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Polity & Governance

One Nation, One Time: Making IST Legally Enforceable

Sources: The Hindu

Relevance: **GS Paper II – Governance | GS Paper III – Science and Technology, Digital Infrastructure and Cybersecurity**

Important Keywords

For Prelims:

- IST | UTC+5:30 | CSIR-NPL | Legal Metrology | Atomic Clock | NTP | PTP | NavIC | RRSL | White Rabbit Technology

For Mains:

- Time Sovereignty | Digital Evidence | Critical Infrastructure | Network Synchronisation | Cybersecurity | Technological Self-Reliance

Why in News?

The Union government notified the **Legal Metrology (Indian Standard Time) Rules, 2026** on August 27, 2026.The Rules make **Indian Standard Time (IST)** the single reference for legal, administrative, commercial and other official purposes across India. They will come into force **180 days after publication in the Official Gazette**, allowing organisations to modify their systems.

What Is Indian Standard Time?

Indian Standard Time is India's official time reference.

- **International reference:** Coordinated Universal Time
- **Offset:** UTC+5 hours 30 minutes
- **Maintained by:** CSIR–National Physical Laboratory
- **Generated using:** Advanced atomic clocks
- **Trademark:** IST® registered by CSIR-NPL in 2024

CSIR-NPL is India's **National Metrology Institute**, responsible for maintaining the country's scientific measurement standards.

What Has Changed?

India has followed IST for decades. However, time itself previously lacked enforceable legal status. Organisations could use different time sources without proving that their clocks were connected to IST.

- Under the new Rules, organisations must ensure that their systems are **synchronised with time traceable to IST**.
- The change is comparable to the regulation of other measurements. Legal Metrology authorities already verify weights and volumes; they can now enforce a common legal standard for time.

Why Is a Common Time Reference Needed?

Modern digital systems depend on accurate timestamps. If different organisations use different

time sources, their clocks may vary by milliseconds, seconds or even minutes.

This can affect:

- banking and digital payments;
- stock exchanges;
- telecommunications and internet services;
- railways, airports and transport systems;
- national power grids;
- government and legal records;
- digital evidence and cyber investigations;
- navigation and scientific research; and
- emergency and time-critical services.

A common reference ensures that events and transactions occurring across different systems can be accurately compared and reconstructed.

What Does "Traceable to IST" Mean?

- Traceability means that a system's clock has an **unbroken and verifiable connection** to the national time standard maintained by CSIR-NPL.
- For example, a computer becomes traceable to IST when it synchronises with an approved **Network Time Protocol server** connected to the national reference.

Traceability can be established through:

- Network Time Protocol;
- Precision Time Protocol;
- satellite links;
- NavIC;
- optical-fibre links; or
- other approved Indian timing sources.

The appropriate method depends on the level of accuracy required.

How Is IST Generated and Distributed?

1. Generation by CSIR-NPL

- CSIR-NPL generates IST using advanced atomic clocks. It maintains India's time within a few nanoseconds of UTC, with an uncertainty of less than **three nanoseconds**.

2. Regional Distribution

- Five **Regional Reference Standard Laboratories (RRSLs)** maintain secondary time scales traceable to CSIR-NPL. This enables IST to be distributed from multiple locations.

3. Network Synchronisation

- CSIR-NPL, the National Informatics Centre and RRSLs provide time services. Organisations can connect their systems to approved servers.

4. Satellite Dissemination

- ISRO maintains traceability to IST through satellite links. **NavIC** satellites and ground systems help distribute accurate Indian timing signals.

Time-Synchronisation Technologies

Technology	Typical accuracy	Main use
NTP	Milliseconds	Banking, offices and ordinary networks
PTP	Microseconds	Telecom, industrial and local networks
Satellite links	Nanoseconds	Space, defence and navigation
Optical links	Picoseconds in specialised systems	Advanced research laboratories

Network Time Protocol

- NTP is the most accessible method and works through the Internet. It regularly compares a device's clock with an

authorised server and corrects any difference.
- Periodic correction is necessary because every clock or oscillator gradually **drifts** after synchronisation.

Precision Time Protocol

- PTP provides greater accuracy than NTP. It is especially effective within local area networks and is suitable for industrial and telecom applications.

Satellite and Optical Links

- Satellite methods, including Common-View GNSS and two-way satellite time transfer, provide nanosecond-level precision. Dedicated optical-fibre links can reach picosecond-level accuracy but are not widely available.

Does Every User Need Nanosecond Accuracy?

No. Accuracy depends on the application.

- Ordinary computer networks may use millisecond-level NTP.
- Industrial and telecom networks may require microsecond-level PTP.
- Banking and financial services may use accurate NTP-based systems.
- ISRO, defence and scientific institutions may require nanosecond precision.

The Rules create one national reference but do not require every organisation to install an atomic clock.

White Rabbit Technology

- In July 2026, a **White Rabbit Technology-based IST Dissemination Demonstration Network** was commissioned at the Regional Reference Standard Laboratory in Bengaluru.
- White Rabbit combines precise time synchronisation with network communication. The pilot demonstrated the distribution of high-accuracy IST for:
  - high-frequency financial markets;
  - stock exchanges;
  - digital banking;
  - telecommunications;
  - national power grids; and
  - other critical systems.

Compliance and Enforcement

Requirements for Organisations

An organisation must be able to demonstrate that:

- its systems are synchronised with IST;
- it receives time from an approved source;
- its timestamps meet the required accuracy; and
- traceability can be verified through technical records.

Computer settings, selected time servers, PTP connections or satellite links may be used as evidence of compliance.

Display of Other Time Zones

- There is no general exemption at present. Hotels, international organisations or space centres may display other time zones when required, provided that they also display IST and use it as the principal legal reference.

Enforcement Authority

- The **Legal Metrology Department** will enforce compliance. CSIR-NPL will provide technical guidance because it maintains the national time standard and helped establish the dissemination system.

Impact on Ordinary Users

- Ordinary users are unlikely to face any

immediate compliance requirement. Service providers will make most technical changes.

- Once service providers comply, mobile phones, computers and online services should automatically receive time traceable to IST.
- Accurate time can help courts and investigators reconstruct events relating to digital fraud, cybercrime and disputed electronic transactions.

Why Reduce Dependence on GPS?

Many Indian networks currently receive time directly or indirectly from the United States-owned **Global Positioning System**.

- A foreign system may technically be degraded, manipulated or denied during a crisis. India's experience during the Kargil War, when access to requested GPS information was denied, strengthened the demand for an independent navigation system.

ISRO subsequently developed the **Indian Regional Navigation Satellite System**, now called **NavIC.**

Role of NavIC

- Provides regional navigation coverage over India and surrounding areas.
- Carries atomic clocks aboard its satellites.
- Maintains ground systems traceable to IST through CSIR-NPL.
- Distributes secure and reliable Indian timing signals.
- Reduces dependence on foreign navigation and timing systems.

CSIR-NPL is also developing indigenous primary frequency standards and advanced atomic clocks to ensure continuity during external disruption.

Significance

Digital and Financial Integrity

- A common timestamp establishes the correct sequence of payments, trades and banking transactions.

Cybersecurity

- Synchronised logs help identify cyberattacks, trace malicious activities and reconstruct digital incidents.

Critical-Infrastructure Resilience

- Telecom networks, transport systems and power grids require precise time coordination for safe operation.

Legal Certainty

- IST-traceable timestamps strengthen electronic records, contracts, government files and digital evidence.

National Security

- Indian timing sources reduce exposure to interruption or manipulation of foreign satellite signals.

Technological Self-Reliance

- CSIR-NPL's atomic clocks, RRSLs and NavIC strengthen India's sovereign digital infrastructure.

Challenges

- Cost of upgrading older systems
- Limited technical capacity among small organisations
- Different accuracy needs across sectors
- Inadequate connectivity in remote areas
- Cyberattacks on national timing infrastructure
- Clock drift and equipment failure
- Need for clear inspection and certification procedures
- Dependence on imported precision components

Way Forward

- Issue sector-specific accuracy and compliance standards.
- Expand timing infrastructure through the five RRSLs.
- Establish geographically separated backup time centres.
- Combine NTP, PTP, satellite and optical channels.
- Conduct regular cybersecurity and resilience audits.
- Promote indigenous atomic clocks and timing equipment.
- Train Legal Metrology officers and technical personnel.
- Provide compliance support to smaller organisations.
- Maintain verifiable logs of continuous synchronisation.
- Periodically test NavIC and emergency backup systems.

Conclusion

The IST Rules transform Indian Standard Time from a widely followed convention into an enforceable national standard. A secure timing network built around CSIR-NPL, RRSLs and NavIC can strengthen India's digital economy, critical infrastructure and technological sovereignty.

India's Path to Blue Skies

Source: Press Information Bureau

Relevance: **UPSC GS Paper II: Environmental governance and institutional mechanisms**

Important Keywords

Prelims

- International Day of Clean Air for Blue Skies, Swachh Vayu Diwas, PM10, PM2.5, NAMP, AQI, NAAQS, NCAP, PRANA Portal, Swachh Vayu Survekshan, CAQM, GRAP, OCEMS

Mains

- Airshed management, source apportionment, environmental governance, clean mobility, industrial emission control, climate co-benefits, public health, performance-linked grants and cooperative federalism

Why in News?

The **International Day of Clean Air for Blue Skies** was observed on September 7, highlighting the need for coordinated action against air pollution. India marked the occasion as **Swachh Vayu Diwas** and reviewed progress under the **National Clean Air Programme**. During 2025–26, **108 NCAP cities** recorded lower annual PM10 levels than in 2017–18.

International Day of Clean Air for Blue Skies

The **United Nations General Assembly** designated September 7 as the International Day of Clean Air for Blue Skies in **2019**.

The observance seeks to:

- Increase public awareness about air pollution;
- Encourage national and international cooperation;
- Promote scientific air-quality management; and
- Support action for cleaner and healthier communities.

Clean air is essential for public health, environmental sustainability, labour productivity and economic development.

Understanding Air Pollution

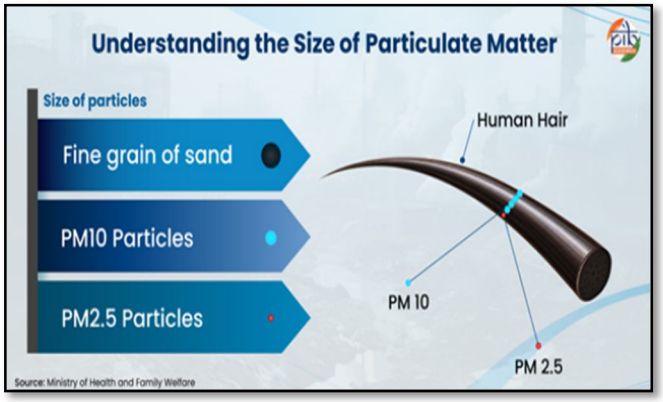
- Air pollution occurs when harmful gases, liquid droplets or solid particles accumulate in the atmosphere at levels that damage human health or the environment.
- Major anthropogenic sources include transport, industries, thermal power, construction activity, road dust, waste burning and crop-residue burning. Natural sources include dust storms, forest fires and volcanic activity.

Particulate Matter

Particulate Matter consists of tiny solid particles or liquid droplets suspended in the atmosphere.

- **PM10:** Particles measuring 10 micrometres or less in diameter.
- **PM2.5:** Finer particles measuring 2.5 micrometres or less.

PM2.5 can penetrate deep into the lungs, while some particles may enter the bloodstream. Long-term exposure increases the risk of respiratory and cardiovascular illness.



Air-Quality Monitoring in India

National Air Quality Monitoring Programme

The **Central Pollution Control Board** initiated the National Ambient Air Quality Monitoring programme, which was subsequently renamed the **National Air Quality Monitoring Programme**.

Its objectives are to:

- Assess ambient air quality periodically;
- Identify pollution trends in urban areas;
- Estimate future changes;
- Detect violations of prescribed standards; and
- Evaluate possible health hazards.

As of March 2026, India's monitoring network consisted of **1,646 stations across 603 cities**, covering 28 States and seven Union Territories.

The **SAMEER application and portal** provide near real-time Air Quality Index information for more than **292 cities**. Public grievance portals have also been established in NCAP cities.



Major Monitoring Systems

Continuous Ambient Air Quality Monitoring System

- **CAAQMS** provides automated, real-time monitoring of pollutants such as PM10, PM2.5, sulphur dioxide, nitrogen oxides, carbon monoxide, ozone and ammonia.

Ambient Air Quality Monitoring System

- **AAQMS** is a wider framework covering manual and automated stations. Manual monitoring generally involves collecting air samples over 24 hours and analysing them in laboratories.
- It also records meteorological factors such as

temperature, humidity, wind speed and wind direction.

Online Continuous Emission Monitoring System

- **OCEMS** measures emissions directly at industrial facilities and continuously transmits data to regulatory authorities.
- The CPCB has directed **17 categories of highly polluting industries** to install OCEMS. In Delhi-NCR, the requirement covers additional red-category industries, food-processing units and metal units.

Air Quality Index

The **Air Quality Index** communicates air quality through six categories. It is calculated using PM10, PM2.5, nitrogen dioxide, sulphur dioxide, carbon monoxide, ozone, ammonia and lead. The pollutant with the worst sub-index determines the overall AQI.

AQI category	Range
Good	0–50
Satisfactory	51–100
Moderate	101–200
Poor	201–300
Very Poor	301–400
Severe	401–500

National Clean Air Programme

- The government launched the **National Clean Air Programme in 2019** as a mission-mode, multi-sectoral initiative covering **130 cities**.
- It involves the Union Government, State governments, district administrations, Urban Local Bodies and other stakeholders. State- and city-specific action plans target locally important pollution sources through short- and long-term interventions.

Progress under NCAP

- Clean Air Action Plans have been prepared by **24 States and Union Territories** and all participating cities.
- Between 2019–20 and 2025–26, **₹16,423.55 crore** was provided through performance-linked grants.
- Cities reported utilisation of **₹11,575.54 crore**, or **70.5%** of the funds.
- In 2025–26, 108 cities recorded lower PM10 concentrations than the 2017–18 baseline.
- Of these, 72 achieved reductions exceeding 20%, while 26 recorded reductions above 40%.
- Fourteen cities complied with the **National Ambient Air Quality Standards**.

PRANA Portal

- The **Portal for Regulation of Air Pollution in Non-Attainment Cities** monitors the physical and financial implementation of NCAP action plans.
- It improves transparency by providing information on activities, expenditure and implementation progress.

Swachh Vayu Survekshan

Launched in **2022–23** by the Ministry of Environment, Forest and Climate Change, **Swachh Vayu Survekshan** assesses cities on their implementation of clean-air measures.

Cities are grouped into three categories:

- Population of 10 lakh or more;
- Population between three lakh and 10 lakh; and
- Population below three lakh.

In 2025, **Indore**, **Amravati** and **Dewas** topped the three respective categories.

In 2026, the leading cities were:

- **Lucknow:** Category 1
- **Rourkela:** Category 2
- **Kalinganagar:** Category 3

The 2026 assessment introduced ward-level evaluation across more than **7,400 wards**. Ward 70 of Lucknow led the largest category, Wards 30 and 36 of Bhubaneswar topped the middle category, and Ward 13 of Rourkela led the smallest category.

Sector-wise Pollution-Control Measures

Vehicular Emissions

- **BS-VI emission norms** have applied nationwide since April 2020.
- The **PM E-DRIVE Scheme** and **PM e-Bus Sewa** promote cleaner mobility.
- Charging infrastructure is being expanded under Ministry of Power guidelines.
- Registered Vehicle Scrapping Facilities and Automated Testing Stations support the Vehicle Scrapping Policy.
- The Pollution Under Control certification system is being strengthened.
- The **PARIVARTAN programme** incentivises replacement of BS-IV and older trucks and buses in the NCR with BS-VI, CNG or electric vehicles.
- From November 1, 2026, only BS-VI, CNG or electric public transport buses will be permitted to enter Delhi.
- Electric three-wheelers are being introduced in phases across Delhi and high-volume NCR districts.

Industrial Emissions

The MoEFCC prescribes sector-specific standards, while industries without separate standards follow the **Environment (Protection) Rules, 1986**.

CPCB has classified **419 industrial sectors and subsectors** according to their pollution potential:

- 125 Red
- 137 Orange
- 94 Green
- 54 White
- 9 Blue

In Delhi-NCR, approved fuel lists and continuous monitoring requirements apply to identified industries. Revised particulate-emission norms of **50 mg/Nm³** for large and polluting units become applicable from October 1, 2026.

- The **Comprehensive Environmental Pollution Index** identifies Critically Polluted and Severely Polluted Areas for targeted remedial action.

Road and Construction Dust

Construction and road dust contribute around **40–50% of PM10** in many cities, based on source-apportionment studies under NCAP.

Important measures include:

- Guidelines for construction and demolition waste;
- Anti-smog guns at large construction sites;
- Online compliance monitoring in Delhi-NCR;
- Mechanised road sweeping;
- Improvement of roads and junctions;
- Greening of open spaces; and
- Dust Control and Management Cells for road-owning agencies.

Seventy such cells have been established across the NCR.

Open Waste Burning

- Waste-related emissions are regulated through rules concerning solid waste, plastic waste, hazardous waste, e-waste, batteries and biomedical waste.
- **Extended Producer Responsibility** makes producers responsible for post-consumer

plastic packaging, e-waste, batteries, tyres and used oil.

- Twelve identified single-use plastic items with low utility and high littering potential have been prohibited since July 2022.

Crop-Residue and Biomass Burning

- CPCB supports paddy-straw pelletisation and torrefaction plants. CAQM has directed **5–10% biomass co-firing** in specified thermal power plants, captive power plants and brick kilns.

Other measures include:

- ₹37.16 crore sanctioned for 34 pelletisation and torrefaction plants;
- ₹4,233.84 crore provided for crop-residue management between 2018–19 and 2025–26;
- More than 3.53 lakh machines distributed to farmers; and
- Over 43,535 Custom Hiring Centres established.

Compared with 2021, paddy-stubble-burning incidents declined in 2025 by **93% in Punjab** and **91% in Haryana**.

Afforestation and Urban Green Cover

- **Green India Mission:** ₹1,019.26 crore released to States by March 2026.
- **CAMPA:** More than 3.20 lakh hectares taken up for compensatory afforestation between 2020–21 and 2024–25.
- **Nagar Van Yojana:** Targets 1,000 Nagar Vans and Vatikas by 2026–27; 626 had received support by March 2026.
- **Aravalli Green Wall:** Targets ecological restoration across 6.31 million hectares in Rajasthan, Gujarat, Haryana and Delhi.
- **Ek Ped Maa Ke Naam:** Recorded plantation of 262.4 crore saplings by December 2025.

Institutional Framework

Central Pollution Control Board

- The **CPCB** is a statutory organisation established under the **Water (Prevention and Control of Pollution) Act, 1974**. It also exercises functions under the **Air (Prevention and Control of Pollution) Act, 1981**.
- It advises the Union Government, establishes standards and coordinates pollution-control activities.

Commission for Air Quality Management

- The **CAQM** was established under the **Commission for Air Quality Management in National Capital Region and Adjoining Areas Act, 2021**.
- It coordinates air-pollution management across the NCR airshed and supervises the implementation of the Graded Response Action Plan.

Graded Response Action Plan

- **GRAP** is an emergency framework under which increasingly strict measures are applied as Delhi's air quality deteriorates.
- Its four stages extend from **Poor**, with AQI between 201 and 300, to **Severe Plus**, when AQI exceeds 450. Measures include restrictions on construction, industrial operations and certain categories of vehicles.

State Pollution Control Boards

- SPCBs implement pollution-control laws, monitor industries, grant regulatory consent and manage waste-related compliance at the State level.

Uniform Consent Framework

- Uniform guidelines for granting, refusing or

cancelling consent under the Air and Water Acts were notified in January 2025.

- The **Unified Consent and Authorisation Management System** enables end-to-end online processing of industrial consent applications. It seeks to standardise fees, siting criteria and timelines while improving transparency.

Significance

India's clean-air policy has gradually shifted from isolated pollution-control measures towards coordinated, city-specific and measurable interventions. Expanded monitoring improves identification of pollution hotspots, while performance-linked grants create incentives for Urban Local Bodies to deliver measurable outcomes.

- The emphasis on transport, industry, dust, waste, biomass burning and green cover recognises that urban air pollution has multiple sources and cannot be addressed by a single department.

Challenges

- Monitoring remains uneven outside major cities.
- Many Urban Local Bodies lack adequate technical and financial capacity.
- Air pollution crosses municipal and State boundaries, while administration remains jurisdiction-based.
- Seasonal emergency measures often receive greater attention than year-round emission reduction.
- Weak enforcement reduces industrial and construction-site compliance.
- The gap between funds released and utilised delays local action.
- PM2.5, secondary pollutants and regional transport of pollution require advanced modelling.
- Public participation remains limited despite grievance platforms.
- Plantation drives require long-term survival audits rather than only sapling counts.

Way Forward

- Adopt **airshed-based management** extending beyond municipal boundaries.
- Expand real-time monitoring to smaller cities and rural industrial clusters.
- Regularly update source-apportionment and emission-inventory studies.
- Link grants to independently verified reductions in pollutant concentrations.
- Strengthen the staffing and laboratory capacity of SPCBs and Urban Local Bodies.
- Integrate public transport, walking and cycling into city clean-air plans.
- Enforce construction-dust, industrial-emission and waste-management standards consistently.
- Use satellite data, forecasting and artificial intelligence for early warning and targeted enforcement.
- Ensure transparent public disclosure through PRANA, SAMEER and city dashboards.
- Measure the survival and ecological performance of urban plantations.

Conclusion

Clean air requires continuous action rather than temporary responses during severe pollution episodes. Scientific monitoring, strong local institutions and coordinated action across airsheds can convert India's expanding policy framework into lasting improvements in public health and environmental quality.

Uniform Civil Code Debate: Balancing Gender Justice and Cultural Diversity

Source: The Hindu

Relevance: **GS Paper II – Constitution, Fundamental Rights, Directive Principles and Government Policies; GS Paper I – Indian Society and Women's Empowerment.**

Important Key Words

Prelims:

- Uniform Civil Code, Article 44, Article 25, Article 29, Directive Principles of State Policy, personal laws, Presidential assent, Hindu Marriage Act, Hindu Succession Act and Shariat Act.

Mains:

- Gender justice, constitutional morality, religious freedom, cultural diversity, tribal customary laws, equality within communities and personal-law reform.

Why in News?

Union Home Minister **Amit Shah** has indicated that the **Uniform Civil Code (UCC)** would be implemented in all **21 NDA-ruled States by 2029**.**Uttarakhand** has had a UCC in force since January 2025. UCC Bills passed by the legislatures of **Assam, Gujarat and Madhya Pradesh** are awaiting Presidential assent.

What is a Uniform Civil Code?

- A **Uniform Civil Code** means a common set of secular personal laws applicable to all citizens, irrespective of religion, caste or tribe.
- It would govern family-related matters such as marriage, divorce, maintenance, custody, adoption, inheritance and succession of property.
- India already has uniform criminal laws and common civil laws covering taxation, contracts and negotiable instruments. However, marriage, divorce and inheritance continue to be governed mainly by community-specific personal laws based on religious doctrines and customary practices.

How are Personal Matters Governed Today?

Community	Existing legal framework
Hindus	Hindu Marriage Act, 1955 and Hindu Succession Act, 1956
Jains, Buddhists and Sikhs	Generally covered by Hindu personal laws
Sikhs	Marriages can also be registered under the Anand Marriage framework
Muslims	Muslim Personal Law (Shariat) Application Act, 1937
Christians and Parsis	Governed by their respective personal laws
Tribal communities	Many follow customary family laws protected through constitutional exceptions

Thus, citizens belonging to different communities may be governed by different legal rules in similar family matters.

Constitutional Position of UCC

Article 44

- Article 44 states:"The State shall endeavour to secure for the citizens a Uniform Civil Code throughout the territory of India."

- It is placed in **Part IV of the Constitution**, which contains the **Directive Principles of State Policy**.

The important features of Article 44 are:

- It places a responsibility on the State to work towards a UCC.
- It is a constitutional objective rather than an immediately enforceable right.
- Being a Directive Principle, it cannot be directly enforced by courts.
- Its implementation requires legislation by the appropriate legislature.

Fundamental Rights Connected with UCC

- **Article 25:** Guarantees freedom of conscience and the right to practise a religion of one's choice.
- **Article 29:** Protects the right of any section of citizens to conserve its distinct culture.
- **Right to equality:** Requires the State to prevent discrimination and secure equal civil rights.

The constitutional question is how to harmonise Article 44 with religious freedom, cultural protection and gender equality.

Constituent Assembly Debate

- The Constitution-makers were divided over the inclusion of UCC.
- Some members wanted it to be made a **Fundamental Right** because they believed that common civil laws would establish legal uniformity and secure equal rights for women.
- Several Muslim members opposed this proposal because they feared that a compulsory UCC could violate the freedom of religion guaranteed under Part III of the Constitution.
- As a compromise, UCC was placed in the non-justiciable **Directive Principles of State Policy** rather than in the enforceable Fundamental Rights.

Arguments in Favour and Against UCC

Arguments in Favour

- Gender justice: It can provide women equal rights in marriage, divorce, maintenance and inheritance.
- Secular civil system: The same secular rules would govern all citizens in personal matters, irrespective of religion.
- Equal citizenship: Civil rights would be determined by citizenship rather than religious identity.
- Legal uniformity: A common code may reduce differences and confusion arising from multiple personal laws.
- Women's empowerment: Discriminatory provisions found in different personal laws can be removed.

Arguments Against

- Religious freedom: Common personal laws may conflict with religious practices protected under Article 25.
- Cultural protection: Community traditions and cultural practices may receive protection under Article 29.
- Loss of diversity: A single code may weaken India's religious and cultural pluralism.
- Tribal customs: A common framework may conflict with constitutionally protected customary practices.
- Uniformity is not equality: A uniform law may still be unjust unless its provisions are fair, inclusive and gender-sensitive.

Issue of Tribal Exemptions

The State-level UCC measures referred to in the article have exempted tribal populations from their ambit.

The main reasons are:

- Constitutional safeguards protecting tribal culture
- Recognition of customary family laws
- The belief that several tribal customs already provide adequate rights to women

However, such exemptions create an equality concern. If tribal groups are exempted to protect their customs while the code is made compulsory for religious minorities, the distinction may appear discriminatory.

Any exemption should therefore be based on clear and constitutionally valid principles.

Why is Gender Justice Central to UCC?

- The principal purpose of personal-law reform is to provide women equal rights in:
  - Marriage and divorce
  - Maintenance and custody
  - Adoption
  - Succession and inheritance
- Religious freedom under Article 25 is subject to constitutional morality and other Fundamental Rights, including equality.
- In the **Section 6A of the Citizenship Act, 1955 case decided in 2024**, the Supreme Court held that practices such as casteism and gender discrimination, which conflict with the constitutional spirit, cannot claim protection under Article 29.
- Therefore, removing discriminatory provisions from personal laws may be viewed as upholding women's equality rather than violating religious or cultural rights.

Landmark Supreme Court Judgments

Judgment	Key observation
Mohd. Ahmed Khan v. Shah Bano Begum, 1985	The Supreme Court upheld a divorced Muslim woman's right to maintenance under Section 125 of the Code of Criminal Procedure. It noted the continued non-implementation of Article 44 and emphasised the need for common civil principles.
Sarla Mudgal v. Union of India, 1995	The Court held that a Hindu husband cannot convert to Islam merely to enter a second marriage without legally dissolving the existing marriage. It warned against the misuse of personal laws.
Daniel Latifi v. Union of India, 2001	The Court upheld the **Muslim Women (Protection of Rights on Divorce) Act, 1986**, while ensuring reasonable and fair provision for a divorced Muslim woman beyond the Iddat period.
John Vallamattom v. Union of India, 2003	The Supreme Court invalidated Section 118 of the **Indian Succession Act, 1925** as discriminatory under Article 14 and connected common civil standards with equal citizenship.
Shayara Bano v. Union of India, 2017	The Court invalidated **Talaq-e-Biddat**, or instant triple talaq. It demonstrated that personal-law practices can be tested against constitutional principles.

Jose Paulo Coutinho v. Maria Luiza Valentina Pereira, 2019	The Supreme Court referred to Goa as an example where common civil rules broadly operate across religious communities while preserving certain limited rights.

Challenges

- **Balancing constitutional rights:** The State must reconcile equality and dignity with religious freedom and cultural protection.
- **Minority apprehensions:** Some minority communities, particularly Muslims, fear interference with their personal laws.
- **Tribal customary practices:** Constitutionally protected traditions complicate the application of a single framework.
- **Unequal exemptions:** Exempting some communities while applying UCC to others may raise discrimination concerns.
- **Absence of consensus:** A code introduced without broad consultation may face social and legal resistance.
- **Diversity within communities:** Customs may vary within the same religious or social community.
- **Gender-just drafting:** A uniform law will promote justice only if its provisions are themselves fair and non-discriminatory.
- **Risk of politicisation:** Political debate may overshadow the objective of reforming unequal family laws.

