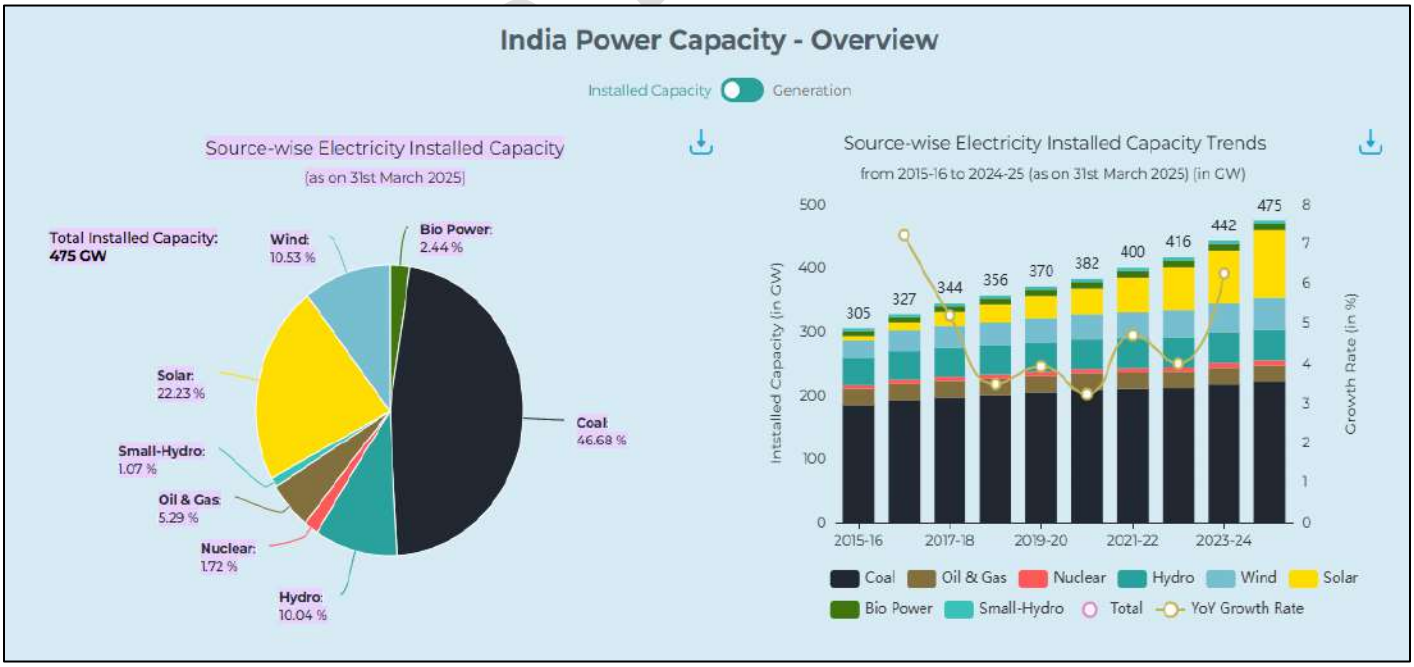
10.7 Energy Sufficiency of India and It's States

Why in the News?

Recently Union Power Minister informed the parliament that India has been transformed from a power deficit to a power sufficient nation in past ten years.

What is the energy status of India?

- **India's Power Capacity** - India's total cumulative power generation capacity reached 475.2 gigawatts (GW) as of March 31, 2025.

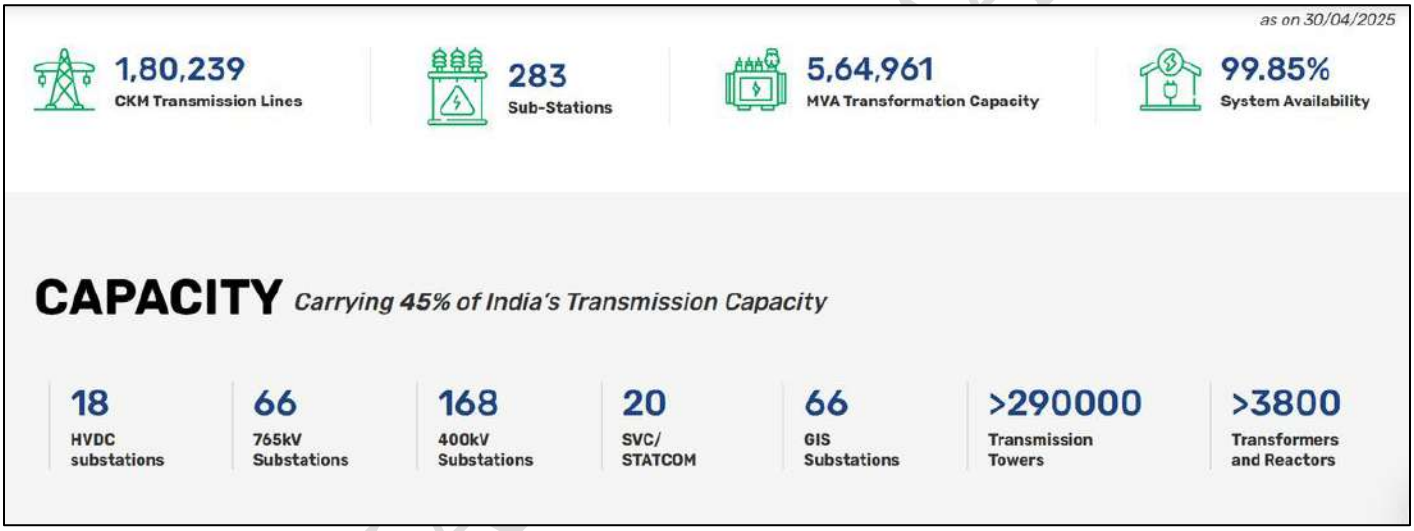


- **Expansion in the last decade** - An addition of 238 GW in generation capacity since 2014 spanning 2,01,088 circuit kilometres (ckm) of transmission lines has helped to boost inter-regional transferring capacity to 1,18,740 MW.
- **Reduction in Energy Gap** - In the past 4 years, the gap between the energy demand & capacity fell to 0.1%.

- **Increase of Renewable Energy** - The contribution of renewable energy as a percentage has gradually increased from 11.5% in 2021-22 to 13.78% in 2024-2025.

How is power transferred between States?

- **Regional Power Grids** - India's States are divided into five regional power grids – North, East, West, South and North-East.
- **Inter-Regional Grid Connection** – It was first accomplished in 1991 when the East and North-Eastern grids were connected and the West followed in 2003 and the North in 2006.
- **National Power Grid** – It was established after the South was synchronously interconnected with the commissioning of the 765 kilo Volt (kV) Raichur-Solapur transmission line in 2013
- It has ensured that the entire nation was operating at one frequency – 50 Hertz (Hz).
- The archipelagos of Lakshadweep and Andaman & Nicobar, which are far away from the Indian mainland, are not connected to the national grid.
- **Load Dispatch centres** - As part of its national grid operations, PGCI manages the
  - national load dispatch centre (NLDC)
  - 5 regional load dispatch centres (RLDC) and
  - State load dispatch centres (SLDC), monitoring the power flow across States.
- Theyinteract with the dispatch centres of private power companies to monitor and regulate their power flow too.



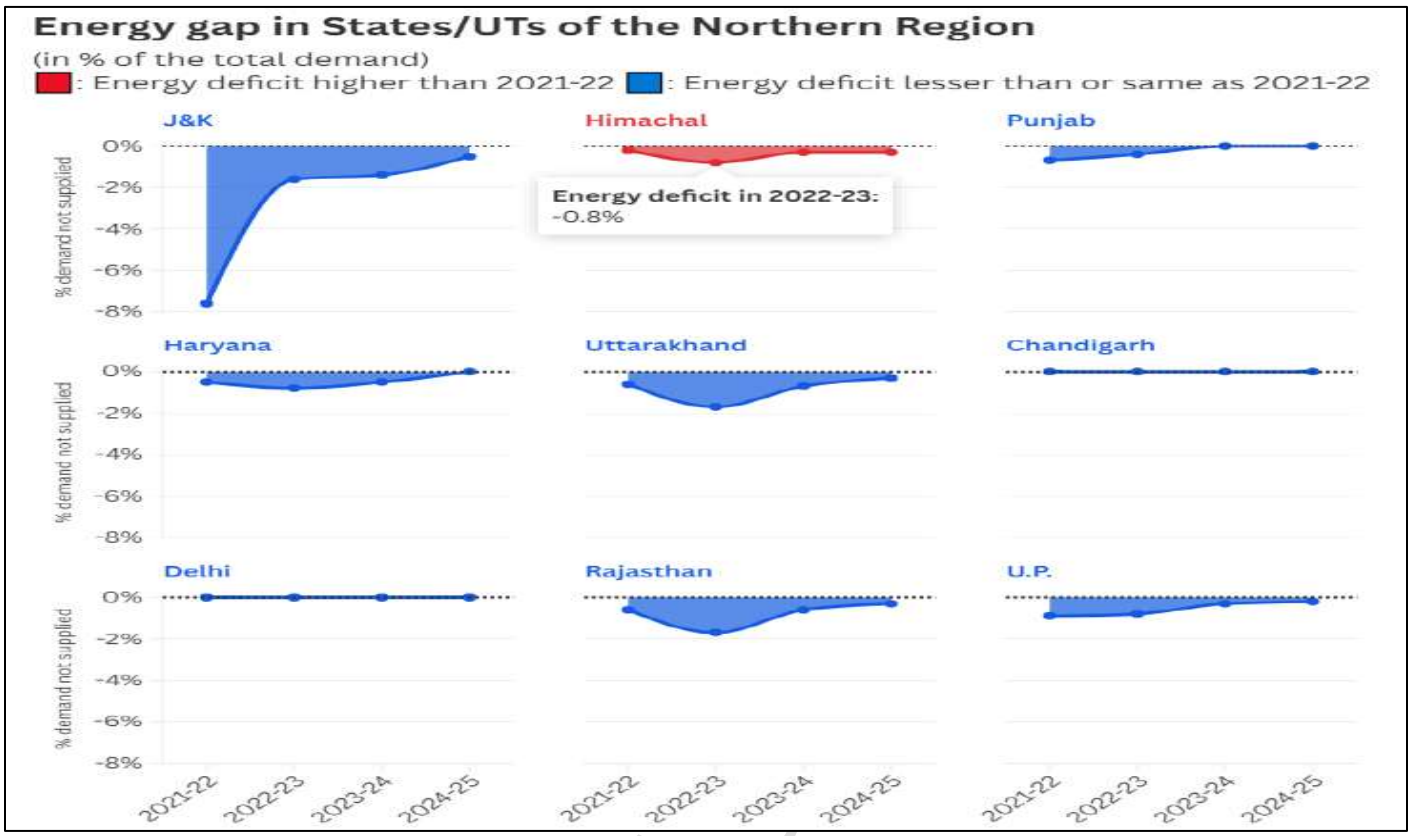
- **Private Dispatch canters** - While the Power Grid is the central transmission utility in India (and the largest), private companies like Adani Transmission, Tata Power, Sterlite Power, and ReNew Power too have their own network and load dispatch centres which are connected to the SLDCs.

Functions of Power Grid Corporation of India

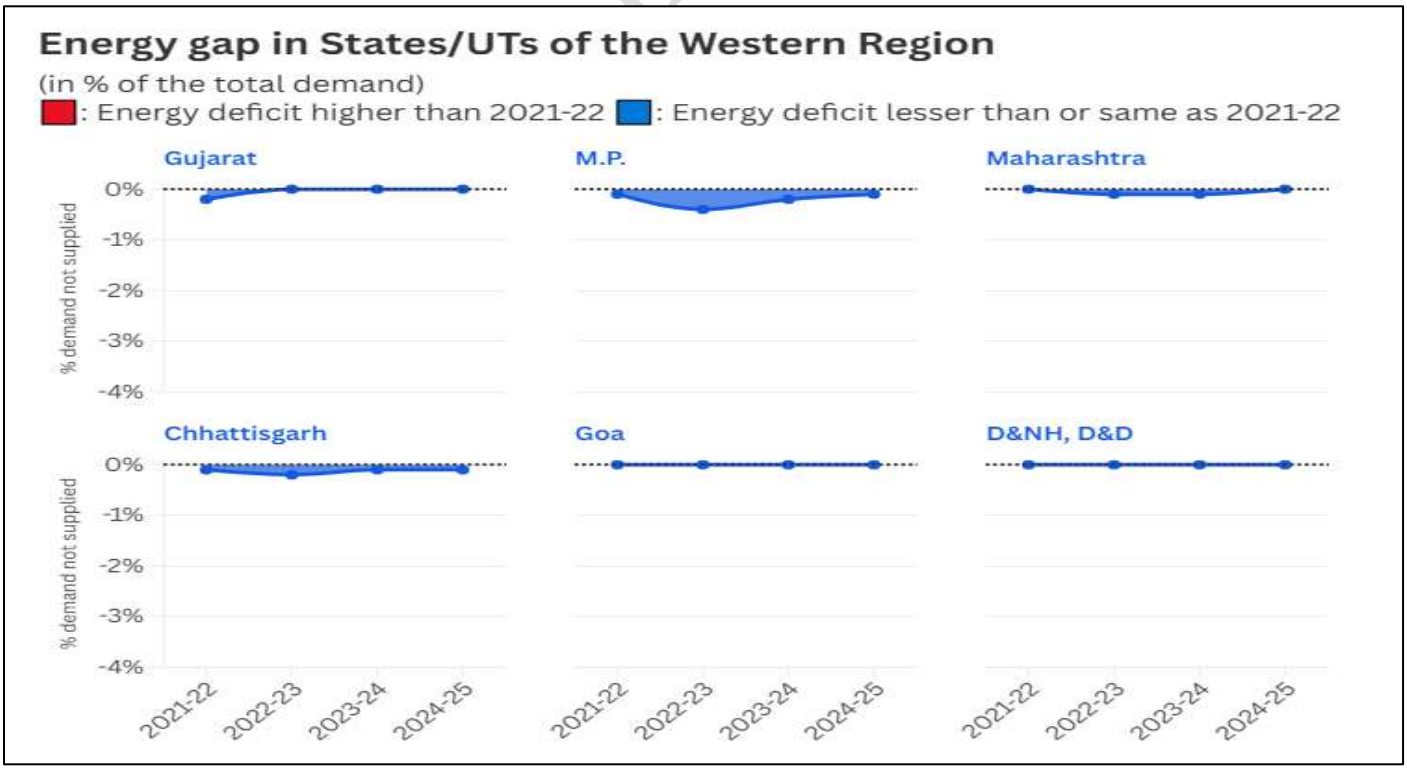
- **Nodal Agency** - National Grid is maintained by the government-run Power Grid Corporation of India Ltd (the Power Grid) to monitor, regulate and facilitate inter-State power flow.
- **Power Transmission** - Overall, the Power Grid carries 45% of India's transmission capacity via its large network of transmission towers, substations of varying voltages, satellite communication, transformers and reactors.
- **Electricity Trade Monitoring** - The Power Grid also oversees power trading between various power entities, States and regions.
- **Integration of Renewable Energy** – It is responsible for integrating power produced by renewable energy sources with the National Grid.
- **International Power Transfer** – The Power Grid facilitates power transfer between India and Bhutan, Nepal, Myanmar, and Bangladesh.

How are States bridging the power gap?