Way Forward

- **Prioritise gender justice:** The central objective must be equal rights for women in marriage, divorce, maintenance and inheritance.
- **Uphold constitutional morality:** Religious and cultural practices should be respected, but practices violating equality and dignity require reform.
- **Build broad consensus:** Women's organisations, religious groups, tribal representatives, legal experts and civil society should participate in consultations.
- **Consider a voluntary UCC:** Dr. B.R. Ambedkar suggested that UCC could initially apply to citizens who formally choose to be governed by it.
- **Reform discriminatory personal laws:** Unequal provisions can be amended without immediately replacing every personal-law system.
- **Adopt gradual implementation:** Reform can begin with clearly discriminatory rules concerning custody, adoption, maintenance, succession and inheritance.
- **Clarify tribal exemptions:** Any exemption should have a transparent constitutional basis and should not create arbitrary differences.
- **Protect individual choice:** Personal-law reform should recognise individuals as rights-bearing citizens rather than treating communities as the only legal units.

Conclusion

The UCC debate is not simply about replacing different personal laws with one common statute. It involves balancing **women's equality, individual dignity and constitutional morality** with **religious freedom, cultural rights and tribal traditions**. A gradual and consultative reform process can protect individual rights without treating cultural uniformity as the final objective.

River Interlinking in India: Potential, Concerns and Sustainable Alternatives



Source: The Hindu

Relevance: GS Paper II: Cooperative Federalism and Inter-State River-Water Disputes

Important Keywords

Prelims Keywords

- Interlinking of Rivers | National Perspective Plan | Himalayan Component | Peninsular Component | NWDA | Inter-basin Water Transfer | Ken–Betwa Link | Article 262

Mains Keywords

- Water Federalism | Integrated River-basin Management | Demand-side Management | Ecological Flows | Groundwater Depletion | Climate-resilient Water Management | Participatory Water Governance

Why in News?

The union home minister has proposed linking major rivers from the Brahmaputra to the Godavari and Cauvery to address long-term water scarcity. However, unresolved inter-State disputes, ecological risks, displacement and limited progress in existing projects have renewed debate over the feasibility of large-scale river interlinking

What is Interlinking of Rivers?

- The **Interlinking of Rivers (ILR)** programme is a large-scale water-management initiative that seeks to transfer water from water-surplus basins to water-deficit regions.
- The transfer is proposed through a network of reservoirs, dams, canals and diversion structures.

- The programme is based on the assumption that some river basins have surplus water that can be transferred to regions experiencing shortages.

Inter-basin Water Transfer

- Inter-basin water transfer means moving water across the natural boundary of one river basin into another.
- Supporters view it as a way to redistribute water, while critics question whether a river basin can be permanently classified as surplus because water availability changes across seasons and years.

Historical Background

- The idea of linking Indian rivers dates back to the 19th century, when **Sir Arthur Cotton** proposed river-based irrigation and navigation projects.
- The proposal gained attention after Independence due to India's uneven rainfall distribution and recurring floods and droughts.
- In 1980, the Ministry of Water Resources formulated the **National Perspective Plan** for interlinking rivers.
- The **National Water Development Agency (NWDA)** was established in **1982** to examine the feasibility of river-linking projects.

National Perspective Plan

- The National Perspective Plan identified **30 major river links**.
- These are divided into two components: **14 links under the Himalayan component and 16 links under the Peninsular component**.

Himalayan Component

- It broadly seeks to link rivers originating in the Himalayan region and transfer water across northern and eastern river basins.

Peninsular Component

- It focuses on linking rivers in peninsular India to transfer water between relatively water-rich and water-deficit regions.

Role of the NWDA

- The NWDA studies the feasibility of river-linking proposals.
- Its work includes assessing river flows, identifying possible links and examining whether water transfers can be technically implemented.
- The agency maintains that river-link planning accounts for the need to improve or protect river flows during lean periods.

Objectives of River Interlinking

Water Security

- The programme seeks to transfer water from relatively water-rich basins to water-deficit areas and reduce regional disparities.

Irrigation Expansion

- Additional water could expand irrigation, support crop diversification, increase agricultural productivity and improve farmers' incomes.

Flood and Drought Management

- Supporters argue that excess water during floods could be diverted to water-scarce regions, reducing the impact of floods and droughts.

Drinking and Industrial Water

- Inter-basin transfers could improve water availability for cities, industries and rural communities facing shortages.

Hydropower Generation

- Reservoirs and related infrastructure may

provide opportunities for generating hydropower.

Balanced Regional Development

- Improved irrigation, water supply, navigation and rural infrastructure could support employment and economic development in water-deficit regions.

Integrated River-basin Management

- River interlinking may encourage coordinated planning of water resources across political and administrative boundaries.

Inter-State Water Disputes in Southern India

- Several southern rivers flow through more than one State, resulting in disputes over dams, irrigation projects, reservoir operations and water sharing during periods of scarcity.
- The delay in resolving existing disputes demonstrates the difficulty of achieving the level of inter-State cooperation required for large-scale river interlinking.

Pennaiyar River Dispute

- Tamil Nadu requested the Union government in **November 2019** to constitute a tribunal for adjudicating its Pennaiyar river dispute with Karnataka.
- Tamil Nadu alleged that Karnataka had violated the **1892 inter-State agreement** and also approached the Supreme Court.
- Two negotiation committees were constituted and 11 meetings were held, but the dispute remained unresolved.
- The Supreme Court directed the Centre to constitute a tribunal and later extended the deadline by six months. However, the tribunal had not been established at the time covered by the source.

Proposal to Use the Mahadayi Tribunal

- The Union government asked whether the Pennaiyar dispute could be referred to the **Mahadayi Water Dispute Tribunal** instead of constituting a separate tribunal.
- The Pennaiyar and Mahadayi disputes concern different river systems and geographical regions.
- The article argues that such a transfer is not permitted under the **Inter-State River Water Disputes Act, 1956**.

Mekedatu Project Dispute

- Karnataka's proposed Mekedatu dam project has faced opposition from Tamil Nadu over concerns about downstream water availability.
- Tamil Nadu requested the Union government in March 2026 to constitute a tribunal on the project.
- The Centre had not responded to this demand at the time covered by the source.

Arguments in Favour of River Interlinking

Improving Agricultural Productivity

- Additional irrigation could increase agricultural output, support crop diversification and improve farmers' incomes.
- The Indira Gandhi Canal Project helped expand irrigation and agriculture in arid parts of Rajasthan.

Enhancing Water Security

- Water could be transferred from relatively water-rich basins to drought-prone and water-deficit regions.
- The Ken–Betwa Link Project, for example, aims to provide irrigation and drinking water to the Bundelkhand region of Madhya Pradesh and Uttar Pradesh.

Managing Floods and Droughts

- Diversion of excess water during high-flow periods could reduce flood pressure while supporting water-scarce regions.
- Proponents argue that this could improve India's long-term water resilience.

Supporting Urban and Industrial Needs

- Inter-basin transfers can help meet the drinking-water requirements of expanding cities.
- The Krishna Water Supply Project transfers Krishna river water to meet Hyderabad's drinking-water needs.

Reducing Regional Imbalances

- Transferring water to dry regions could promote settlement, agriculture and economic development in areas with limited natural water availability.

Arguments Against River Interlinking

Difficulty in Identifying Surplus Water

- A river may carry excess water during a good monsoon but experience scarcity during a weak rainfall year.
- Calculations based on average flows may not accurately reflect seasonal variations, drought years or future climate conditions.

Climate-change Uncertainty

- Climate change is altering rainfall patterns, glacier behaviour and river flows.
- These changes make assumptions about permanent water-surplus and water-deficit basins increasingly uncertain.

Ecological Effects

- River ecosystems are interconnected. Changing natural flows can affect aquatic biodiversity, fish migration, wetlands, sediment transport, groundwater recharge and downstream ecosystems.
- Diversions may also alter the ecological balance of donor and recipient river basins.

Impact on the Vembanad Wetland

- Kerala opposes the **Pamba–Achankovil–Vaippar Link Project**.
- It argues that diverting water from the Pamba and Achankovil rivers could harm the **Vembanad wetland ecosystem**, into which these rivers drain.

Claims During Distress Years

- Recipient regions may begin to treat transferred water as a permanent entitlement.
- They may continue demanding water during drought years, potentially reducing supplies available to the original basin.

Inter-State Water Conflicts

- Rivers are shared by multiple States, making allocation politically sensitive.
- The Pennaiyar and Mekedatu disputes demonstrate the difficulty of securing agreement on river-water use.

Land Acquisition and Displacement

- Large dams, canals and reservoirs require extensive land.
- Such projects may displace local and tribal communities and affect livelihoods, cultural connections and access to natural resources.

Economic and Technical Difficulties

- River-linking projects involve high financial costs, complex engineering, continuous maintenance and long gestation periods.
- Growing resistance to land acquisition can further delay implementation.

Diversion from Sustainable Alternatives

- Excessive dependence on mega engineering

projects may reduce attention to water conservation, watershed development, groundwater management and efficient use.

Successful Inter-basin Transfer Projects

Mullaperiyar Dam Project

- The project involves Kerala and Tamil Nadu.
- Water from the **Periyar basin in Kerala** is diverted to the **Vaigai basin in Tamil Nadu** for irrigation and drinking-water purposes.
- It has supported agriculture in the drought-prone regions of Tamil Nadu.

Parambikulam–Aliyar Project

- The project involves Kerala and Tamil Nadu.
- It is a multi-reservoir inter-State project that diverts waters from rivers of the Western Ghats to provide irrigation benefits in Tamil Nadu.
- It represents cooperation between States in sharing river water.

Krishna Water Supply Project

- The project is associated with Maharashtra, Karnataka, Telangana and Andhra Pradesh.
- It transfers Krishna river water to meet the drinking-water requirements of Hyderabad.
- It demonstrates the use of inter-basin transfers to address urban water shortages.

Indira Gandhi Canal Project

- The project involves Punjab, Haryana and Rajasthan.
- It transfers water from the **Sutlej–Beas river system** to the arid regions of Rajasthan.
- It transformed parts of the Thar Desert by expanding irrigation, agriculture and settlement.

Limited Number of Projects

- India has implemented only a handful of major inter-basin water-transfer projects during the last 130 years.
- Their limited number demonstrates the technical, financial, political and social difficulties involved.

Status of River-linking Efforts

- After returning to power in 2014, the Union government constituted a **Special Committee for Interlinking of Rivers**.
- The committee has held more than two dozen meetings.
- Despite these meetings, the national river-linking programme has made limited progress.
- Major barriers include State consent, water-sharing arrangements, environmental concerns, land acquisition, rehabilitation and questions over surplus-water availability.

Ken–Betwa Link Project

- The project seeks to transfer water from the Ken basin to the Betwa basin.
- It aims to provide irrigation and drinking-water benefits to drought-prone **Bundelkhand in Madhya Pradesh and Uttar Pradesh**.
- In 2024, the Prime Minister laid the foundation stone for the **₹44,000-crore project**.
- The project has faced protests from tribal communities in Chhatarpur over displacement, environmental effects and loss of traditional livelihoods.
- It shows that technical and financial approval alone cannot ensure ecological sustainability or social acceptance.

Supply-side and Demand-side Approaches

Supply-side Approach

- A supply-side approach tries to increase water availability through dams, reservoirs, canals and inter-basin transfers.
- River interlinking follows this approach because it transports additional water to areas experiencing shortages.

Demand-side Approach

- Demand-side management focuses on conserving existing water, reducing wastage and improving water-use efficiency.
- It includes micro-irrigation, groundwater conservation, rainwater harvesting, watershed management and restoration of traditional water bodies.
- It also involves sensitising and incentivising farmers to use irrigation water efficiently.
- The article argues that governments and civil society should prioritise demand management instead of continuously depending on mega supply-side projects.

Challenges

Federal and Governance Challenges

- States may disagree over surplus-water calculations, project designs, costs and allocation arrangements.
- Delays in creating tribunals and implementing decisions weaken dispute-resolution mechanisms.

Ecological Challenges

- Altered river flows may affect biodiversity, wetlands, sediment movement, groundwater recharge, fisheries and downstream ecosystems.
- Climate change makes long-term water-availability estimates increasingly uncertain.

Social Challenges

- Large projects can displace local and tribal communities.
- Fair compensation, rehabilitation and livelihood restoration remain difficult.

Economic and Technical Challenges

- Mega projects involve high financial costs, complex engineering, long construction periods and continuous maintenance.
- Extensive land acquisition can delay projects and increase opposition.

Water-use Challenges

- Additional water may not solve scarcity if agricultural consumption remains inefficient.
- Indiscriminate groundwater extraction, including extraction encouraged by free agricultural electricity, can worsen ecological stress.

Institutional Challenges

- More than two dozen committee meetings have not produced substantial progress.
- Limited consensus among States can delay individual links and the wider programme.

Way Forward

Strengthen Water-governance Institutions

- The National River Linking Project and ILR programme should follow a scientific, transparent and participatory approach.
- The NWDA should conduct detailed basin-level studies before recommending transfers.

Improve Dispute Resolution

- Mechanisms under the **Inter-State River**

Water Disputes Act, 1956 should be strengthened to ensure timely tribunal formation and implementation of decisions.

- The constitutional framework under **Article 262** should support equitable and cooperative management of inter-State rivers.

Adopt Basin-level Planning

- Planning should consider the entire river basin, including downstream users, wetlands, ecological flows and seasonal variations.
- States, technical experts, local communities and other stakeholders should participate in decision-making.

Introduce Climate-risk Assessment

- Project planning should account for changing rainfall patterns, glacier behaviour, droughts and extreme weather.
- Surplus-water calculations should not depend only on past average flows.

Strengthen Environmental Safeguards

- Projects should undergo credible environmental-impact assessments.
- Ecological flows, aquatic biodiversity, sediment movement, groundwater recharge and downstream ecosystems must be protected.

Ensure Rehabilitation and Community Participation

- Affected communities should participate in project planning, compensation, rehabilitation and livelihood restoration.
- Tribal and local rights must be considered before land acquisition.

Prioritise Demand-side Management

- India should expand micro-irrigation, groundwater conservation, rainwater harvesting, watershed management and restoration of traditional water bodies.
- Farmers should be sensitised and incentivised to use water efficiently.

Regulate Groundwater Extraction

- Indiscriminate extraction should be curbed, particularly where free electricity encourages excessive pumping.

Examine Local Alternatives First

- Local water harvesting, aquifer recharge, efficient irrigation and restoration of tanks should be examined before approving mega transfers.

Promote Cooperative Federalism

- The Centre and States should rely on transparent data, consultation and mutually accepted water-sharing arrangements.
- Integrated river-basin management can reduce conflicts and improve long-term water security.

Conclusion

River interlinking may support water security in carefully selected cases, but it cannot be a universal solution. India needs a balanced strategy based on conservation, efficient use, groundwater management, ecological protection and cooperative federalism.

International Relations

26th SCO Summit: India Calls for Unified Action Against Terrorism

Sources: The Hindu

Relevance: **GS Paper II – International Relations | Regional and Global Groupings**

Important Keywords

For Prelims:

- SCO | Shanghai Five | Bishkek Declaration | RATS | Shanghai Spirit | SCO Development Bank | Civilisation Dialogue Forum

For Mains:

- Eurasian Security | Terror Financing | Strategic Autonomy | Sovereignty-Based Connectivity | Afghanistan Stability | Multipolarity

Why in News?

Prime Minister Narendra Modi participated in the **26th Meeting of the SCO Council of Heads of State**, held in Bishkek, Kyrgyz Republic, from August 31 to September 1, 2026.The summit marked the SCO's **25th anniversary**. India called upon members to dismantle the complete ecosystem of terrorism, including financing, recruitment, radicalisation and safe havens.Pakistan assumed the SCO chairmanship for **2026–27**.

Theme and Key Facts

Theme: *"25 Years of the SCO: Together Towards Sustainable Peace, Development and Prosperity."*

Feature	Details
Summit	26th SCO Council of Heads of State
Venue	Bishkek, Kyrgyz Republic
Dates	August 31–September 1, 2026
Host	Kyrgyz Republic
Chair	President Sadyr Japarov
Occasion	SCO's 25th anniversary
Members	10 countries
Next chair	Pakistan, 2026–27

About the SCO

The **Shanghai Cooperation Organisation (SCO)** is a Eurasian grouping working on security, economic cooperation, connectivity and regional stability.

Origin and Expansion

- **1996:** Shanghai Five formed by China, Russia, Kazakhstan, Kyrgyzstan and Tajikistan.
- **2001:** SCO established in Shanghai with Uzbekistan.
- **2017:** India and Pakistan became full members.
- **2023:** Iran joined.
- **2024:** Belarus became the tenth member.

Member States

- India | China | Russia | Pakistan | Kazakhstan | Kyrgyzstan | Tajikistan | Uzbekistan | Iran | Belarus

Permanent Bodies

- **SCO Secretariat:** Beijing, China
- **Regional Anti-Terrorist Structure:** Tashkent, Uzbekistan

Shanghai Spirit

- The "Shanghai Spirit" emphasises mutual trust, sovereign equality, non-interference and mutually beneficial cooperation. SCO decisions are generally taken through consensus.

India's Three-Pillar Vision

India's approach to the SCO rests on:

1. Security

- Combating terrorism, extremism, radicalisation, drug trafficking and other transnational threats.

2. Connectivity

- Developing trusted transport and trade links that respect the sovereignty and territorial integrity of every country.

3. Opportunity

- Expanding cooperation in technology, innovation, entrepreneurship, start-ups, youth engagement and people-to-people exchanges.

India's Call Against Terrorism

India called for committed action against the entire terrorist ecosystem rather than relying only on an "action-reaction" approach.

The Prime Minister identified four connected elements:

- terror financing;
- recruitment;
- radicalisation; and
- safe havens.

India argued that terrorism must never be treated as a **strategic asset** or instrument of state policy. It also rejected double standards in which some terrorist groups are condemned while others receive protection or support.

- The Bishkek Declaration similarly described attempts to use terrorist, separatist or extremist groups for political gain as unacceptable.

Afghanistan and Drug Trafficking

India linked Eurasian security with peace and stability in Afghanistan.

It highlighted:

- India's development and humanitarian assistance;
- the need for lasting peace and security;
- the regional threat posed by drug trafficking; and
- the importance of preventing Afghan territory from contributing to instability.

The Bishkek Declaration called for an **inclusive government** in Afghanistan with the participation of all ethnopolitical groups.

West Asia and Iran

India noted that conflict in West Asia affects:

- energy security;
- maritime security;
- global supply chains; and
- the economies of the Global South.

The Bishkek Declaration expressed deep concern over developments in the Persian Gulf region, supported Iran's sovereignty and called for a diplomatic resolution.

It also criticised unilateral deployment of global missile-defence systems when such actions negatively affect international security.

Peaceful Use of Nuclear Energy

SCO members affirmed the inalienable right of

countries to:

- develop and use atomic energy for peaceful purposes; and
- pursue equal, sustainable and mutually beneficial international nuclear cooperation without discrimination.

The summit also adopted decisions relating to nuclear safety.

Connectivity and Economic Cooperation

India supported connectivity initiatives that link markets and expand trade but maintained that they must respect sovereignty and territorial integrity.

The wider SCO agenda included:

- transport corridors;
- trade facilitation;
- energy cooperation;
- investment;
- digital technology;
- environmental protection; and
- sustainable development.

Proposed SCO Development Bank

SCO members welcomed ongoing work towards establishing an **SCO Development Bank** and agreed to complete consultations for a founding document.

The proposed institution could finance:

- infrastructure;
- transport networks;
- investment projects; and
- regional development initiatives.

Its success will depend on agreement over capital contribution, governance, lending priorities and institutional control.

Major Summit Outcomes

The summit adopted:

- the **Bishkek Declaration**;
- four Memoranda of Understanding; and
- more than 20 decisions and statements.

These covered:

- counterterrorism;
- climate change;
- nuclear safety;
- energy conservation;
- drug-addiction control;
- economic cooperation;
- youth engagement; and
- cultural exchange.

Pakistan assumed the next SCO chairmanship, while **Lahore** was designated the **SCO Tourism and Cultural Capital for 2026–27**. Kyrgyzstan also named one of its mountain peaks the **"SCO Peak."**

India's Initiatives Recognised

English in the SCO Charter

- India's proposal to include **English as an official language of the SCO** found a place in the summit outcomes. Traditionally, Russian and Chinese have been the organisation's official languages.

Civilisation Dialogue Forum

- India offered to host the first **SCO Civilisation Dialogue Forum** later in 2026 to promote exchanges among member states' ancient civilisations.

Young Scientist Forum

- The forum seeks to promote collaboration among young researchers and encourage scientific innovation.

Young Authors' Conclave

- The conclave promotes literary and cultural engagement among young writers from SCO countries.

Significance for India

- Provides sustained engagement with Central Asia.
- Supports cooperation against terrorism and drug trafficking.
- Enables dialogue with major Eurasian powers.
- Provides a forum to discuss Afghanistan.
- Creates opportunities in trade, energy and technology.
- Allows India to advocate sovereignty-based connectivity.
- Strengthens India's role in a multipolar international order.
- Expands civilisational and youth exchanges.

Challenges

- India–Pakistan differences over cross-border terrorism
- India–China disputes over territory and connectivity
- Divergent positions on Eurasian and West Asian conflicts
- Limited direct Indian access to Central Asia
- Consensus-based decision-making can delay action
- Possibility of declarations remaining unimplemented
- Competition over the proposed Development Bank's governance
- Risk of geopolitical tensions weakening security cooperation

Way Forward

- Strengthen RATS and financial-intelligence cooperation.
- Develop common standards against terror financing and safe havens.
- Ensure that connectivity projects respect sovereignty.
- Convert summit declarations into time-bound programmes.
- Advance consultations on the SCO Development Bank transparently.
- Expand cooperation in healthcare, climate action and digital technology.
- Improve India–Central Asia transport and trade connectivity.
- Promote an inclusive and stable Afghanistan.
- Use scientific, youth and cultural forums to build long-term trust.

Conclusion

The Bishkek Summit expanded the SCO's agenda from regional security to connectivity, development and culture. However, its credibility will depend on consistent action against terrorism, respect for sovereignty and implementation of agreed projects.

BRICS: Evolution, Cooperation and India's 2026 Leadership

Source: **PIB**

Relevance

- **UPSC GS Paper II: International Groupings, Global Governance and India's Foreign Policy.**
- **UPSC GS Paper III: International Economic Cooperation, Innovation and Sustainable Development.**

Important Keywords

Prelims:

- BRICS, Partner Countries, New Development Bank, Contingent Reserve

Arrangement, Delhi Declaration, BIMSTEC, BRICS AGRIN, BRICS CONNECT, NIMHANS, Global Value Chains.

Mains:

- Global South, Reformed Multilateralism, South–South Cooperation, Economic Diplomacy, Financial Resilience, Inclusive Global Governance

Why in News?

- India is scheduled to host the **18th BRICS Summit in New Delhi on September 12–13, 2026**, during its **fourth Chairship**.
- The theme is **"Building for Resilience, Innovation, Cooperation and Sustainability."**
- **More than 350 meetings and high-level engagements across 25 cities** have advanced cooperation in agriculture, health, energy, trade, technology and urban development.
- The initiatives emerging from ministerial meetings include both established cooperation platforms and proposals requiring further implementation.

What is BRICS?

- **BRICS** is a forum of major emerging economies and developing countries that coordinates positions on international issues and promotes practical cooperation.
- It seeks to strengthen the participation of the **Global South** in international decision-making. Its activities cover development, finance, security, technology, trade and cultural exchanges.

Global Importance

BRICS brings together countries with large populations, major markets, energy resources, agricultural capacity and technological capabilities. The figures presented for the expanded grouping are:

- **49.5% of the global population**.
- Around **40% of global GDP**.
- **26% of global trade**.

The GDP figure should be used with its measurement basis clearly identified; it should not automatically be interpreted as a share of nominal GDP.

Evolution and Expansion

From an Economic Acronym to a Cooperation Forum

- The term **BRIC** was introduced in **2001** by economist **Jim O'Neill** of Goldman Sachs in the paper **"Building Better Global Economic BRICs."** It referred to **Brazil, Russia, India and China**, whose growing economic importance was expected to reshape the world economy.

Year	Development
2001	The BRIC acronym was introduced.
2006	Cooperation among the four countries took an institutional form through diplomatic dialogue.
2008	The global financial crisis strengthened demands for reform of international financial governance.
2009	The first BRIC Summit was held in **Yekaterinburg, Russia**.
2010–2011	South Africa was invited in **2010** and first participated as a member in **2011**, transforming BRIC into BRICS.
2014	The agreement establishing the **New Development Bank** was signed at **Fortaleza, Brazil**.
2024	Membership expansion substantially widened the grouping's reach.

2025	Indonesia joined, while partner-country engagement expanded.
2026	India assumed its fourth Chairship.

Role of the 2008 Financial Crisis

The crisis exposed weaknesses in the global financial system. BRIC countries sought:

- Greater representation in the **International Monetary Fund (IMF)** and **World Bank**.
- A more balanced international financial architecture.
- Opposition to protectionism.
- Support for an open, rules-based multilateral trading system.

These shared positions helped establish the foundation for regular summit-level cooperation.

Full Members

- India's September 2026 official listing identifies **11 BRICS members**:
- **Brazil, Russia, India, China, South Africa, Egypt, Ethiopia, Iran, Saudi Arabia, the United Arab Emirates and Indonesia.**
- The expansion process brought in countries from Africa and West Asia during **2024**, followed by **Indonesia in January 2025**.

Partner Countries

- The **Partner Country category** provides structured engagement without granting full membership.
- The **10 partner countries identified during 2025** are:
- **Belarus, Bolivia, Cuba, Kazakhstan, Malaysia, Nigeria, Thailand, Uganda, Uzbekistan and Vietnam.**
- This wider network creates opportunities for cooperation in trade, finance, climate action and development across Asia, Africa, Latin America and Eurasia.

Objectives and Areas of Cooperation

BRICS seeks a more representative and balanced international order while addressing the development needs of its members.

- **Global Governance Reform:** Greater representation and equity in institutions such as the **IMF, World Bank and WTO**.
- **Inclusive Development:** Sustainable economic growth, social inclusion and shared prosperity.
- **Economic Cooperation:** Trade, investment, agriculture, international finance and telecommunications.
- **Security Cooperation:** Counter-terrorism and dialogue on international and regional issues.
- **Resource Security:** Food security, energy security and climate resilience.
- **Social Cooperation:** Health, labour, employment, education, youth and cultural exchanges.

Three Pillars of BRICS Cooperation

1. **Political and Security Cooperation**
2. **Economic and Financial Cooperation**
3. **Cultural and People-to-People Exchanges**

Presidency and Financial Mechanisms

Rotating Chairship

The BRICS Chairship runs from **January 1 to December 31**.

The chair country:

- Sets annual priorities.
- Hosts the leaders' summit.
- Coordinates ministerial and working-group meetings.
- Facilitates consensus and follow-up.

The traditional rotation followed the sequence of the original BRICS members. An updated rotation formula is being discussed following expansion.

New Development Bank

- The **New Development Bank (NDB)** mobilises resources for **infrastructure and sustainable development projects**.
- India proposed examining such a bank at the **2012 New Delhi Summit**. The agreement establishing it was signed at the **2014 Fortaleza Summit**.

Contingent Reserve Arrangement

- The **Contingent Reserve Arrangement (CRA)** is intended to provide short-term liquidity support during external financial pressures.
- **Key Distinction:** The **NDB finances development projects**, whereas the **CRA provides a financial safety mechanism against liquidity difficulties**.

India's Previous Chairships

India chaired BRICS in **2012, 2016 and 2021** before assuming the role in **2026**.

2012: New Delhi Summit

- India hosted the **Fourth BRICS Summit on March 29, 2012**.
- **Theme:** *"BRICS Partnership for Global Stability, Security and Prosperity."*
- The summit adopted the **Delhi Declaration** and an **Action Plan**.

Major Contributions

- Proposed exploring a development bank for infrastructure and sustainable development.
- Signed the **Master Agreement on Extending Credit Facility in Local Currency** to support intra-BRICS economic activity.
- Advanced discussions on financial cooperation and safety mechanisms.
- Strengthened cooperation in **agriculture, health and science**.
- Addressed governance reform, sustainable development, food security and energy security.

2016: Goa Summit

- India hosted the **Eighth BRICS Summit in October 2016**.
- **Theme:** *"Building Responsive, Inclusive and Collective Solutions."*

Major Contributions

- Consolidated the NDB's early operations, including its first loans, primarily supporting renewable-energy projects.
- Prioritised **clean energy, energy access and energy security**.
- Strengthened health cooperation on **HIV and tuberculosis**.
- Advanced counter-terrorism cooperation and adherence to **FATF standards**.
- Promoted cooperation through the **Agriculture Research Platform, Railway Research Network, Sports Council and youth forums**.

BRICS–BIMSTEC Outreach

- The outreach summit connected BRICS with the wider **Bay of Bengal region**. Discussions covered terrorism, trade, energy, investment, environment, technology and infrastructure.

2021: Virtual Summit

- India hosted the **13th BRICS Summit on September 9, 2021**, marking the grouping's **15th anniversary**.
- **Theme:** *"BRICS@15: Intra-BRICS Cooperation for Continuity, Consolidation and Consensus."*

Major Contributions

- Adoption of the BRICS Counter-Terrorism Action Plan.
- Organisation of the first BRICS Digital

Health Summit.

- Agreement on the BRICS Remote Sensing Satellite Constellation, supporting environmental protection, disaster management and climate monitoring.
- Advancement of vaccine research cooperation.
- Cooperation through the BRICS Alliance for Green Tourism and the first BRICS Water Ministers Meeting.

The **BRICS Vaccine Research and Development Centre** was endorsed during India's **2021 Chairship** and formally launched jointly on **March 22, 2022**.

Major Initiatives under India's 2026 Chairship

India assumed the Chairship on **January 1, 2026**. Ministerial meetings have advanced the following initiatives.

1. Agriculture and Food-System Resilience

- **BRICS Centres of Excellence on Agro-Ecology:** Support joint research, knowledge exchange and capacity building in **natural, organic and regenerative farming**. Initial coordination is assigned to **ICAR–Indian Institute of Farming Systems Research, Modipuram**.
- **BRICS Network on Digital Agriculture:** Promotes **AI-based decision support, geospatial intelligence, IoT monitoring and advanced data analytics**. **IIT Delhi** is the initial coordinating institution.
- **BRICS AGRIN:** The **Agro-Inputs, Genetic Resources and Information Network** is a voluntary, farmer-centred framework for cooperation in seeds, germplasm and agricultural inputs.

2. Preventive Healthcare

- The **BRICS Mission for Healthy Lifestyle**, accompanied by a **2026–2029 roadmap**, promotes prevention of **obesity and other non-communicable diseases**.
- It supports technical cooperation, knowledge exchange and coordinated awareness across different stages of life.

3. Traditional and Integrative Medicine

The **Expert Working Group on Traditional, Complementary and Integrative Medicine (TCIM)** provides a platform for:

- Policy dialogue and evidence-based research.
- Capacity building and academic exchanges.
- Digital knowledge platforms.
- Quality and regulatory standards.
- Protection of traditional and indigenous knowledge.

4. Mental Health Cooperation

- A **BRICS Training Hub Network** and **Network of Centres of Excellence**, coordinated by **NIMHANS, India**, seek to strengthen mental-health services.
- Their priorities include professional upskilling, standardised training, task-sharing and integration of mental well-being into **primary healthcare**.

5. Traditional Knowledge and Climate Adaptation

Members adopted principles supporting:

- **People-centred and community-based climate adaptation**.
- Academic collaboration on **traditional and indigenous knowledge systems**.

These initiatives recognise the contribution of local knowledge to climate resilience.

6. Sustainable Lifestyles

A **Network of BRICS Institutions** and **Sustainable Lifestyles Week** support:

- Sharing policies and practical experiences.
- Research and innovation.
- Capacity-building workshops.

- Dialogue among academic institutions and other stakeholders.
- Compilation of case studies.

7. Employment and Skills: BRICS CONNECT

BRICS CONNECT means **Cooperation Network for Capacity Building, Employability, and New Skills and Technologies**.

Building on the **BRICS Virtual Liaison Office**, it covers four areas:

- Social-security capacity building.
- Women's participation in the workforce.
- Skills and employability.
- Digital Public Infrastructure.

Participation is **voluntary and non-binding**.

8. Smart Grids and Energy Storage

The **BRICS Guiding Principles on Energy Storage and Smart Grids** and a **Digital Centre of Excellence** support:

- Knowledge sharing and technical training.
- Exchange of policy and regulatory practices.
- Pilot initiatives.

Smart grids and storage can help electricity systems manage renewable-energy generation and changing demand.

9. Sustainable Urban Development

- **BRICS Urban Mobility Hub:** A virtual platform for knowledge exchange, capacity building and technical cooperation in sustainable transport.
- **Voluntary Principles for Climate-Resilient Urban Infrastructure:** Integrate climate and disaster risks into planning, design, investment, construction and maintenance.
- **Urban Research and Knowledge Network:** Encourages applied research, cross-country learning and institutional collaboration.

10. MSME Cooperation

The **BRICS MSME Cooperation Portal** connects enterprises, technology centres, clusters, trade associations, financial institutions, training bodies and policymakers.

It is supported by:

- An institutionalised **Dialogue on MSME Finance**.
- A **Workplan on the Internationalisation of MSMEs**.

Together, these initiatives aim to improve access to finance and overseas markets.

11. Start-ups and Innovation

- **BRICS Incubator Network:** Connects national nodal agencies, selected incubators and start-ups. It enables enterprise registration, institutional linkages and referrals across countries.
- **BRICS Startup Innovation Fund:** Intended to support early- and growth-stage enterprises.
- **BRICS Science and Research Repository:** Provides a structured platform for storing and sharing scientific knowledge.

12. Logistics and Supply Chains

The **BRICS Logistics Supply-Chain Cooperation Framework** is voluntary and consensus-based.

It addresses fragmented supply chains and weak connectivity through:

- Technical exchange on cargo and shipping services.
- Knowledge sharing on local assembly and manufacturing.
- Capacity building.
- Environmentally sustainable and climate-resilient logistics.

13. Global Value Chains

- The **GVC Action Plan, 2026–2030**, includes a **Technical Council** and **Joint Study**.
- Its objectives are to improve production-network resilience, efficiency and productivity, while supporting market opening and economic diversification.

- A **global value chain** involves different stages of producing a good or service taking place across countries.

14. Customs Cooperation

Members expressed **in-principle approval and willingness to sign** the **Agreement on Cooperation and Mutual Administrative Assistance in Customs Matters**.

It aims to:

- Accelerate legitimate trade.
- Reduce transaction costs.
- Strengthen border security.
- Improve the business environment.
- Address illicit trade.

In-principle approval is distinct from signing or bringing an agreement into force.

15. Standardisation

- An MoU signed by **BRICS National Standards Body Heads** supports cooperation in developing, adopting and implementing standards.
- It also promotes information exchange, technical training and quality infrastructure, helping protect consumers and reduce technical barriers to trade.

16. Youth Cooperation

- The **BRICS Youth Cooperation Framework, 2026**, provides a reference for continuity and structured engagement under the youth track.
- It supports dialogue, experience sharing and consideration of practical initiatives.

17. Sports Technology

- A new **Sports Technology Working Group** promotes the exchange of good practices, institutional experience, technical information and research.

Significance for India and the Global South

- **Reformed Multilateralism:** BRICS provides a collective platform to seek more representative global institutions.
- **Development Cooperation:** Agriculture, health, skills and infrastructure initiatives connect diplomacy with everyday development needs.
- **Economic Opportunities:** MSME and start-up networks can improve market access, research links and business collaboration.
- **Climate and Energy Resilience:** Cooperation supports sustainable infrastructure, energy transitions and adaptation.
- **India's Leadership:** India can build consensus among diverse members and share experience in digital systems, skills and public-service delivery.
- **South–South Exchange:** Members and partners can learn from each other's development approaches.

Challenges

- **Divergent Interests:** Different strategic priorities and economic structures can make consensus difficult.
- **Implementation Gaps:** Announcements need finance, staff, institutional responsibilities and sustained follow-up.
- **Unequal Capacities:** Some members may need additional support to participate in advanced technology and research programmes.
- **Coordination Complexity:** Expansion increases the need for clear arrangements on chairship rotation and partner engagement.
- **Global Uncertainty:** Economic fragmentation, geopolitical tensions, technological disruption and climate pressures can affect cooperation.

Way Forward

- **Prioritise Practical Outcomes:** Focus on initiatives with clear development benefits and realistic timelines.
- **Ensure Institutional Continuity:** Carry agreed projects forward across successive chairships.
- **Strengthen Capacity Building:** Enable less-resourced participants to benefit from cooperation.
- **Clarify Implementation Status:** Distinguish proposals, agreements, launched platforms and operational programmes.
- **Review Results:** Assess outcomes in trade, skills, research, public services and resilience.

Conclusion

BRICS has evolved into a broad platform for cooperation among emerging economies. India's 2026 Chairship seeks to convert wider representation into meaningful development outcomes. Effective implementation and sustained consensus will determine its contribution to global governance. A practical and inclusive approach can strengthen **South–South cooperation and sustainable development**.

U.S. Sanctioning Russia and Iran Act, 2026: Implications for India

Source: The Hindu

Relevance

- **GS Paper II: India–U.S. Relations; Effect of policies of developed countries on India**

Important Keywords

Prelims

- USTR, Executive Order, Section 301, Section 232, Ad Valorem Tariff, Presidential Waiver

Mains

- Secondary Sanctions, Strategic Autonomy, Energy Security, Export Competitiveness, Trade Protectionism

Why in News?

U.S. President Donald Trump has signed the **Lindsey O. Graham Sanctioning Russia and Iran Act, 2026** into law. The Act allows the United States to impose **tariffs of up to 100%** on imports from countries that continue to buy large quantities of Russian crude oil or natural gas. India could be affected because it is one of the world's largest buyers of Russian crude oil.

What is the U.S. Sanctioning Russia and Iran Act?

- The law seeks to reduce Russia's energy revenue and thereby weaken its ability to finance the Russia–Ukraine war.
- It was proposed by the late U.S. Senator **Lindsey O. Graham** and was subsequently named after him.
- Its scope was later expanded to include Iran. Sanctions relating to Iran have been extended for five years, until **2031**.

Main Objectives

- Reduce Russia's earnings from oil and natural-gas exports
- Pressure major buyers of Russian energy
- Sanction important Russian individuals and entities
- Prevent the evasion of Russian oil sanctions
- Increase economic pressure connected with the Russia–Ukraine conflict

Why is the Act Important for India?

- The law creates the possibility of penalising Indian exports because of India's energy transactions with Russia.
- This resembles a **secondary sanction**, in which a third country is targeted for maintaining specified economic relations with the main sanctioned country.

India is therefore required to balance:

- Affordable Russian oil
- Access to the U.S. export market
- Domestic fuel-price stability
- Strategic relations with Russia
- Growing economic ties with the United States

When Can the Tariff Apply?

- The relevant tariff provisions can be applied after a **30-day period following enactment**.
- A country may face tariffs under either of two conditions.

Major Importer of Russian Energy

The country:

- Was among the five largest importers, by volume, of Russian crude oil or natural gas during the preceding 12 months; and
- Continues such purchases after the 30-day period.

This condition is especially relevant to **India and China**, the two largest importers of Russian crude oil.

Facilitating Sanctions Evasion

- A country may also face tariffs if it was among the five leading countries facilitating evasion of sanctions on Russian oil.
- India faces a lower risk under this condition because Indian oil-marketing companies have maintained that their purchases complied with the applicable sanctions.

Is a 100% Tariff Automatic?

No. The Act permits a tariff of **up to 100%**.

The United States may impose a lower rate. This provides India with diplomatic space to negotiate:

- A lower tariff
- An exemption
- A transition period
- A formal presidential waiver

Why is the New Law More Serious than the Earlier Measure?

Earlier Tariff

- The earlier 25% punitive tariff imposed on India for purchasing Russian oil was based on an **Executive Order**.
- In February 2026, the U.S. Supreme Court struck down the broader tariff regime that included this punitive tariff.
- An Executive Order can generally be modified or withdrawn through executive action and may face judicial review.

Present Tariff

The new measure has been:

- Passed by the U.S. Congress
- Signed by the President
- Converted into federal law

It therefore has greater legal permanence. A presidential waiver also requires formal justification to Congress.

Why is India Particularly Exposed?

Dependence on Russian Crude

Russia supplied more than **51% of India's crude-oil imports in July 2026**.

A major reduction within 30 days would require India to:

- Find alternative suppliers
- Renegotiate supply contracts
- Identify suitable crude grades

- Arrange new shipping routes
- Bear higher transportation and insurance costs

High Oil Prices

- Global oil prices are above **$100 per barrel**. Alternative crude supplies could therefore be considerably more expensive.

Strait of Hormuz Constraints

- Movement through the Strait of Hormuz remains constrained. This affects supplies from important West Asian producers and limits India's immediate alternatives.

Importance of the U.S. Market

- The United States accounts for roughly **20% of India's goods exports**.
- A high tariff could therefore affect India's export growth, manufacturing activity, employment and MSME sector.

Are the New Tariffs Additional to Existing Duties?

- Yes. The law states that the tariff will be imposed **in addition to any other applicable duty**.

Section 301 of the Trade Act, 1974

- Section 301 allows the **United States Trade Representative** to investigate foreign trade practices that harm American commerce and impose retaliatory measures.
- India faces a **10% tariff** connected with a U.S. investigation into goods produced using forced labour.

Section 232 of the Trade Expansion Act, 1962

- Section 232 allows the U.S. government to restrict imports when they are considered a threat to national security.
- The United States imposed tariffs of **50% on steel, aluminium, copper and certain related products**.
- A new Russia-related tariff may be imposed on top of these existing duties.

How Does a 100% Tariff Work?

Suppose an Indian product worth **$100** enters the United States.

If a 100% tariff is imposed:

- Product value: $100
- Customs duty: $100
- Landed cost before other expenses: $200

The American importer pays the customs duty. However, the importer may demand a lower price from the Indian exporter or shift to another supplier.

Possible Impact on India

- The impact depends on two possible situations.

India Continues Russian Oil Imports

Decline in Exports

Indian products may become more expensive than goods supplied by competing countries.

This can result in:

- Lower export orders
- Loss of U.S. customers
- Reduced market share
- Pressure on export earnings

Evidence from Earlier Tariffs

- India's merchandise exports to the U.S. grew by nearly **18% during April–August 2025** compared with the same period of the previous year.
- Part of this growth came from exporters sending goods early before the tariffs were imposed.
- However, export growth slowed to **3.8% during April 2025–February 2026**, indicating a substantial slowdown after the earlier tariffs came into effect in August 2025.

Pressure on MSMEs

- During the earlier 50% tariff period, some Indian exporters shared part of the additional cost with American buyers to retain them.
- Absorbing a possible 100% tariff would be much more difficult.

MSMEs may face:

- Reduced profit margins
- Order cancellations
- Cash-flow problems
- Lower production
- Loss of customers
- Employment pressure

India Reduces Russian Oil Imports

- India has earlier reduced oil imports from Venezuela, Iran and Russia in response to American pressure.
- However, reducing Russian purchases under current conditions could create significant energy-related problems.

Higher Energy Costs

- Alternative suppliers may charge higher prices, increasing India's oil-import bill.

Domestic Fuel Prices

- Higher crude costs may create pressure for increases in petrol and diesel prices.

Inflationary Impact

Expensive fuel can increase:

- Transportation costs
- Agricultural input costs
- Manufacturing expenses
- Prices of essential goods

Political Sensitivity

Large fuel-price increases may be politically difficult because several important State elections are scheduled in the following year.

Options Before India

Reduce Russian Oil Imports

Advantage:

- Indian exports may avoid very high U.S. tariffs.

Difficulties:

- Alternative crude may be more expensive.
- The oil-import bill may rise.
- Domestic fuel prices may increase.
- Thirty days may be insufficient for adjustment.

Continue Russian Imports

Advantage:

- India can maintain access to Russian crude supplies.

Risks:

- Indian exports may become uncompetitive.
- MSMEs may lose American customers.
- Manufacturing and employment may suffer.

Negotiate a Lower Tariff or Waiver

The provision for tariffs of "up to 100%" provides room for negotiations.

India can seek:

- A lower tariff rate
- A temporary exemption
- A longer transition period
- A presidential waiver

Waiver Provision

The U.S. President can waive the tariff after submitting to Congress:

1. Written certification that the waiver is in the **national interest of the United States**
2. A report explaining the reasons for granting it

The President therefore possesses waiver authority, but it is subject to congressional reporting.

Review Mechanism

The USTR, in consultation with the U.S. Secretary of State and Secretary of Energy, must review the list of major Russian oil and gas importers.

The review will:

- Take place within 180 days after the initial tariffs
- Use the most recent 12-month trade data
- Reassess the five largest importers of Russian crude oil and natural gas

India's position may therefore change if its import pattern changes.

Conditions for Ending the Measures

The sanctions framework may be affected if Russia:

- Signs a peace agreement accepted by the internationally recognised Government of Ukraine
- Ceases military hostilities
- Ends activities aimed at undermining the Ukrainian government

Challenges for India

- **Energy–trade dilemma:** Affordable Russian oil must be balanced against access to the U.S. market.
- **Short adjustment period:** Thirty days is insufficient for changing major energy contracts.
- **Expensive alternatives:** Replacement crude may raise India's import bill.
- **Cumulative tariffs:** The new duty may be added to existing tariffs.
- **MSME vulnerability:** Smaller firms cannot absorb a steep tariff burden.
- **Inflation risk:** Higher crude prices can increase costs across the economy.
- **Export dependence:** The U.S. receives a major share of Indian goods exports.
- **Strategic balancing:** India must protect relations with both Russia and the United States.

Way Forward

- Intensify diplomatic negotiations with the United States.
- Seek a reduced tariff, transition period or presidential waiver.
- Present evidence that Indian oil purchases complied with applicable sanctions.
- Avoid a sudden reduction that could threaten domestic energy security.
- Gradually diversify crude-oil suppliers.
- Support export-oriented MSMEs through credit and market assistance.
- Help exporters enter markets beyond the United States.
- Closely monitor crude prices and shipping conditions.
- Coordinate foreign, trade and energy policies through a unified approach.
- Protect India's strategic autonomy while safeguarding economic interests.

Conclusion

The U.S. Sanctioning Russia and Iran Act presents India with a difficult choice. Continuing Russian oil imports may expose Indian exports to steep tariffs, while reducing those imports could raise energy costs and domestic fuel prices.

India requires a calibrated strategy based on diplomatic negotiations, gradual energy diversification and support for vulnerable exporters. The objective should be to protect energy security, export competitiveness and strategic autonomy simultaneously.

Economy

Emergency Credit Line Guarantee Scheme 5.0: Supporting Business Continuity and Economic Resilience

Source: PIB

Relevance: **GS Paper III – Indian Economy; MSMEs; Industrial Growth; Employment and Financial Inclusion**

Important Keywords

For Prelims:

- ECLGS 5.0, NCGTC, Member Lending Institutions, Working Capital, Credit Guarantee, Jan Samarth Portal, EBLR, MCLR, Moratorium, Credit Guarantee Scheme for Exporters.

For Mains:

- Business Resilience, MSME Financing, Liquidity Support, Credit Risk Sharing, Employment Protection, Supply-Chain Stability, External Economic Shocks.

Why in News?

The **Emergency Credit Line Guarantee Scheme (ECLGS) 5.0** provides additional credit support to eligible businesses affected by external economic disruptions.It uses **government-backed credit guarantees** to support working capital, maintain business operations, protect employment and strengthen supply chains. The scheme aims to facilitate additional credit of up to **₹2.55 lakh crore**.

Background and Evolution

- Geopolitical developments can disrupt supply chains, raise logistics costs and delay business receipts. Enterprises may consequently face difficulty meeting expenses even when their operations remain viable.
- The original **ECLGS was launched in 2020 under the Aatmanirbhar Bharat Package** to address financial stress during the COVID-19 pandemic.

Its successive phases responded to different sectoral requirements.

Phase	Main coverage
ECLGS 1.0	MSMEs, business enterprises, Mudra borrowers and individual business loans
ECLGS 2.0	Stressed sectors identified by the Kamath Committee and healthcare
ECLGS 3.0	Hospitality, travel and tourism, leisure and sporting activities, and civil aviation
ECLGS 4.0	Healthcare infrastructure, including hospitals and oxygen-related facilities
ECLGS 5.0	Eligible businesses facing external

	disruptions, including MSMEs, eligible non-MSMEs and scheduled passenger airlines

The earlier phases concluded in **2023**. ECLGS 5.0 was approved in **2026**.

Objectives of ECLGS 5.0

- Provide additional working capital to eligible businesses.
- Reduce lenders' credit risk through government-backed guarantees.
- Help enterprises meet short-term financial commitments.
- Support uninterrupted domestic production.
- Preserve employment and business continuity.
- Strengthen supply chains during global uncertainty.

How the Credit Guarantee Works

- The scheme is implemented by the **National Credit Guarantee Trustee Company (NCGTC)**.
- It provides guarantees to **Member Lending Institutions (MLIs)**, enabling them to extend additional loans to eligible borrowers with reduced credit risk.

The arrangement involves three participants:

- **NCGTC:** Provides guarantee support under the scheme.
- **MLI:** Assesses eligibility and extends credit.
- **Borrower:** Uses the loan for permitted business requirements and remains responsible for repayment.

A credit guarantee is not a loan waiver. It protects the lender against specified losses under scheme conditions; it does not cancel the borrower's repayment obligation.

What Is Working Capital?

- **Working capital** supports everyday business operations, such as purchasing raw materials, paying wages and meeting other operating expenses.
- For example, a manufacturer facing delayed customer payments may need additional working capital to continue production and pay workers.

Eligibility and Financial Support

Operational Period

- ECLGS 5.0 operates until **March 31, 2027**, or until guarantees amounting to **₹2.55 lakh crore** are issued, whichever occurs earlier.

Eligible MSMEs and Non-MSMEs

According to the source, borrowers must:

- Have existing working capital facilities with MLIs as on **March 31, 2026**.
- Have repayments overdue by **no more than 60 days**.
- Meet other eligibility and lending conditions prescribed by NCGTC.

Treatment of Exporter Credit Support

- Borrowers who have received additional credit under the **Credit Guarantee Scheme for Exporters (CGSE)** cannot receive overlapping assistance under ECLGS 5.0 **up to the amount already availed under CGSE**.
- This is an adjustment for existing assistance, rather than an automatic exclusion of every CGSE beneficiary.

Sectoral Coverage and Exclusions

The scheme covers **MSMEs across all sectors**, subject to eligibility conditions.

For **non-MSME borrowers**, the excluded sectors include:

- NBFCs.
- Power generation, transmission and distribution.
- Telecom service providers.
- Sugar and ethanol.
- Information technology companies.
- Paper and paper products.
- Educational institutions.
- Beverages other than tea and coffee, and tobacco.

Where a borrower operates in both eligible and excluded sectors, the lender determines eligibility using the proportion of turnover from eligible sectors during **FY 2025–26**.

- **Important distinction:** Eligible NBFCs can participate as **lenders**, although NBFC businesses are excluded as borrowers within the specified non-MSME category.

Loan Terms for MSMEs and Eligible Non-MSMEs

Feature	Provision
Guarantee coverage for MSMEs	100%
Guarantee coverage for eligible non-MSMEs	90%
Additional credit	Up to 20% of peak fund-based working capital outstanding during the fourth quarter of FY 2025–26
Maximum additional credit	₹100 crore per borrower
Bank interest rate	Applicable benchmark plus up to 0.75 percentage points, subject to a 9% annual ceiling
Eligible NBFC interest rate	Maximum 13% annually
Loan tenure	Five years, including a one-year moratorium
Guarantee fee	No guarantee fee payable by MLIs

For bank loans, the source specifies **EBLR for MSMEs** and **MCLR for eligible non-MSMEs**.

Understanding the Terms

- **EBLR:** External Benchmark Lending Rate; linked to an external benchmark.
- **MCLR:** Marginal Cost of Funds-based Lending Rate; an internal bank lending benchmark.
- **Moratorium:** A permitted postponement of specified repayments. It does not automatically mean an interest-free period.
- **Fund-based credit:** Credit involving an actual release of funds, such as a loan or cash-credit facility.

Special Provisions for Scheduled Passenger Airlines

Scheduled passenger airlines receive support under a separate set of conditions.

Eligibility

Airlines must have outstanding fund-based and non-fund-based credit facilities with MLIs as on **March 31, 2026**.

These facilities must be classified as **Standard, excluding SMA-2**, on that date.

Non-fund-based facilities include arrangements such as bank guarantees, where funds are not immediately disbursed.

Financial Support

- **Guarantee coverage:** 90%.
- **Additional credit:** Up to 100% of the eligible base, subject to prescribed conditions.

- **Maximum credit:** ₹1,500 crore per borrower.
- **Promoter contribution:** Credit beyond ₹1,000 crore and up to ₹1,500 crore requires proportionate equity contribution from promoters or owners.
- **Interest rate:** Determined according to the lender's Board-approved policy.
- **Tenure:** Seven years, including a two-year moratorium.
- **Guarantee fee:** None payable by MLIs.

The interest-rate ceilings specified for MSMEs and eligible non-MSMEs should not be automatically applied to airlines.

Implementation and Access

Member Lending Institutions

- MLIs are institutions registered under the scheme to extend eligible credit. Participating categories include banks, eligible cooperative banks, financial institutions and eligible NBFCs.

Digital Access

Eligible borrowers can access the scheme through the **Jan Samarth Portal**.

Outreach

Awareness campaigns involve:

- State Level Bankers' Committees.
- NCGTC and PSB Alliance.
- Banks and other lending institutions.
- Industry associations and enterprises.

The source reports that **MSMEs account for the dominant share of guarantees**, both by number and guaranteed amount.

Significance

Improved Access to Institutional Credit

- Guarantees reduce the risk borne by lenders, supporting additional lending during uncertain conditions.

Business Continuity

- Working capital helps enterprises maintain production despite delayed receipts or rising operating costs.

Employment Protection

- Liquidity support can help businesses continue wage payments and avoid interruptions that threaten jobs.

Supply-Chain Stability

- Supporting individual enterprises also benefits suppliers, transporters and customers connected to them.

Targeted Sectoral Support

- Different provisions for MSMEs, non-MSMEs and airlines recognise differences in their financing requirements.

Digital Financial Access

- The Jan Samarth Portal and lender outreach can improve awareness and access to formal credit.

Challenges

The scheme's design raises several issues for implementation:

- **Liquidity versus viability:** Additional borrowing can address temporary cash shortages but may be insufficient for persistently unviable businesses.
- **Debt-servicing capacity:** Borrowers must generate enough future income to repay the additional credit.
- **Credit assessment:** Guarantee protection should not weaken responsible lending.
- **Coverage limitations:** The requirement for existing working capital facilities limits access for businesses outside established lending relationships.

- **Fiscal exposure:** Government guarantees create potential liabilities if eligible defaults result in claims.
- **Outcome assessment:** Guarantees issued should be distinguished from credit disbursed and improvements in business performance.

Way Forward

- Ensure timely credit delivery to eligible enterprises.
- Maintain sound appraisal despite guarantee protection.
- Clearly explain repayment, interest and moratorium conditions.
- Expand awareness through industry bodies and digital channels.
- Monitor business survival, employment and repayment outcomes.
- Prevent overlapping assistance and track guarantee-related fiscal risks.

Conclusion

ECLGS 5.0 uses government-backed guarantees to help eligible enterprises manage external disruptions. Its effectiveness will depend on timely credit delivery, responsible lending and borrowers' ability to restore sustainable cash flows. Credit support should preserve viable businesses while maintaining financial discipline.

Jute: India's Golden Fibre and Green Economy

Source: Press Information Bureau

Relevance: **UPSC GS Paper III: Agriculture, Agro-based Industries and Environment**

Important Key Words

Prelims:

- Jute | Mesta | Golden Fibre | Jute Geotextile | JCI | NJB | NJDP | JUTE-ICARE | JUTE-SMART | BHUVAN JUMP | PATSAN | Jute Packaging Act, 1987 | Jute Mark India

Mains:

- Green Economy | Sustainable Textiles | Rural Livelihoods | Agro-based Industry | Product Diversification | Circular Economy | Digital Agriculture | Export Competitiveness

Why in News?

- India produced **76 lakh bales of raw jute** and **12.80 lakh MT of jute goods** during FY 2025-26.
- India exported **22,700 MT of raw jute worth ₹225.11 crore** and **1.71 lakh MT of jute goods worth ₹3,155.27 crore**.
- Government interventions are promoting farmer incomes, modernisation, digital monitoring, product diversification and global competitiveness.

What is Jute?

Jute is a natural **bast fibre**, obtained from the stem of the jute plant. Its golden colour and silky lustre have earned it the name **"Golden Fibre."**

In trade and industry, **jute and mesta** are collectively classified as raw jute because they have similar uses.

- **Jute:** Mainly cultivated in hot, humid and high-rainfall regions.
- **Mesta:** A cost-effective bast-fibre crop suitable for relatively drier agro-climatic regions.