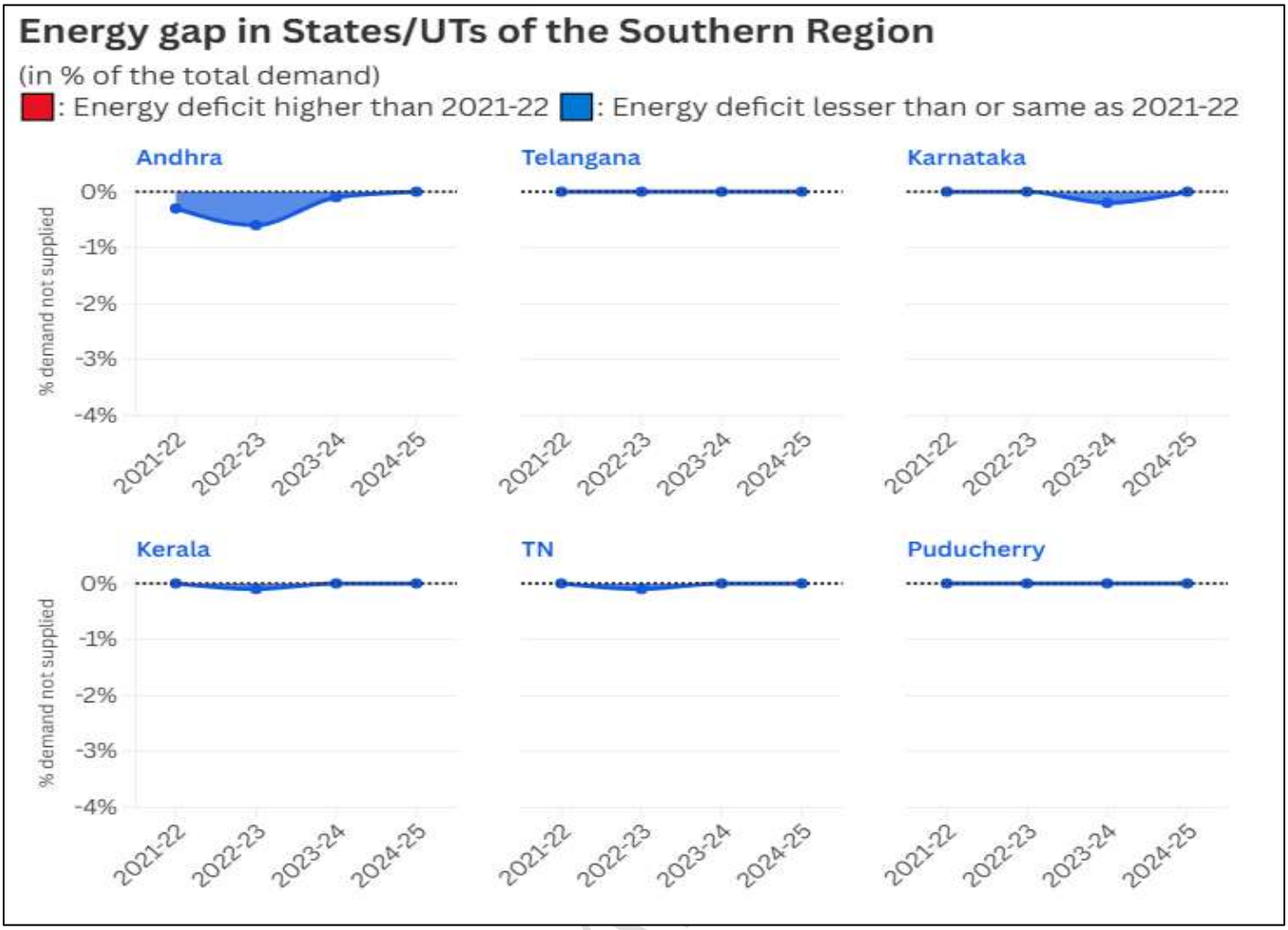
- **Reduction in North Grid** - Uttar Pradesh, Uttarakhand, Rajasthan, Punjab, Jammu-Kashmir, Himachal Pradesh, Haryana, Delhi and Chandigarh, in the North has consistently *reduced from 1% from 2021-22 to 0.2% in 2024-2025.*



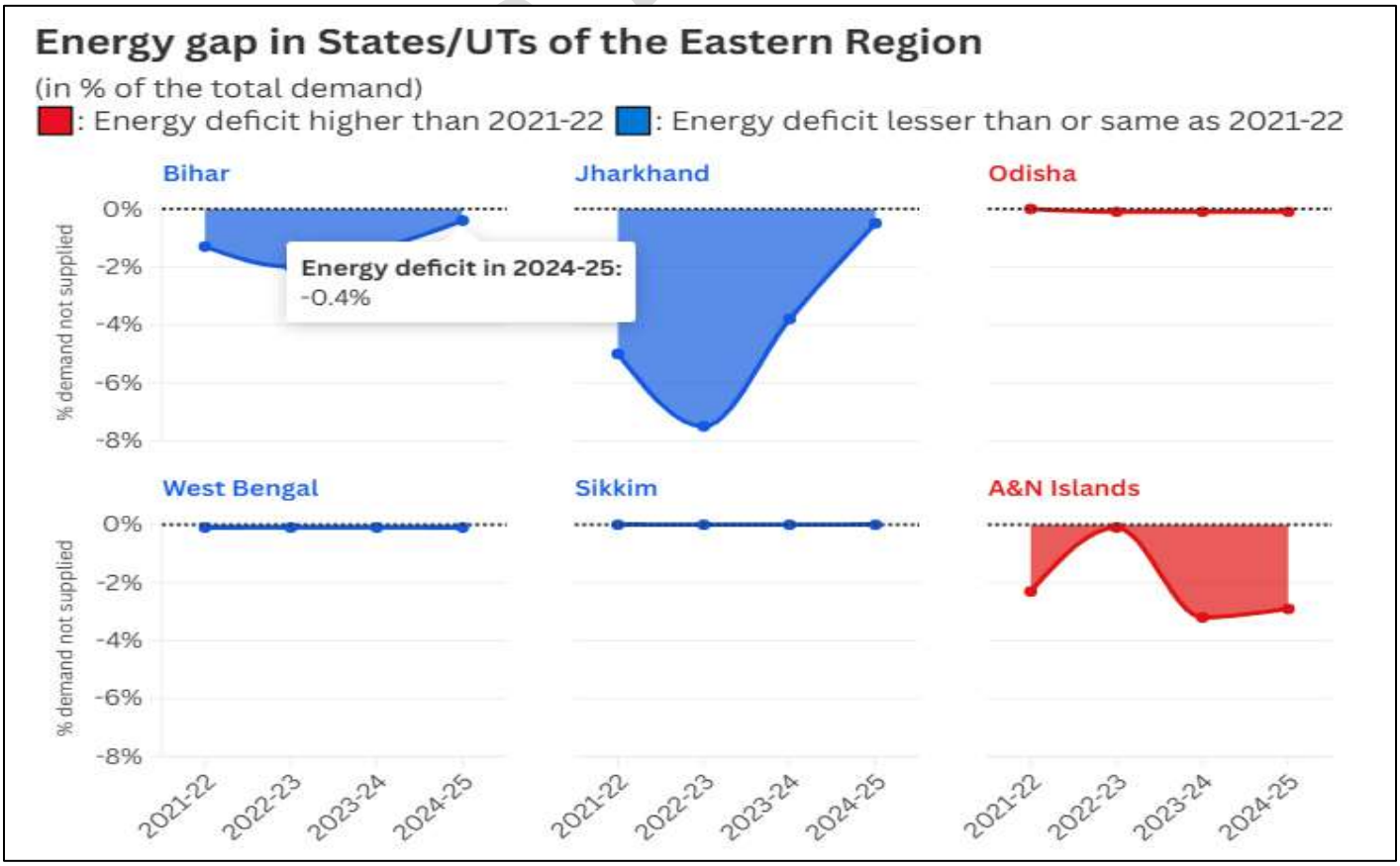
- **South & West** - These two regions which *cover India's largest power consuming states* like Maharashtra, Gujarat, Tamil Nadu, Madhya Pradesh and Telangana, have managed to keep their energy gap limited to 0.1% through the years.



- **South** – The region with Tamil Nadu, Karnataka, Andhra Pradesh, and Telangana have large power requirements, ballooned from 3,50,672 MU in 2021-22 to 4,19,531 MU in 2023-24.

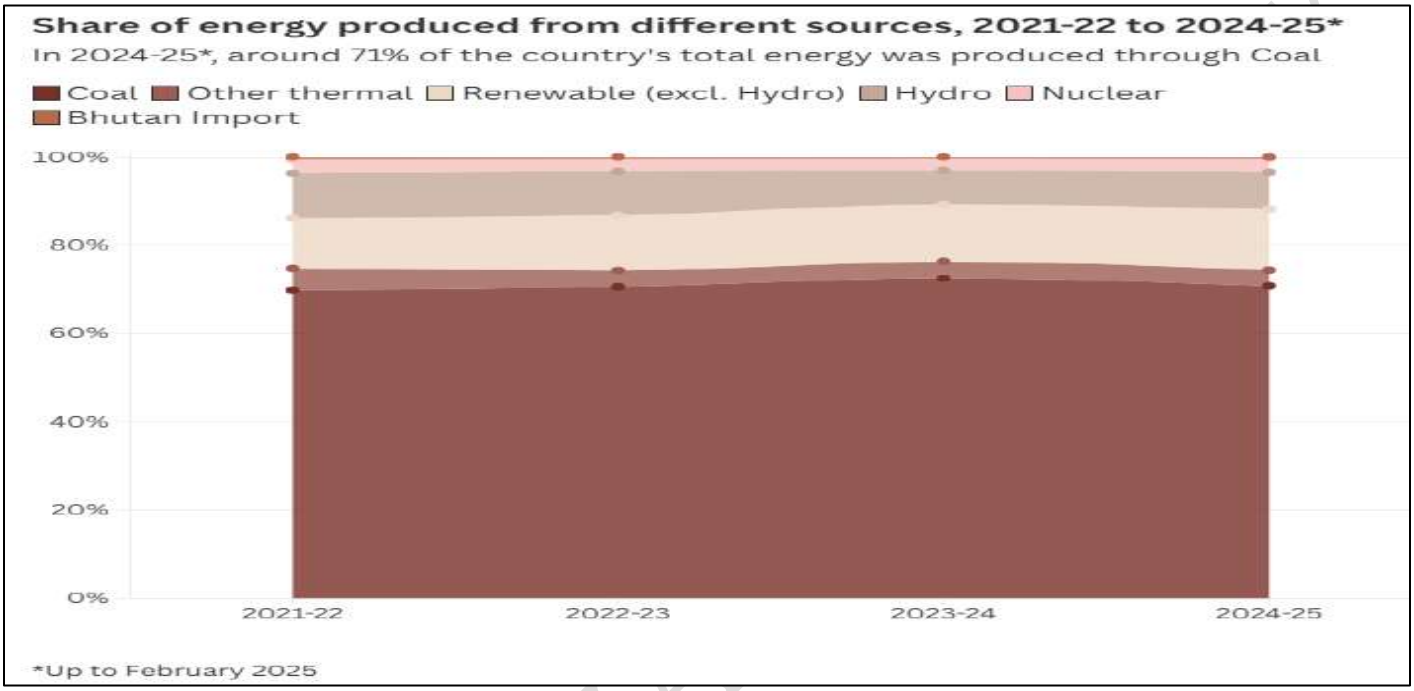


- **East & North-East** - Despite it being one of the first regions to get an interconnected grid, East grid's States like Bihar and Jharkhand have been unable to meet their power demands.



What are the measures to taken to reduce the energy gap?

- **Expansion of Transmission Lines** – As per Power Ministry's annual report 2024-25, India has added 14,360 ckm this year, enhancing the country's transformation capacity and interregional capacity of 2200 MW.
- **Addition of Extra-High Voltage (EHV) lines** – Six EHV lines of voltages above 400 kV, have been commissioned through the year in Uttar Pradesh, Rajasthan, Karnataka, Maharashtra, Assam and Meghalaya.
- **Increase in Renewable Energy** - Centre revealed that in the past four years, renewable energy production has increased from 1,70,912 MU in 2021-22 to 2,30,867 MU in 2024-25.
- Rajasthan has almost doubled its capacity from 24,099 MU to 50,322 MU, followed by Gujarat which added 15,644 MU in this time.



What lies ahead?

- With India's plan to boost its non-fossil energy capacity to 500 GW by 2030, the Centre needs to install the transmission system needed to evacuate the power.
- Interstate transmission networks for the evacuation of 161.9 GW of the installed capacity of 209 GW of renewable energy are under construction.
- Transmission systems for delivery of power to the Green Hydrogen/Green Ammonia Manufacturing hubs at Mundra, Kundla, Gopalpur, Paradeep, and Vizag are under planning.
- Public or private investment up to ₹9.15 lakh crore is needed in the transmission sector to realise the Centre's plan.

10.8 Reviving the Manufacturing Sector

Why in News?

Recently Centre for Social and Economic Progress (CSEP) has released Competitiveness Index (CI) for the year 2025.

Why is the manufacturing sector essential for India?

- **Employment Generation** - Manufacturing provides employment to millions, especially for semi-skilled and unskilled workers, which is vital in a country with a large and young labour force and addressing employment issues in India.
- **Strengthen Forex** - A strong manufacturing base boosts exports, improves trade balance, and brings in foreign exchange.
- **Support for Other Sectors** - Manufacturing has strong backward and forward linkages with agriculture (e.g., food processing) and services (e.g., logistics, design, and maintenance).
- **Urbanization** - Manufacturing leads to the development of industrial zones, towns, and cities, boosting urban infrastructure and services.

- **Infrastructure Development** – Transport and Logistics demands better connectivity, prompting investments in roads, ports, railways, and logistics networks.
- **National Security** - Domestic manufacturing in areas like defence, electronics, and pharmaceuticals strengthens national security.

What are challenges faced by India's manufacturing sector?

- **Less Growth** – Manufacturing sector's share of gross domestic product (GDP) to just 13% in 2023.
- **Stagnant Contribution** - India's share in global manufacturing exports has remained largely stagnant in recent years, inching up from 1.7 % in 2017 to 1.8 % in 2023, while Vietnam's share rose from 1.5 % to 1.9 %.
- **Inadequate Global Integration** - Despite its large economic size, India has struggled to integrate into manufacturing global value chains (GVCs), unlike many of its Asian peers.
- **High & Fragmented Tariff Regime** - It inflates input costs, reduces export competitiveness, and pushes firms to focus on domestic rather than global markets.
- **Absence From Major Trade Blocs** – India's rejection to join major trade groups such as the Regional Comprehensive Economic Partnership (RCEP) and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) puts its exporters at a disadvantage compared to peers like Vietnam.
- **Regulatory Restrictions** - Current labour laws impose restrictions once firms cross certain workforce size limits, discouraging expansion.
- **Inadeqaute Technology and R&D Investment** - India invests only 0.6% of its GDP in R&D, which is insufficient compared to competitors like Malaysia (0.9 per cent) and Thailand (1.2%).
- Despite various government incentives, private R&D remains low, primarily due to limited competitive pressure.

What lies ahead?

- The structural barriers limiting India's participation in GVCs needs to be addressed.
- India needs to deepen its FTA engagement, signing agreements with new partners and deepening existing agreements.
- Regulatory reform is crucial to help firms grow and scale.
- Effective urban planning and affordable housing policies are vital to boost labour mobility and lower costs for both workers and employers.
- Practical measures, such as building worker dormitories and improving transport, can significantly attract skilled workers, especially women, who remain vastly underrepresented in India's workforce.
- India needs to prioritise technology adoption and scale up investment in R&D to move up the value chain — from producing low-value-added goods to high-value-added, high-tech products.

11. ENVIRONMENT

11.1 Waste Management challenges and Role of Judiciary

Why in News?

According to a new study published in Nature, *India is the biggest plastic polluter* in the world, releasing 9.3 million tonnes (Mt) annually.

What are the challenges in pollution control in India?

- **Inadequate sanitary landfills** - Dumpsites (uncontrolled land disposal) outnumber sanitary landfills by 10:1.
- **Exclusion of various sources** – Although national collection coverage is reported at 95%, official statistics fail to account for waste in rural areas, uncollected waste subjected to open burning, or materials recycled by the informal sector.
- **Lack of methodology on data collection** - Waste generation data regarding the total solid waste and plastic waste in the country is based on data supplied by State Pollution Control Boards (SPCB) or Pollution Control Committees (PCC).
- In turn, these are based on data supplied by the municipal bodies in the respective States/Union Territories.

- There is nothing in any of the reports regarding the methodology adopted by SPCBs or PCCs or municipal bodies or any waste audit which explains how the figures have been arrived at.
- **Incorrect statistics on waste generation and collection** – Due to missed out sources, India's official plastic waste generation rate (approximately 0.12 kilograms per capita per day (kg cap–1 day–1) is probably underestimated and waste collection may be overestimated.
- **Regulatory non-compliance** – Supreme Court has recently noted in a judgement that violations occur while various Supreme Court directives and environmental norms are flouted.
- The schemes or plans framed by the Government remain on paper, failing to achieve any meaningful results.
- **Determining compensation** - The process of determining an equitable compensation amount is fraught with challenges, as it must account for both the tangible and intangible damage inflicted on the environment and the affected communities.