Status of India's Jute Sector

- India is the **world's largest producer of raw jute**.
- Combined production of jute and mesta increased from **88.02 lakh bales in 2024-25** to **94.03 lakh bales in 2025-26**, according to the Third Advance Estimates.
- India produces nearly **75% of the world's jute goods**.
- The industry provides direct employment to approximately **3.70 lakh workers**.
- Nearly **40 lakh farm families** depend on jute cultivation.
- India had **120 composite jute mills** as of December 2025.
- **West Bengal** alone had **89 mills**, the highest among the States.
- Domestic consumption stood at **12.05 lakh MT**, or about **94% of total jute-goods production**, in FY 2025-26.
- India is self-reliant in jute-goods production, with domestic output meeting national requirements.

Major Jute-Producing States

West Bengal → Bihar → Assam → Odisha → Jharkhand

The industry's cultivation and processing base is concentrated mainly in eastern and northeastern India.

History of Jute Production in India

- Jute use in India can be traced to approximately the **third century BCE**.
- It became an important commercial commodity during British rule, partly because of its military and packaging applications.
- The East India Company established jute mills in Bengal, making the region a major cultivation and processing centre.
- Following Partition in 1947, nearly **80% of jute-growing areas** became part of East Pakistan, now Bangladesh, while most mills remained in India.
- To overcome the resulting raw-material shortage, the government launched the **Grow More Jute Campaign in September 1949**.
- Raw jute production increased from **6.7 lakh tonnes in 1951-52** to **14.56 lakh tonnes in 1961-62**.
- The **Jute Packaging Materials (Compulsory Use in Packing Commodities) Act, 1987** created assured demand for jute packaging.

Conditions Required for Jute Cultivation

- **Climate:** Hot and humid
- **Rainfall:** Approximately **700–1,500 mm** during the growing period
- **Sowing season:** March–April
- **Harvesting period:** Within **100–110 days**
- **Nature of cultivation:** Predominantly rainfed
- **Farm structure:** Mainly cultivated by small and marginal farmers

Importance and Uses of Jute

Environmental Properties

Jute is:

- biodegradable;
- recyclable;
- rapidly renewable;
- cost-effective; and
- an eco-friendly alternative to synthetic materials and plastics.

Physical Properties

Jute fibre is:

- strong and durable;

- breathable;
- highly moisture-absorbent;
- suitable for thermal and acoustic insulation;
- low in static generation; and
- capable of blending with natural and synthetic fibres.

Major Applications

- packaging bags and sacks;
- handicrafts and home furnishings;
- ropes and industrial textiles;
- construction materials;
- agricultural products;
- apparel and blended fabrics; and
- soil conservation and road construction.

Jute Leaves as Food

Jute leaves are consumed as vegetables in parts of:

- Africa;
- the Middle East;
- Southeast Asia; and
- Japan, where they are recognised as a health food.

They contain vitamins, carotenoids, calcium, potassium and dietary fibre. Technologies have also been developed for antioxidant herbal drinks and healthcare products from jute leaves.

Jute Apparel at Commonwealth Games 2026

Indian athletes and team members wore **jute-viscose-blended apparel** at the **2026 Commonwealth Games**.

- The fabric was developed by the **National Jute Board**.
- The apparel was designed by **NIFT, New Delhi**.
- The initiative showcased biodegradable jute-based fabric and provided global visibility to Indian manufacturers.

Jute Geotextiles

Jute Geotextile (JGT) is a specially treated and woven jute product belonging to the category of **technical textiles**.

It is biodegradable and helps stabilise soil while improving soil structure and fertility.

Major Applications

- **Slope protection:** Used in embankments, hill cuttings, canals and riverbanks.
- **Erosion control:** Surface roughness holds soil and reduces its removal by water.
- **Road construction:** Improves load distribution and controls settlement.
- **Railway tracks:** Helps stabilise track formations.
- **Drainage:** Regulates water flow while preventing soil migration.
- **Soft-soil treatment:** Accelerates consolidation and improves bearing capacity.
- **Ecological restoration:** Maintains lower soil temperature & supports seed germination.

The **National Jute Board** provides technical assistance on design, testing, procurement and installation of JGT.

Government Interventions for the Jute Industry

Minimum Support Price

- The MSP for raw jute was fixed at **₹5,925 per quintal for FY 2026-27**.
- It provides a return of **61.8%** over the all-India weighted average cost of production.
- It represents an increase of approximately **147%** over the ₹2,400 MSP in 2014-15.
- MSP payments increased from **₹441 crore during 2004-05 to 2013-14** to **₹1,342 crore during 2014-15 to 2025-26**.

Mandatory Jute Packaging

Under the **Jute Packaging Materials Act, 1987**, the government mandated jute packaging for:

- **100% of foodgrains**; and
- **20% of sugar**.

This creates assured demand for jute bags and supports farmers and mill workers.

Jute Corporation of India

The **Jute Corporation of India (JCI)** is the sole nodal agency for implementing the MSP policy for raw jute.

- It procures directly from farmers when market prices fall below MSP.
- It operates around **110 Departmental Purchase Centres**.
- These centres are located in West Bengal, Assam, Bihar, Andhra Pradesh, Odisha and Tripura.

National Jute Development Programme

The **National Jute Development Programme (NJDP)** is the umbrella scheme for developing and promoting the jute sector.

- **Implementing agency:** National Jute Board
- **Outlay:** ₹485.58 crore
- **Period:** FY 2021-22 to FY 2025-26
- **Focus:** Productivity, farmer incomes, diversification and market promotion

Its two major components are:

- **JUTE-ICARE**; and
- **Jute Diversification Scheme**.

National Jute Board

The **National Jute Board (NJB)** is the nodal agency for development, promotion and diversification across the jute value chain.

Its functions include:

- improving cultivation and fibre quality;
- enhancing productivity & standardisation;
- promoting domestic and export markets;
- supporting research and diversified products; and
- strengthening artisans, women's groups and MSMEs.

JUTE-ICARE

The **Jute Improved Cultivation and Advanced Retting Exercise**, launched in FY 2015-16, improves productivity and fibre quality through:

- certified seeds;
- scientific cultivation;
- field demonstrations;
- mechanisation; and
- improved retting techniques.

It is implemented with the **Central Research Institute for Jute and Allied Fibres** and JCI. Retting ponds are supported through convergence with **PMKSY** and **RKVY**.

Jute Diversification Scheme

The scheme promotes processing, value addition, modernisation and marketing.

- **Jute Raw Material Banks:** Supply raw materials to artisans, women's groups, MSMEs and small producers at mill-gate price plus transportation cost.
- **Capital subsidy:** Provides a **30% subsidy** for machinery purchased by eligible mills and MSMEs producing diversified products.
- **Resource-cum-Production Centres:** Offer cluster-based training and production support.
- **Retail outlets:** Provide **25% sales assistance**, up to ₹9 lakh per unit.
- **Export incentives:** Link assistance to raw-material use and export value realisation.

Jute Mark India

The **Jute Mark India** logo certifies:

- authenticity;

- compliance with quality standards; and
- jute content in blended products.

It improves consumer confidence and brand recognition.

Market Promotion

During FY 2025-26, the government organised more than **57 regional jute fairs**, including participation in:

- India International Trade Fair;
- Surajkund Mela; and
- Bharat Tex.

Organisations from Uttarakhand, West Bengal, Uttar Pradesh and Odisha used NJB training and exhibitions to enter organised production and secure domestic and export orders.

Workers' Welfare Scheme

- Under the **National Jute Board Act, 2008**, scholarship and incentive support is provided to girl children of workers in jute mills and jute-product MSMEs after passing Secondary and Higher Secondary examinations.

Digital and Technological Interventions

JUTE-SMART

- **JUTE-SMART** is an end-to-end e-governance portal developed by the Office of the Jute Commissioner in November 2016.
- It manages procurement and supply of B.Twill jute bags for foodgrain packaging.

By August 2026:

- **303 lakh bales** of B.Twill bags had been procured;
- each bale contained approximately **500 bags**;
- procurement value exceeded **₹1 lakh crore**; and
- more than **20 State procurement agencies**, including Telangana and Andhra Pradesh, and the FCI used the portal.

The portal was upgraded in 2026 to digitally onboard transporters, raw-jute traders, importers and mills and enable online filing of returns.

Jute Crop Information System

- The **National Remote Sensing Centre of ISRO**, in collaboration with JCI and NJB, developed the Jute Crop Information System.

It combines remote sensing and field data to monitor jute cultivation.

Its two major tools are:

- **BHUVAN JUMP:** Mobile application for field-level jute monitoring.
- **PATSAN:** Web-based platform providing near-real-time crop surveillance and analytics.

Significance of the Jute Sector

- Supports nearly **40 lakh farm families** and 3.70 lakh industrial workers.
- Promotes rural employment, women's groups, artisans and MSMEs.
- Provides an environmentally sustainable alternative to plastic packaging.
- Strengthens India's biodegradable and technical-textile industries.
- Supports soil conservation and sustainable infrastructure through JGT.
- Generates export earnings and promotes self-reliance.
- Links traditional agriculture with digital monitoring and product innovation.

Future Priorities

- Expand diversified products beyond traditional packaging.

- Modernise mills and improve fibre-processing technology.
- Strengthen branding and export-market access.
- Promote JGT in roads, railways and erosion-control projects.
- Expand scientific retting and quality certification.
- Increase digital crop monitoring and market intelligence.
- Strengthen farmer, artisan and women's-group participation.

Conclusion

Jute connects agricultural livelihoods, industrial development and environmental sustainability. Government support through MSP, mandatory packaging, diversification, technology and market promotion has strengthened the sector. Greater innovation and value addition can establish the Golden Fibre as a major component of India's green economy and contribute to inclusive development and **Viksit Bharat 2047**.

India's Fortification Fight: Addressing Hidden Hunger through Food Fortification and Biofortification

Source: The Indian Express

Relevance: **UPSC GS Paper III: Agriculture, biotechnology, food security and sustainable development**

Important Key Words

Prelims

- Global Nutrition Report 2026 | Global Hunger Index 2025 | NFHS-6 | WHO | UNICEF | SDG 2 | SDG 3 | National Nutrition Week | UN Decade of Action on Nutrition | Food Fortification | Biofortification | Anemia Mukt Bharat | ICDS | PM-POSHAN | PMGKAY | PDS

Mains

- Hidden Hunger | Nutrition Security | Public Health Governance | | Child Malnutrition | Food Security | Dietary Diversity | Sustainable Agriculture | Biotechnology in Agriculture | SDG-linked Development

Why in News?

- India continues to face a serious nutrition challenge involving **under-nutrition, over-nutrition and micronutrient deficiency**. The **Global Nutrition Report 2026** estimates that nearly **2.6 billion people worldwide** cannot afford a healthy diet. **Food fortification** and **biofortification** are being promoted as important strategies to address **hidden hunger** in India.

Understanding Hidden Hunger

Hidden hunger refers to the deficiency of essential micronutrients such as **iron, iodine, zinc, folic acid, vitamin A, vitamin B12 and vitamin D**.

A person affected by hidden hunger may get enough calories but may still lack essential vitamins and minerals. This makes the problem difficult to identify in the early stages.

Hidden hunger can lead to:

- Weak immunity
- Poor physical growth
- Anaemia
- Learning difficulties among children
- Low productivity in adulthood
- Higher disease burden

Thus, hidden hunger is not only a health issue. It is also linked with **education, productivity, poverty reduction and human capital development**.

India's Malnutrition Challenge

India faces a multi-pronged malnutrition problem. It includes both lack of nutrition and excess nutrition.

The major forms are:

- **Under-nutrition:** Low intake of adequate food and nutrients.
- **Micronutrient malnutrition:** Deficiency of essential vitamins and minerals.
- **Over-nutrition:** Rising obesity and overweight among adults.

According to the **World Health Organization**, India accounts for nearly **one-third of global undernutrition**. This shows the scale of India's public health challenge.

The problem has worsened due to several factors:

- Impact of **COVID-19**
- Climate change
- Regional conflicts
- Food price rise
- Disruption in food supply chains
- Poor dietary diversity

These factors affect India's progress towards:

- **SDG 2:** Zero Hunger
- **SDG 3:** Good Health and Well-being

What is Food Fortification?

The **World Health Organization** defines food fortification as the deliberate increase of one or more micronutrients in food.

In simple terms, food fortification means adding essential vitamins and minerals to commonly consumed foods.

It is done to:

- Improve the nutrient value of food
- Restore nutrients lost during processing
- Reduce micronutrient deficiency among large populations
- Improve public health through staple food systems

Examples of Food Fortification

- Iodine added to salt
- Iron, folic acid and vitamin B12 added to rice
- Vitamins A and D added to edible oil
- Double Fortified Salt containing iodine and iron

Food fortification is useful in a country like India because large numbers of people depend on staple foods such as rice, wheat, salt and edible oil.

Global Importance of Food Fortification

Food fortification is widely used across the world as a public health strategy.

According to the **Global Nutrition Report**:

- More than **100 countries** have salt iodisation programmes.
- Salt iodisation has helped prevent nearly **750 million cases of goitre** in the past **25 years**.
- At least one cereal grain is fortified in **86 countries**.
- More than **30 countries** have fortified edible oils.

These examples show that food fortification can produce large public health benefits when it is properly implemented and monitored.

What is Biofortification?

Biofortification means increasing the nutrient density of crops at the production stage.

It can be done through:

- Conventional plant breeding

- Transgenic approaches
- Modern biotechnology-based methods

Unlike food fortification, where nutrients are added after harvest during processing, biofortification improves the crop itself.

For example, a biofortified pearl millet variety may naturally contain higher iron content. When people consume such crops regularly, they receive better nutrition through their normal diet.

Promising Results of Biofortification

According to the **WHO**, iron-biofortified crops have shown encouraging results in different countries.

Examples include:

- **Philippines:** Iron-biofortified rice
- **India:** Iron-biofortified pearl millet
- **Rwanda:** Iron-biofortified beans

These examples show that biofortification can help reduce iron deficiency among target populations.

Biofortification is especially important for rural and low-income communities because it improves nutrition through crops that people already grow and consume.

India's Progress in Biofortification

Between **2014 and 2024**, India developed and released **152 biofortified crop varieties** through the **National Agricultural Research System**.

These include:

- **Wheat:** 53 varieties
- **Millets:** 26 varieties
- **Maize:** 24 varieties
- **Rice:** 14 varieties
- **Oilseeds:** 21 varieties
- **Pulses:** 9 varieties
- **Grain amaranth:** 5 varieties

This shows that India is trying to integrate nutrition goals with agricultural research.

Biofortified crops can support:

- Nutrition security
- Farmer-level adoption of healthier crops
- Sustainable agriculture
- Reduction in hidden hunger
- Better health outcomes among rural communities

Food Fortification and Biofortification: Difference

Aspect	Food Fortification	Biofortification
Stage	Nutrients are added during processing	Nutrients are improved during crop production
Main method	Addition of vitamins and minerals to food	Plant breeding or biotechnology
Example	Fortified rice, iodised salt, fortified oil	Iron-rich pearl millet, zinc-rich wheat
Cost nature	Requires repeated processing support	Requires one-time investment in seed development
Delivery system	Works through PDS, ICDS, PM-POSHAN and markets	Works through farmers, seeds and agriculture systems
Main advantage	Quick large-scale nutrient delivery	Sustainable long-term nutritional improvement

Both methods are complementary. India needs both approaches because the scale of malnutrition is large and diverse.

India's Policy Push for Fortified Food

Grains

- India's focus on fortified food grains increased after the launch of **Anemia Mukt Bharat** in **2018**.
- The objective was to address anaemia and micronutrient deficiency, especially among women, children and adolescents.

Rice Fortification Programme

A pilot programme for rice fortification was launched in **2019**.

The fortified rice included:

- Iron
- Folic acid
- Vitamin B12

By **March 2024**, the Union government decided to replace all custom-milled rice with **fortified rice** under major government schemes.

These schemes include:

- **Public Distribution System**
- **Integrated Child Development Services**
- **PM-POSHAN**
- **Pradhan Mantri Garib Kalyan Anna Yojana**

Extension till 2028

The fortified rice scheme was extended till **December 2028**.

The central government allocation for this was **₹17,082 crore**.

PM-POSHAN Guidelines

Under **PM-POSHAN**, the Department of School Education and Literacy instructed the use of:

- **Double Fortified Salt**
- Fortified edible oil containing **vitamins A and D**
- Fortified rice

This is important because schools are a major platform to improve child nutrition.

Temporary Discontinuation under PMGKAY

In **February 2026**, after a review of **PMGKAY**, the government temporarily discontinued rice fortification under PMGKAY and allied schemes.

This decision was based on an **IIT Kharagpur report**, while the government looked for a more robust and effective nutrient-delivery system.

However, this decision does not affect:

- **PDS**
- **ICDS**
- **Mid-Day Meal schemes**

Significance

Food fortification and biofortification are important for India because they directly address micronutrient deficiency.

Public Health Significance

- Reduce anaemia and vitamin deficiency.
- Improve immunity among children and women.
- Help in better physical and mental development.
- Reduce long-term disease burden.

Educational Significance

- Better nutrition improves concentration and learning ability.
- Healthy children are more likely to attend school regularly.
- It supports better outcomes under school nutrition programmes.

Economic Significance

- Malnutrition reduces productivity in adulthood.
- Improved nutrition strengthens human capital.

- A healthier workforce supports long-term economic growth.

Governance Significance

- Fortification can use existing welfare systems such as **PDS**, **ICDS** and **PM-POSHAN**.
- Biofortification connects agriculture with public health.
- It promotes coordination among health, agriculture, education and food departments.

Challenges

- India's diverse geography and climate make uniform implementation difficult.
- Storage and transportation conditions may affect the shelf life of fortified rice.
- Poor packaging can reduce the quality of fortified food grains.
- Monitoring of nutrient content and quality standards remains essential.
- Biofortified crops require greater awareness among farmers.
- Farmers may need support through subsidised seeds, inputs and assured procurement.
- Nutrition outcomes may not improve if people lack dietary diversity.
- Rising obesity shows that nutrition policy must focus on both deficiency and excess consumption.
- The success of these programmes cannot be judged only by the amount of fortified food distributed.

Way Forward

- Strengthen quality control for fortified food grains at production, storage and distribution stages.
- Promote biofortified seeds through agricultural extension services.
- Provide subsidised seeds and necessary inputs to farmers.
- Encourage assured procurement and minimum support price support for biofortified crops.
- Improve awareness among people about balanced diets and micronutrient needs.
- Use schools, Anganwadi centres and health workers to spread nutrition awareness.
- Link nutrition programmes with local food diversity.
- Measure success through improved health indicators such as reduction in anaemia, stunting, wasting and underweight children.
- Ensure coordination among health, agriculture, food, education and welfare departments.

Conclusion

India must move from mere food security to **nutrition security**. Food fortification and biofortification can play a major role in reducing hidden hunger, especially among children, women and low-income groups. However, they should be supported by dietary diversity, strong quality control, farmer awareness and effective public health monitoring. A combined approach can improve human capital, promote inclusive development and contribute to India's goal of **Viksit Bharat 2047**.

Global Fintech Fest 2026: India's Digital Finance Model and the Next Wave of FinTech Innovation

Source: PIB

Relevance: UPSCGS Paper III: Indian economy, digital economy, financial inclusion, science and technology, cybersecurity

Important Key Words

Prelims

- Global Fintech Fest 2026 | GFF | Digital Public Infrastructure | Aadhaar | UPI | JAM Trinity | NPCI | Payments Council of India | Fintech Convergence Council | MeitY | RBI | SEBI | IFSCA | PFRDA | NITI Aayog | DBT | DigiLocker | ONDC | Regulatory Sandbox | DPDP Act 2023 | SRO-FT | SACHET Portal

Mains

- Digital Economy | Financial Inclusion | Inclusive Finance | Digital Governance | Cybersecurity | Data Protection | Digital Sovereignty | Innovation Ecosystem | Responsible AI | Global South Cooperation | FinTech Regulation

Why in News?

- The **7th Global Fintech Fest 2026** is being held in **Mumbai from 8 to 11 September 2026**. The event highlights India's growing role in the global fintech ecosystem through **Digital Public Infrastructure**, **UPI**, **Aadhaar**, **JAM Trinity** and digital welfare delivery. The theme of GFF 2026 focuses on **Agentic AI, Tokenisation and Quantum technologies** for building trusted and inclusive financial systems.

Understanding FinTech

- FinTech means the use of technology to improve financial services. It includes digital payments, online banking, digital lending, insurance technology, wealth technology, blockchain-based services and data-driven financial products.
- In simple terms, FinTech helps people access financial services faster, cheaper and more conveniently. For example, a person can transfer money through **UPI**, open a bank account using digital identity, or receive government benefits directly into a bank account through **DBT**.
- FinTech is important because it can reduce transaction costs, improve transparency, support financial inclusion and make financial services available to people who were earlier outside the formal banking system.

Global Fintech Fest 2026

The **Global Fintech Fest 2026** is the 7th edition of the event. It is being held in **Mumbai from 8 to 11 September 2026**.

Since its beginning in **2020**, GFF has grown into one of the world's leading fintech gatherings. It reflects India's increasing importance in digital finance and financial technology.

The event provides a platform for:

- Global dialogue on financial technology
- Collaboration among governments, regulators and fintech firms
- Showcasing India's digital finance model
- Strengthening India's engagement with

developed economies, emerging markets and the Global South

The principal organisers of GFF are **Payments Council of India**, **National Payments Corporation of India** and **Fintech Convergence Council**.

The event is supported by major institutions such as **MeitY**, **Department of Financial Services**, **NEST Division of Ministry of External Affairs**, **NITI Aayog**, **RBI**, **SEBI**, **IFSCA** and **PFRDA**.

Theme and Core Technologies

The theme of **GFF 2026** is:

- **"Potential to Impact: Agentic AI | Tokenisation | Quantum: Trusted, Connected, Global Systems for Inclusive Finance."**
- This theme shows that the next stage of financial innovation will depend on advanced technologies that can make financial systems more intelligent, programmable and secure.

Agentic AI

- Agentic AI refers to artificial intelligence systems that can sense, decide and act in real time under proper governance frameworks.
- In finance, it can help in fraud detection, regulatory monitoring, customer support, risk assessment and personalised financial services. However, its use must remain transparent, explainable and accountable.

Tokenisation

- Tokenisation means converting assets into digital units that can be securely recorded and transferred.
- It can support fractional ownership, instant settlement and better liquidity. It may transform capital markets, payments and digital asset-based financial services.

Quantum Technology

- Quantum technology can bring major changes in computation and cybersecurity. In finance, it can support risk optimisation, faster computation and quantum-safe cryptography.
- This is important because future financial systems will need stronger protection against advanced cyber threats.

Key Enabling Technologies Used by FinTech

FinTech depends on several technologies. These technologies help financial institutions provide faster and more efficient services.

Technology	Meaning
API	A set of rules that allows software systems to communicate with each other
Cloud Computing	Use of online computing resources to improve flexibility and reduce cost
Biometrics	Use of unique human features such as fingerprints or iris for identification
Distributed Ledger Technology	A system where transaction records are stored in multiple places at the same time
Big Data	Large volumes of data analysed through digital tools
AI and Machine Learning	Computer systems that learn from data and perform tasks requiring intelligence

India's FinTech Transformation

- India's fintech growth is based on scale, innovation and public digital infrastructure. The introduction of **Aadhaar**, expansion of internet access and development of **UPI** have transformed the delivery of financial

services.

- India's model is significant because it combines public infrastructure with private innovation. The government creates open digital systems, and private players build services on top of them.
- This has helped India expand digital identity, instant payments and consent-based data sharing at population scale.

Importance and Benefits of FinTech

- FinTech has changed the financial sector by improving efficiency, inclusion and competition.
- **UPI** is a major example. It is recognised by the **IMF** as the world's largest real-time payment system. In **July 2026**, UPI processed **2,365.8 crore transactions** worth **₹29.88 lakh crore**, with **741 banks** live on the platform. Its transaction volume has grown nearly **12,000-fold since FY 2016–17**.
- FinTech also helps overcome market failures such as high transaction costs and information gaps. India's **Financial Inclusion Index** improved from **43.4 in March 2017** to **70.0 in March 2026**.
- The growth of fintech has also diversified credit sources beyond traditional banking. This can improve competition, reduce overdependence on a few banks and strengthen the resilience of the financial ecosystem.

Foundation of India's FinTech Success

- India's fintech ecosystem is built on **Digital India** and **Digital Public Infrastructure**. These systems provide universal access, digital identity, interoperable payments and open digital networks.

JAM Trinity

- The **Jan Dhan-Aadhaar-Mobile Trinity** is the foundation of digital financial inclusion.
- **Jan Dhan accounts** provide access to banking. **Aadhaar** provides digital identity. Mobile connectivity enables people to use digital financial services.
- As of **26 August 2026**, **59.15 crore Jan Dhan accounts** had been opened. Aadhaar enrolments crossed **144 crore by March 2026**.

Unified Payments Interface

- **UPI** provides an interoperable digital payment system. It allows instant transfer of money between bank accounts.
- UPI transactions reached **24,509 million in August 2026**. The platform handles nearly **50% of global real-time digital transaction volume** and operates in **11 countries**.
- This shows India's growing global influence in digital payments.

Digital Identity and Documents

- **Aadhaar e-KYC** helps verify customers digitally. It reduces paperwork and saves time in opening accounts and accessing financial services.
- Aadhaar e-KYC processed more than **2,458 crore transactions** as of **29 June 2026**.
- **DigiLocker** had over **73.53 crore registered users** and issued **936.03 crore documents**. It helps citizens store and share verified digital documents.

Digital Welfare Delivery

- **Direct Benefit Transfer** uses digital financial infrastructure to send government benefits directly into beneficiaries' bank accounts.
- This reduces intermediaries, leakages and

delays. Cumulative DBT transfers reached **₹53.26 lakh crore as of September 2026**.
- DBT shows how digital finance can support welfare governance and transparency.

Open Digital Commerce

- **Open Network for Digital Commerce** extends India's open digital approach beyond payments.
- By **June 2026**, ONDC reached more than **20 crore buyers** and **5 lakh sellers** across **1,000+ cities**.
- Its financial services category can help fintech firms reach new users and markets.

Regulatory and Consumer Protection Framework

As fintech expands, regulation becomes essential to protect consumers and maintain trust. India has created a regulatory framework to support innovation while managing risks.

Major Regulatory Measures

- **RBI's Framework for Self-Regulatory Organisations in FinTech Sector**, issued in **May 2024**, promotes ethical conduct, market integrity and dispute resolution.
- **RBI's Master Directions on Digital Payment Security Controls, 2021** prescribe minimum security standards for digital payment channels such as internet banking and mobile banking.
- **NPCI** uses **AI and Machine Learning-based fraud monitoring** for UPI transactions.
- The **Digital Personal Data Protection Act, 2023** and **Digital Personal Data Protection Rules, 2025** aim to protect personal data.
- The **RBI Regulatory Sandbox**, introduced in **August 2019**, allows new financial products and services to be tested in a controlled environment.
- For digital lending, safeguards include a **Digital Lending Apps directory**, the **National Cybercrime Reporting Portal**, helpline **1930**, and the **SACHET portal** for complaints related to illegal deposit collection.

Significance

GFF 2026 is important because it presents India as a global leader in inclusive digital finance. India's model shows how technology can support financial inclusion at population scale.

- It also supports India's economic diplomacy. By sharing its digital public infrastructure experience with emerging economies and the Global South, India can strengthen its role as a trusted technology partner.
- For citizens, fintech improves access to payments, savings, credit, insurance and welfare benefits. For the economy, it supports formalisation, transparency and innovation-led growth.

Challenges

- Cybersecurity threats may increase as digital financial transactions expand.
- Digital fraud, fake lending apps and data misuse can affect consumer trust.
- The digital divide may exclude people without smartphones, internet access or digital literacy.
- Overuse of AI may create risks of bias, lack of transparency and weak accountability.
- Dependence on large digital platforms may create concentration risks.
- Strong regulation is needed without discouraging innovation.

Way Forward

- Strengthen cybersecurity and fraud detection systems.
- Improve digital literacy, especially among rural users, senior citizens and first-time users.
- Promote responsible use of AI with transparency and accountability.
- Expand secure digital public infrastructure to more sectors.
- Encourage fintech innovation through regulatory sandboxes.
- Strengthen data protection and consumer grievance redressal.
- Share India's DPI experience with the Global South through digital cooperation.

Conclusion

India's fintech journey shows how public digital infrastructure can support inclusive growth. Platforms such as **Aadhaar**, **UPI**, **DBT**, **DigiLocker** and **ONDC** have expanded access, reduced costs and improved transparency. However, the next phase of fintech must focus on cybersecurity, data protection, responsible AI and consumer trust. A secure, inclusive and innovation-friendly fintech ecosystem can support India's digital economy and contribute to **Viksit Bharat 2047**.

PMMSY: Transforming India's Fisheries and Blue Economy

Source: PIB

Relevance: UPSC GS Paper III: Fisheries, food security, infrastructure, technology and sustainable development.

Important Keywords

Prelims:

- **PMMSY**, **PM-MKSSY**, **Blue Economy**, **NFDP**, **FFPO**, **NFDB**, **RAS**, **Biofloc Technology**, mariculture, seaweed cultivation, aquaparks, **SDG 14**.

Mains:

- Fisheries Value Chain, Post-Harvest Management, Coastal Livelihoods, Digital Formalisation, Climate Resilience, Collective Entrepreneurship, Sustainable Aquaculture

Why in News?

- The **Pradhan Mantri Matsya Sampada Yojana (PMMSY)** completed six years in September 2026. Fish production, fisheries exports and employment have increased, while investments have expanded into cold chains, aquaculture technologies, digital platforms and coastal resilience.

What is the Importance of India's Fisheries Sector?

- The fisheries sector supports the livelihoods of nearly **three crore people**, particularly fishing communities, small fish farmers and other coastal and rural households.
- It is considered a **sunrise sector** because it has considerable potential for production, employment, exports and technological development.

Fish is also an important source of affordable animal protein. Therefore, the sector contributes to:

- Nutritional and food security
- Rural employment
- Export earnings
- Women's participation

- Coastal economic development
- Diversification of farmers' incomes

Fisheries includes **marine fisheries, inland fisheries and aquaculture**. Thus, it is connected with both the Blue Economy and the wider rural economy.

What is the Blue Economy?

- The **Blue Economy** refers to the sustainable use of ocean and coastal resources for economic growth, employment and livelihoods while protecting marine ecosystems.It includes fisheries, aquaculture, ports, shipping, tourism, offshore energy and marine biotechnology.
- PMMSY supports the Blue Economy by promoting responsible fishing, modern aquaculture, resilient coastal communities and stronger fisheries infrastructure.

What is PMMSY?

- The **Pradhan Mantri Matsya Sampada Yojana** was launched in **2020**
- implemented by the **Department of Fisheries under the Ministry of Fisheries, Animal Husbandry and Dairying**.
- It builds upon the earlier **Blue Revolution Scheme** and seeks to address gaps across the fisheries value chain.
- A fisheries value chain covers all activities from breeding and production to harvesting, storage, transport, processing and marketing.

Major Objectives

- Increase fish production and productivity.
- Modernise fisheries and aquaculture.
- Improve the incomes of fishers and fish farmers.
- Generate employment in fisheries-related activities.
- Strengthen cold storage, transport and market facilities.
- Promote exports and increase the sector's **Gross Value Added**.
- Improve the safety and social security of fishers.
- Strengthen fisheries management and regulation.
- Encourage sustainable use of aquatic resources.

What are the Components of PMMSY?

- PMMSY is an umbrella scheme consisting of two components.

Central Sector Component

It is funded and implemented by the Union Government. It supports:

- Genetic improvement and fisheries research
- Innovation and technology demonstration
- Training and capacity building
- Aquatic quarantine and disease surveillance
- Modernisation of fishing harbours
- Fisheries databases and information systems
- Safety of fishers at sea
- **Fish Farmers Producer Organisations**
- Cooperatives and Self-Help Groups
- Certification, accreditation, labelling and traceability
- Strengthening of the **National Fisheries Development Board**

Centrally Sponsored Component

It is jointly supported by the Union and State governments and implemented through States and Union Territories.

Its major areas include:

- **Production:** Inland fisheries, marine fisheries, mariculture, seaweed cultivation

and ornamental fisheries.

- **Infrastructure:** Fishing harbours, fish landing centres, cold chains, markets and coastal fishing villages.
- **Management:** Monitoring, control, surveillance, insurance and extension services.
- **Welfare:** Safety at sea and nutritional and livelihood support for fishing communities.

What is PM-MKSSY?

- The **Pradhan Mantri Matsya Kisan Samridhi Sah-Yojana (PM-MKSSY)** is a Central Sector sub-scheme under PMMSY.
- It is being implemented across all States and Union Territories from **2023–24 to 2026–27**.

Objectives of PM-MKSSY

- Formalise the fisheries sector.
- Expand insurance coverage.
- Improve access to institutional credit.
- Promote quality assurance.
- Introduce traceability across the value chain.
- Reduce financial risks faced by fishers.
- Improve access to organised markets.

Formalisation helps fishers and fish farmers access government support, bank credit, insurance and organised markets.

How has PMMSY Strengthened the Fisheries Sector?

Growth in Production and Exports

- Fish production increased from **141.64 lakh tonnes in 2019–20** to **197.75 lakh tonnes in 2024–25**.
- Fisheries exports increased from **₹46,663 crore** to **₹73,890 crore** during the corresponding period mentioned in the official data.
- PMMSY has also generated direct and indirect employment opportunities for around **58 lakh people** in fisheries and aquaculture-related activities.

Aquaculture Development

The scheme supports:

- Integrated aquaparks
- Reservoir cage culture
- Pond-based inland aquaculture
- Seaweed cultivation
- Ornamental fish production
- Recirculatory Aquaculture Systems
- Biofloc units

An **Integrated Aquapark** brings production, processing, storage, marketing, training and other fisheries services together within a common infrastructure system.

Post-Harvest Infrastructure

Fish is highly perishable and requires proper storage immediately after harvesting. PMMSY therefore supports:

- Ice plants and cold-storage facilities
- Refrigerated and insulated transport
- Live-fish vending units
- Fish kiosks
- Retail and wholesale markets
- Fishing harbours
- Fish landing centres
- Dredging of harbour channels

Such facilities reduce spoilage, improve food safety and allow producers to reach distant markets.

Porbandar Ice-Plant Example

- A fisheries entrepreneur in **Porbandar, Gujarat**, received assistance under PMMSY to establish an ice plant.

- The facility supplies ice to fishing boats, helping them preserve fish during fishing operations. It demonstrates how post-harvest infrastructure can reduce losses and strengthen small fisheries enterprises.

How does PMMSY Empower Fishing Communities?

Fish Farmers Producer Organisations

- **Fish Farmers Producer Organisations (FFPOs)** bring fishers and fish farmers together as collective enterprises.
- PMMSY has supported the formation of **2,195 FFPOs** through assistance for incubation, management and equity.

FFPOs can help members:

- Purchase inputs collectively.
- Improve bargaining power.
- Access institutional credit.
- Use storage and transport facilities.
- Undertake processing and marketing.
- Negotiate better prices.

Climate-Resilient Coastal Fishermen Villages

- PMMSY has identified **100 coastal fishing villages** for development as **Climate Resilient Coastal Fishermen Villages**.

The initiative supports:

- Climate-resilient infrastructure
- Alternative livelihood opportunities
- Post-harvest facilities
- Economic development of coastal communities
- Improved capacity to face extreme weather events

This is relevant because fishing communities face cyclones, coastal erosion, changing fish distribution and damage to boats and infrastructure.

What Technologies are Promoted under PMMSY?

Recirculatory Aquaculture System

A **Recirculatory Aquaculture System (RAS)** treats and recirculates water used for fish farming.

It:

- Removes waste and impurities.
- Reduces the need for fresh water.
- Allows fish farming in limited space.
- Supports controlled and high-density production.

However, RAS requires reliable electricity, technical knowledge and continuous monitoring of water quality.

Biofloc Technology

Biofloc Technology uses beneficial microorganisms to recycle nutrients and waste present in water.

These microorganisms form small clusters called **bioflocs**, which:

- Help maintain water quality.
- Provide supplementary natural feed.
- Reduce the need for frequent water replacement.
- Support intensive fish production in small areas.

How is the Fisheries Sector Being Digitised?

- The **National Fisheries Digital Platform (NFDP)** was launched under PM-MKSSY in **September 2024**.
- It creates work-based digital identities and a national database of fisheries stakeholders.

Major Functions

- Formal registration of fishers and fish farmers

- Access to institutional credit
- Aquaculture insurance
- Product traceability
- Performance-based incentives
- Training and capacity building
- Support to fisheries cooperatives
- Single-window access to services

The platform has recorded more than **37 lakh registrations**, indicating its role in bringing stakeholders into the formal system.

Significance of PMMSY

- **Livelihood Security:** Supports incomes and employment among fishing and coastal communities.
- **Nutritional Security:** Expands the availability of protein-rich food.
- **Export Promotion:** Improves quality, traceability and access to international markets.
- **Reduction of Post-Harvest Losses:** Cold chains and transport help preserve fish.
- **Women's Empowerment:** SHGs and producer organisations create opportunities in aquaculture, processing and marketing.
- **Climate Resilience:** Supports coastal villages and livelihood diversification.
- **Digital Governance:** NFDP connects stakeholders with finance, insurance and government services.
- **Sustainable Development:** Responsible fisheries contribute to **SDG 14—Life Below Water**.
- **Cooperative Federalism:** Union and State governments jointly implement the Centrally Sponsored component.

Challenges

- **Overexploitation of Resources:** Excessive fishing can reduce fish stocks and disturb aquatic ecosystems.
- **Post-Harvest Losses:** Cold-storage and processing facilities remain unevenly distributed.
- **Climate Vulnerability:** Cyclones, ocean warming and coastal erosion affect fishing livelihoods.
- **Limited Institutional Credit:** Small fishers often depend on informal sources of finance.
- **Disease Risks:** Intensive aquaculture can increase disease outbreaks without proper monitoring.
- **Digital Divide:** Limited connectivity and digital literacy can restrict access to NFDP services.
- **Implementation Gaps:** Sanctioned infrastructure must be completed, maintained and used effectively.
- **Marine Pollution:** Plastics, industrial waste and untreated sewage affect aquatic resources.

Way Forward

- **Adopt Scientific Fisheries Management:** Use stock assessments, seasonal restrictions and monitoring to prevent overfishing.
- **Strengthen Cold Chains:** Expand storage, transport and processing facilities near landing and production centres.
- **Promote Producer Organisations:** Enable FFPOs to manage inputs, credit, processing and marketing collectively.
- **Improve Credit and Insurance:** Ensure that digital registration leads to usable financial services.
- **Strengthen Extension Services:** Train producers in disease control, water-quality

management and sustainable aquaculture.

- **Develop Climate-Resilient Infrastructure:** Protect harbours, villages and post-harvest facilities from extreme weather.
- **Ensure Digital Inclusion:** Provide local assistance for registration and platform-based services.
- **Protect Aquatic Ecosystems:** Integrate production targets with pollution control and ecological carrying capacity.

Conclusion

PMMSY has expanded the scope of fisheries development from production to infrastructure, technology, welfare and digital governance. Its success will depend on improving fishers' incomes while conserving aquatic resources. Strong producer institutions, scientific management and climate-resilient infrastructure can make fisheries an important pillar of India's **inclusive and sustainable Blue Economy**.

Bamboo Economy: From Green Stems to Green Enterprises

Source: PIB

Relevance: **GS Paper III: Agriculture, rural economy, MSMEs, inclusive growth, environment and green technology**

Important Keywords

Prelims:

- Bamboo, **Bambusoideae**, **Poaceae**, **Indian Forest Act, 1927**, 2017 amendment, **National Bamboo Mission**, **NECTAR**, engineered bamboo, **Gadchiroli Agarbatti Project**, **CSIR-NEERI**, Self-Help Groups.

Mains:

- Green economy, rural entrepreneurship, women-led development, bamboo value chain, sustainable construction, tribal livelihoods, circular economy, local value addition, bioeconomy, climate-resilient livelihoods.

Why in News?

Bamboo has gained attention as a sustainable resource capable of supporting **rural employment, tribal livelihoods, women-led enterprises, handicrafts, construction and green industries**.At the **SARAS Aajeevika Mela 2026** in Gurugram, bamboo products made by rural women entrepreneurs demonstrated how traditional skills, policy reforms and government support are transforming bamboo into a modern commercial resource.

About Bamboo

Bamboo belongs to the subfamily **Bambusoideae** of the grass family **Poaceae**. It includes more than **115 genera and 1,400 species** distributed mainly across tropical, subtropical and mild temperate regions.

Important Characteristics

- Bamboo is an **evergreen and perennial plant**.
- It has woody and usually hollow stems that develop from underground **rhizomes**.
- Some bamboo species can grow by nearly **30 centimetres a day** under favourable conditions.
- Bamboo regenerates rapidly after harvesting, making it a renewable biological resource.
- It is generally propagated through vegetative methods such as stem cuttings

because its flowering and seed production are irregular.

- It grows well in warm climates and well-drained sandy to clay soils.
- It is often called **"poor man's timber"** because of its affordability, versatility and importance to rural livelihoods.

Bamboo is used to produce baskets, fishing equipment, musical instruments, furniture, incense sticks, food products, housing materials, handicrafts and modern construction components.

India's bamboo resources are concentrated mainly in the northeastern States of **Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura**.

Policy Reform of 2017

- Under the **Indian Forest Act, 1927**, bamboo was legally treated as a "tree". Consequently, its harvesting, transit and transportation were subject to forestry regulations. This discouraged farmers and private enterprises from taking up bamboo cultivation outside forests.
- In **2017**, the Act was amended to exclude bamboo grown on **non-forest land** from the definition of a tree.

Impact of the Reform

The amendment:

- simplified harvesting and transportation of bamboo grown outside forests;
- encouraged commercial bamboo cultivation by farmers;
- promoted investment in processing and manufacturing;
- created opportunities for artisans, Self-Help Groups and MSMEs;
- facilitated local value addition in bamboo-rich regions; and
- strengthened the potential of bamboo as an agricultural and industrial raw material.

However, bamboo located inside notified forest areas continues to be regulated under applicable forest laws.

India's Emerging Bamboo Economy

Bamboo is moving beyond its traditional association with handicrafts. It is increasingly used in furniture, interior decoration, processed foods, renewable energy and construction materials.

Different States illustrate this transition:

- **Sikkim:** Women-led enterprises produce furniture, handicrafts, incense sticks and interior decoration products.
- **Tripura:** Manufacturers are adopting technology to improve bamboo-product manufacturing.
- **Nagaland:** SHGs and local enterprises are producing bamboo food items, furniture and handicrafts.
- **Mizoram:** Scientific cultivation is being promoted through tissue culture and poly-house management.
- **Assam:** Women artisans are connecting traditional bamboo skills with urban markets and trade exhibitions.

This diversification can reduce the dependence of rural producers on the sale of untreated bamboo poles and enable them to earn more through finished products.

National Bamboo Mission

- The **National Bamboo Mission (NBM)** was launched in **2006–07**. It has been implemented as a restructured **Centrally Sponsored Scheme** since **2018–19**.
- The Mission promotes the holistic development of the bamboo sector through a **cluster-based approach**. It connects

farmers, processors, manufacturers and markets across the bamboo value chain.

Major Areas of Support

- Expansion of bamboo cultivation on suitable non-forest land
- Establishment and strengthening of nurseries
- Availability of quality planting material
- Processing and value-addition facilities
- Training and capacity-building for farmers and artisans
- Development of markets for bamboo products
- Creation of linkages between farmers and industries
- Promotion of region-specific bamboo varieties and products

The Mission seeks to establish bamboo as **"Green Gold"**—a renewable resource that supports livelihoods, industrial growth and the green bioeconomy.

Farm-Level Impact

- In Madhya Pradesh, farmer **Vijay Patidar** shifted towards bamboo cultivation after suffering losses from conventional crops. With assistance under the Mission, he planted around **4,000 bamboo saplings**.
- He earned approximately **₹75,000** from selling bamboo poles within two years. The plantation also allowed him to intercrop chilli, capsicum, ginger and garlic. This shows that bamboo can function as both a long-term asset and a source of livelihood diversification.

Technology and Value Addition

- The economic potential of bamboo depends on processing, product design, machinery, skills and market access. Without these facilities, farmers may receive only a small share of the value generated from the final product.
- The **North East Centre for Technology Application and Reach (NECTAR)** has supported the application of bamboo technology in:
  - food and agro-processing;
  - manufacturing machinery;
  - construction materials;
  - renewable energy;
  - industrial products;
  - furniture and interior design.
- These interventions are estimated to generate around **30 million man-days of employment annually**. They have also increased value addition in bamboo commodities from about **10% to as high as 70%**.

Skill Development

In June 2026, **CSIR–National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur**, organised a five-day bamboo-handicraft training programme for women SHGs.

The programme covered:

- bamboo harvesting and treatment;
- processing techniques;
- handicraft production;
- product development and design;
- entrepreneurship;
- branding and marketing.

It also demonstrated the possibility of cultivating bamboo on reclaimed **fly-ash dumping sites**, connecting livelihood creation with the productive restoration of degraded land.

Engineered Bamboo

- **Engineered bamboo** is a composite material

manufactured by binding and compressing bamboo fibres, strips or particles. It provides bamboo with greater uniformity, strength and durability for construction and industrial applications.

- More than **42 lakh square feet** of engineered bamboo structures have been created for disaster relief and rehabilitation. In **Chhattisgarh**, **576 school classrooms** made from engineered bamboo provide educational space for nearly **20,000 children**.

Importance of Engineered Bamboo

- Expands bamboo use beyond conventional handicrafts
- Provides a renewable alternative to some traditional construction materials
- Creates demand for processed bamboo
- Encourages innovation in architecture and interior design
- Supports prefabricated construction for schools and disaster relief
- Increases income opportunities across the value chain

Quality standards, fire resistance, structural testing and long-term durability must be ensured before engineered bamboo is adopted on a wider scale.

Women-Led Bamboo Enterprises

- Women's SHGs are becoming important participants in bamboo cultivation, processing, handicrafts and marketing.

Gadchiroli Agarbatti Project

The **Gadchiroli Agarbatti Project** was started in Maharashtra in 2012 to establish bamboo-based incense-stick production centres.

By 2020:

- **32 production centres** had been established;
- around **1,100 persons** were employed;
- nearly **90% of the workers were women**;
- women earned approximately **₹5,000 per month**; and
- annual employment increased from around **45–60 days to more than 225 days**.

The project brought employment closer to women's homes, reduced physically strenuous work and lowered dependence on forests for subsistence income. It also strengthened their technical skills, confidence and leadership.

Major Success Stories

Vishakha Didi—Assam

- Vishakha Didi joined an SHG in 2014 and revived her family's bamboo craft enterprise by introducing new designs. Government support and participation in exhibitions connected her products with wider markets.
- Her bamboo products generated around **₹2 lakh in sales** at the **India International Trade Fair, 2025**. Her experience shows how SHGs, product innovation and market access can transform traditional craft into a viable enterprise.

Chimi Ongmu Bhutia—Sikkim

- Fashion designer and sustainable innovator **Chimi Ongmu Bhutia** established the women-led **Lagstal Design Studio** near Gangtok. The enterprise produces bamboo handicrafts, incense sticks, furniture and interior decoration items.
- It represents the movement of bamboo from traditional household production towards modern design-based manufacturing.

Significance of the Bamboo Sector

Rural and Tribal Livelihoods

- Bamboo provides income to farmers, forest-dependent communities, artisans and tribal households. Local processing can create employment within villages and reduce distress migration.

Women's Empowerment

- SHG-based enterprises allow women to acquire skills, earn independent incomes and participate in business decisions. They promote the transition from livelihood assistance to women-led entrepreneurship.

Green Industrialisation

- Bamboo is a rapidly renewable biological resource. Its use in furniture, construction and industrial products can support the development of a low-carbon bioeconomy.

Agricultural Diversification

- Bamboo offers a long-term source of income and can be combined with suitable intercrops during the early years of plantation. This can reduce dependence on a single agricultural commodity.

Development of Northeast India

- The Northeast possesses extensive bamboo resources and traditional knowledge. Processing industries, design centres and market linkages can convert this natural advantage into employment and regional development.

Restoration of Degraded Land

- Bamboo can be considered for selected degraded areas, including scientifically reclaimed industrial sites. Such plantations must be based on suitable species, local ecology and proper land assessment.

Challenges

- **Weak processing infrastructure:** Many bamboo-producing regions lack treatment, storage and manufacturing facilities.
- **Limited market access:** Rural artisans often depend on intermediaries and have inadequate access to organised markets.
- **Quality concerns:** Lack of uniform standards affects the use of bamboo in construction and high-value manufacturing.
- **Inadequate planting material:** Farmers may not have easy access to certified, region-appropriate bamboo varieties.
- **Long gestation period:** Commercial returns may take time, requiring financial support during the initial years.
- **Skill and design gaps:** Traditional producers need training in modern design, branding, packaging and digital marketing.
- **Fragmented value chain:** Weak coordination among cultivators, processors, manufacturers and buyers restricts value addition.
- **Ecological risks:** Large monoculture plantations and the introduction of unsuitable species may affect local biodiversity and water availability.

Way Forward

- Develop bamboo clusters near major cultivation areas with common processing and treatment facilities.
- Improve access to certified planting material and scientific cultivation advice.
- Create assured purchase arrangements between farmer groups and industries.
- Develop national standards for engineered bamboo, furniture and construction products.
- Expand credit, insurance and working-

capital support for SHGs and bamboo-based MSMEs.

- Promote geographical and cultural branding of traditional bamboo products.
- Strengthen e-commerce, government procurement and participation in national exhibitions.
- Encourage collaboration among agricultural universities, design institutes, research organisations and artisans.
- Support bamboo cultivation through region-specific ecological assessments rather than uniform plantation models.
- Integrate bamboo enterprises with rural development, tribal welfare, women's livelihood and green-skilling programmes.

Conclusion

India's bamboo sector is changing from a traditional livelihood activity into a diversified green-enterprise ecosystem. The 2017 regulatory reform, the National Bamboo Mission, technological innovation and women-led SHGs have expanded its commercial possibilities. Stronger processing infrastructure, quality standards, finance and market access can enable bamboo to support inclusive rural development. Its growth must remain ecologically responsible and ensure that farmers, artisans, women and tribal communities receive a fair share of the value created.

PM Vishwakarma: Strengthening India's Traditional Artisans and Craftspeople

Source: PIB

Relevance: **UPSC GS Paper III: MSMEs, employment, inclusive growth, digital economy and skill development**

Important Keywords

Prelims:

- **PM Vishwakarma**, Central Sector Scheme, **Ministry of MSME**, 18 traditional trades, **Udyam Assist Platform**, Common Service Centres, **GeM**, **ONDC**, One Station One Product, AVSAR, TRIFED.

Mains:

- Artisan economy, informal sector, financial inclusion, cultural preservation, skill upgradation, enterprise formalisation, digital inclusion, market linkages, Guru-Shishya tradition, inclusive growth.

Why in News?

PM Vishwakarma, launched on **17 September 2023**, is approaching its third anniversary. The scheme has achieved its registration target of **30 lakh beneficiaries**.It has provided traditional artisans with skill training, modern toolkits, collateral-free loans, digital transaction incentives and wider market access. A concurrent evaluation by **IIM Mumbai** also found that a large proportion of surveyed beneficiaries reported income improvements after training.

About PM Vishwakarma

PM Vishwakarma is a **Central Sector Scheme** designed to provide end-to-end support to artisans and craftspeople engaged in traditional, family-based occupations.

The scheme recognises that traditional artisans contribute to:

- India's cultural heritage;

- the rural and urban informal economy;
- local employment;
- family-based skill transmission; and
- production of handmade goods and services.

It was launched with an outlay of **₹13,000 crore** for the period from **2023–24 to 2027–28**. The scheme covers artisans working in **18 notified traditional trades**.

- The **Ministry of Micro, Small and Medium Enterprises** is the nodal ministry. The scheme is implemented with support from the **Ministry of Skill Development and Entrepreneurship** and the **Department of Financial Services**.

Objectives of the Scheme

PM Vishwakarma seeks to:

- recognise artisans as **Vishwakarmas**;
- improve their skills through structured training;
- provide modern and efficient tools;
- facilitate access to affordable institutional credit;
- promote digital transactions;
- strengthen branding, packaging and marketing;
- connect artisans with domestic and global supply chains;
- promote formalisation of informal micro-enterprises; and
- preserve the **Guru-Shishya parampara** and family-based traditional knowledge.

Guiding Pillars

The scheme is based on three principles:

- **Samman:** Recognition and respect for traditional artisans
- **Samarthya:** Improvement of skills, productivity and enterprise capacity
- **Samriddhi:** Higher income, market access and long-term prosperity

Who Is Eligible?

The scheme is open to artisans and craftspeople who:

- are at least **18 years of age**;
- work with their hands and tools;
- are engaged in one of the 18 notified traditional trades;
- work in the unorganised sector;
- are self-employed; and
- satisfy the prescribed family and credit-related conditions.

Important Eligibility Conditions

- **One beneficiary per family:** Registration is limited to one member of a family. For this purpose, a family includes the husband, wife and unmarried children.
- **No government employee:** A person in government service and members of his or her family are not eligible.
- **Credit-related restriction:** Applicants should generally not have availed loans under similar government credit-based self-employment schemes during the preceding five years.
- However, beneficiaries of **Pradhan Mantri MUDRA Yojana** and **PM SVANidhi** who have fully repaid their loans are eligible.

Traditional Trades Covered

PM Vishwakarma covers the following 18 family-based traditional trades:

1. Carpenter
2. Boat maker
3. Armourer
4. Blacksmith or metalsmith

5. Hammer and toolkit maker
6. Locksmith
7. Goldsmith
8. Potter
9. Sculptor and stone breaker
10. Cobbler, shoesmith and footwear artisan
11. Mason
12. Basket, mat and broom maker or coir weaver
13. Doll and toy maker
14. Barber
15. Garland maker
16. Washerman
17. Tailor
18. Fishing-net maker

Major Components of PM Vishwakarma

Recognition

After registration and verification, every eligible beneficiary receives:

- a **PM Vishwakarma Certificate**; and
- a **PM Vishwakarma Identity Card**.

The certificate provides formal recognition to artisans whose occupations have traditionally remained outside organised economic systems.

Skill Upgradation

Training introduces artisans to modern tools, improved production techniques, innovative designs, digital payments, entrepreneurship and marketing.

- **Basic Training:** Five to seven days
- **Advanced Training:** Fifteen days or more
- **Training stipend:** ₹500 per day

Skill training seeks to improve product quality and productivity without removing the traditional character of the craft.

Toolkit Incentive

Eligible beneficiaries receive a toolkit incentive of up to **₹15,000** to purchase modern tools relevant to their occupation.

Improved tools can:

- reduce physical effort;
- increase production speed;
- improve product quality; and
- strengthen workplace safety.

Collateral-Free Credit Support

The scheme provides collateral-free **Enterprise Development Loans** of up to **₹3 lakh** in two tranches.

First Tranche

- Loan amount: Up to **₹1 lakh**
- Repayment period: **18 months**
- Eligibility: Completion of Basic Training

Second Tranche

- Loan amount: Up to **₹2 lakh**
- Repayment period: **30 months**
- Eligibility: Timely repayment of the first loan and either adoption of digital transactions or completion of Advanced Training

The beneficiary pays a concessional interest rate of **5%**. The government bears an interest subvention of up to **8%**.

Digital Transaction Incentive

Beneficiaries receive **₹1 for every eligible digital payment or receipt**, subject to a maximum of **100 transactions per month**.

The incentive encourages artisans to:

- create formal transaction records;
- reduce dependence on cash;
- improve financial transparency;
- establish a digital business history; and
- access formal credit more easily.

Marketing Support

The scheme provides support through:

- branding and packaging;
- quality certification;
- trade fairs and exhibitions;
- advertising and publicity;
- e-commerce onboarding;
- Government e-Marketplace;
- buyer-seller linkages; and
- domestic and international market promotion.

Formalisation Through Udyam Assist

- PM Vishwakarma beneficiaries are onboarded on the **Udyam Assist Platform**.
- The platform registers informal micro-enterprises and provides them with an **Udyam Registration Number and certificate**. This helps artisans enter the formal MSME ecosystem and access applicable government benefits.
- Formalisation can improve their access to banking services, markets, procurement opportunities and enterprise-development programmes.

Progress Under PM Vishwakarma

As of **15 September 2026**, the scheme recorded the following progress:

- Registration target of **30 lakh beneficiaries** achieved
- More than **24.37 lakh artisans** completed Basic Training
- More than **18.16 lakh beneficiaries** received toolkits
- Over **6.19 lakh loans**, worth approximately **₹5,316 crore**, sanctioned
- More than **8.11 lakh beneficiaries** received digital incentives
- Over **₹42 crore** disbursed as digital transaction incentives
- More than **12,000 artisans** trained to use artificial intelligence tools

The AI training covers areas such as:

- product design;
- branding;
- packaging;
- marketing; and
- digital presentation of products.

Market Access Initiatives

Exhibitions and Outreach

The scheme has organised:

- more than **1,500 awareness programmes and camps**;
- over **50 workshops**;
- **82 trade fairs**;
- **37 State-level exhibitions**; and
- more than **50 flash-mob awareness activities**.

The first **PM Vishwakarma National Exhibition-cum-Trade Fair** was held at **Dilli Haat, New Delhi**, from **17 to 31 January 2026**.

More than **117 artisans** participated, recording sales of over **₹2 crore**. The event attracted more than **60,000 visitors**, including foreign diplomats and senior government officials.

E-Commerce Integration

More than **30,000 beneficiaries** have been onboarded on platforms such as:

- **Government e-Marketplace**
- **Open Network for Digital Commerce**
- Meesho
- Amazon
- Fabindia
- Sulekha

The **Ministry of MSME** has also signed an MoU with Amazon to facilitate the onboarding of eligible artisans.