How judiciary contributed to environmental protection?

- **Safeguarding fundamental rights** - The Supreme Court of India has observed that environmental protection is not only a regulatory obligation but also a constitutional imperative aimed at safeguarding the fundamental rights of individuals and preserving ecological balance.
- The Supreme Court has broadened the interpretation of the right to life to include the right to a clean and healthy environment in the *M.C. Mehta v. Union of India (Ganga Pollution Case)* case.
- **Enforcement of environmental laws** - Courts enforce existing environmental regulations and ensure that violators—whether government bodies or private entities—are held accountable.
- **Judicial scrutiny** – Supreme Court and high courts constitute committees to report on the compliance of the order.
- **Punishing the polluters** - Courts have reiterated the polluter pays principle to cast absolute liability on the polluter for the harm caused to the environment.
- It also extends not only to compensate the victims of pollution but also the cost of restoring the environmental degradation.
- **Holding government accountable** - Court applied the Government Pay Principle to make the government pay compensation to the affected individuals/families and recover the same from the polluters, until the damage caused to the ecology is fully reversed.
- **Public Interest Litigation (PIL)** - The judiciary, has actively entertained PILs on environmental issues, providing a platform for citizens and environmental groups to seek legal remedies against environmental degradation.

Environmental Principles Developed by Judiciary		
Case	**Principle**	**About**
Vellore Citizens Welfare Forum v. Union of India	**Precautionary Principle**	It states that lack of scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation where there are threats of serious or irreversible damage.
M.C. Mehta v. Union of India - Oleum Gas Leak Case	**Absolute Liability**	The entity undertaking hazardous or inherently dangerous activities is liable for any damage caused, irrespective of whether they took reasonable care
Indian Council for Enviro-Legal Action v. Union of India	**Polluter Pays Principle**	It holds that the financial cost of preventing or remedying environmental damage should lie with the entity causing the pollution
M.C. Mehta v. Kamal Nath	**Public Trust Doctrine**	It asserts that the State is a trustee of natural resources like air, water, and forests, and these resources should be available for public use and not be subject to private ownership or exploitation

What lies ahead?

- The gathered data regarding waste can be put out in the public domain and shall faces 3rd party scrutiny.

- Regular updating of infrastructure data that the country has built over the years to deal with the management and processing of this waste can be done.
- Waste management infrastructure can be geotagged to help in tracking.
- Every local government, whether in an urban or in rural area can be linked with a material recovery facility (MRF), recyclers of various waste streams, extended producer responsibility (EPR) kiosks and sanitary landfills.
- All producers, importers, and brand owners (PIBOs) who have a legal obligation can form kiosks across the country to gather waste from all local bodies thereby to operationalise EPR.
- There can be time bound implementation of judicial order on environmental matters.

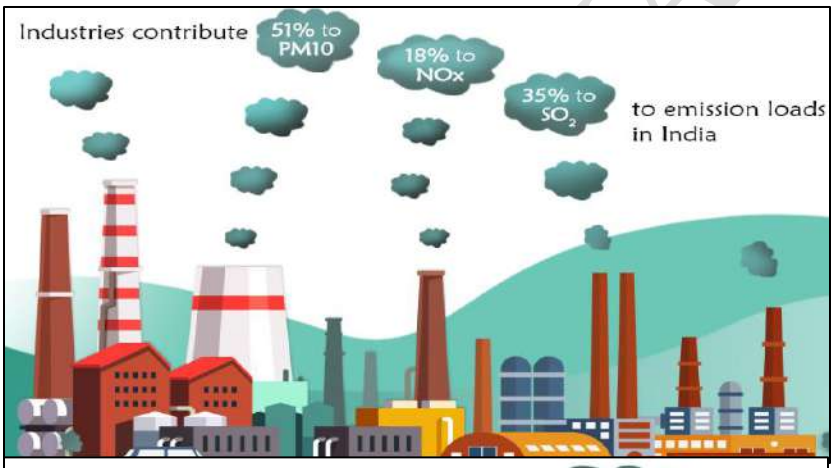
11.2 Industrial Pollution

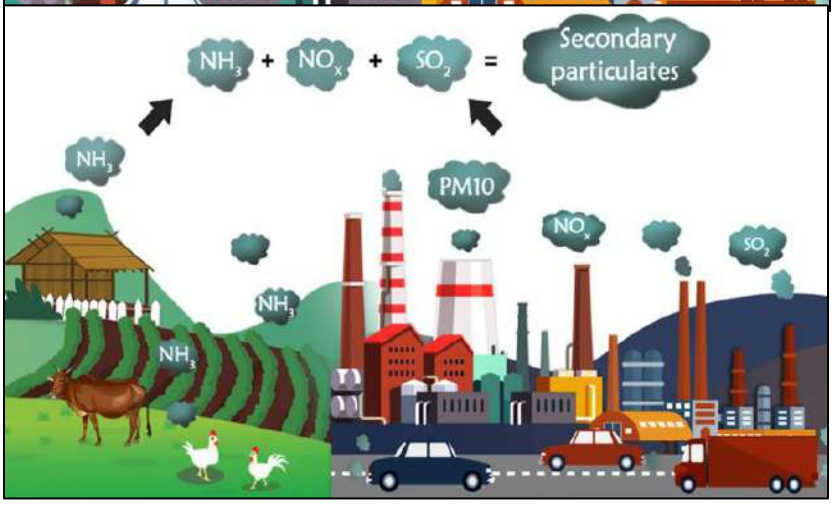
Why in News?

Residents in various parts of Chennai have raised concerns over the rising industrial pollution in their neighbourhoods.

What are the types of industrial pollution?

- Industrial pollution refers to environmental contamination arising directly from industrial activities and facilities, impacting air, water, and soil.
- **Air Pollution** - Industrial emissions like smoke, chemicals, and gases from steel plants, cement factories, oil refineries, and more contribute to air pollution.
- **Water Pollution** - Industrial wastewater and discharges containing toxic chemicals, heavy metals, and other contaminants pollute water bodies, harming aquatic life and potentially contaminating human water supplies.
- **Soil Pollution** - Industrial waste, including toxic chemicals, is dumped onto the soil, contaminating it and affecting the health of organisms living in it.
- **Noise Pollution** - Industrial machinery and operations can produce excessive noise levels, impacting human health and well-being.





- Top 10 polluting industries in the World
- 1.) Fuel & Energy Industry - 75% of Global GHG Emissions
- 2.) Construction Industry - 23% of Global Air Pollution
- 3.) Transport Industry - 74.5% of Transport CO_2 Emissions from Road Vehicles
- 4.) Agriculture & Food Production - 18% of Global Emissions
- 5.) Fashion Industry (Fast Fashion)
- 6.) Food Retail
- 7.) Plastics Manufacturing
- 8.) Waste Management and Disposal - Landfills Cause 20% of Methane Emissions
- 9.) Chemical Manufacturing - Major VOC, NOx, SO_2 Pollutant
- 10.) Technology - 200-250 TWh Electricity Use in 2023

Industrial Pollution	
Energy Industry	Fossil fuels used for electricity and heat produce 75% of global greenhouse gas emissions, making the energy sector the biggest polluter.
Chemical Industry	The chemical industry releases harmful VOCs, NOx, SO_2, and PM, leading to acid rain, smog, and serious health risks.
Mining Operations	Mining activities can lead to significant water pollution, including acid mine drainage.
Power Generation	Power plants, especially those using fossil fuels, generate wastewater and release pollutants into the air.
Food Processing	Industries like meat packing and dairy production generate organic waste and wastewater.
Textile Industry	The textile industry uses a variety of chemicals and dyes, many of which are hazardous to the environment.
Pulp and Paper Industry	This industry uses a large amount of water and generates wastewater containing chemicals and organic matter.

What are the impacts of industrial pollution?

- **Human Health** - Industrial pollution can cause various health problems, including respiratory illnesses, cancer, and cardiovascular diseases.
- Toxic substances like heavy metals (lead, mercury, arsenic), volatile organic compounds (VOCs), and gases (sulfur dioxide, nitrogen oxides) can infiltrate air, water, and soil, posing significant risks especially to children and the elderly.
- **Environmental Damage** - Pollution from industries harms ecosystems, reduces biodiversity, and affects the quality of air, water, and soil.
- Water pollution from industrial waste-often containing heavy metals, toxic chemicals, and organic sludge-can render water sources unusable for humans and animals, and disrupt agricultural productivity.
- **Food Chain Contamination** - Soil contamination from heavy metals and persistent organic pollutants (POPs) makes it difficult for plant and animal life to thrive, and can lead to food chain contamination.
- **Climate Change** - The release of greenhouse gases (such as carbon dioxide and methane) from burning fossil fuels in industrial processes is a major driver of global warming and climate change
- **Economic Costs** - Industrial pollution can lead to significant economic costs related to healthcare, environmental cleanup, and lost productivity.
- **Social Impacts** - Industrial pollution imposes substantial costs on society, including healthcare expenses, loss of productivity, and property devaluation in affected communities
- **Deterioration of Infrastructure and Cultural Heritage** - Pollutants can corrode buildings, monuments, and vital infrastructure, leading to costly repairs and loss of cultural heritage.

What are regulations in India?

Central Pollution Control Board (CPCB) Regulations on Industrial Pollution	
Categorization of Industries	The CPCB has categorized industries based on their Pollution Index (PI) into four main categories. • Red (highly polluting) • Orange (moderately polluting) • Green (less polluting) • White (non-polluting) • Blue (Essential environmental services)

Emission and Effluent Standards	• The standards prescribe the permissible limits for various pollutants in industrial emissions (gases and particulate matter released into the air) and effluents (liquid waste discharged into water bodies or land). • These standards are legally binding and are specified under Schedule-I of the Environment (Protection) Rules, 1986. • They cover a wide range of industries, including chemical, pharmaceutical, textile, and power plants.
National Ambient Air Quality Standards (NAAQS)	• These are benchmarks set by the Central Pollution Control Board (CPCB) to regulate and monitor air quality across India.
Consent Mechanism	• Industries are required to obtain Consent to Establish (CTE) before setting up a new unit and Consent to Operate (CTO) before commencing production. • These consents are granted by the respective State Pollution Control Boards (SPCBs) or Pollution Control Committees (PCCs) in Union Territories.
Online Continuous Effluent/Emission Monitoring Systems (OCEMS)	• These are automated systems that continuously monitor and analyse the quality of effluent wastewater or emissions from industrial processes in real-time.

What can be done to address industrial pollution?

- **Source Control** - This approach focuses on preventing or reducing pollution at its source.
- It involves modifying industrial processes, technologies, or raw materials to minimize pollutant generation.
    - **Examples** include using cleaner production techniques, optimizing combustion processes, or substituting hazardous substances with less harmful alternatives.
- **Pollution Prevention** - This control strategy aims to eliminate or minimize the generation of pollutants.
- It involves implementing efficient waste management practices, recycling and reusing materials, and adopting sustainable production methods to minimize waste and emissions.
- **Treatment Systems** - Industrial wastewater treatment and air pollution control systems are vital for reducing the impact of pollution.
- These systems employ various techniques such as physical, chemical, and biological processes to remove or neutralize pollutants before their release into the environment.
- **Energy Efficiency** - Enhancing energy efficiency in industrial processes reduces the overall environmental impact.
- By optimizing energy use, industries can lower greenhouse gas emissions and decrease the demand for fossil fuels, thus mitigating air pollution and climate change.
- **Environmental Monitoring** - Regular monitoring and assessment of industrial operations help identify potential pollution sources and evaluate the effectiveness of control measures.
- Real-time monitoring systems can detect anomalies and trigger corrective actions promptly.

11.3 E-Waste Management

Why in News?

South Korean tech giants LG and Samsung have filed legal petitions against the Indian government, challenging a newly introduced e-waste recycling regulation that mandates a minimum payout to recyclers.

What is the status of e-waste in India?

India ranks as the world's 3rd largest generator of electronic waste, after China and the United States.

- **E Waste** - Electronic waste is the discarded electrical and electronic equipment and its parts, often containing toxic materials.
- It includes items like computers, mobile phones, and household appliances that have reached the end of their useful life and are discarded.

- **Composition** - E-waste contains a variety of materials, including precious metals like gold and copper, as well as hazardous substances like mercury, lead, and cadmium.
- **Solid Waste** - Electronic waste (e-waste) is one of the fastest growing solid waste streams in the world.
- **E waste Generation Rate** - In 2022, an estimated 62 million tonnes of e-waste were produced globally, up 82% from 2010 but Only 22.3% was documented as formally collected and recycled.
- The world's generation of electronic waste is rising five times faster than documented e-waste recycling, reports the UN's fourth Global E-waste Monitor (GEM).
- **India's E waste Generation** - India's e-waste generation surged by 73% in five years, reaching 1.751 million MT in 2023-24.

Financial Year	Generation	Quantity of e-waste collected, dismantled and recycled / disposed	
	(Tonne)	(Tonne)	(%)
2019-20	10,14,961.21	2,24,041.0	22.07
2020-21	13,46,496.31	3,54,291.22	26.31
2021-22	16,01,155.36	5,27,131.57	32.92

What are the impacts of e-waste?

- **Soil and Water Contamination** - E-waste contains toxic substances like lead, mercury, cadmium that can leach into the soil and water when disposed of improperly.
- **Air Pollution** - Burning or improper shredding of e-waste releases harmful pollutants into the air, like dioxins, furans, and particulate matter, contributing to air quality degradation.
- **Health Problem** - Exposure to the harmful chemicals from e-waste creates severe health hazards that can be fatal.
- The toxins enter our bodies through inhalation, ingestion of food or water, and skin absorption.

Metal	Health effects e-waste-related
Lead	Damages brain function, particularly in children
Americium	Can induce cancer
Mercury	Causes memory loss, muscle weakness, reduced fertility, and more
Cadmium	Severe lung damage if breathed in
Sulfur	Damages the liver, heart, kidneys, and eyes
Chromium	A known cause of cancer

- **Climate Change** - The decomposition of e-waste in landfills and incineration of e-waste produces greenhouse gases like methane, a potent greenhouse gas, which contribute to climate change.
- **Biodiversity Loss** - Pollution caused by e-waste impacts some animal species more than others, which may be endangering these species and the biodiversity of certain regions that are chronically polluted.
- **Economic Losses** - The improper disposal of valuable materials in e-waste results in a loss of resources and economic opportunities.

India loses more than $10 billion annually due to water pollution from the disposal of cyanide and sulphuric acid solutions, air pollution caused by lead fumes, open coal burning, and plastic incineration, and soil pollution.

E- Waste regulations in India

- The management of E-Waste in India is presently regulated under E-Waste (Management) Rules, 2022 under the Environment Protection Act, 1986 and notified by Central Pollution Control Board.
- **Extended Producer Responsibility** – The EPR mandates that producers of Electrical and Electronic Equipments are responsible for the entire lifecycle of their products, including post-consumer waste management.
- This responsibility encompasses the collection, recycling, and environmentally sound disposal of e-waste.
- **Rules Applicability** - It apply to every manufacturer, producer, refurbisher, dismantler, and recycler involved in the lifecycle of EEE listed in Schedule I.
- **Environmental Compensation** – It shall be levied for non-compliances of provisions of E-Waste (Management) Rules, 2022 and amendments thereof.
- **Mandatory Registration** - All the manufacturer, producer, refurbisher and recycler are required to register on portal developed by CPCB.
- No entity shall carry out any business without registration and also not deal with any unregistered entity.
- **Floor Price** – The 2022 rule introduced a floor price for EPR certificates to ensure fair returns for registered recyclers, curbing informal, hazardous recycling (practices that dominate 95% of the sector).

What are the challenges in e-waste management?

- **Infrastructure Limitations** - Many regions lack the infrastructure necessary for proper e-waste collection, sorting, and recycling.
- **High Costs of Recycling Infrastructure** - Setting up a proper infrastructure and employing advanced recycling technologies can be expensive, discouraging investment, especially in developing countries.
- **Rapid Technological Change** - The rapid pace of technological innovation leads to shorter product life cycles and more frequent disposal, outpacing the capacity of recycling systems to adapt.
- **Product Complexity** - Modern electronic devices are made from a mix of materials (plastics, metals, glass) and often feature miniaturized, embedded, or non-removable components, making dismantling, sorting, and recycling resource-intensive and technically challenging.
- **Inefficient Collection** - There is often a lack of accessible, visible collection points and clear information about proper disposal methods.
- **Lack of Public Awareness** - Many people are unaware of what qualifies as e-waste or how to dispose of it properly, leading to illegal dumping, hoarding, or mixing e-waste with household trash.
- **Transboundary Movement** - Significant volumes of e-waste are exported, often illegally, from developed to developing countries, where they are processed under unsafe conditions, exacerbating environmental and health problems.