Market Support for Divyangjan Artisans

- The scheme uses the **One Station One Product** initiative to provide retail space to Divyangjan Vishwakarma artisans at selected high-footfall railway stations.
- More than **42 Divyangjan beneficiaries**, representing different trades, have received stalls across **14 States and Union Territories**.
- Artisan stalls have also been established at airports, including **Bhopal and Chandigarh**, under the **AVSAR scheme** of the Ministry of Civil Aviation.

Branding and Packaging

- In collaboration with the **Indian Institute of Packaging**, workshops were organised across six cities. Around **1,500 artisans**, with 250 participants from each city, were trained in packaging and branding.
- The Ministry has also collaborated with **TRIFED** to organise Tribal Artisan Melas and connect tribal PM Vishwakarma beneficiaries with platforms such as **Tribes India**.
- Products have also been displayed through stalls in selected hotels and resorts in States and Union Territories such as Bihar, Gujarat, Goa, Himachal Pradesh, Odisha and Puducherry.

Significance of PM Vishwakarma

Recognition of Informal Workers

- Traditional artisans have often remained outside formal databases and welfare systems. Certification, identity cards and Udyam registration give them an officially recognised economic identity.

Preservation of Cultural Heritage

- The scheme supports the transmission of traditional skills through families and the **Guru-Shishya tradition**. It links cultural preservation with viable livelihood opportunities.

Financial Inclusion

- Collateral-free loans reduce dependence on informal moneylenders. Concessional interest lowers the cost of enterprise development.

Modernisation Without Displacement

- Skill training and toolkits introduce modern technology while allowing artisans to retain their traditional occupations and local identity.

Women and Social Empowerment

- Many traditional occupations involve women and socially vulnerable communities. Training, formal credit and market access can improve their income and participation in household decisions.

Digital Inclusion

- Digital transaction incentives, AI training and e-commerce onboarding connect traditional artisans with the expanding digital economy.

Local Employment

- The scheme promotes self-employment and decentralised production. It can reduce distress migration by creating livelihood opportunities within local communities.

Major Challenges

- **Low digital literacy:** Some artisans may find e-commerce, digital payments and AI tools difficult to use.
- **Unequal market access:** Artisans in remote

regions may remain disconnected from transport, logistics and organised markets.

- **Working-capital constraints:** Toolkit support alone may not meet the recurring cost of raw materials and production.
- **Design and quality gaps:** Traditional products must meet changing consumer preferences without losing authenticity.
- **Credit absorption:** Some beneficiaries may hesitate to borrow because of uncertain market demand and repayment concerns.
- **Intermediary dependence:** Artisans may receive only a small portion of the final sale price.
- **Limited social security:** Credit and skills do not automatically provide health insurance, pensions or protection against livelihood shocks.
- **Risk of standardisation:** Excessive commercialisation may reduce regional diversity and weaken the cultural identity of traditional crafts.
- **Monitoring quality:** Achieving registration targets must be followed by assessment of income, productivity and enterprise sustainability.

Way Forward

- Develop trade-specific artisan clusters with common production and storage facilities.
- Provide continuous mentoring after completion of formal training.
- Strengthen partnerships with design institutes, technical universities and packaging institutions.
- Improve transport, logistics and digital support in remote craft-producing regions.
- Facilitate access to working capital and suitable micro-insurance products.
- Promote direct-to-consumer marketing to reduce dependence on intermediaries.
- Use geographical indications and authenticity certification to protect traditional knowledge.
- Reserve suitable procurement opportunities for artisan products on **GeM**.
- Provide regional-language digital training and assisted e-commerce services.
- Link artisans with social-security schemes, pensions and health protection.
- Measure success through sustained income, loan repayment, market expansion and enterprise continuity—not merely registration numbers.

Conclusion

PM Vishwakarma provides an integrated framework of recognition, skills, tools, credit, digital incentives and marketing support to traditional artisans. It seeks to transform hereditary skills into sustainable micro-enterprises without separating them from their cultural roots. Its long-term success will depend on continuous mentoring, fair market access, social security and protection of craft diversity. A strong artisan economy can support inclusive growth while preserving India's living cultural heritage.

UPI Merchant Discount Rate: Who Pays, Who Is Exempt and Who Gains?

Sources: The Hindu;

Relevance: UPSC GS Paper III: Indian economy, banking, financial inclusion and digital payments

Important Keywords

Prelims:

- **Merchant Discount Rate**, **Unified Payments Interface**, **NPCI**, P2P, P2M, P2PM, UPI AutoPay, payer bank, acquiring bank, TPAP, PSP.

Mains:

- Digital public infrastructure, payment-system sustainability, financial inclusion, merchant formalisation, consumer protection, platform concentration, cashless economy.

Why in News?

The **National Payments Corporation of India** has announced a Merchant Discount Rate framework for specified UPI merchant payments. It will take effect from **October 15, 2026**.

- The transition period will allow acquiring banks, payment aggregators, fintech applications and corporate accounting platforms to update their billing and software systems.
- The announcement followed the government's exemption of UPI payments up to ₹2,000 and RuPay debit-card transactions from bank charges.

What Is Merchant Discount Rate?

Merchant Discount Rate, or **MDR**, is a fee paid by a merchant to the entities that facilitate a digital transaction.

These entities include:

- banks;
- payment-service providers; and
- third-party UPI applications.

MDR is deducted from the merchant payment and distributed among different participants in the payment ecosystem. It is not designed as a direct charge on the customer making the payment.

Types of UPI Transactions

Person-to-Person

- A **P2P transaction** is a transfer between two individuals, such as payments to friends, family members or personal contacts.

Person-to-Merchant

- A **P2M transaction** occurs when an individual uses UPI to pay a registered business for goods or services.

Person-to-Person-Merchant

- **P2PM** is a special category covering micro-merchants, such as street vendors, who receive UPI payments through QR codes into personal bank accounts within the prescribed monthly limit.

MDR Rate Structure

Transaction category	Applicable MDR
Regular merchant payment up to ₹2,000	No MDR
Regular merchant payment above ₹2,000	**0.4%**
Regular merchant payment of ₹75,000 or more	Maximum **₹300**
Essential or thin-margin sector payment of ₹2,000 or	Flat **₹5**

more	
Specified capital-market payment	**0.02%**, capped at ₹300
P2P transfer	No MDR
Eligible P2PM payment	No MDR
UPI AutoPay or Mandate transaction	No MDR

General Merchant Payments

- Mid-sized and large merchants receiving individual UPI payments above ₹2,000 will pay **0.4% of the transaction value**.
- For a merchant payment of ₹75,000 or more, the levy cannot exceed ₹300.

Essential and Thin-Margin Sectors

A flat MDR of ₹5 will apply to eligible transactions of ₹2,000 or more in sectors such as:

- railways;
- telecommunications;
- insurance;
- fuel;
- electricity;
- water supply;
- piped gas;
- education; and
- agricultural inputs.

The fixed charge is intended to provide greater cost certainty to public services and businesses operating on narrow margins.

Capital-Market Transactions

- Payments involving mutual funds, securities, stockbrokers and dealers will attract an MDR of **0.02%**, subject to a maximum of ₹300.
- The lower rate is intended to support retail participation in formal financial markets.

Which Transactions Are Exempt?

Individual Transfers

- All P2P payments will remain free irrespective of the value transferred.
- No transaction fee, platform charge or other levy can be imposed on individuals for sending or receiving money through UPI.

Automated Recurring Payments

Payments made through **UPI Mandates or AutoPay** will not attract MDR. These include:

- monthly utility bills;
- OTT subscriptions;
- recurring investments; and
- other standing instructions.

RuPay Debit Cards

- RuPay debit-card transactions have also been exempted from bank charges under the government's announcement.

How Will Small Merchants Be Treated?

- Street vendors and other small merchants receiving up to **₹1 lakh per month** through UPI QR codes into personal bank accounts will remain exempt under the P2PM category.
- They do not have to replace or re-register their existing QR codes.
- Banks and payment-service providers will use a **transaction-velocity check** to monitor the monthly inflow limit. A P2PM merchant receiving aggregate UPI credits exceeding ₹1 lakh per month for **three consecutive months** will be shifted to the regular P2M category.
- After this reclassification, individual merchant payments above ₹2,000 will attract the prescribed MDR.

Will Consumers Have to Pay?

The government has maintained that customers will not directly bear MDR.

Banks have been advised to ensure that merchants do not pass the charge on to buyers. UPI applications are expressly prohibited from imposing:

  - platform fees;
  - hidden charges; or
  - transaction fees on individual users.
- However, smaller or informal businesses may attempt to recover the charge through higher prices or encourage customers to pay in cash.
- NPCI has argued that merchants generally absorb nominal processing costs to gain higher business volumes. It has also stated that the UPI charge is significantly lower than card-processing charges and applies only above specified thresholds.

Why Has MDR Been Introduced?

Banks and other payment-system participants have so far borne the cost of operating UPI infrastructure.

The annual cost of maintaining the system is estimated at up to **₹20,000 crore**. It covers:

- cloud storage;
- payment applications;
- transaction processing;
- security;
- settlement systems; and
- customer-support services.

The government's position is that MDR revenue can support continued investment in digital-payment infrastructure.

Critics, however, argue that UPI provides wide public benefits and should continue as a no-cost digital public good. They fear that merchant charges could slow digital-payment adoption and encourage a return to cash.

Comparison with Card-Payment Charges

The basic UPI MDR is lower than conventional card-processing charges.

- **UPI MDR:** 0.4% on eligible merchant transactions
- **Debit-card MDR:** Capped at up to 0.90%
- **Credit-card MDR:** Generally between 1.5% and 2.5%

UPI also provides specific exemptions, reduced sectoral rates and a ceiling for high-value transactions.

How Widely Will MDR Apply?

- Different figures describe the MDR-eligible category because they use different denominators.

Share in Total UPI Volume

- P2P transfers constitute approximately **37% of all UPI transactions**. Merchant payments up to ₹2,000 constitute another **60.5%**.
- Together, these categories account for **97.5% of total UPI transaction volume** and will remain free. Therefore, P2M payments above ₹2,000 represent only 2.5% of all UPI transactions by volume.
- The P2PM exemption makes the actual chargeable proportion still smaller.

Share in Merchant Payments

Within P2M transactions alone, payments above ₹2,000 accounted for:

- approximately **4% of merchant-payment volume** in 2025–26; but
- nearly **two-thirds of merchant-payment value**.

Thus, high-value payments are few in number but account for a substantial share of the money transferred to merchants.

More than **24,000 crore UPI transactions**, worth ₹314 lakh crore, were conducted during 2025–26.

National Payments Corporation of India (NPCI)

1. Background

- The RBI's **Department of Payment and Settlement Systems (DPSS)** gave in-principle approval to NPCI on **24 September 2009**.
- NPCI received authorisation to operate the **National Financial Switch (NFS)** ATM network from **15 October 2009**.
- It took over NFS operations from the **Institute for Development and Research in Banking Technology (IDRBT), Hyderabad**, on **14 December 2009**.

2. About NPCI

- NPCI is the umbrella organisation that operates **retail payment and settlement systems in India**.
- It was established as an initiative of the:
  - **Reserve Bank of India (RBI)**
  - **Indian Banks' Association (IBA)**
- It functions within the framework of the **Payment and Settlement Systems Act, 2007**.

3. Legal Status

- NPCI is a **not-for-profit company**.
- It was originally incorporated under **Section 25 of the Companies Act, 1956**.
- It is now governed under **Section 8 of the Companies Act, 2013**.
- NPCI is neither a statutory body nor a department of the RBI.

4. Purpose and Mission

NPCI aims to:

- Create a robust payment and settlement infrastructure.
- Provide standardised payment platforms to the banking system.
- Promote innovation in retail digital payments.
- Improve the efficiency and security of payment operations.
- Expand digital-payment services across the country.
- Support financial inclusion and a less-cash economy.

5. Major Payment Systems

Payment system	Main function
UPI	Instant bank-to-bank digital payments
RuPay	Indigenous card-payment network
IMPS	Immediate interbank fund transfer
NACH	Bulk and recurring electronic payments
AePS	Aadhaar-enabled banking transactions
APBS	Aadhaar-based transfer of government benefits
NFS	Interconnects ATM networks
NETC FASTag	Electronic toll payments

How Will MDR Be Distributed?

The reported distribution of MDR among payment-system participants is as follows:

Participant	Share of MDR	Main responsibility
Customer's or payer's bank	**40%**	Authorisation, account security and settlement
Merchant's or payee bank	**30%**	Merchant relationship, QR deployment and settlement
UPI application or TPAP	**20%**	User-facing payment application
Payment Service Provider	**10%**	Connecting the app and partner bank to the central UPI network

Who Stands to Gain the Most?

Banking Segment

- **Yes Bank** is the payer bank in more than 50% of UPI transactions. It is followed by **ICICI Bank**, with approximately 18.3%.
- Yes Bank is also the receiving bank in about 55% of transactions, followed by **Axis Bank**, with around 19%.
- Its presence on both sides of the payment chain places Yes Bank among the largest potential beneficiaries.

UPI Application Segment

Among third-party application providers:

- **PhonePe** processes approximately 46% of UPI transactions by volume.
- **Google Pay** processes nearly 32%.

Their market shares give them the largest potential benefit from the portion allocated to UPI applications.

Potential MDR Revenue

- In August 2026, UPI transactions totalled approximately **₹29.8 lakh crore**.
- P2M transactions above ₹2,000 were worth around **₹5.99 lakh crore**, representing approximately 20% of the value of all UPI transactions.

Applying 0.4% to the entire amount produces a theoretical maximum of:

- approximately **₹2,400 crore per month**; and
- around **₹28,000 crore annually**.

Actual revenue will be lower because of sectoral flat rates, lower capital-market charges, transaction caps, AutoPay exclusions and small-merchant exemptions.

Fund for Small-Merchant Adoption

- The government will create a dedicated fund to encourage UPI use among small merchants.
- An amount equivalent to **5% of total MDR collections** will be contributed to the fund. However, it has not yet been specified whether this contribution will come from banks, application providers, Payment Service Providers or a combination of participants.

Key Concerns

Indirect Burden on Consumers

- Merchants may attempt to recover MDR through higher prices or by asking customers to use cash.

Impact on Digital-Payment Momentum

- If merchants discourage UPI payments above ₹2,000, the framework could affect the shift from cash to digital payments.

Concentration of Revenue

- A substantial part of MDR income may flow to a small number of banks and UPI

applications because they dominate transaction volumes.

P2PM Reclassification

- Small merchants crossing the ₹1 lakh monthly threshold for three consecutive months will enter the regular merchant category, increasing their payment-processing costs.

Lack of Clarity About the Fund

- The participant responsible for contributing the additional amount equivalent to 5% of MDR collections has not been identified.

Way Forward

- Enforce the prohibition on platform fees and hidden consumer charges.
- Monitor whether merchants recover MDR through higher retail prices.
- Communicate P2PM eligibility and reclassification rules clearly.
- Ensure that small merchants are not required to replace functioning QR codes.
- Publish transparent data on MDR collections and their distribution.
- Clarify how the small-merchant adoption fund will be financed and used.
- Periodically assess whether MDR affects digital-payment use or increases cash transactions.
- Balance payment-system sustainability with UPI's role as accessible digital public infrastructure.

Conclusion

The MDR framework seeks to provide revenue for maintaining UPI infrastructure while protecting individual users, small payments and eligible micro-merchants. Although only a small proportion of transactions by volume will attract the levy, they represent a significant share of merchant-payment value. Effective consumer protection, transparent revenue sharing and careful monitoring of merchant behaviour will determine whether the framework strengthens the digital-payment ecosystem without weakening financial inclusion.

India Begins Exporting Hilsa to Bangladesh: Understanding the Reversal in Fish Trade

Source: The Indian Express

Relevance: UPSCGS Paper III: Fisheries, Blue Economy, Food Processing and Biodiversity

Important Key Words

Prelims

- Hilsa, Ilish, Clupeidae, Tenualosa ilisha, Tenualosa toli, anadromous fish, Bay of Bengal, Petrapole Land Port, PMMSY, PM-MKSSY

Mains

- Blue Economy, sustainable fisheries, transboundary species, fisheries value chain, stock management, post-harvest infrastructure, market linkages, livelihood security

Why in News?

India has started exporting **Hilsa fish to Bangladesh**, reversing the traditional trade pattern under which Bangladesh supplied Hilsa to India.Around **500 tonnes** of Hilsa were exported to Bangladesh through the **Petrapole Land Port** in West Bengal during the previous two months. Traders expect another **150–200 tonnes** to be exported in the coming weeks.



What is Hilsa?

Hilsa, popularly known as **Ilish** in Bengali, belongs to the **Clupeidae family**, which also includes herring fish.

It is highly valued for its:

- Delicate flavour
- Distinctive taste
- Soft and oily texture
- Nutritional value

Hilsa has a silvery and relatively flat body, a pointed head and numerous small bones.

Two important species found in the Bay of Bengal region are:

- Tenualosa ilisha
- Tenualosa toli

Hilsa is the **State Fish of West Bengal** and the **National Fish of Bangladesh**. Bangladesh produces nearly **70% of the world's Hilsa**.

The fish is classified as **Least Concern** on the **IUCN Red List**. However, local populations may still decline because of overfishing and habitat degradation.

Habitat and Distribution

Hilsa lives in both marine and freshwater environments. It is found in rivers, estuaries and coastal waters of:

- India
- Bangladesh
- Pakistan
- Myanmar
- Persian Gulf region

Major river systems associated with Hilsa include:

- **Padma and Meghna** in Bangladesh
- **Hooghly-Bhagirathi, Ganga and Godavari** in India

The **Bay of Bengal** provides an important marine habitat for the species.

Migratory and Breeding Pattern

- Hilsa is an **anadromous fish**. This means that it spends most of its adult life in the sea but migrates into freshwater rivers for breeding and spawning.
- Its major breeding migrations take place during:
  - **Mid-February to April**
  - **September to October**
- Hilsa may be caught throughout the year, but the monsoon is its peak fishing season. Strong river flows during this period support its upstream movement.
- Therefore, the survival of Hilsa depends on continuous ecological connectivity between the sea, estuaries and rivers.

Cultural and Economic Importance

- Hilsa occupies an important place in the traditions of Bengali communities in India and Bangladesh.

Ilish Utsab

- West Bengal celebrates **Ilish Utsab**, during which restaurants and households prepare different Hilsa dishes.

Joda Ilish

- A pair of Hilsa fish is called **Joda Ilish**. It symbolises harmony, prosperity and good

fortune and is associated with weddings and festivals.

Livelihood Importance

- Hilsa supports the livelihoods of fishers, traders, transporters, wholesalers and food-processing enterprises. Its high market value makes it economically important for coastal and riverine communities.

Traditional Hilsa Trade

- Traditionally, India imported Hilsa from Bangladesh, especially during the **Durga Puja** season.
- Bangladesh began restricting Hilsa exports in **2012** to protect domestic stocks and maintain local availability.
- Since **2019**, Bangladesh has generally permitted exports to India for a limited period of about one month during Durga Puja.

However, actual imports have remained much lower than the permitted quantities.

Period	Quantity permitted	Quantity actually imported
September 2024	**2,420 tonnes**	**577 tonnes**
September 2025	**1,200 tonnes**	**150 tonnes**

The short permission period creates difficulties in procurement, transportation and marketing. Bangladesh has currently paused its Hilsa exports to India.

Efforts to Resume Imports

The **Fish Importers Association in West Bengal** has sought the removal of Bangladesh's export restrictions.

- Its delegation visited **Dhaka in August 2026**.
- It met Bangladesh's Commerce Secretary **Ataur Rehman Khan**.
- The Association also wrote to the Prime Minister of Bangladesh seeking the lifting of the restrictions.

Despite these efforts, the export restrictions continued.

Current Reversal in Hilsa Trade

For the first time, significant quantities of Indian Hilsa are being exported to Bangladesh.

The present trade has the following features:

- Approximately **500 tonnes** were exported during the previous two months.
- An additional **150–200 tonnes** are expected to be exported.
- A large part of the catch has come from the **Bharuch region of Gujarat**.
- Some supplies have moved through the **Howrah wholesale fish market**.
- The consignments entered Bangladesh through the **Petrapole Land Port**.

The development represents a reversal of the established Bangladesh-to-India trade flow.

Aquaculture

Aquaculture is the controlled cultivation of aquatic organisms such as fish, molluscs, crustaceans and aquatic plants.

It involves human intervention through activities such as:

- Regular stocking
- Feeding
- Protection from predators
- Management of production conditions

Aquaculture differs from capture fishing, which depends mainly on naturally available wild fish stocks.

Why Has the Trade Reversed?

Increased Availability in India

- A substantial catch from Gujarat has created an exportable supply of Hilsa.

Strong Demand in Bangladesh

- Hilsa has exceptional cultural and culinary importance in Bangladesh. Strong consumer demand exists even though Bangladesh is the world's leading producer.

Pause in Bangladesh's Exports

- Bangladesh's decision to stop exporting Hilsa to India altered the existing market relationship and encouraged traders to develop Indian supplies.

Improved Market Linkages

- Connections among Gujarat suppliers, the Howrah wholesale market and the Petrapole border have enabled the movement of Indian Hilsa to Bangladesh.

Changing Production and Demand

- The reversal reflects changing patterns of fish availability, production, market prices and consumer demand in the two countries.

Significance for India

New Export Opportunity

- Demand from Bangladesh can provide additional income to Indian fishers, traders and exporters.

Fisheries-Based Employment

- The trade can support employment in fishing, cold storage, transportation, processing and retail marketing.

Value-Added Hilsa Economy

The development offers an opportunity to build a science-based Hilsa economy through:

- Stock management
- Quality grading
- Hygienic processing
- Cold-chain infrastructure
- Product packaging
- Traceability
- Stronger market connections

Contribution to the Blue Economy

- Sustainable Hilsa production and trade can strengthen fisheries exports, coastal livelihoods and India's **Blue Economy**.

India–Bangladesh Relations

- Hilsa is a shared cultural symbol. Predictable trade in Hilsa can strengthen economic and people-to-people relations between India and Bangladesh.

Government Initiatives for Fisheries Development

Pradhan Mantri Matsya Sampada Yojana

- The **Pradhan Mantri Matsya Sampada Yojana (PMMSY)** was launched on **September 10, 2020** to promote a Blue Revolution through sustainable and responsible development of India's fisheries sector.
- It is implemented by the **Department of Fisheries under the Ministry of Fisheries, Animal Husbandry and Dairying**.

The scheme seeks to develop a fisheries sector that is:

- Ecologically healthy
- Economically viable
- Socially inclusive

Areas Supported under PMMSY

PMMSY addresses gaps across the fisheries value chain, including:

- Fish production, productivity and quality
- Technology adoption
- Fishing harbours and fish-landing centres

- Safe docking and berthing facilities
- Post-harvest infrastructure
- Cold-chain and marketing facilities
- Fish retail markets and kiosks
- Ornamental fish-rearing units
- Traceability and fisheries management
- Welfare of fishers and fish farmers

PM-MKSSY

- The **Pradhan Mantri Matsya Kisan Samridhi Sah-Yojana (PM-MKSSY)** is a Central Sector sub-scheme under PMMSY.
- It aims to formalise the fisheries sector and support fisheries-based micro and small enterprises.

Challenges

Overfishing

- Growing demand can result in excessive harvesting of mature and breeding Hilsa.

Capture of Juvenile Fish

- Catching young Hilsa before they reproduce can reduce future fish populations.

Obstruction of Migratory Routes

- Dams, barrages and other river structures may interrupt the movement of Hilsa between the sea and freshwater breeding grounds.

River and Estuarine Pollution

- Sewage, industrial discharge and plastic waste can damage breeding and nursery habitats.

Changes in River Flow

- Reduced freshwater discharge and changes in sediment movement can disturb the conditions required for migration and spawning.

Climate Change

- Changes in rainfall, water temperature and salinity can affect the geographical distribution and breeding cycle of Hilsa.

Weak Cold-Chain Infrastructure

- Inadequate refrigeration, storage and transportation may result in post-harvest losses.

Uncertain Trade Policy

- Short export windows and sudden restrictions create uncertainty for fishers, importers and exporters.

Way Forward

Adopt Science-Based Stock Management

- Authorities should regularly assess Hilsa populations and determine sustainable fishing limits.

Protect Breeding Seasons

- Seasonal restrictions should be enforced during major spawning periods.

Prevent Juvenile Fishing

- Minimum catch-size rules and restrictions on harmful fishing nets should be implemented effectively.

Restore River Connectivity

- Environmental flows and fish-passage systems should be considered while managing dams and barrages.

Control Water Pollution

- River and estuarine pollution must be reduced to protect spawning and nursery habitats.

Strengthen Post-Harvest Infrastructure

- Cold storage, refrigerated transport, processing facilities and quality-testing systems should be expanded under **PMMSY**.

Introduce Traceability

- Traceability and certification systems can

identify the origin, handling conditions and quality of exported fish.

Establish Predictable Trade Arrangements

- India and Bangladesh should develop a transparent and stable Hilsa trade mechanism instead of depending only on short seasonal permissions.

Promote Regional Conservation

- Both countries should cooperate in stock assessment, breeding-ground protection, fisheries research and river management because Hilsa is a transboundary migratory resource.

Conclusion

India's Hilsa exports to Bangladesh represent an important change in the traditional fish trade between the two countries. The shift creates opportunities for fishers, processors and exporters, while strengthening the fisheries value chain. However, rising commercial demand must not lead to the depletion of wild stocks. Scientific management, habitat protection, improved cold-chain infrastructure and stable bilateral cooperation are essential for developing a sustainable and inclusive Hilsa economy.

India Cine Hub: Strengthening India's Film Production Ecosystem

Source: PIB

Relevance: GS Paper III: Creative Economy, Employment, Tourism and Digital Infrastructure

Important Keywords

Prelims

- India Cine Hub, NFDC, Film Visa, Film Bazaar, GIS Mapping, Co-production Treaty, Live Events Development Cell

Mains

- Creative Economy, Ease of Doing Business, Film Tourism, Cultural Diplomacy, State Integration, Single-Window Clearance

Why in News?

The **India Cine Hub** is being developed as a centralised, single-window digital platform to simplify film-shooting permissions in India.The platform brings together permissions from Union Ministries, State governments, police departments and local authorities. It also facilitates film visas, co-production applications, filming incentives, location mapping and access to verified production services.

What is India Cine Hub?

- The **India Cine Hub**, or **ICH**, is an online platform designed to facilitate domestic and international film production in India.
- It is managed by the **National Film Development Corporation of India** and provides a common system through which filmmakers can apply for permissions required to shoot films, television programmes, documentaries and other audiovisual content.

It supports applications relating to:

- Film-shooting permissions
- Film visas
- International co-productions
- Central and State incentives
- Aerial and animal filming
- Forest and monument locations
- Production vendors and local services
- Live-event permissions

Thus, the platform seeks to replace multiple separate applications with a coordinated digital process.

Why Does India Need a Single-Window Film Portal?

Multiple Permissions

- Filmmakers may require approvals from several authorities, including State governments, police departments, forest authorities, local bodies and agencies managing monuments.
- Approaching every authority separately increases administrative delays and production costs.

Different State Procedures

- States follow different rules, application formats and approval processes. This creates uncertainty, especially for projects filmed across multiple States.

Growing Content Industry

- India's film, television and digital-content sector generated approximately **$13.1 billion in 2023–24**, registering an increase of around 18% from 2019.
- It is expected to grow by 6–10% and reach an estimated value of **$17.5–19.7 billion by 2028–29**.

Global Filming Potential

- India offers diverse locations ranging from Himalayan landscapes and deserts to beaches, forests, historic cities, forts, palaces and UNESCO World Heritage Sites.
- A simplified permission system can convert this geographical and cultural diversity into an economic opportunity.

Key Functions of India Cine Hub

Centralised Filming Permissions

- The portal provides a common application system for domestic and international creators.
- Applications are digitally forwarded to the relevant Union Ministries, State nodal officers and local authorities.
- For States without an online permission system, the platform provides a standard application format.

Film Visa Facilitation

- Foreign filmmakers can use the portal to apply for filming permission and obtain assistance in securing a **Film Visa**.
- A Film Visa allows foreign film crews and production professionals to undertake approved filming activities in India.

Incentive Management

- The portal lists and processes Central and State-level incentives available to filmmakers.
- Eligible international productions may receive incentives of up to **40% of qualifying production expenditure**, subject to the applicable conditions.

GIS-Based Location Mapping

The portal provides a Geographic Information System-based database containing information about:

- Shooting locations
- Production infrastructure
- Available local resources
- Permit authorities
- Major film-production hubs

This allows producers to assess potential locations before beginning production.

Standardised Workflows

Simplified and uniform procedures have been introduced for:

- Film permissions
- Non-film projects
- Incentive applications
- International productions
- Co-production approvals

Standardisation improves transparency and reduces variations in administrative processing.