What lies ahead?

- The number and capacity of certified recycling and refurbishing facilities can be increased, ensuring they are equipped with advanced, eco-friendly technologies to safely process a wide range of electronic wastes.
- A well-structured, nationwide e-waste collection network with accessible drop-off points for consumers and businesses can be created.
- Informal e-waste handlers can be channelized into the formal system through structured partnerships, training, and incentives, ensuring safe and environmentally sound recycling practices.
- A robust reverse supply chain can be built for the collection, transportation, and tracking of discarded electronics.
- Partnerships among government, private sector, and NGOs can be promoted to drive innovation, investment, and best practices in e-waste management.

11.4 Decarbonising Maritime Industry

Why in News?

Recently, International Maritime Organization (IMO) has approved net-zero regulations for global shipping

Why it is import to control global shipping emission?

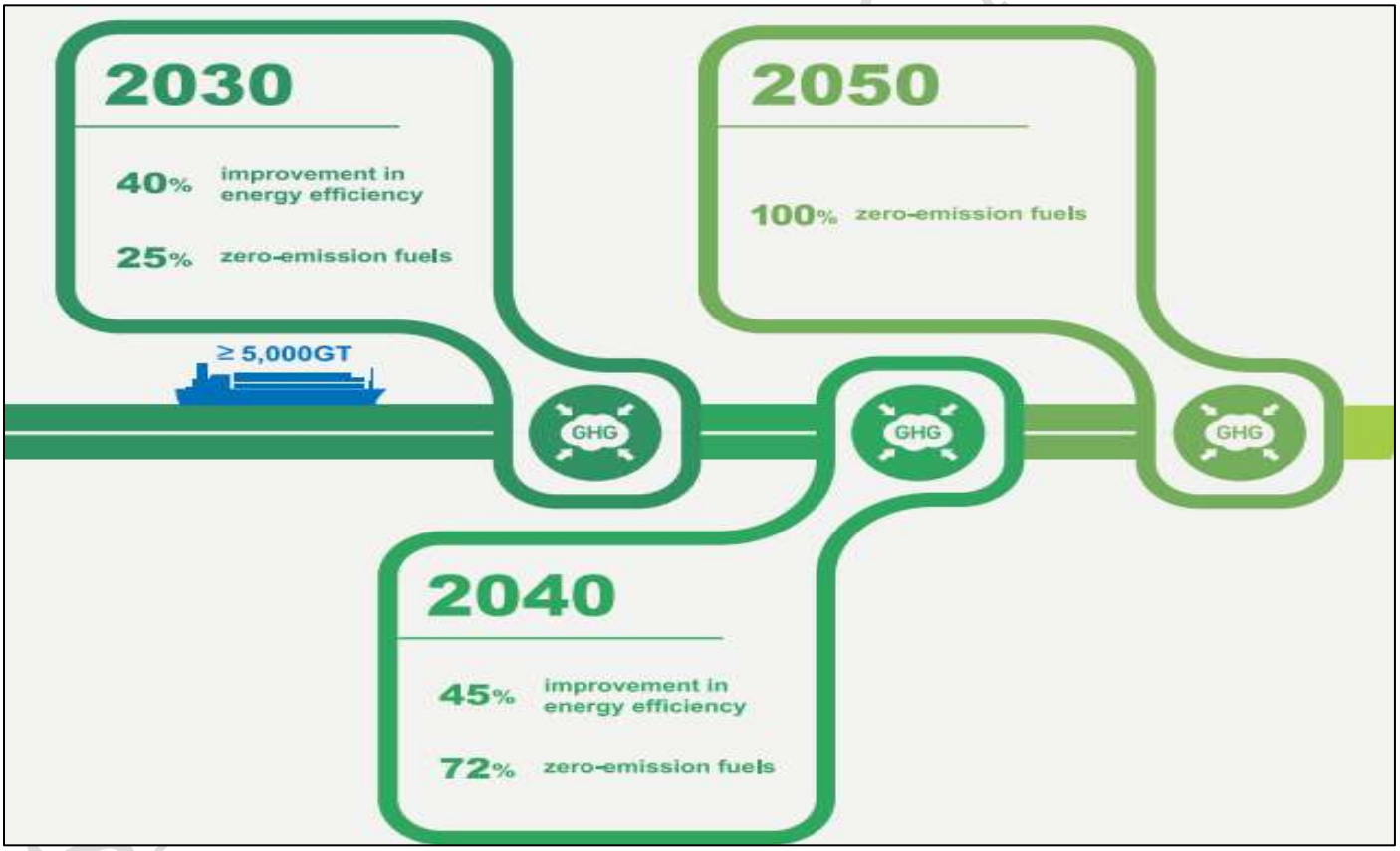
- **Shipping Emissions** - The sector emits approximately *one billion metric tonnes of GHG each year*, representing about 2.8% of total global emissions.
- If ranked as a country, international shipping would be the *sixth-largest emitter in the world*, between Germany and Japan.
- **Future Increase** - Projections indicate that, without corrective action, emissions from shipping could rise by as much as 50 to 250% by 2050.
- **International Emission Targets** - To align with the 13th UN Sustainable Development Goal as well as the Paris Agreement.

> ***Sustainable Development Goal (SDG) 13**, "Climate Action," aims to take urgent action to combat climate change and its*

What are the measures taken by IMO to reduce shipping emission?

- **The MARPOL convention** - The International Convention for the Prevention of Pollution from Ships, is a major international treaty aimed at preventing pollution of the marine environment by ships.
- It was adopted at the International Maritime Organization (IMO) in 1973.
- **IMO GHG Strategy** - IMO began implementing emissions-reduction measures in 2011, followed by the Initial GHG Strategy in 2018.
- **IMO GHG Strategy in 2023** - It aims at reaching net-zero GHG emissions by or around 2050.

> ***International Maritime Organization (IMO)** is a body that regulates the shipping industry with a range of legislations. It currently has 174 member states and 3 associate members.*

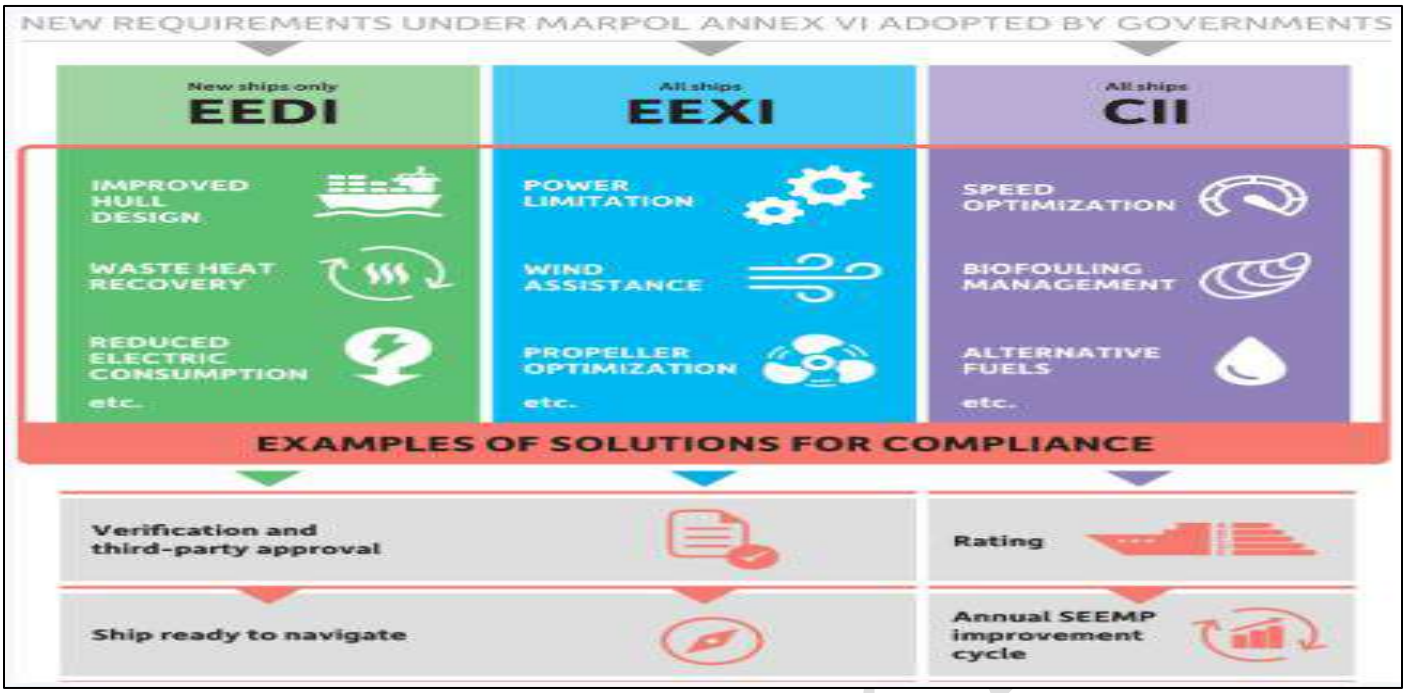


- **Ship Energy Efficiency Management Plan** – It is a mandatory, ship-specific plan designed to improve the energy efficiency of a vessel.
    - All ships of 400 gross tonnage (GT) and above engaged in international voyages are required to develop and maintain a SEEMP.
- **Energy Efficiency Design Index (EEDI)** – It is an important technical measure aiming at promoting the use of more energy efficient equipment and engines for the design of new ships in order to make them less polluting.

What is the IMO Net Zero framework?

- **IMO Net Zero Framework** – This is the first in the world to combine mandatory emissions limits and GHG pricing across an entire industry sector.

- **Adoption and Enforcement** - These measures are set to be formally adopted in October 2025 before entry into force in 2027.



- **Applicability** – They will be applicable to large ocean-going ships over 5,000 gross tonnages.
- This category ships account for 85% of the total CO_2 emissions from international shipping.
- **MARPOL Convention** - The IMO Net-Zero Framework will be included in the International Convention for the Prevention of Pollution from Ships (MARPOL).

What are the features of IMO framework?

- The framework combines mandatory emissions limits and GHG pricing across an entire industry sector.
- The measures include a new fuel standard for ships and a global pricing mechanism for emissions
- **Global fuel standard** - Ships must reduce, over time, their annual greenhouse gas fuel intensity (GFI) – that is, how much GHG is emitted for each unit of energy used.
- **Global economic measure** - Ships emitting above GFI thresholds will have to acquire remedial units to balance its deficit emissions.
- Those using zero or near-zero GHG technologies will be eligible for financial rewards.
- **Ensuring compliance** - Ships that emit above the set thresholds can balance their emissions deficit by:
    - Transferring surplus units from other ships
    - Using surplus units, they have already banked
    - Using remedial units acquired through contributions to the IMO Net-Zero Fund.
- **MO Net-Zero Fund** - The IMO Net-Zero Fund will be established to collect pricing contributions from emissions.

What are the potential impacts for India?

- **Initial Short-Term Challenges** - While the carbon levy and GHG targets set by the IMO may pose short-term challenges for certain sectors of the Indian economy, India is likely to emerge as a long-term beneficiary of the new framework.
- **Moderate impact on Logistics Cost** - According to the United Nations Conference on Trade and Development, the impact on India's maritime logistics costs will be modest in the near term — ranging from 4.98 to 7.29% on imports and 5.92 to 8.09% on exports by 2030.
- **No Impact on Coastal Fleet** - Since the new framework applies only to international shipping, India's coastal fleet remains unaffected.

India currently operates nearly 236 ships over 5,000 gross tonnages, with only 135 involved in international voyages.

- **Increase in Fuel Cost** - At present, India spends roughly $400 million per year on fuel for its international fleet.
- The new targets are projected to increase this by approximately $108 million by 2030.
- **Boost to Green Energy Export** - India is now investing heavily in green hydrogen through its National Hydrogen Mission and three Indian ports are preparing to offer green hydrogen bunkering services.
- This alignment creates a significant opportunity for India to export green fuels globally and capitalise on international incentives.

What lies ahead?

- A Market-Based Measure (MBM) need to adopted that can balance environmental effectiveness with economic fairness.
- The proposed emissions levy on global shipping should be implemented globally by encouraging more countries to accept the Singapore's hybrid model based on India's proposal as the IMO's Net Zero Framework.

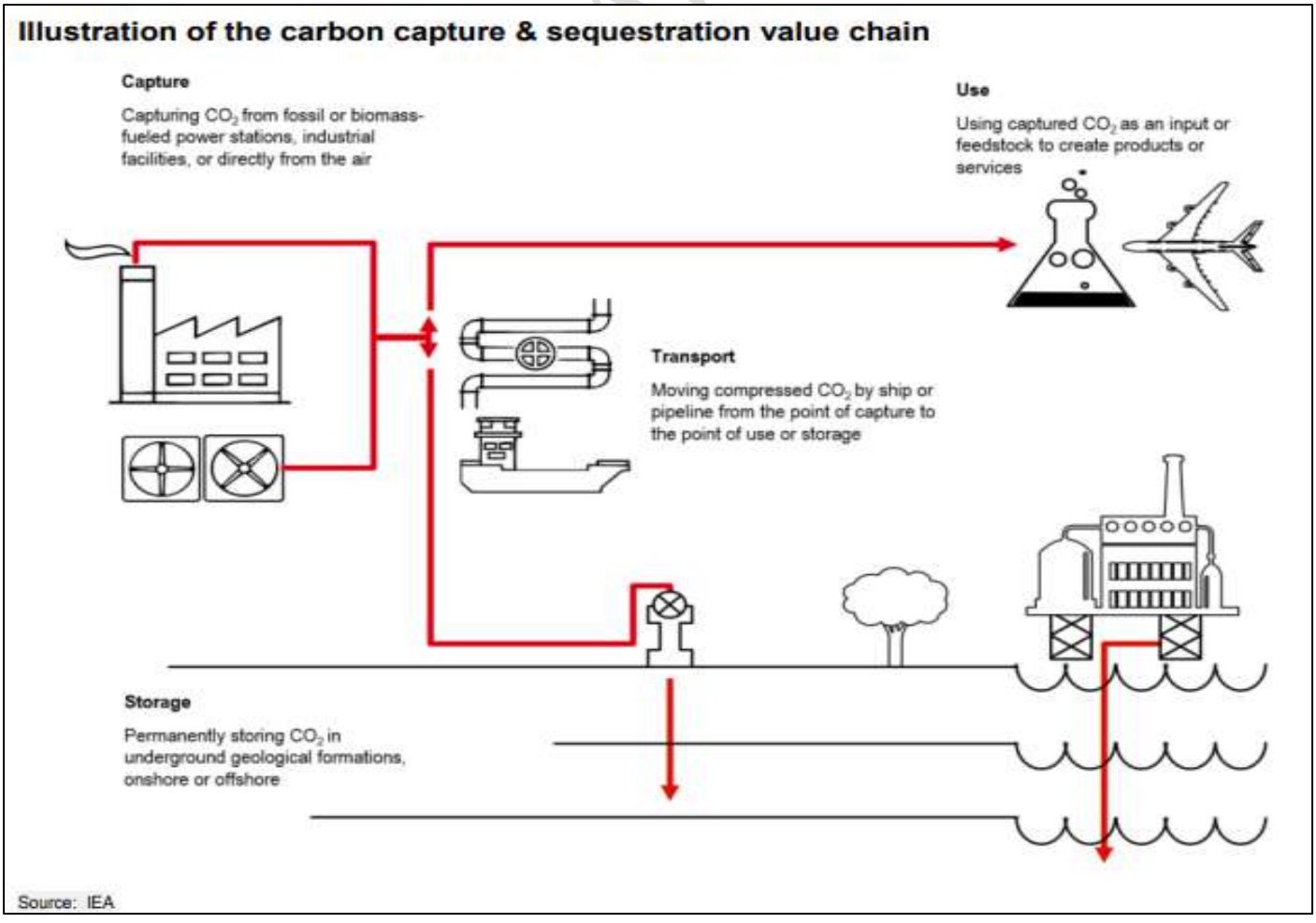
11.5 Carbon Capture Usage Storage (CCUS)

Why in News?

India has introduced several initiatives to achieve net-zero emissions by 2070 - one of which is the emphasis on harnessing Carbon Capture Usage Storage (CCUS) technology.

What is Carbon Capture Usage Storage (CCUS)?

- It is also called as *Carbon Capture Utilization Storage.*
- **CCUS** – It refers to an array of technologies designed to *capture carbon dioxide (CO_2) emissions* from large point sources such as thermal plants, oil refineries, and the steel and cement industries.
- The captured CO_2 is either *transferred into the earth or reused* for industrial applications in various forms.
    - CCUS (Carbon Capture, Utilization, and Storage) was a prominent topic at COP28, the UN Climate Change Conference held in Dubai in 2023.



- CCUS technology comprises *3 stages of capture, utilisation and storage*.
- **First stage (Capture)** - There are different types of carbon capture technologies, and their use is determined by the nature of the gas stream and the intended application.
    - Chemical-solvent based - It is used when the gas streams contain lower concentrations of CO_2.
    - Physical solvent methods – It is preferred for gas streams with relatively higher concentrations of CO_2.
    - Adsorption techniques – This is used to capture carbon when gas streams contain moderate CO_2 concentrations such as Steam Methane Reforming (SMR) flue gas.
- **Second Stage (Utilization)** – In this stage, the captured carbon is converted into value-added products such as green urea, dry ice, carbonated drinks, building materials and chemicals.
- **Third stage (Storage)** – It entails storing the CO_2 in saline aquifers, depleted oil and gas fields, and other similar geological formations.

What are the potentials of CCUS?

- **Direct Emissions Reduction** - CCUS captures CO_2 at the source—before it enters the atmosphere.
- **Decarbonisation of Industrial Sector** - CCUS has tremendous potential for reducing emissions in hard-to-abate sectors such as coal, steel, cement, oil refineries, which form the backbone of Indian industry.
- **Access to Renewable Fuels** - The captured CO_2 can be converted into green fuels such as hydrogen, green ammonia, methane, etc.
- **Transition to Cleaner Energy** - CCUS also plays an important role in facilitating the transition to cleaner energy sources and complementing options like solar and wind power.
- **Climate Change Mitigation** - By reducing the amount of greenhouse gases released, CCUS helps slow the pace of global warming.
- **Job Creation** - The deployment and operation of CCUS facilities can generate significant employment opportunities in construction, operation, and the broader supply chain.

What are the challenges in CCUS?

- **High Costs** - CCUS requires substantial upfront investment for capture equipment, transportation infrastructure (like pipelines), and secure storage facilities.
- **Technical Challenge** - Direct Air Capture (DAC), a method that captures carbon directly from the air regardless of the source or concentration – is in its nascent phase.
- **Not enough Investment** - Since CCUS technology remains a niche area, it has yet to attract significant businesses and investors.
- **Infrastructure Challenges** - Transporting CO_2 safely requires specialized pipelines, which are expensive to build and maintain.
- Existing oil and gas pipelines are generally unsuitable, and impurities in CO_2 can cause pipeline damage.
- **Storage Challenge** - Identifying suitable geological storage sites is complex, time-consuming, and costly.
- Not all regions have adequate storage capacity, and some sites may be remote from emission sources, increasing transport costs.

What lies ahead?

- Viability gap funding (VGF), production-linked incentives (PLI), tax credits are needed to encourage investment in the sector.
- Clear regulations for CO_2 capture, transport, utilization, and long-term storage are needed.
- R&D Support to advance CCUS technologies, improve capture efficiency, reduce costs, and develop innovative CO_2 utilization pathways is needed.

India is preparing to launch a national CCUS mission to decarbonize hard-to-abate sectors like power, steel, and cement.

11.6 Oil Spill

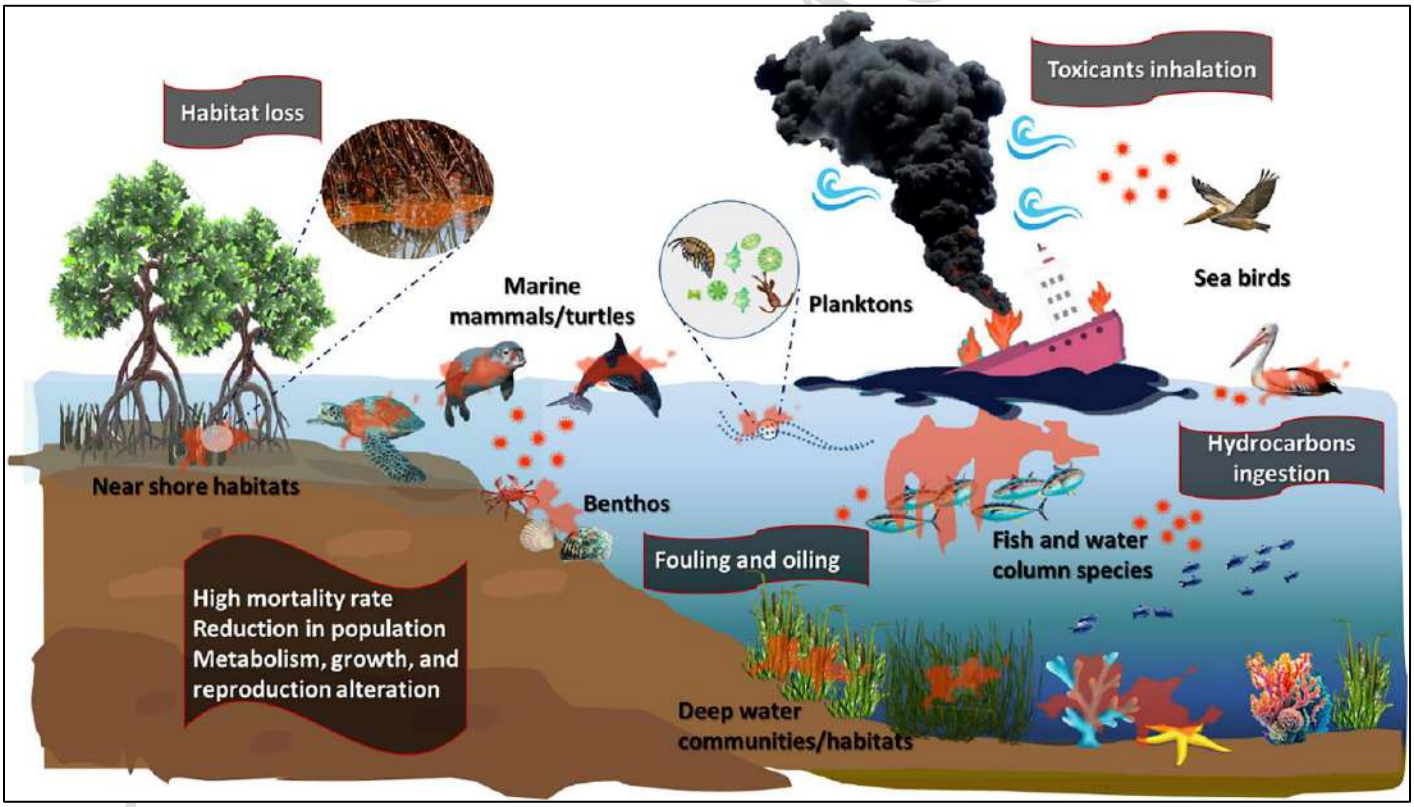
Why in News?

A Liberian-flagged cargo ship carrying 640 containers onboard, including 13 hazardous cargoes, capsized and sank in the sea off the coast of Kerala, raising fears of an oil spill.

What are the impacts of oil spill?

*An **oil spill** is the release of a liquid petroleum hydrocarbon into the environment, especially marine areas, due to human activity. It is usually applied to marine oil spills, where oil is released into the ocean or coastal waters, but spills may also occur on land.*

- **Impacts on Marine Life** - Oil can coat feathers and fur of marine animals, including seabirds, marine mammals, and fish, hindering insulation and leading to hypothermia or overheating.
- Acute exposure to oil can kill large numbers of animals.
- **Habitat Loss -** Sensitive habitats such as wetlands, coral reefs, and mangrove forests can be severely damaged by oil spill.
- **Ecosystem Disruption** - Oil can smother plants and animals, disrupt food chains, and cause long-term changes in ecosystem structure and function.
- **Contamination of Water Sources** - Oil spills can contaminate drinking water supplies, impacting human health.
- **Health Risks** - Oil spills can cause respiratory problems, skin irritation, and other acute health effects for people exposed directly to oil or fumes, including cleanup workers and coastal residents.
- **Water and Air Pollution** - Spilled oil can contaminate drinking water supplies and increase air pollution, leading to broader public health concerns.
- **Damage to Fisheries and Livelihoods** - Oil spills can force the closure of commercial and recreational fisheries, causing significant financial losses for fishermen and related industries.
- **Tourism Losses** - Contaminated beaches and water lead to a sharp decline in tourism.



Oil Spill Prevention Norms

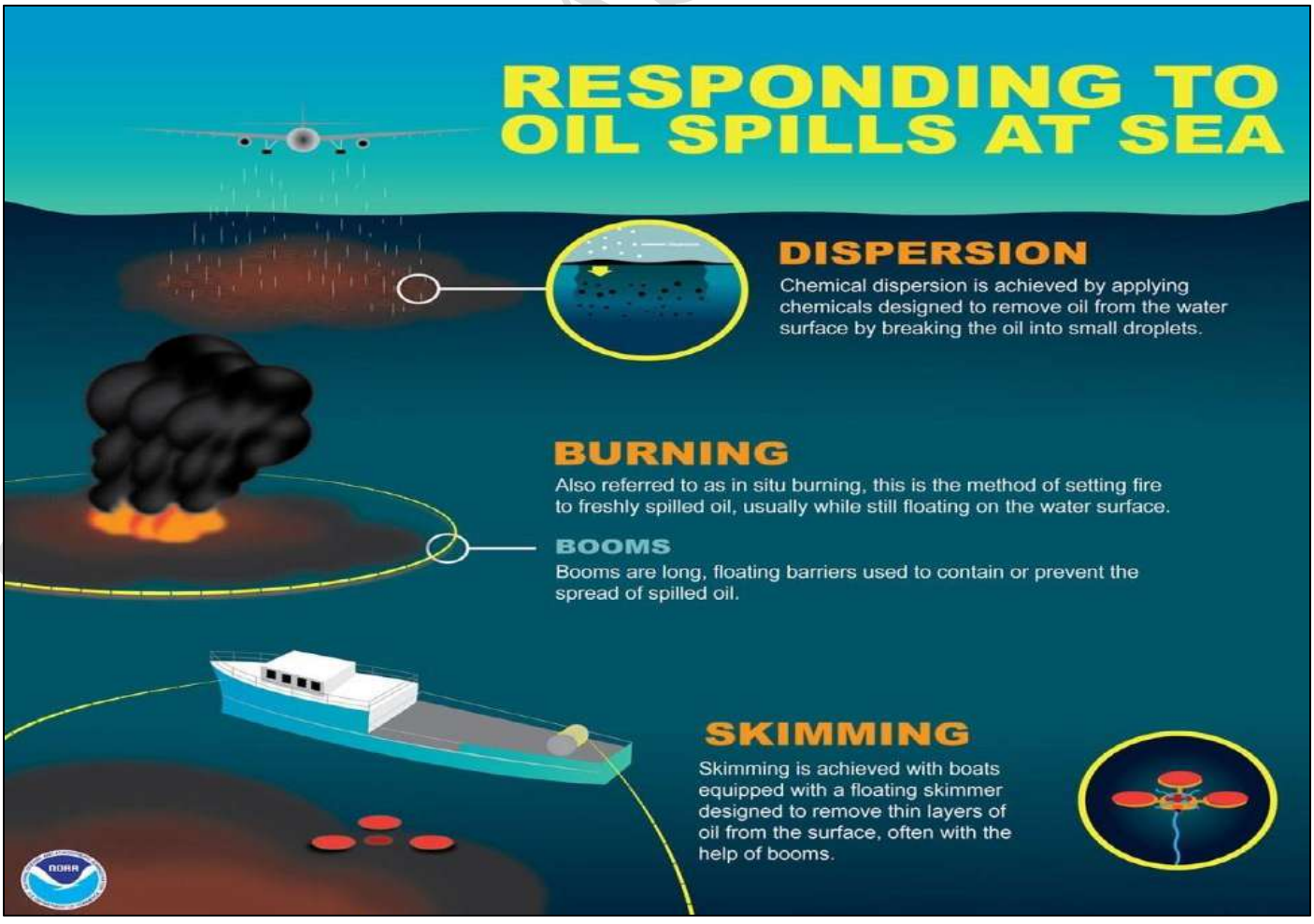
- **International Convention for the Prevention of Pollution from Ships (MARPOL)** – It covers prevention of pollution from ships by Oil, Noxious liquid substances, Dangerous goods in packaged form, Sewage, Garbage and Air pollution from ships.
- India is a signatory to the convention.

- **Merchant Shipping Act of 1958 in India** - It includes provisions to prevent and control marine pollution, particularly oil pollution, in Indian waters and by Indian ships.
- It sets the framework for liability, prevention, and response to oil spills and other forms of marine pollution.
- **Port Contingency Plans** - Ports also maintain oil spill contingency plans to handle local cases, while the Indian Coast Guard is the nodal agency.
- **National Oil Spill Disaster Contingency Plan (NOS-DCP)**- It is a comprehensive framework developed by the Indian Coast Guard (ICG) to address oil pollution incidents in Indian waters.

*Though Indian Coast Guard is the **central coordinating agency for marine oil spills**, effective response requires collaboration with state governments, ports, oil companies, and local communities.*

How are oil spills cleaned?

- **Containment** - Booms are floating physical barriers, made of plastic, metal or other materials, which slow the spread of oil and keep it contained.
- A boom may be placed around a tanker that is leaking oil, to collect the oil, or along a sensitive coastal area to prevent oil from reaching it.
- **Skimming** – It involves removing oil from the sea surface by skim or scoop before it can reach sensitive areas along the coastline.
- **In-situ Burning** – It is a method of burning freshly spilled oil, usually while it's floating on the water.
- **Dispersants** - They are chemicals that are applied directly to the spilled oil to disperse it into the water column.
- It makes much less oil spill stay at the surface where it could move to coastal wetlands, beaches, and tidal flats endangering critical habitat and nursery areas.
- **Bioremediation** - The use of oil-degrading microorganisms (bacteria, fungi, or algae) to break down oil into less harmful substances.
- **Sorbents** - Materials (like peat moss, straw, or synthetic pads) that absorb oil, making it easier to collect and are best for small spills or remnants after other method.