State Integration

The portal connects Union and State authorities through designated nodal officers.

States and Union Territories can use the platform to showcase their:

- Filming locations
- Studio infrastructure
- Production facilities
- Local service providers
- Tourism potential
- Film incentives

Regulatory Guidance

The portal provides guidelines relating to:

- Film visas
- Aerial filming
- Filming with animals
- Forest locations
- Protected monuments
- General filming regulations

Verified Resource Directory

Filmmakers can obtain information about verified local service providers, including:

- Film studios
- Equipment-rental agencies
- Post-production companies
- Casting agencies
- Performers and technicians
- Property-rental services
- Hotels and accommodation
- Catering services
- Travel operators
- Security and medical facilities

Digital Monitoring

- A dashboard records the number of applications and tracks approvals at State, national and international levels.
- The portal uses encryption and is designed to manage large volumes of applications and user traffic.

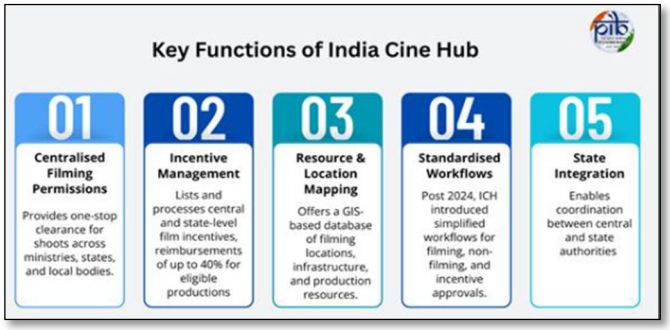
Extension to Live Events

- The India Cine Hub is also being expanded as the core digital infrastructure of the **Live Events Development Cell**.

Under this system:

- Event venues are digitally mapped.
- Applications are routed to the concerned authorities.
- Local nodal officers coordinate permissions.
- Event organisers can monitor the approval process.

Nine major venues have already been included in the system.



What is a Film and Media Co-production?

A **film co-production** is a collaborative project involving producers from two or more countries.

Such collaborations facilitate:

- **Joint production:** Producers jointly develop and finance a project.

- **Talent collaboration:** Artists, technicians and creative professionals work across countries.
- **Resource pooling:** Partners share locations, equipment, finance and infrastructure.
- **Risk sharing:** Financial and production risks are divided among partners.
- **Market expansion:** Films gain easier access to audiences and distributors in partner countries.

The India Cine Hub processes applications for official co-productions and provides guidelines relating to co-production treaties.

India's Co-production Treaty Partners

India has official audiovisual co-production treaties with 17 countries:

- Australia
- Bangladesh
- Brazil
- Canada
- China
- Colombia
- France
- Germany
- Israel
- Italy
- New Zealand
- Poland
- Portugal
- Republic of Korea
- Russia
- Spain
- United Kingdom

Examples of official co-productions include:

- *Union Leader* — India–Canada
- *Sir* — India–France
- *Mujib: The Making of a Nation* — India–Bangladesh
- *All We Imagine as Light* — India–France
- *Quo Vadis* — India–Poland
- *Parikrama* — India–Italy



What is the National Film Development Corporation?

- The **National Film Development Corporation of India** was established in 1975 to promote the growth of Indian cinema.

It developed into an integrated film institution after incorporating the functions of bodies such as:

- Film Finance Corporation
- Indian Motion Picture Export Corporation
- Films Division
- Directorate of Film Festivals
- National Film Archive of India
- Children's Film Society, India

Major Functions of NFDC

- **Film production:** Co-produces films through public-private partnerships.
- **Talent development:** Supports scripts, workshops and emerging filmmakers.

- **International production:** Provides line-production support to foreign filmmakers.
- **Film promotion:** Promotes multilingual Indian cinema in domestic and international markets.
- **Film preservation:** Supports the preservation of India's cinematic heritage.
- **Film Bazaar:** Conducts Film Bazaar alongside the International Film Festival of India in Goa.

Film Bazaar India is an important South Asian platform for co-production, distribution, financing and interaction among filmmakers and investors.

India's Major Film-Production Hubs

- India's important production centres include Mumbai, Hyderabad, Chennai, Kolkata, Bengaluru, Delhi, Guwahati, Bhubaneswar, Thiruvananthapuram and Kochi.
- These hubs together employ more than **1.6 lakh people**.

Mumbai Film City

- Established in 1977
- Renamed **Dadasaheb Phalke Chitranagari** in 2001
- Spread across more than 520 acres
- Contains approximately 42 outdoor locations
- Offers studios, forests, hills, valleys and water bodies

Ramoji Film City, Hyderabad

- Established in 1996
- Spread over approximately 2,000 acres
- Provides more than 500 filming locations
- Employs around 6,000 people
- Can support nearly 40 Indian film projects simultaneously
- Recognised as the world's largest film-studio complex

Noida Film City

- Spread over approximately 100 acres
- Contains 16 studios
- Houses media companies, broadcasters and publication organisations
- Employs approximately 17,000 media professionals
- Supports wider livelihood opportunities for nearly 1.5 lakh people

Development of New Film Cities

- States such as Uttar Pradesh, Punjab, Madhya Pradesh, Assam, Chhattisgarh, Odisha and Bihar are developing film infrastructure in cooperation with private investors.

The expansion is being driven by:

- Growth of regional cinema
- Online streaming services
- Short-form video content
- Gaming
- Live streaming
- Vernacular digital platforms
- State-level production incentives

Employment in the segment may reach around two lakh people by 2030.

Role of Digital Connectivity

India's growing digital infrastructure has expanded the demand for audiovisual content.

- Internet subscribers increased from **25.15 crore in 2014** to more than **109.2 crore by March 2026**.
- Wireless data costs fell from around **₹308 per GB** to **₹7.51 per GB** during the same period.

- 5G services became available in **99.9% of districts**.

Affordable internet has enabled India to move from being mainly a large content-consuming market towards becoming an important centre of content creation and distribution.

Role in Promoting Film Tourism

- Films can transform lesser-known shooting locations into popular tourism destinations.
- For example, *3 Idiots* increased the visibility of Ladakh, while international productions such as *Slumdog Millionaire* and *Life of Pi* presented Indian locations to global audiences.

Film tourism can:

- Generate local employment
- Increase demand for hotels and transport
- Support handicrafts and small businesses
- Promote rural economies
- Showcase cultural heritage
- Improve the global visibility of destinations

Madhya Pradesh received the **Most Film Friendly State Award** at the 68th National Film Awards.

States such as Rajasthan, Uttar Pradesh, Kerala and Uttarakhand attract film productions through location-fee waivers, infrastructure support and financial subsidies.

Significance of India Cine Hub

- **Ease of doing business:** It reduces the need to approach multiple authorities independently.
- **Administrative transparency:** Digital applications and dashboards allow filmmakers to monitor approvals.
- **Cooperative federalism:** It connects Union, State and local authorities through a common system.
- **Employment generation:** Productions create work for artists, technicians, vendors and local workers.
- **Film tourism:** States can promote their natural and cultural locations through cinema.
- **Regional development:** Film crews create demand for accommodation, food, transport and other local services.
- **Cultural diplomacy:** International co-productions help Indian stories and talent reach global audiences.
- **Foreign investment:** Simplified procedures can attract international production companies.
- **Growth of creative industries:** The platform supports films, television, streaming content and live events.

Challenges

- **Multiple authorities:** Final permissions still depend on timely action by different departments.
- **Uneven State capacity:** States differ in digital infrastructure and administrative preparedness.
- **Lack of fixed timelines:** Delays may continue unless authorities follow defined approval periods.
- **Security concerns:** Filming near borders, airports and strategic locations requires careful scrutiny.
- **Environmental concerns:** Forests and ecologically sensitive areas require responsible filming practices.
- **Data protection:** Information relating to locations, foreign applicants and production plans must be secured.
- **Infrastructure concentration:** Major studios

and post-production facilities remain concentrated in a few cities.

- **Limited awareness:** Small and regional filmmakers may not know about the portal or available incentives.

Way Forward

- Integrate all States and Union Territories with the platform.
- Prescribe fixed timelines for processing permissions.
- Develop a system for monitoring delays and fixing administrative responsibility.
- Provide multilingual application and support services.
- Train State nodal officers and local officials.
- Regularly update location, incentive and vendor information.
- Strengthen cybersecurity and protection of confidential production data.
- Expand studios and post-production facilities in emerging regional centres.
- Publish clear eligibility rules for film incentives.
- Link film production with tourism and local-development policies.
- Ensure that local workers and communities benefit from filming activities.
- Expand international co-production partnerships and global promotion of Indian locations.

Conclusion

The India Cine Hub combines digital governance with the development of India's creative economy. By simplifying permissions, film visas, co-productions, incentives and access to production resources, it can make India a more competitive filming destination.Its long-term success will depend on effective State integration, timely approvals, reliable digital systems and coordination among authorities. With these improvements, the platform can promote employment, tourism, cultural diplomacy and India's emergence as a global centre for audiovisual content.

World Tourism Day 2026: India's Tourism Growth and Digital Transformation

Source: PIB

Relevance: GS Paper III: Tourism, Infrastructure, Technology, Employment and Inclusive Growth

Important Keywords

Prelims

- World Tourism Day | UNWTO | Tourism Satellite Account | National Digital Tourism Stack | NIDHI+ | e-Visa | Swadesh Darshan 2.0 | PRASHAD | CBDD | MICE Tourism

Mains

- Digital Tourism Ecosystem | AI-enabled Tourism | Sustainable Tourism | Destination-centric Development | Community-based Tourism | Tourism-led Employment | Regional Connectivity | Inclusive Growth

Why in News?

World Tourism Day 2026 was observed on **27 September** under the theme **"Digital Agenda and Artificial Intelligence to Redesign Tourism."**The global observance was held in **El Salvador**. The

theme highlighted the role of digital innovation, data and Artificial Intelligence in transforming tourism planning, destination management and visitor experiences.



About World Tourism Day

- World Tourism Day is an initiative of the **United Nations World Tourism Organisation (UNWTO)**. It is observed annually on 27 September to commemorate the adoption of the UNWTO statutes in 1970. It was first celebrated in 1980.
- The day highlights tourism's contribution to socio-economic development and the **Sustainable Development Goals**.

Theme for 2026

- The theme **"Digital Agenda and Artificial Intelligence to Redesign Tourism"** focuses on using technology and AI to improve decision-making, strengthen skills, personalise travel, manage destinations and make tourism more inclusive and sustainable.

World Tourism Day Celebrations in India

Central Celebration

- The central celebration was held at **Bharat Mandapam in New Delhi**.
- The Ministry of Tourism announced the **National Digital Tourism Stack** and **Dekho Apna Desh 2.0**.
- The Ministry also proposed partnerships with industry organisations to improve destination visibility, digital outreach, experiential tourism, sustainable tourism and community participation under the Incredible India framework.

Telangana

- Telangana organised cultural programmes, workshops, tourism film screenings, concerts and artisanal stalls displaying food, handlooms and handicrafts.
- The **Telangana State Tourism Awards** recognised travel agents, tour operators, classified hotels, restaurants, independent hotels and other participants in the tourism industry.

Delhi

- The Delhi Government organised **"RANG • RAS • ROOH"** at Baansera, the bamboo park at Sarai Kale Khan on the banks of the Yamuna, on 26–27 September.
- The programme combined art, culture, food, entertainment and tourism experiences. It also included a Qawwali performance by the Nizami Brothers.

Status of Global Tourism

In 2024, global travel and tourism contributed **US$10.9 trillion**, accounting for around **10% of global GDP**. The sector supported approximately **357 million jobs** and generated **US$1.9 trillion** in international visitor spending.

Status of Tourism in India

- Tourism connects people with India's culture, heritage, natural landscapes and communities. It also generates employment,

supports local businesses and contributes to foreign exchange earnings.

Tourism Satellite Account

- The **Tourism Satellite Account (TSA)** is the official accounting framework used to measure tourism's direct and indirect economic contribution.
- Tourism contributes **5.22% to India's GDP**. Employment in the sector increased from **6.94 crore in 2019-20** to **8.46 crore in 2023-24**.

Growth in Tourist Visits

- Domestic Tourist Visits increased from **67.7 crore in 2021** to **428.55 crore in 2025**. Foreign Tourist Visits increased from **0.1 crore to 2.53 crore** during the same period.
- Foreign exchange earnings from tourism rose from **₹63,978 crore in 2021** to **₹2,76,831 crore in 2025**.

Digital Transformation of Tourism

- Tourism is moving from physical maps, guidebooks and manual bookings towards smartphones, online platforms and AI-enabled services.
- Digital technology now helps travellers discover destinations, plan journeys, book transport and accommodation, obtain real-time weather information, explore cities, purchase tickets and receive emergency assistance.
- AI can analyse a traveller's interests, budget and preferences to provide personalised travel plans. It can also improve destination management, tourism promotion and decision-making.

Major Digital Tourism Initiatives

National Digital Tourism Stack

- The **National Digital Tourism Stack** is an open digital public infrastructure initiative. It seeks to make tourism offerings more discoverable, accessible and trustworthy.
- It can connect information about destinations, transport, accommodation, service providers and visitor facilities through a common digital ecosystem.

Dekho Apna Desh 2.0

- Dekho Apna Desh 2.0 focuses on tourism-ready but lesser-known destinations. It seeks to promote domestic tourism, reduce pressure on overcrowded destinations, distribute tourist footfall more evenly and generate local livelihoods.

e-Visa Facility

- India introduced Electronic Travel Authorisation in 2014 for nationals of 43 countries. The e-Visa facility is now available to nationals of **172 countries**.
- Entry is permitted through **88 international ports—37 airports, 38 seaports and 13 land ports**. India issues approximately **78% of its visas electronically**, while nearly **95% of e-Visa applications are processed within 72 hours**.

Incredible India Digital Platform

- The revamped Incredible India Digital Platform presents virtual experiences related to culture, heritage, adventure, gastronomy, wellness, arts and crafts, and rural tourism.
- Its AI-powered services provide personalised information, real-time weather updates, city-exploration support and essential travel services.
- The platform connects travellers with Online Travel Agents for booking flights, hotels, cabs and buses. It also supports ticket booking for Archaeological Survey of India monuments.

- Its integration with NIDHI provides information about registered tour operators and travel agents.

NIDHI+

- **NIDHI+**, or the **National Integrated Database of Hospitality Industry**, is a unified digital platform for the registration, recognition and classification of tourism service providers.
- It provides end-to-end online processing, integrated payments and transparent approvals while improving ease of doing business.

Google India Partnership

- In June 2026, **the Ministry of Tourism signed an MoU with Google India to promote Indian** tourism through digital technologies, AI, data-driven insights and capacity building.
- The partnership uses information on global travel trends, traveller behaviour and digital engagement. It also includes training for Ministry officials in digital marketing, campaign optimisation, content creation and emerging technologies.

Multilingual Tourist Helpline

- The Ministry operates a **24×7 multilingual Tourist Helpline** through the toll-free number **1800111363** and short code **1363**.
- It provides information in 12 international languages, **including Arabic, French, German, Italian, Japanese, Korean, Chinese, Portuguese, Russian and Spanish**. It also assists tourists during emergencies and alerts the authorities when required.

Tourism Start-ups and Innovation

- As of 17 April 2023, India's travel and tourism sector had **1,497 DPIIT-recognised start-ups across 262 districts**, generating employment for nearly **13,919 people**. About **58%** were located in Tier II and Tier III cities.
- These start-ups operate in travel technology, online booking, homestays, rural tourism, experiential tourism, smart mobility and AI-enabled travel planning.
- **Highway Delite** has created a digitally connected highway-amenities network; **VilloTale** promotes rural tourism through homestays and community-based experiences; and **udChalo** provides technology-enabled travel services to more than 2.8 million defence personnel, veterans and their dependants through digital platforms and over 70 booking offices.

India's Diverse Tourism Landscape

Spiritual and Pilgrimage Tourism

- India has important pilgrimage destinations associated with Hinduism, Buddhism, Jainism and Sikhism. Major destinations include **Ayodhya, Kashi, Bodh Gaya, Amritsar, Tirupati and Puri**.
- PRASHAD and Swadesh Darshan support infrastructure and visitor facilities at religious destinations.

Buddhist Tourism

- **Bodh Gaya in Bihar and Sarnath and Kushinagar in Uttar Pradesh** are important sites associated with the life of the Buddha.
- These destinations reflect India's historical and civilisational connections with Buddhist communities across Asia.

Heritage and Cultural Tourism

- India's cultural tourism resources include forts, palaces, temples, archaeological sites, museums, historic cities, classical music, dance, festivals, handicrafts and regional cuisines.

Wellness, Yoga and Medical Tourism

- India's traditions of Yoga, Ayurveda and other traditional systems of medicine give the country a distinct position in wellness tourism. These traditions are supported by modern healthcare facilities and medical services.

Eco-tourism and Wildlife Tourism

- National parks, tiger reserves, wetlands, mangroves, forests and Himalayan landscapes support wildlife safaris, birdwatching, trekking and nature trails.
- Responsible tourism can promote conservation while creating livelihoods for communities living around these destinations.

Rural, Homestay and Community-based Tourism

- Homestays, village experiences, local cuisine, handicrafts, agricultural activities and community-led experiences provide visitors with closer exposure to rural life.
- They can generate additional income for rural households, artisans, local enterprises and tribal communities.

Coastal, Cruise and Experiential Tourism

- Sea cruise passenger traffic increased from **1.08 lakh in 2014-15** to **4.62 lakh in 2025-26**, recording **328% growth**.
- International cruise terminals at **Visakhapatnam, Mumbai and Chennai** have been upgraded and operationalised. Puducherry has been added to the East Coast Cruise Circuit.
- A QR-based immigration system has reduced clearance time to around **30 seconds per passenger**. Digitised customs procedures and e-Group Visit Visas also support smoother entry for international cruise groups.

Lighthouse Tourism

- Lighthouses traditionally function as **Marine Aids to Navigation**.
- Under **Section 23 of the Marine Aids to Navigation Act, 2021, the** government is promoting lighthouses for educational, cultural and tourism purposes.
- Lighthouse museums at **Chennai, Mahabalipuram, Alappuzha, Kannur, Muttom, Dwarka and Gopnath** present India's maritime history and the evolution of lighthouse technology.

MICE Tourism

- MICE tourism refers to **Meetings, Incentives, Conferences and Exhibitions**.
- India is strengthening its business-events ecosystem through Bharat Mandapam and Yashobhoomi in Delhi and the Jio World Centre in Mumbai.
- The government has identified the potential to develop at least **10 Indian cities**, particularly in South India, as global MICE destinations.
- The global MICE industry is projected to grow from **US$870 billion to more than US$1.4 trillion by 2030**. India currently holds approximately **5% of the global market**.

International Tourism Cooperation

BRICS and the Jaipur Declaration

- During India's BRICS Chairship in 2026, the BRICS Tourism Ministers' Meeting was held in Jaipur and adopted the **Jaipur Declaration**.
- Its four priorities are **AI and tourism, sustainable and responsible tourism, tourism skilling and capacity building, and tourism exchanges with seamless travel facilitation**.

- It also supports cooperation in tourism planning, destination management, visitor services and multilingual communication.

G20 and Tourism Promotion

- During India's G20 Presidency, more than **200 meetings were held across 60 cities**.
- These meetings presented India's heritage, regional cuisines and local crafts to an international audience. They also promoted destinations beyond metropolitan cities and demonstrated India's capacity to organise major global events.

Infrastructure-led Destination Development

- India is moving from developing isolated attractions towards creating integrated destination ecosystems. Such an ecosystem combines tourism attractions, transport connectivity, accommodation, visitor facilities, safety, cleanliness, digital services and community participation.

Regional Air Connectivity

- A total of **687 UDAN routes connecting 95 airports** have been operationalised.The Modified UDAN scheme for **2026-27 to 2035-36** has an approved outlay of **₹28,840 crore** and proposes the development of **100 airports and 200 modern helipads**.These measures seek to improve regional and last-mile access to tourist destinations, particularly in underserved regions.

Major Government Initiatives

Swadesh Darshan

- Swadesh Darshan was launched in **2014-15** to develop thematic tourism circuits.Under the scheme, **76 projects worth more than ₹5,295.24 crore** were sanctioned across **15 thematic circuits**, and 75 projects were physically completed.The circuits include Buddhist, Coastal, Desert, Eco, Himalayan, North-East, Ramayana, Rural, Spiritual and Tribal tourism.

Swadesh Darshan 2.0

- Swadesh Darshan 2.0 follows a destination-centric approach based on sustainable tourism, experience-based tourism, integrated planning, infrastructure and improved visitor experiences.
- Under the scheme, **53 projects worth ₹2,207.08 crore** have been sanctioned.

PRASHAD

- PRASHAD stands for **Pilgrimage Rejuvenation and Spiritual, Heritage Augmentation Drive**.
- Launched in 2014-15, it provides financial assistance to States and Union Territories for developing pilgrimage and heritage destinations.
- Under PRASHAD, **54 projects worth ₹1,726.18 crore** have been sanctioned.
- The scheme supports tourist facilitation centres, sound-and-light shows, parking facilities, ghats, solid-waste management systems, solar panels and CCTV installations.

Special Assistance to States for Capital Investment

- The SASCI scheme supports iconic tourist destinations through improved infrastructure, connectivity, visitor facilities and local employment.
- Under the scheme, **40 projects across 23 States** were approved. It received **₹3,295.76 crore in 2024-25** with **100% Central funding**.
- Under the amended 2025-26 guidelines, eligible States that had not received funds under Part III of SASCI 2024-25 could

receive up to ₹250 crore under Part II.

- Accordingly, **₹250 crore each** was sanctioned and released to **Nagaland, Mizoram and Himachal Pradesh**.

Tourism Skill Development

Capacity Building for Service Providers

- The **Capacity Building for Service Providers (CBSP)** programme provides skilling, upskilling and reskilling for local communities, tribal populations, underprivileged youth and tourism-sector workers.**Hunar Se Rozgar Tak** is implemented under the programme.Training is provided through Institutes of Hotel Management, Food Craft Institutes, the Indian Culinary Institute and empanelled private institutions.

Paryatan Mitra and Paryatan Didi

- Launched in 2024, the initiative trains local service providers in hospitality, cleanliness, safety and sustainability.
- Around **4,382 candidates** have been trained, including cab and auto drivers, transport employees, hotel and restaurant workers, homestay owners, guides, police personnel, street vendors, shopkeepers and students.
- Women and marginalised communities are also included. Partnerships with **21 Central Institutes of Hotel Management and eight leading hospitality groups** support professional training.

Significance

- **Economic growth:** Tourism contributes to GDP and foreign exchange earnings.
- **Employment:** It generates jobs across hospitality, transport and local services.
- **Regional development:** Lesser-known destinations can receive new economic opportunities.
- **Community empowerment:** Rural tourism supports households, artisans and local enterprises.
- **Entrepreneurship:** Tourism start-ups create opportunities beyond metropolitan cities.
- **Cultural diplomacy:** Tourism presents India's heritage and civilisational links globally.
- **Sustainability:** Responsible tourism can connect conservation with livelihoods.
- **Ease of travel:** e-Visa and integrated platforms simplify the visitor experience.

Challenges

- Unequal digital access among small tourism service providers.
- Limited last-mile connectivity at emerging destinations.
- Excessive pressure on popular tourism centres.
- Need to balance tourist growth with environmental protection.
- Uneven quality of safety, cleanliness and visitor facilities.
- Shortage of professionally trained tourism workers.
- Limited participation of communities in destination management.
- Need for reliable and regularly updated digital information.
- Requirement of coordination among government, industry and communities.
- Risk of commercial tourism weakening local culture and heritage.

Way Forward

- Expand digital training for local service providers and small enterprises.

- Improve last-mile connectivity to emerging destinations.
- Promote lesser-known locations through Dekho Apna Desh 2.0.
- Use AI and data for planning, demand assessment and visitor management.
- Integrate tourism information through the National Digital Tourism Stack.
- Improve safety, cleanliness and visitor amenities.
- Include local communities in tourism planning and livelihood creation.
- Expand skilling through hospitality institutions and industry partnerships.
- Develop environmentally responsible tourism infrastructure.
- Promote homestays, local cuisine, handicrafts and community-led experiences.

Conclusion

India is moving from isolated tourist attractions towards integrated, destination-centric and digitally connected tourism ecosystems.AI, digital platforms, infrastructure, connectivity and skill development can make tourism more accessible and competitive. However, technology must also support sustainable destinations, local livelihoods and inclusive visitor experiences.India's future tourism model must therefore be **digital, inclusive, sustainable, people-centred and globally competitive**.

Environment & Ecology, DM

Pichavaram Mangroves: Valuing India's Natural Coastal Capital

Source: The Hindu

Relevance: **GS Paper III—Environment, Biodiversity, Climate Change, Disaster Management and Sustainable Development**

Important Keywords

For Prelims:

- Mangroves | Pichavaram | Blue Carbon | Pneumatophores | Prop Roots | Vivipary | Ramsar Convention | MISHTI | Coastal Regulation Zone | Total Economic Value

For Mains:

- Ecosystem Services | Natural Capital Accounting | Green GDP | Nature-based Solutions | Payment for Ecosystem Services | Climate Finance | Coastal Resilience | Community Conservation

Why in News?

A recent study titled *Economic Valuation and Blue Carbon Assessment of Ecosystem Services in the Pichavaram Mangrove Forest* estimated the ecosystem's **Total Economic Value (TEV) at ₹2,485.38 crore**, or approximately **₹1.83 crore per hectare**.The assessment shows that mangroves are not merely forests but valuable natural infrastructure supporting coastal protection, carbon sequestration, biodiversity, fisheries, tourism and local livelihoods.

About Pichavaram Mangrove Forest

Pichavaram is an ecologically significant coastal wetland ecosystem in Tamil Nadu. It provides interconnected ecological, economic and social benefits, including:

- protection against coastal hazards;
- conservation of biodiversity;
- support for fish, crab and shrimp populations;
- storage and sequestration of carbon;
- regulation of oxygen and nutrient cycles;
- tourism and recreation; and
- livelihood security for coastal communities.

The study used both primary and secondary information. Primary data were collected from **302 households** across five mangrove-dependent villages—MGR Thittu, Kalaignar Nagar, Chinnavaikal, Patriadi and Mudasalodai.

Meaning and characteristics of mangroves

What are Mangroves?

Mangroves are salt-tolerant trees and shrubs found in the intertidal zones of tropical and subtropical coastlines. They grow in saline or brackish water and survive tidal fluctuations, waterlogged soil, high salinity and low oxygen conditions.

They serve as an ecological bridge between terrestrial and marine ecosystems.

Major Adaptations

- **Salt tolerance:** Roots filter salt, while some species remove excess salt through their leaves.
- **Pneumatophores:** Aerial roots rise above waterlogged soil to absorb oxygen.
- **Prop roots:** Provide stability against tides, waves and storm surges.
- **Vivipary:** Seeds germinate while attached to the parent plant, improving survival in saline environments.
- **Efficient carbon storage:** Mangroves store substantial carbon in vegetation and waterlogged sediments.

Economic Valuation of Pichavaram

The study assigned monetary value to various market and non-market services provided by the ecosystem.

Ecosystem service	Estimated value
Fish, crab and shrimp	₹3.47 crore
Coastal protection	₹147.17 crore
Nutrient cycling	₹10.53 crore
Oxygen regulation	₹181.22 crore
Annual carbon sequestration	₹26.86 crore
Biodiversity conservation	₹19.48 crore
Recreation and tourism	₹484.25 crore
Carbon stock in vegetation	₹387.77 crore
Soil organic carbon	₹1,224.63 crore
Total Economic Value	**₹2,485.38 crore**

The valuation reveals that conventional economic assessments significantly underestimate mangroves because many of their services—such as storm protection, carbon storage and nutrient cycling—do not have direct market prices.

Blue-Carbon Potential

Blue carbon refers to carbon captured and stored by coastal and marine ecosystems such as mangroves, salt marshes and seagrass beds.

The study found that Pichavaram's vegetation stores, on average:

- **79.449 tonnes of carbon per hectare**; and
- carbon equivalent to approximately **291.33 tonnes of CO_2 per hectare**.

Mangrove sediments contain a still larger carbon reservoir:

- average soil organic carbon stock: **251.14 tonnes per hectare**;
- economic value of soil carbon: **₹90.24 lakh per hectare**; and
- total soil organic carbon value: **₹1,224.63 crore**.

The combined economic value of vegetation and soil carbon in Pichavaram was estimated at **₹1,612.40 crore**.

Why Below-Ground Carbon Matters

- A majority of mangrove carbon is stored in waterlogged soil and sediments. Low-oxygen conditions slow the decomposition of organic material, allowing carbon to remain stored for long periods.
- Therefore, conservation must protect not only visible mangrove vegetation but also the underlying hydrology and sediments. Clearing or disturbing mangrove soil can release accumulated carbon back into the atmosphere.