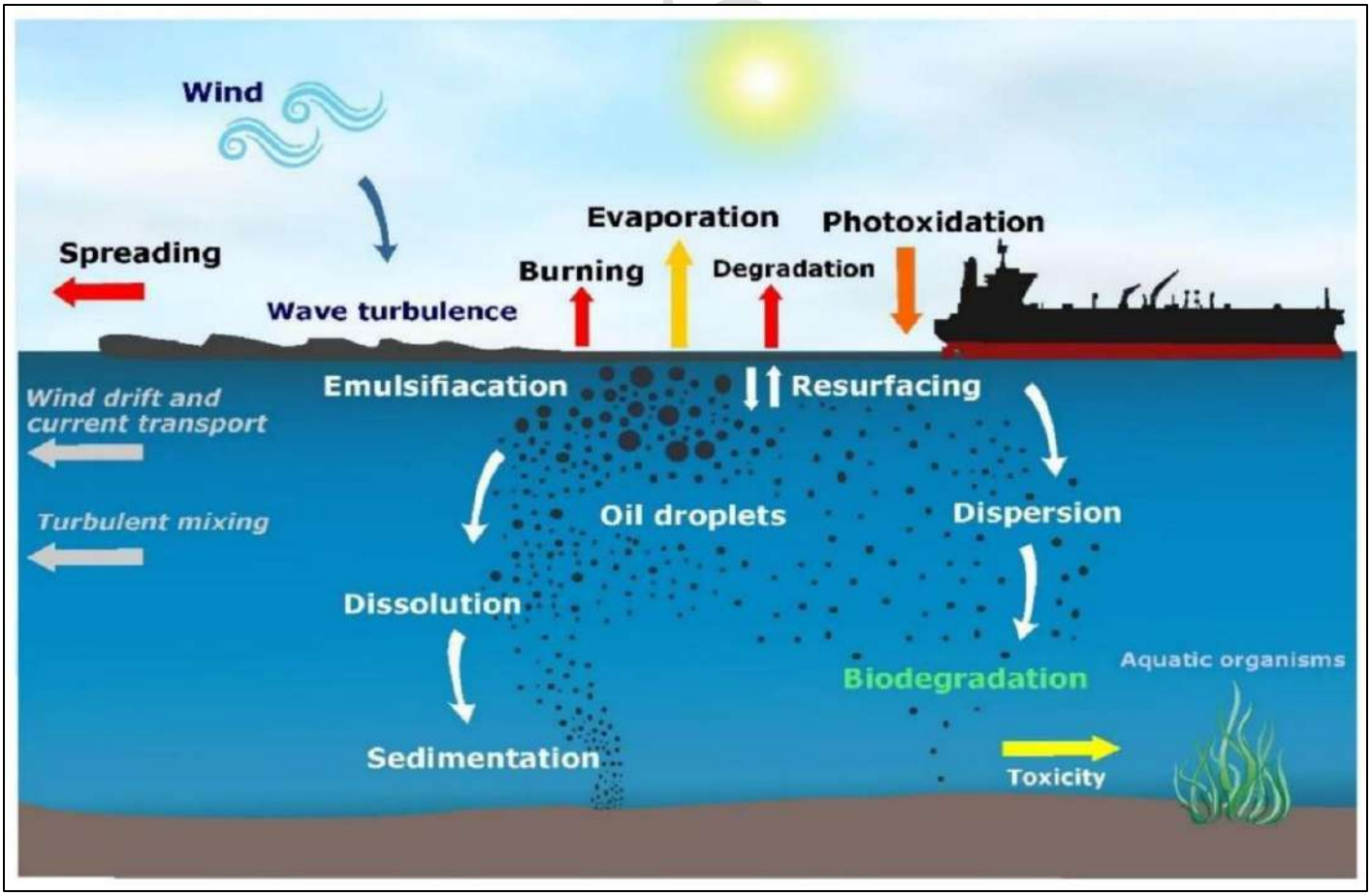


What are the challenges in oil spill cleaning?

- **Quick Spread** - Oil spreads quickly across water by rough seas and strong currents, forming thin films that become harder to recover as time passes.
- **Difficult seperation** - Oils vary in properties, with some sinking or emulsifying with water and making separation tough.

Oil Type	Key Properties	Preferred Cleanup Methods
Light Oils	Low viscosity, volatile	Natural recovery, water washing, dispersants
Medium Oils	Moderate viscosity	Vacuum, sorbents, mechanical removal, SWAs
Heavy Oils	High viscosity, persistent	High-pressure washing, manual/mechanical, SWAs
Non-Persistent	Highly volatile	Natural recovery, safety precautions
Sinking Oils	High density, sink	Shallow-water vacuum, sediment relocation

- **Incomplete Removal** - Oil spill cleanup can never achieve 100% removal of spilled oil.
- Residual oil often remains in the environment, continuing to pose risks to ecosystems and wildlife
- **Scale and Duration of Impact** - The sheer scale of some spills, and the fact that oil can drift and spread over vast areas, makes comprehensive cleanup nearly impossible.
- **Safety and Health Risks** - Cleanup operations can expose workers to hazardous substances and dangerous conditions, requiring specialized training and protective equipment.
- **Technological Limitations** - Many innovative materials and techniques are still in the experimental stage or are only practical for small spills.



What lies ahead?

- Routine inspection of vessels, storage tanks, pipelines, and transfer operations to detect and fix leaks or weaknesses before spills occur.

- Detailed information on contents of container vessels entering waters can be shared to facilitate quick action.
- Expansion and modernization of oil spill response infrastructure, including more Pollution Response Teams, vessels, and equipment at key coastal and port locations.

12. SCIENCE & TECHNOLOGY

12.1 National Supercomputing Mission

Why in News?

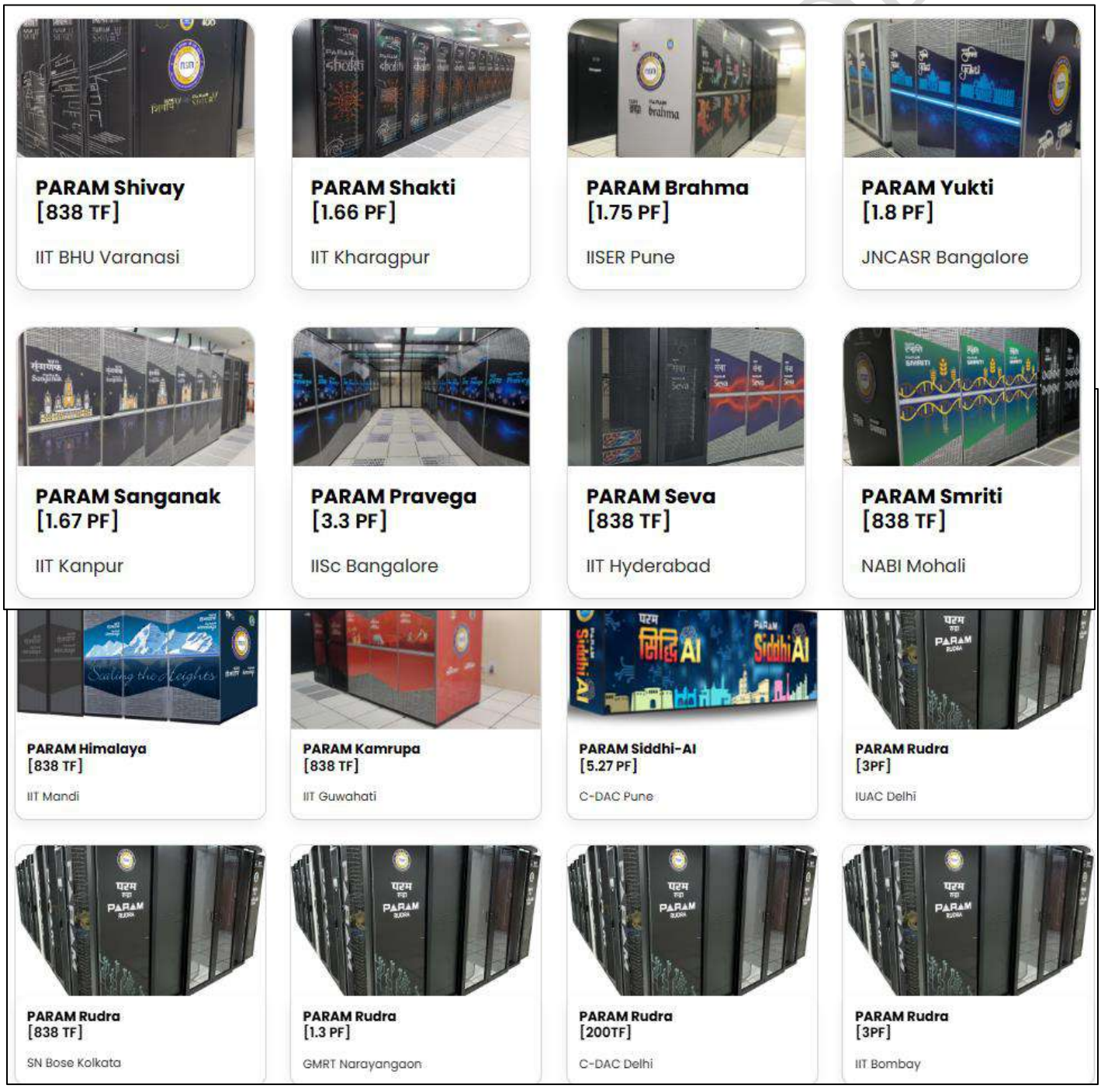
Recently, the National Supercomputing Mission has been extended till December 2025.

What is the National Supercomputing Mission (NSM)?

- **NSM** - It is a flagship initiative by the Government of India, launched in 2015, to empower the country with high-performance computing (HPC) capabilities.
- **Aim** - To enhance India's technological prowess in supercomputing, foster research and development (R&D), and support scientific advancements across academia, industry, and government sectors.
- **Features** - The Mission envisages empowering our national academic and R&D institutions spread over the country by installing supercomputers of various capacities.
- **Nodal ministry** - The Mission is being steered jointly by the Department of Science and Technology (DST) and Ministry of Electronics and Information Technology (MeitY)
- **Implementing agency** - Centre for Development of Advanced Computing (C-DAC), Pune and the Indian Institute of Science (IISc), Bengaluru.
- **Phases of implementation**
    - **Phase 1** - Creating a basic supercomputing infrastructure by installing six supercomputers across various institutions.
    - **Phase 2** - Indigenous manufacturing of supercomputers, including developing a local software stack.
    - **Phase 3** - Complete indigenization of supercomputing, including the design, development, and manufacturing of key components within India.
- **National Knowledge Network (NKN)** – Academic institutions and R&D labs are connected over a high-speed network to provide access to supercomputers.
- Academic and R&D institutions as well as key user departments/ministries would participate by using these facilities and develop applications of national relevance.
- **Trinetra Network** - Under the NSM, C-DAC has developed the indigenous high-speed communication network, "Trinetra," to enhance data transfer and communication between computing nodes, strengthening India's supercomputing capabilities.
- **Trinetra Phases** – It is being implemented in 3 phases
    - Trinetra-POC, a proof-of-concept system to validate key concepts
    - Trinetra-A (100 Gigabits per second), a network with advanced connections, successfully deployed and tested in the 1PF PARAM Rudra at C-DAC Pune;
    - Trinetra-B (200 Gigabits per second), an upgraded version with improved capabilities, set to be deployed in the upcoming 20PF PARAM Rudra supercomputer at C-DAC Bangalore.
- **Rudra servers** - PARAM Rudra supercomputers are built using indigenously designed and manufactured HPC servers, known as "Rudra", along with an indigenously developed system software stack.
- "Rudra" Server is the first of its kind in India which is at par with globally available other HPC class Servers.
- **Human resource development** - Mission also includes development of highly professional High-Performance Computing (HPC) aware human resource for meeting challenges of development of these applications.

What is the current status of the mission?

- **Current strength of super computers** - Under NSM, as of March 2025, a total of ***34 supercomputers*** with a combined compute capacity of ***35 Petaflops***, have been deployed across various academic institutions, research organizations, and R&D labs.
- **Latest addition** - In 2024, three PARAM Rudra supercomputers were dedicated to facilitate advanced studies in physics, earth sciences, and cosmology.
- **Utilization rate** - The supercomputing systems commissioned under NSM have achieved an overall utilization rate of over 85%, with many systems exceeding 95%, demonstrating a high level of usage and efficiency in their computational capacity.
- **Applications** - These supercomputing systems have supported research in critical domains such as Drug Discovery, Disaster Management, Energy Security, Climate Modelling, Astronomical Research, Computational Chemistry, Fluid Dynamics, and Material Research.
- **Inclusive approach** - NSM has created opportunities for researchers from Tier II and Tier III cities to conduct research by providing access to state-of-the-art supercomputing facilities.
- Start-ups and MSMEs are leveraging these supercomputing resources to advance their HPC-driven projects.
- **AIRAAWAT** – It is the AI supercomputer installed at C-DAC, Pune with the capacity of 13,170 teraflops.



What is the role of semiconductor mission in strengthening supercomputing mission?

- **The India Semiconductor Mission (ISM)** – It aims to build a strong semiconductor and display ecosystem, positioning India as a global hub for electronics manufacturing and design.
- **Supporting NSM** – The semiconductor mission is set to give a big boost to the National Supercomputing Mission (NSM).
- Supercomputers need powerful parts like processors, memory chips, and special accelerators — all of which are made using advanced semiconductor technology.
- **Reducing import dependency** - Until now, India had to rely heavily on imports for these components.
- With ISM, India is focusing on making these high-tech parts right here at home.
- **Specialization** - It will also allow India to build supercomputers that are customized for our own scientific and industrial needs.
- By developing these technologies within the country, ISM will help NSM move closer to its dream of making India self-reliant and a global leader in supercomputing.

What lies ahead?

- This Mission is a transformative initiative that strengthens India's position in global supercomputing.
- By fostering indigenous development, research, and innovation, NSM supports critical sectors and prepares the nation for future technological challenges.
- With continued investment and strategic deployment, India is poised to become a global leader in High-Performance Computing.

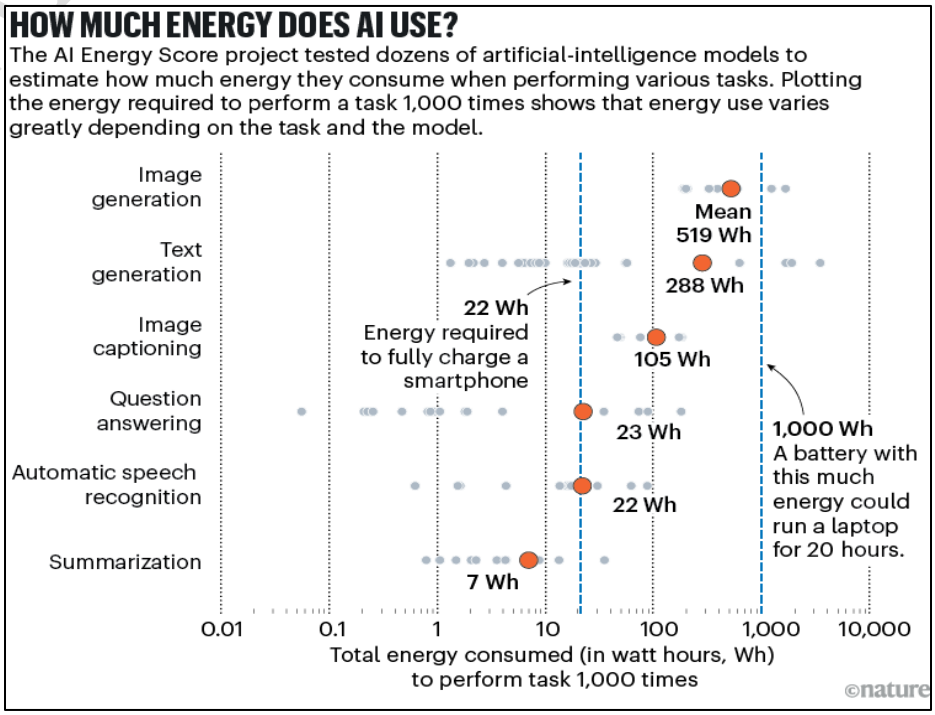
12.2 Energy Footprint of AI

Why in News?

Recently, OpenAI's CEO Sam Altman said that the courtesy phrases like 'thank you' to AI, are increasing OpenAI's operating costs by tens of millions of dollars a year.

What is the energy cost of AI?

- **Generative Artificial Intelligence (AI)** – It is a type of AI that can *create new content*, including text, images, music, and videos, based on learned patterns from data.
- Unlike traditional AI that might focus on prediction or classification, GenAI can *generate entirely new content that didn't previously exist.*
- **High computation demand** - Training and running large AI models requires powerful hardware (GPUs, TPUs) operating at peak loads which come with a heavy environmental footprint.
- **Energy consumption** - Every time one uses ChatGPT or any other AI tool, somewhere in the world, there is a data centre chugging electricity, much of which is generated from fossil fuels.
- The power required for "inference" — when models process real-time queries — can account for up to 60% of AI's total energy consumption.
- This resource consumption is staggering, and it is becoming more unsustainable as AI adoption grows.



- **CO2 emission** – Fossil fuel that is used to training an AI model, whether it is a conversational tool such as ChatGPT or an image-generator tool such as Midjourney, can generate the *same amount of CO2 as 5 cars running continuously across their life.*
- Recent research shows that training GPT-3 consumed approximately 1,287 megawatt-hours (MWh) of electricity, emitting 502 metric tons of CO_2, which is roughly equivalent to the emissions of 112 gasoline-powered cars over a year.
- **Growing demand** - As AI models grow in complexity, the *energy required to train and deploy them* skyrockets, raising concerns about the environmental footprint of AI-driven technologies.
- Projections indicate that *AI data centres could account for 10% of the world's total electricity usage by 2030.*

What are the advantages of using Small Modular Reactors (SMR) for AI energy needs?

- **Small Modular Reactors (SMR)** - These are advanced nuclear reactors that have a *power capacity of up to 300 MW(e) per unit,* which is about one-third of the generating capacity of traditional nuclear power reactors.

To Know more about it, Click here.

- SMR is a powerful potential solution to the energy demands created by AI and other emerging technologies.
- **Supports existing energy infrastructure** - SMRs present a transformative opportunity for the global energy landscape to support booming AI and data infrastructure.
- **Less resource requirement** - Unlike traditional large-scale nuclear power plants that demand extensive land, water, and infrastructure, SMRs are designed to be compact and scalable.
- **Location flexibility** – The flexibility of SMR allows them to be deployed *closer to high-energy-demand facilities,* such as data centres, which require consistent and reliable power.
- **Faster deployment** - Their modular construction reduces construction time and costs, enabling faster deployment to meet the rapidly growing demands of AI and data-driven industries.
- **Better safety** - SMRs offer enhanced safety features, with passive safety systems that rely on natural phenomena to cool the reactor core and safely shut down, reducing the risk of accidents.
- **Better acceptability** – Enhanced safety features make SMR more acceptable and easier to integrate into regions where large-scale nuclear facilities would face opposition.
- **Better efficiency** - The ability of SMR to operate in diverse environments, from urban areas to remote locations, also supports the decentralisation of energy production, reducing transmission losses and enhancing grid resilience.
- **Viable alternative to renewables** - Their ability to provide *24X7, zero-carbon, baseload electricity* makes them an ideal alternative to renewable sources such as solar and wind by ensuring a stable energy supply regardless of weather conditions.

What are the challenges in adopting SMR?

- **Regulatory challenges** - Significant policy shifts will be required to create a robust regulatory framework that addresses safety, waste management and public perception.
- **High investment** - There is also the matter of substantial upfront investment, as the technology is still maturing and may face issues of cost competitiveness when compared to established energy sources.
- **Balancing with renewables** - coordinating SMR deployment with existing renewable energy initiatives will require careful planning to maximise synergies while minimising redundancy.

What can be done to make AI energy sustainable?

- AI companies need to be transparent about their energy consumption and environmental impact.
- Data on amount of energy consumption, sources of energy and the purpose of AI use would provide further insights on where energy is being used the most and encourage research and development to create a more sustainable model of AI development.
- A public-private partnership model presents a realistic solution to the challenges of sustainable AI development.
- By leveraging the strengths of both sectors, this model can facilitate the efficient development of SMRs alongside other forms of renewable energy to support advancements in AI.

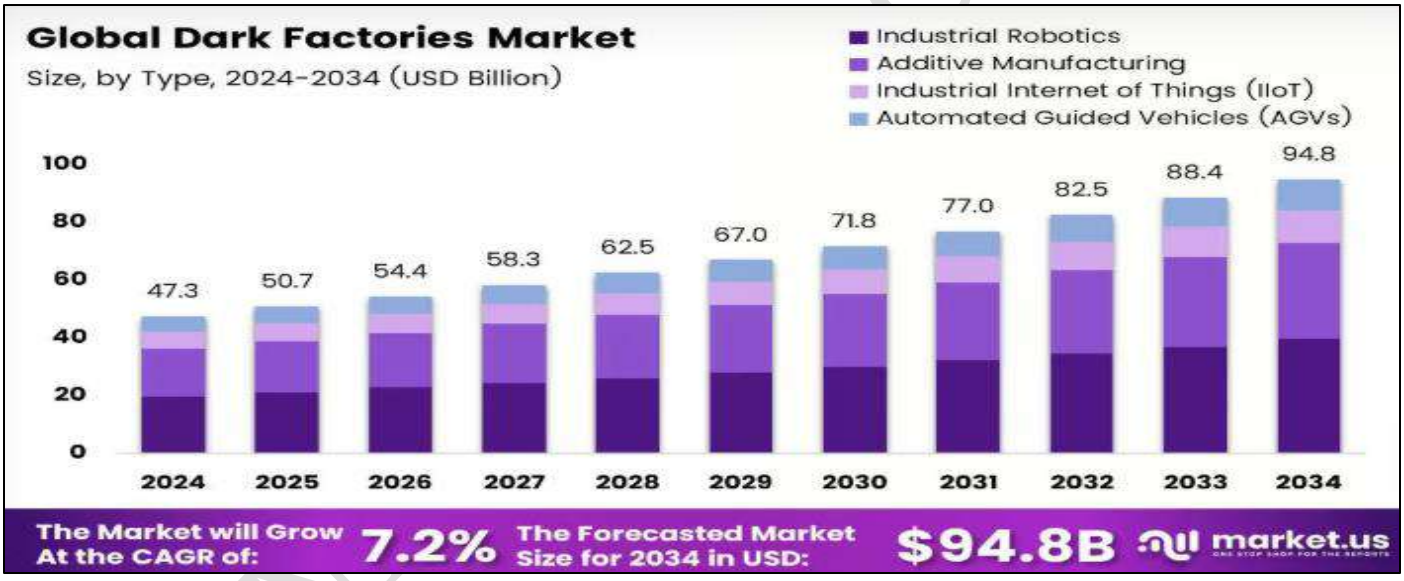
12.3 Dark Factories

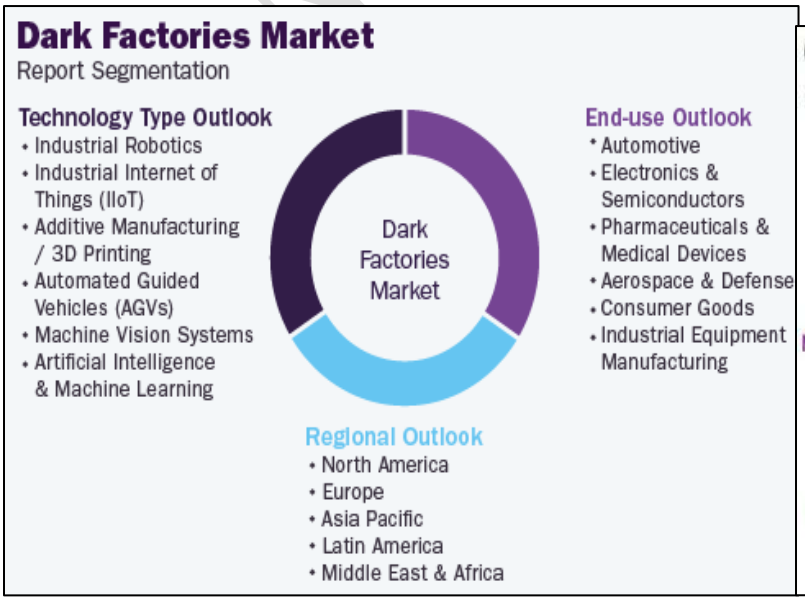
Why in News?

Recently, N. Chandrasekaran, chairman, Tata Consultancy Services said that the rise of automation promises a future of 'dark factories.

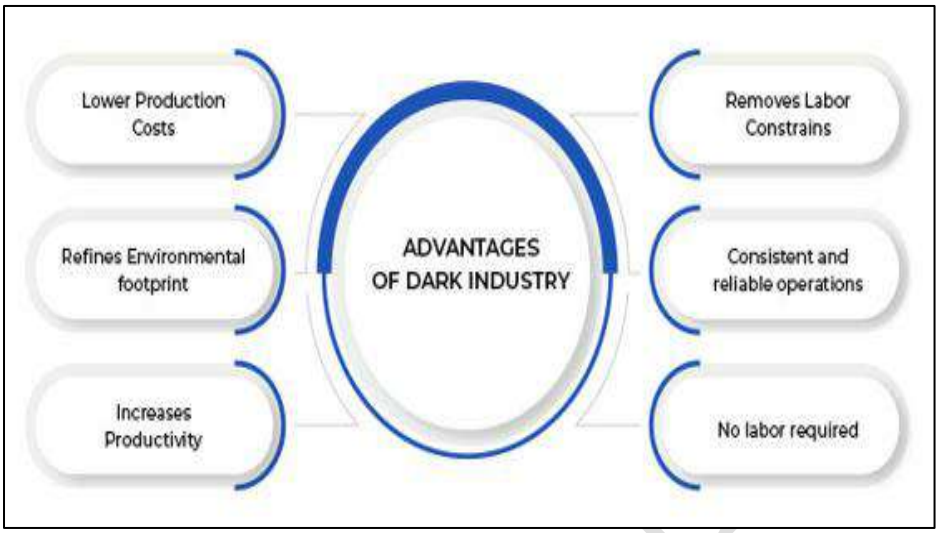
What are the characteristics of dark factories?

- **Dark Factories** - Also known as "lights-out" factories, they are *fully automated manufacturing facilities* where robots, AI, and IoT devices handle all production processes without human intervention.
    - Several Chinese companies have implemented dark factories, *including Xiaomi, which has a dark factory* for its mobile phone manufacturing.
- **Full Automation** - Robots and AI-powered systems perform all tasks, from material handling to final assembly.
    - Many automated warehouses also operate as dark factories, with robots handling all aspects of inventory management and order fulfilment.
- **No Human Presence** - Minimal or no human workers are needed on-site.
- **Advanced Technology Integration** - These factories leverage the latest in robotics, artificial intelligence (AI), the Internet of Things (IoT), machine learning, and visual technologies.
- **24/7 Operation** - Continuous production without breaks or shift changes.
- **Self-Monitoring and Maintenance** - Many dark factories feature self-diagnosing and self-maintaining systems.





What are the benefits of dark factories?



- **Increased Efficiency** - Automated systems work at maximum speed and precision, minimizing delays and errors.
- **Higher Productivity** - Dark factories can produce more goods with fewer resources.
- **Scalability and Flexibility** - Processes can be easily adapted to changing demands and new products.
- **Better Quality** - Automated systems can maintain consistent quality standards.
- **Lower Production Costs** –Employee salaries are eliminated due to the lack of a workforce, as articulated robots can work in dark and non-climate-controlled situations, thereby conserving the utilities.
- **Reduces Environmental Footprint** – Lights-out manufacturing is a sustainable manufacturing strategy that reduces the impact on the environment.

What are the challenges of dark factories?

- **High Initial Costs** - Implementing a fully automated system requires significant upfront investment in technology and infrastructure.
- **Job Displacement** - Some traditional manufacturing jobs may be lost due to automation.
- **Need for Skilled Workers** - While reducing the need for manual labour, dark factories require skilled technicians to maintain and operate the automated systems.
- **Potential for High Downtime** - If automated systems fail, it can be difficult to quickly fix the problem, potentially causing production delays.
- **Ethical Considerations** - The displacement of workers and the potential for a more unequal society need to be addressed.

What lies ahead?

- A comprehensive, multi-faceted actions across policy, education, industry, and workforce development needs to be taken for successful adaptation.
- Investment in digital infrastructure, such as high-speed internet and cloud computing is essential to enable smart factory operations and industrial IoT adoption.
- Education systems have to be transformed to focus on skills relevant to automation, such as robotics, AI, data analytics, and digital literacy.
- Social safety nets can be enhanced to support workers affected by job displacement, including unemployment benefits, job placement services, and targeted support for vulnerable communities.

13. SECURITY

13.1 AI in Defense

Why in the News?

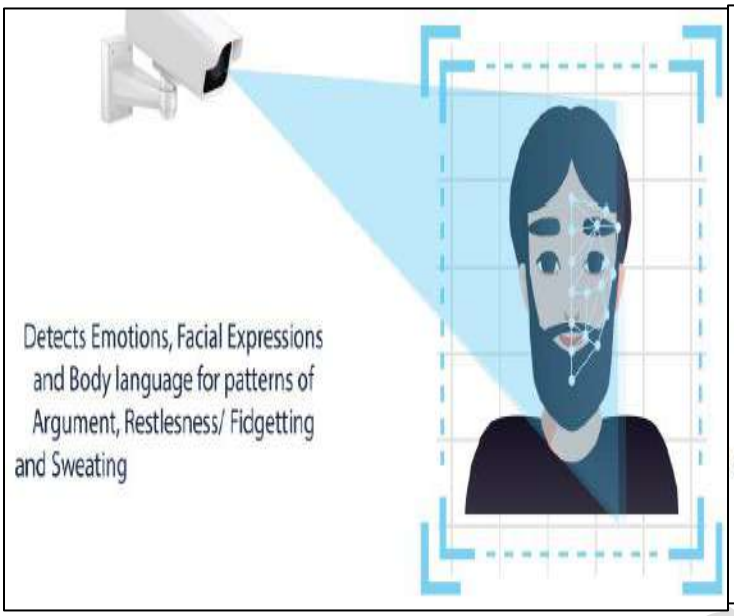
India used AI technologies in Operation Sindoor.

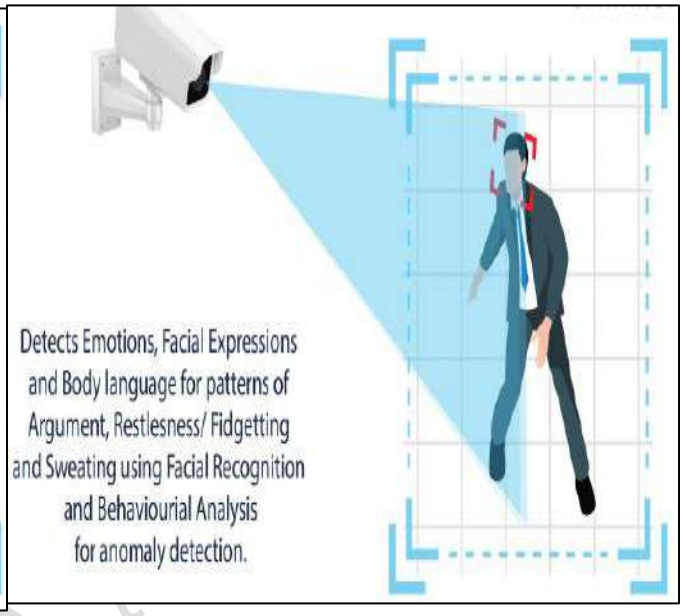
What are the applications of AI in Defence?

- **Air Defence** - The Indian armed forces used AI cloud-based integrated air command and control systems to detect and position any hostile objects in the sky.

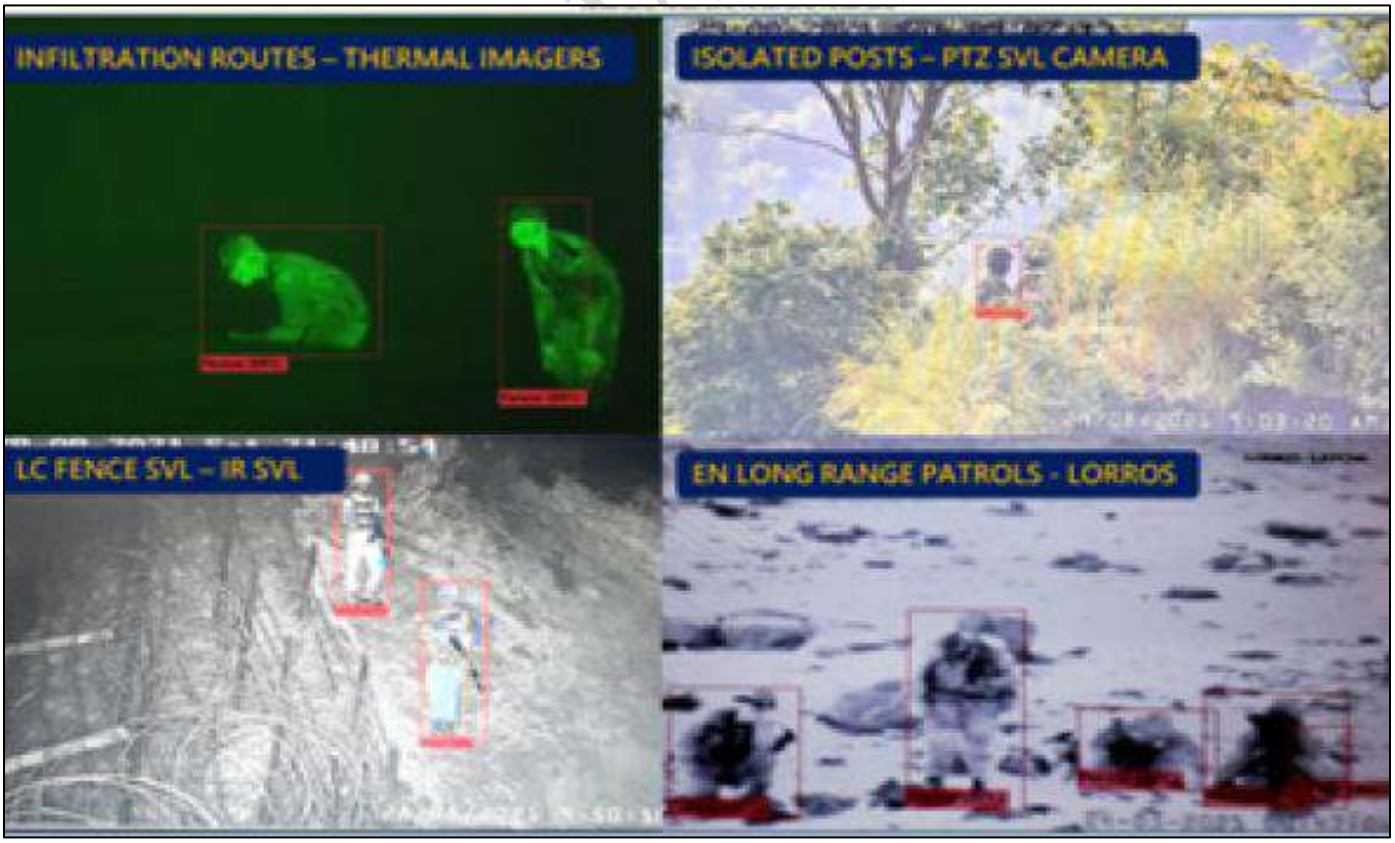
- **Neutralize Airborne Threats** - *Akashteer (AkashTeer) is India's first indigenous AI-driven war cloud* that can intercept and neutralize airborne threat, from drones to missiles, without detection.
- **Intelligence, Surveillance, and Reconnaissance (ISR)** - Automated target recognition, image analysis, and predictive analytics are widely used for real-time intelligence and surveillance.
- iSentinel is a deep learning-based threat detection and tracking system that can track and trace terror movements in real time.

> ***Integrated Air Command and Control System (IACCS)*** *is an automated command and control system that integrates data from all air defence assets to detect, identify, intercept, and destroy hostile intruders.*

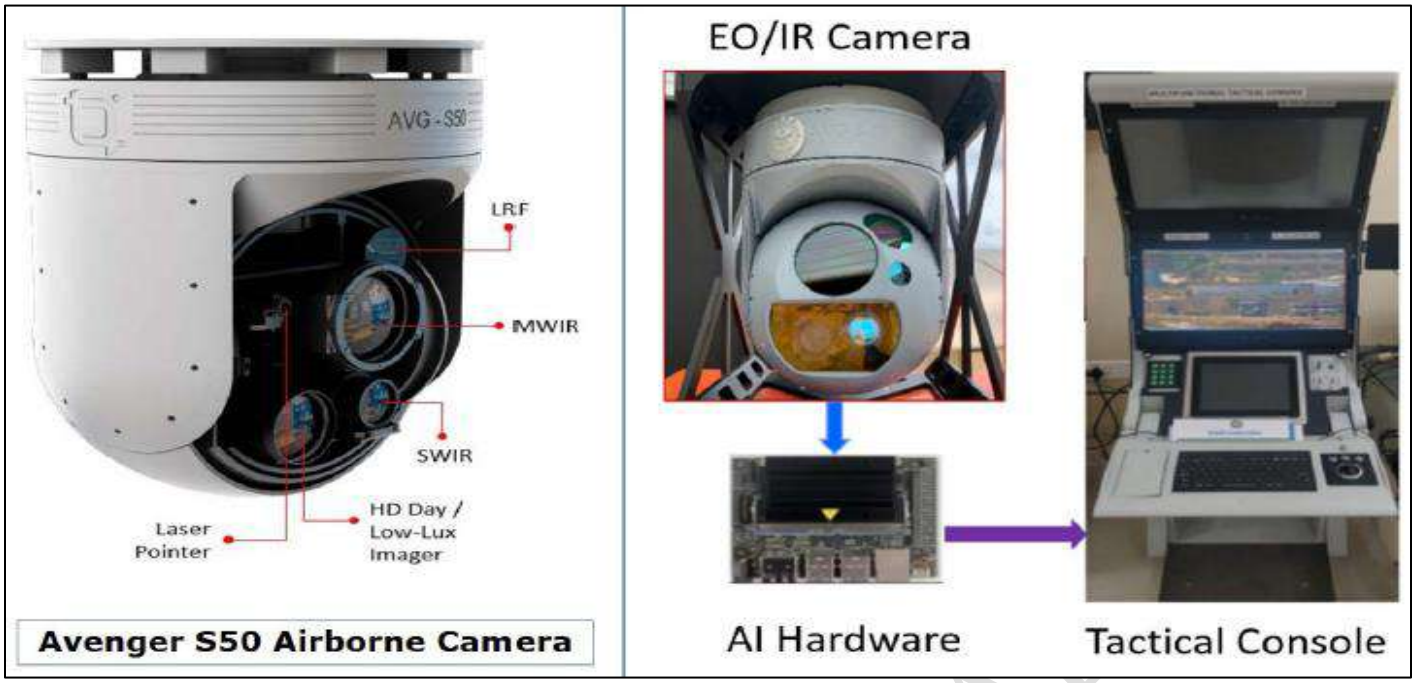




- **Border and Maritime Surveillance** - AI-based solutions integrate data from cameras, radars, and sensors for effective border and maritime surveillance, aiding in the detection of illegal activities and unauthorized movements.



- AI-Enabled Airborne Electro-Optic Infrared System (EO/IR) camera is DRDO's state-of-the-art AI-based object detection and classification system.



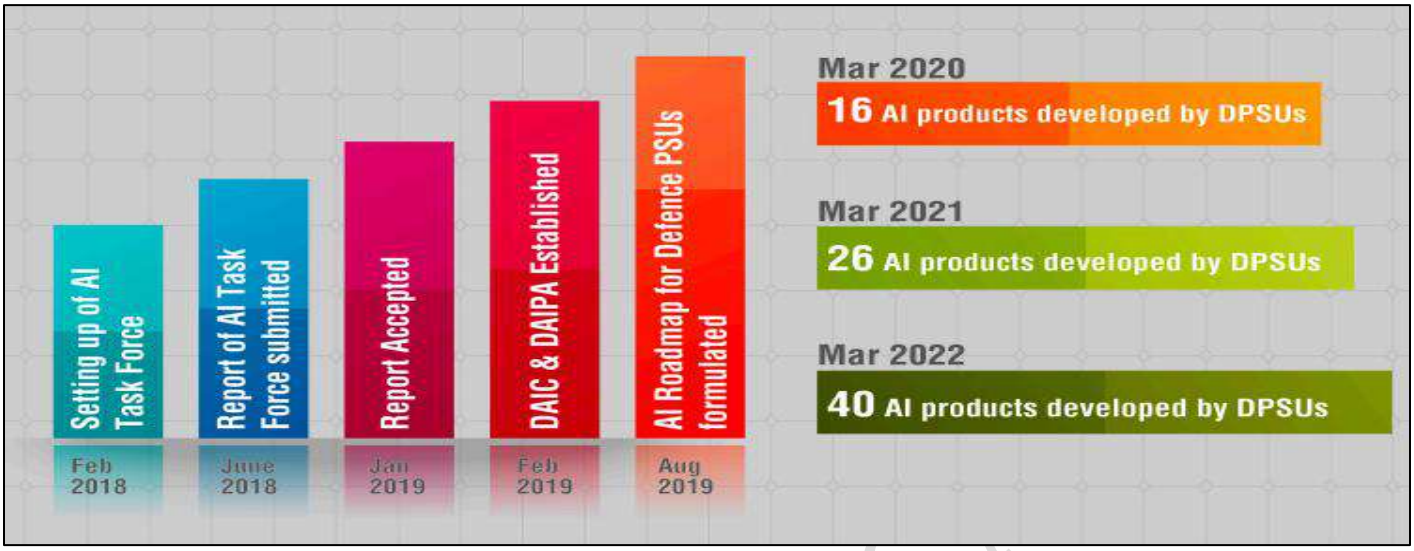
- **Autonomous Vehicles and Weapon Systems** - AI powers unmanned aerial vehicles (UAVs), ground vehicles, and submarines for reconnaissance, surveillance, logistics, and even combat operations.
    - Loitering munitions (e.g., AI-guided "kamikaze drones") that can identify and attack targets autonomously.
- **Aids in Decision Making** - By taking advantage of AI technology in defence, the performance of forces can be enhanced as such technologies improve computational and decision-making skills.
- **Cybersecurity and Cyber Operations** - AI is used for real-time detection and response to cyber threats, protecting military networks and infrastructure.
- **Combat Simulation and Training** - AI-driven simulations provide realistic training environments for soldiers and pilots, including war-gaming and virtual adversary tactics
- **Drone Swarms** – They are a group of drones operating in conjunction with ground manoeuvre forces.
- AI enables coordinated drone swarms for surveillance, electronic warfare, and offensive missions, multiplying force effectiveness.

Advantages of using AI in Defence	
Advantage	**Description**
Enhanced Safety	Reduces human exposure to danger
Faster Decision-Making	Real-time data processing for rapid responses
Increased Efficiency	Automates tasks, optimizes logistics and maintenance
24/7 Operation	Continuous, fatigue-free operation
Improved Cybersecurity	Real-time threat detection and response
Adaptability	Learns and evolves with new threats
Strategic Advantage	Enables split-second, data-driven tactical and strategic decisions

What are the government initiatives to adopt AI in Defence?

- **Multi-stakeholder Task Force** - In 2018, the Ministry of Defence (MoD) had set up a multi-stakeholder task force to study issues around the strategic implications of AI from a national security perspective.
- **Defence Artificial Intelligence Council (DAIC)** – It has been set up to provide necessary guidance and structural support for the enhancement of capabilities of ai technology.

- **Defence AI Project Agency (DAIPA)** – It has been created for enabling AI based processes in defence Organisations.
- **AI Roadmap** - In 2022, the government also finalised a roadmap for defence public sector companies under which 70 defence specific AI projects were finalised, of which 40 had been completed.
- **Fund Allocation** - As of 2022, Rs 100 crore was allocated by each defence service for AI implementation.



13.2 Cyberwarfare

Why in the News?

Following the terrorist attack on tourists in Pahalgam and the subsequent Operation Sindoor, more than one million cybersecurity incidents were flagged within 10 days.

What is cyberwarfare?

- **Cyberwarfare** – It is the use of information technology for military or political purposes, including cyberattacks, espionage, and information warfare.
- It has become a critical domain alongside land, sea, air, and space, with the potential to cause real-world damage and influence military and political outcomes.
- **Activities** - It involves disrupting, damaging, or gaining an advantage over an adversary's digital infrastructure and information systems through cyberattacks, cyberespionage, and information warfare.
- **Methods** – It utilizes various techniques like computer viruses, denial-of-service attacks, and phishing.
- **Targets** – During cyberwarfare, any government, civilian, and military systems are targeted.
- **Actors** – While cyberwarfare can involve non-state actors, it is typically associated with actions by or on behalf of nation-states, often with political, military, or economic motivations.

Types of Cyberwarfare Attacks		
Type	**Description**	**Example Attacks**
Cyber Espionage	Unauthorized access to steal sensitive information for political, military, or economic advantage	Fancy Bear (Russian group)
Cyber Sabotage	Disruption or destruction of systems to hinder operations or cause harm	Stuxnet (Iran nuclear facilities)
Data Theft	Stealing data for intelligence, ransom, or to incite chaos	Sony Pictures hack (North Korea)
Ransomware	Encrypting data and demanding payment for its release	WannaCry (North Korea)

Denial-of-Service	Overwhelming systems to disrupt access or operations	NotPetya attack (Ukraine)
Disinformation	Spreading false information to influence public opinion or destabilize society	Election interference campaigns

What are the major targets of cyberwarfare?

- **Cyberwarfare operations** – They are designed to disrupt, damage, or gain control over critical assets and infrastructure of adversaries.
- **Critical Infrastructure** – Power plants, electric grids, airports are frequent targets, as attacks can cause widespread blackouts or disrupt public activities.
- **Internet and Communication Infrastructure** - Attacks can target the backbone of the internet, including ISPs, web servers, and network equipment, to cause widespread outages or intercept communications.
- **Military Systems** - Cyberwarfare can target military command-and-control systems, weaponry, and logistics to disrupt operations or steal classified information.
- **Financial Sector** – Attacks on banks, payment systems and stock markets are used to destabilize the economic functioning of a country.
- **Healthcare** - Hospitals and health systems are targeted due to the critical nature of their services and the sensitive data they hold, making them susceptible to ransomware and data breaches.
- **Industrial Control Systems** - Systems that manage physical infrastructure, such as factories and utilities, are targeted to cause physical damage or halt production.

Major Targets during Cyberwarfare		
Target Sector	**Examples of Assets Attacked**	**Potential Impact**
Critical Infrastructure	Power grids, water, transportation, telecom	Blackouts, service disruption, public safety
Government & Military	Agencies, military networks, weapon systems	Espionage, military disruption, data theft
Financial Sector	Banks, stock exchanges, payment systems	Economic instability, theft, loss of trust
Healthcare	Hospitals, health records	Ransomware, data breaches, patient risk
Education	Universities, research data	IP theft, data breaches, operational impact
Industrial Control	Factories, utilities, process controls	Physical damage, production halts
Private Sector	Corporations, trade secrets	Espionage, sabotage, financial loss
Internet Infrastructure	ISPs, web servers, network hardware	Outages, interception, loss of connectivity
Information/Propaganda	Media, social networks	Public opinion manipulation, unrest

What are the government measures against cyberwarfare?

- **Defence Cyber Agency** – It a *tri-service command* of the Indian Armed Forces responsible for handling cybersecurity threats.
- The DCyA is tasked with formulating cyber doctrine, strategy, and policy for the defense forces, conducting joint trainingand exercises, and managing cyber operations.

*India achieved top Tier in its cybersecurity efforts i.e. Tier 1 status in the **Global Cybersecurity Index (GCI) 2024**, published by the International Telecommunication Union (ITU).*

- **Cyber Emergency Response Teams (CERT)** - To mitigate cyber threats, all the three Services have established their respective Cyber Emergency Response Teams (CERT).
- **Bharat National Cyber Security Exercise** - National Security Council in strategic partnership with Rashtriya Raksha University (RRU) organizes annually Bharat NCX to strengthens vigilance and preparedness in safeguarding our nation's invaluable digital assets.
- **National Cybersecurity Policy, 2013** - It lays down a comprehensive strategy for addressing the multifaceted challenges of cybersecurity to build a secure and resilient cyberspace in India.
- **National Cybersecurity Strategy, 2020** – It is a significant step forward in India's efforts to secure its cyberspace against evolving threats.
- It aims to create a safe, secure, and resilient cyberspace for citizens, businesses, and the government.
- **Institutional Framework** - Indian Computer Emergency Response Team (CERT-In), Indian Cybercrime Coordination Centre (I4C) and the National Critical Information Infrastructure Protection Centre (NCIIPC) ensure a coordinated response to cyber incidents.
- **Cyber Swachhta Kendra (CSK)**- It is a citizen-centric service provided by CERT-In, which extends the vision of Swachh Bharat to the Cyber Space.

What is the international law on cyberwarfare?

- **UN Charter** – It recognizes the inherent right of individual or collective self-defense if an armed attack occurs including the cyberwarfare attack.
- **Budapest Convention on Cybercrime** – It is a treaty that establishes international cooperation and provides a framework for tackling cybercrime.
- **UN Convention against Cybercrime** – Adopted in 2024, this new convention aimed at strengthening international cooperation in preventing and combating cybercrime.
- **Tallinn Manual**- This non-binding academic study interprets how international law applies to cyberwarfare, addressing sovereignty, state responsibility, and countermeasures.

What lies ahead?

- Large data fiduciaries can strengthen authentication and access control to their digital systems.
- Automated tools can be used to regularly update the systems with the latest software and security protocols.
- Running continuous infrastructure scans for all possible vulnerable ports.
- Old digital infrastructure can be isolated or removed.

****