Ecosystem Services of Mangroves

1. Provisioning Services

- Mangroves provide fish, crabs, shrimp, honey, timber and other biological resources. They function as breeding and

nursery grounds for several aquatic species and support local and commercial fisheries.

2. Regulating Services

Mangroves:

- absorb wave energy;
- reduce coastal erosion;
- moderate storm surges;
- provide protection from cyclones and tsunamis;
- store carbon;
- regulate oxygen; and filter pollutants, sediments and excess nutrients.

Their ability to purify coastal water has earned them the description **"Kidneys of the Planet."**

3. Supporting Services

- They assist in nutrient cycling, soil formation, biodiversity maintenance and the functioning of coastal food chains.

4. Cultural Services

- Mangrove landscapes support recreation, education, scientific research and ecotourism. At Pichavaram, recreation and tourism were valued at **₹484.25 crore**, making them a major component of its economic value.

Importance of Mangrove Valuation

Recognition as Natural Infrastructure

- Mangroves provide coastal protection services that would otherwise require expensive sea walls, embankments or other artificial infrastructure.

Improved Development Decisions

- Assigning monetary value to ecosystem services enables governments to compare the ecological cost of destroying mangroves with the expected benefits of coastal projects.

Climate Finance

- Measured carbon stocks can support blue-carbon projects, carbon-credit programmes and climate-finance mechanisms.

Natural Capital Accounting

- Mangrove valuation can be included in **Natural Capital Accounts** and **Green GDP**, thereby reflecting environmental gains and losses alongside conventional economic growth.

Community Welfare

- Economic valuation strengthens the case for directing conservation benefits towards communities dependent on fisheries, tourism and other mangrove resources.

Mangrove Cover in India

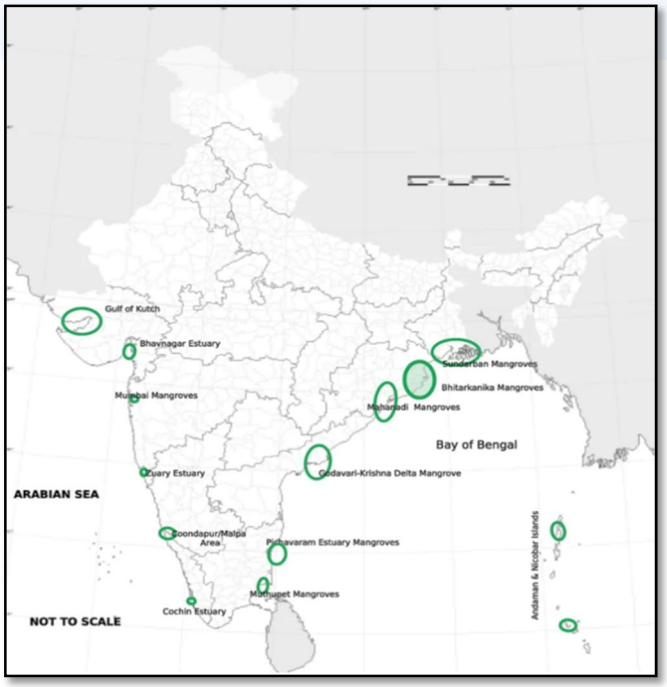
According to the India State of Forest Report 2023:

- India has 4,992 sq. km of mangrove cover;
- mangroves account for around 0.15% of India's geographical area;
- mangrove cover increased from 4,628 sq. km in 2013 to 4,992 sq. km in 2023;
- West Bengal has the largest share, followed by Gujarat and the Andaman and Nicobar Islands.

Major Mangrove Regions

- **Sundarbans, West Bengal:** India's largest mangrove forest and habitat of the Royal Bengal Tiger.
- **Bhitarkanika, Odisha:** A Ramsar site known for its estuarine crocodiles.
- **Mahanadi, Godavari and Krishna deltas:** Important for fisheries and coastal security.
- **Pichavaram, Tamil Nadu:** A major mangrove complex with significant tourism and blue-carbon value.
- **Gulf of Kutch, Gujarat:** A distinctive mangrove ecosystem in an arid region.

- **Andaman and Nicobar Islands:** Important habitats supporting diverse marine and terrestrial species.



Threats to Mangroves

The IUCN's 2024 global assessment warned that **50% of the world's mangrove ecosystems are at risk of collapse**.

Natural and Climate-related Threats

- cyclones and storm surges;
- sea-level rise;
- coastal erosion;
- altered tidal flows;
- changing salinity;
- increasing temperature; and
- extreme weather events.

Mangroves can protect coastlines from cyclones, but repeated severe events may also damage their vegetation and sediment structure.

Human-induced Threats

- conversion for shrimp farming and agriculture;
- rapid coastal urbanisation;
- construction of ports and tourism infrastructure;
- industrial effluents and untreated sewage;
- plastic pollution and oil spills;
- illegal logging for fuel and timber; and
- hydrological disruption caused by embankments and land reclamation.

Habitat fragmentation can weaken natural regeneration and reduce the movement of fish and other species.

Mangrove Conservation Initiatives

MISHTI

- The **Mangrove Initiative for Shoreline Habitats and Tangible Incomes (MISHTI)** was launched in 2023 to promote mangrove plantation and restoration along coastlines and saltpan lands. It received an initial outlay of ₹100 crore.
- The programme connects ecological restoration with livelihood creation and coastal resilience.

Coastal Regulation Zone Rules

- CRZ regulations restrict activities such as industrial construction, dumping and land reclamation in ecologically sensitive coastal areas, including mangrove habitats.

Sustainable Aquaculture in Mangrove Ecosystems

- Sustainable integrated mangrove-aquaculture models seek to reconcile livelihood requirements with ecosystem protection instead of replacing mangroves with intensive aquaculture farms.

Other Measures

- National Mangrove Committee;
- Conservation and Management of

Mangroves and Coral Reefs programme;

- Magical Mangroves public-awareness campaign;
- Ramsar Convention on Wetlands;
- UNESCO's Man and the Biosphere Programme;
- IUCN restoration programmes; and
- international Blue Carbon Initiative.

Challenges

- Conversion of mangroves for aquaculture and agriculture
- Coastal urbanisation, ports and tourism infrastructure
- Industrial effluents, sewage, plastics and oil spills
- Illegal logging for fuel, timber and charcoal
- Cyclones, coastal erosion and rising sea levels
- Changes in tidal flow, salinity and sediment supply
- Weak valuation of non-market ecosystem services
- Fragmented monitoring and limited community participation
- Poorly planned restoration using unsuitable species
- Inadequate inclusion of soil carbon in climate policies

Way Forward

- Integrate mangrove valuation into coastal planning and environmental impact assessments.
- Include mangrove assets in **Natural Capital Accounting and Green GDP**.
- Expand **MISHTI** through scientifically planned, native-species restoration.
- Strengthen enforcement of **Coastal Regulation Zone rules**.
- Protect natural tidal flows, sediments and below-ground carbon reserves.
- Develop **blue-carbon finance, carbon credits and Payment for Ecosystem Services**.
- Promote community-managed fisheries, sustainable aquaculture and ecotourism.
- Ensure fair benefit-sharing with mangrove-dependent communities.
- Control industrial discharge, untreated sewage and plastic pollution.
- Use satellites, GIS, drones and artificial intelligence for regular monitoring.
- Encourage individuals and institutions to adopt and maintain mangrove patches.
- Strengthen long-term research on biodiversity, carbon storage and climate resilience.

Conclusion

The valuation of Pichavaram demonstrates that conserving mangroves is an economic and developmental investment, not merely an environmental obligation. Their benefits extend from fisheries and tourism to carbon storage, biodiversity conservation and disaster-risk reduction.India must integrate mangrove values into coastal planning, Green GDP, climate finance and natural-capital accounting. Scientific restoration, strict regulation and community participation can ensure that mangroves continue to protect both coastal ecology and human well-being.

Panchayat-Level Climate Action: Localising India's Climate Governance

Source: The Indian Express

Relevance: **UPSC GS Paper III: Climate change, disaster management, agriculture, water resources, sustainable development**

Important Key Words

Prelims

- Gram Panchayat | Gram Sabha | 73rd Constitutional Amendment | Article 243G | Eleventh Schedule | PESA Act 1996 | GPDP | NAPCC | SAPCC | PMKSY | MGNREGA | National Mission for Sustainable Agriculture | Climate Smart Gram Panchayat Action Plan | Bela Gram Panchayat | Net-zero Panchayat

Mains

- Climate Governance | Decentralised Planning | Local Climate Resilience | Community Participation | Natural Resource Management | Climate Adaptation | Climate Mitigation | Cooperative Federalism | Grassroots Democracy | Sustainable Rural Development

Why in News?

Climate change is increasingly affecting everyday life in rural India through agriculture, water availability, natural resources and rural livelihoods.This has brought attention to the need for **panchayat-level climate planning**, because climate risks differ across regions, villages and communities.Recent initiatives in States such as **Uttar Pradesh** and **Karnataka** have also highlighted the importance of involving Gram Panchayats in climate action.

Why Climate Planning Needs Localisation

- Climate change is not experienced uniformly across India. Its effects differ between urban and rural areas, and even from one village to another.
- In cities, climate risks are shaped by urbanisation, land-use change, infrastructure pressure and population density. In rural areas, climate risks are closely linked with agriculture, water availability, forests, common lands and natural-resource dependence.
- A drought-prone village may need groundwater recharge, water conservation and crop diversification. A flood-prone village may need drainage improvement, restoration of water bodies and protection of vulnerable infrastructure.
- Therefore, uniform national or State-level climate responses may not fully address the specific vulnerabilities of different local ecosystems. This makes decentralised and community-based climate planning important.

What is a Panchayat-Level Climate Action Plan?

- A **panchayat-level climate action plan** is a local framework through which a Gram Panchayat identifies climate risks in its area and integrates suitable responses into development planning.
- It does not treat climate action as a separate environmental activity. Instead, it links climate concerns with local development priorities such as agriculture, water, health, sanitation, livelihoods and natural-resource management.

Panchayat-level climate actions may include adaptation and mitigation measures.

Type	Examples
Adaptation Measures	Crop diversification, climate-resilient agriculture, soil conservation, rainwater harvesting, groundwater recharge, restoration of local water bodies
Mitigation Measures	Afforestation, renewable energy, energy efficiency, improved waste management, reduction of fossil fuel dependence

The plan can be integrated into the existing **Gram Panchayat Development Plan (GPDP)**. This avoids creating a new bureaucracy and allows panchayats to use existing schemes and funds.

What are the Constitutional Foundations of Panchayat Climate Governance?

- The **73rd Constitutional Amendment** gave constitutional status to panchayats and inserted **Part IX** into the Constitution.
- **Article 243G** empowers State legislatures to devolve powers and responsibilities to panchayats for preparing plans for economic development and social justice.
- The **Eleventh Schedule** is especially relevant to climate action because it includes subjects linked with rural resilience and natural resources.

Important subjects include:

- Agriculture
- Land improvement & soil conservation
- Minor irrigation
- Water management
- Watershed development
- Social and farm forestry
- Minor forest produce
- Drinking water
- Fuel and fodder
- Rural electrification
- Non-conventional energy
- Health and sanitation
- Maintenance of community assets

These subjects overlap with climate adaptation and mitigation. Hence, panchayat-level climate planning does not require an entirely new institutional mandate. It can build upon the existing constitutional role of local self-government.

How does PESA Strengthen Local Climate Governance?

In Scheduled Areas, the **Panchayats (Extension to Scheduled Areas) Act, 1996** provides an additional basis for local climate governance.

- PESA requires that panchayat laws in Scheduled Areas respect customary law, traditional practices and community management of resources.
- It gives the **Gram Sabha** an important role in protecting community resources and approving local development plans.
- This is important for climate action because many tribal and forest-dependent communities rely directly on land, forests, water bodies and minor forest produce. Their participation is essential for natural-resource management and climate resilience.
- Thus, PESA helps view panchayats not merely as implementing agencies, but as institutions of community-led resource governance.

How can Panchayats Complement National and State Climate Policies?

- India's climate policy has largely followed a top-down framework.

- The **National Action Plan on Climate Change (NAPCC)** was launched in **2008**. It included eight national missions covering solar energy, energy efficiency, sustainable habitat, water, sustainable agriculture, forests, Himalayan ecosystem and strategic knowledge for climate change.
- The **State Action Plans on Climate Change (SAPCCs)** were meant to translate national priorities into State-specific strategies.
- However, many climate-related actions are actually implemented at the local level. Water conservation, watershed development, irrigation, sustainable agriculture and natural-resource management often depend on rural institutions and local communities.
- Panchayats can complement national and State climate policies by making local development planning climate-responsive. They can use existing schemes such as **MGNREGA**, **PMKSY** and the **National Mission for Sustainable Agriculture** to implement climate-related activities.
- The idea is not to create a parallel climate bureaucracy, but to weave climate action into normal panchayat planning.

What is the Example of Bela Gram Panchayat?

- **Bela Gram Panchayat** in Maharashtra is an important example of panchayat-level climate action.
- It undertook several measures such as planting more than **90,000 trees**, installing solar panels in houses and panchayat offices, and introducing waste segregation.
- These measures helped Bela become India's first **net-zero panchayat**.
- This example shows that local governments can play a meaningful role in climate mitigation and adaptation when community participation and planning are strong

What are the Benefits of Panchayat-Level Climate Action?

- **Context-specific Planning:** Climate risks differ across villages, so local planning can identify the exact needs of each community.
  - A drought-prone area can prioritise water conservation, while a flood-prone area can prioritise drainage and flood protection.
- **Better Community Participation:** Gram Sabha discussions can bring local knowledge into climate planning.
  - This improves ownership and makes climate action more practical.
- **Convergence with Existing Schemes:** Climate action can be integrated with **GPDP**, **MGNREGA**, **PMKSY** and other schemes.
  - This reduces the need for separate administrative structures.
- **Protection of Vulnerable Groups:** Climate impacts are often severe for farmers, landless labourers, women, tribal communities and natural-resource-dependent households.
  - Panchayats can identify such groups more accurately.
- **Strengthening Local Democracy:** Panchayat-level climate planning deepens decentralisation.
  - It converts climate action from a top-down policy issue into a community-level governance process.

Challenges

- **Institutional Capacity Gap:** Many Gram Panchayats lack technical capacity to assess climate risks, interpret climate data and design adaptation measures.

- They need regular support from district administrations, line departments, universities and specialised institutions.

- **Lack of Localised Climate Data:** Effective planning requires data on rainfall, temperature, groundwater, cropping patterns, natural resources and vulnerable households.
  - Panchayats need simple and accessible data that can be combined with local knowledge.
- **Finance Constraints:** Climate action should not depend only on new funds, but existing funds are often fragmented across schemes.
  - Better convergence of GPDP resources, panchayat funds, Central schemes, State schemes and CSR can support implementation.
- **Weak Community Participation:** Climate plans may become administrative documents if Gram Sabha participation is weak.
  - Plans must emerge through local discussions and community priorities.
- **Accountability Deficit:** Without clear targets and indicators, it is difficult to know whether climate actions are reducing vulnerability.
  - Periodic review and social audit can improve accountability.
- **Implementation Gap:** Panchayats may prepare plans but fail to implement them due to lack of functionaries, funds or technical guidance.
  - This requires strengthening the "3Fs": funds, functions and functionaries.

Way Forward

- **Integrate Climate Action into GPDP:** Panchayat-level climate planning should be included within the existing **Gram Panchayat Development Plan**.
  - This avoids parallel structures and makes climate action part of routine local development.
- **Strengthen Local Capacity:** Panchayat members and officials should be trained in climate risk assessment, vulnerability mapping and adaptation planning.
  - DIETs, Krishi Vigyan Kendras, universities and district-level institutions can support capacity building.
- **Improve Local Data Systems:** Panchayats should receive user-friendly data on rainfall, groundwater, agriculture, natural resources and vulnerable groups.
  - Local observations and community knowledge should also be formally included.
- **Ensure Scheme Convergence:** Climate-related activities can be funded through convergence of **MGNREGA**, **PMKSY**, agriculture schemes, water schemes and panchayat funds.
  - CSR and private finance may supplement public funds where appropriate.
- **Empower Gram Sabhas:** Gram Sabha discussions should guide climate priorities.
  - This will make plans democratic, locally relevant and accountable.
- **Create Monitoring Indicators:** Each panchayat climate plan should have clear targets and indicators.
  - Periodic reviews can help assess whether vulnerability is actually reducing.

Conclusion

Climate change is no longer only an environmental issue; it is also a governance challenge. Since rural community's experience climate impacts through agriculture, water and natural resources, panchayats must become active institutions of local climate governance. Panchayat-level climate planning can complement national and State climate policies by making them locally relevant, participatory and accountable. Strengthening panchayats with funds, functions, functionaries, data and technical capacity is essential for building climate-resilient rural India.

Incentive Scheme for Promotion of Domestic PNG Connections

Source: Press Information Bureau

Relevance: UPSC GS Paper III: Energy security, infrastructure and environmental sustainability

Important Key Words

Prelims

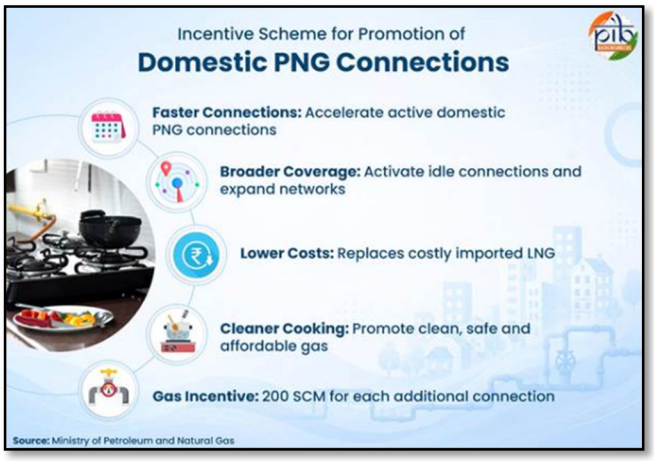
- **Piped Natural Gas**, **City Gas Distribution**, **Petroleum and Natural Gas Regulatory Board**, Geographical Area, **Administered Price Mechanism gas**, Standard Cubic Metre, Liquefied Natural Gas, Compressed Natural Gas, Right of Way, National PNG Drive 2.0, domestic PNG connection and unified registration portal

Mains

- Clean cooking energy, household energy transition, energy security, last-mile connectivity, urban gas infrastructure, regulatory reforms, consumer welfare, public health, ease of living and sustainable urbanisation

Why in News?

- The **Incentive Scheme for Promotion of Domestic PNG Connections** was launched on **August 18, 2026**. The scheme came into effect on **September 1, 2026** and will operate in two tranches spread over six months. It provides additional domestically produced **APM gas** to City Gas Distribution entities that add active, billed household PNG connections beyond prescribed targets. The scheme seeks to improve access to clean, safe and affordable piped cooking gas.



What is Piped Natural Gas?

- **Piped Natural Gas** is natural gas supplied directly to households through a network of underground pipelines. It is mainly used as a cooking fuel.
- Unlike Liquefied Petroleum Gas, PNG does not require households to book, store or replace cylinders. Consumption is measured through a meter, and consumers pay according to the quantity used.

PNG forms part of a wider **City Gas Distribution network**, which supplies natural gas to:

- Households
- Commercial establishments
- Industrial units
- Transport vehicles through CNG stations

What is a City Gas Distribution Network?

- A **City Gas Distribution network** consists of pipelines and associated facilities developed to supply natural gas within an authorised area.
- CGD networks are developed by entities authorised by the **Petroleum and Natural Gas Regulatory Board**.
- A **Geographical Area** is a specific region assigned by PNGRB to an authorised entity for developing and operating the CGD network.

Status of Domestic PNG Connections in India

- PNGRB has authorised CGD entities in **309 Geographical Areas**. Together, these areas cover the entire mainland of India.As of **August 18, 2026**, India had approximately **1.74 crore domestic PNG connections**.
- Although geographical authorisation has expanded, creating an authorised CGD area does not automatically mean that every household is connected. Pipeline construction, last-mile connections, consumer registration and conversion of inactive connections into billed connections remain important tasks.

About the Incentive Scheme

The **Incentive Scheme for Promotion of Domestic PNG Connections** aims to accelerate the addition of active household PNG connections.

Its major objectives are to:

- Convert unbilled connections into active, billed connections.
- Encourage CGD companies to connect households more rapidly.
- Extend pipeline networks to new localities.
- Improve access to clean and convenient cooking fuel.
- Reduce the time required by companies to recover the cost of household connections.

The scheme will be implemented in **two tranches over six months**.

How Does the Incentive Mechanism Work?

- A minimum number of connections has been prescribed for every Geographical Area.
- During the performance period, an eligible CGD entity must add billed domestic PNG connections beyond this minimum threshold.
- For every eligible incremental connection, the entity will receive an additional allocation of **200 Standard Cubic Metres of gas**.

What is an Incremental Connection?

- An incremental connection is an additional active and billed domestic PNG connection created beyond the minimum target fixed for a Geographical Area.
- Thus, the scheme rewards actual gas usage rather than the mere installation of an unused pipeline or meter.

What is a Standard Cubic Metre?

- A **Standard Cubic Metre** is a standard unit used for measuring the volume of gas under specified temperature and pressure conditions.

Why is APM Gas Provided as an Incentive?

- The additional allocation will consist of domestically produced gas supplied under the **Administered Price Mechanism**.
- APM gas is generally priced lower than imported **Liquefied Natural Gas**. The additional APM gas will replace costlier LNG presently purchased by CGD entities for their **Compressed Natural Gas transport segment**.

This mechanism will:

- Reduce the overall gas-purchasing cost of CGD companies.
- Improve the commercial viability of domestic PNG connections.
- Encourage faster expansion into new residential areas.
- Allow companies to recover their capital expenditure more quickly.

The payback period for the capital spent on a household connection is expected to decline from approximately **ten years to nearly three years**.

Therefore, the scheme aligns the commercial interests of CGD companies with the national objective of expanding clean household energy.

Benefits of PNG for Households

Safe and Secure Supply

- PNG is supplied through underground pipelines at low pressure. Households do not need to store or handle gas cylinders.
- Natural gas is lighter than air and generally rises and disperses when released. However, regular inspection, leak detection and adherence to safety standards remain essential.

Everyday Convenience

PNG provides a continuous household supply. Consumers need not book cylinders, wait for delivery or replace empty cylinders.

This is particularly useful for:

- High-rise residential buildings
- Densely populated urban colonies
- Large housing complexes
- Households with regular cooking requirements

Metered Billing

- Consumers pay for the gas they actually use. Billing is based on meter readings, similar to electricity and water services.

Lower Household Expenditure

- On a comparable energy basis, PNG generally costs less than LPG. Regular users may therefore experience a reduction in monthly cooking-fuel expenditure.

Cleaner Cooking Fuel

PNG burns more cleanly than many conventional cooking fuels and produces fewer local air pollutants. It can:

- Improve indoor air quality
- Reduce smoke and soot
- Support cleaner urban energy use
- Lower carbon emissions compared with more polluting fuels

However, natural gas remains a fossil fuel. Therefore, leak prevention and methane-emission control are important for achieving its environmental benefits.

Assured Availability

- Pipeline supply reduces dependence on cylinder transportation and delivery logistics. It provides a more continuous and predictable cooking-fuel supply.

Initiatives Supporting PNG Expansion

Accelerated Approval Framework

An **Accelerated Approval Framework** has been introduced under the **Natural Gas and Petroleum Products Distribution (Through Laying, Building, Operation and Expansion of Pipelines and Other Facilities) Order, 2026**.

It seeks to:

- Process pipeline-related applications on priority.
- Ensure approvals within defined timelines.
- Reduce delays in CGD infrastructure development.
- Improve coordination among implementing authorities.

Uniform Right-of-Way Charges

- The 2026 Order provides for uniform charges for pipeline **Right of Way**.
- Right of Way refers to official permission to use land, roads or public spaces for laying, operating and maintaining pipelines.
- Uniform charges can reduce differences between jurisdictions and improve the predictability of project costs.

Reduction of VAT on Natural Gas

- States have been encouraged to reduce **Value Added Tax on natural gas to 5%**.
- Several States have already lowered VAT. Tax rationalisation can reduce the cost of piped gas and improve its affordability for consumers.

National PNG Drive 2.0

- The **National PNG Drive 2.0** was conducted from **January 1 to June 30, 2026**.
- It aimed to accelerate domestic PNG connections across authorised Geographical Areas and increase public awareness about piped cooking gas.

Unified PNG Registration Portal

A unified digital platform is being developed to provide a single-window system for domestic PNG applications.

The proposed portal will allow consumers to:

- Apply for a new connection.
- Track the status of an application.
- Access information about service availability.
- Reduce the need to approach multiple offices.

Significance of the Scheme

Expansion of Clean Cooking Energy

- The scheme can extend cleaner cooking fuel to more urban and semi-urban households, improving health, convenience and quality of life.

Improved Commercial Viability

- Cheaper APM gas reduces the sourcing cost of CGD companies. This makes the expansion of household connections financially more attractive.

Activation of Existing Connections

- By rewarding billed connections, the scheme encourages companies to convert installed but unused connections into active household services.

Development of Urban Infrastructure

- Expansion of CGD networks strengthens the energy infrastructure of cities and growing towns.

Reduced Cylinder-Delivery Dependence

- Piped supply can reduce the need for LPG cylinder transportation, storage and delivery in densely populated areas.

Energy Security

- Greater use of domestically produced APM gas can reduce dependence on costlier imported LNG. However, long-term energy security will also depend on domestic gas availability and responsible demand management.

Ease of Living

Continuous supply, metered billing and digital registration can make household cooking-energy services more accessible and convenient.

Major Challenges

High Initial Investment: Laying underground pipelines and providing last-mile household connections require substantial capital expenditure.

- **Right-of-Way Delays:** Pipeline construction often requires permission from urban local bodies, road authorities and other agencies.
- **Inactive Connections:** Some households may obtain a connection but continue using LPG due to familiarity, rental arrangements

or uncertainty about consumption charges.

- **Uneven Network Development:** Authorisation of an area does not guarantee immediate pipeline access to every locality.
- **Urban Construction Difficulties:** Congested roads, underground utility lines and densely built settlements complicate pipeline installation.
- **Tax Differences:** Natural gas remains outside the Goods and Services Tax framework, and varying State VAT rates can affect consumer prices.
- **Supply and Price Risks:** Limited domestic gas availability may increase dependence on imported LNG, which is exposed to international price fluctuations.
- **Safety and Maintenance:** Pipeline integrity, accurate metering, emergency response and regular leak detection are necessary for consumer confidence.
- **Regional Inclusion:** Remote settlements and low-density areas may be less commercially attractive to CGD companies.

Way Forward

Ensure Last-Mile Connectivity

- CGD companies should prioritise actual household connections and gas usage rather than limiting expansion to trunk pipelines.

Strengthen Centre–State Coordination

- The Union Government, State governments and urban local bodies should coordinate to provide timely permissions and standardised Right-of-Way procedures.

Improve Consumer Awareness

- Households should receive clear information about installation charges, billing, safety practices and the comparative cost of PNG.

Expand Digital Services

- The unified registration portal should provide application tracking, billing support and grievance redressal in multiple Indian languages.

Maintain Safety Standards

- Regular pipeline inspections, smart meters, leak-detection systems and emergency-response mechanisms should be made integral to network expansion.

Rationalise Taxes

- Greater coordination among States on VAT rates can reduce regional price differences and improve consumer affordability.

Protect Vulnerable Consumers

- Connection costs and security deposits should not prevent low-income households from accessing piped cooking gas. Suitable payment facilities may be considered.

Improve Environmental Performance

- Methane leakage must be monitored across production, transportation and distribution networks. Expansion of natural gas should complement, rather than delay, the long-term transition towards renewable energy.

Conclusion

The Incentive Scheme for Promotion of Domestic PNG Connections shifts attention from network creation to active household usage. By providing lower-priced APM gas for incremental billed connections, it gives CGD entities a commercial reason to expand faster. Its success will depend on reliable gas availability, affordable tariffs, timely approvals and strict safety standards. Proper implementation can support cleaner cooking energy, urban infrastructure, energy security and improved ease of living.

S & T, Internal Security

Cyber-Physical Systems: Foundation for India's Technology-Driven Future

Source: PIB

Relevance: **GS Paper III – Science and Technology | Artificial Intelligence | Cybersecurity | Indigenisation of Technology**

Important Keywords

For Prelims:

- Cyber-Physical Systems | NM-ICPS | Technology Innovation Hubs | TTRPs | CHANAKYA Fellowship | BharatGen | Digital Twin

For Mains:

- Technology Sovereignty | Translational Research | Industry–Academia Collaboration | Critical Infrastructure | Indigenous Innovation | Viksit Bharat

Why in News?

India is expanding its indigenous Cyber-Physical Systems ecosystem through the **National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS)**. Its Technology Innovation Hubs and Technology Translation Research Parks are converting research into practical applications across healthcare, agriculture, mining, communications, cybersecurity and mobility.

What are Cyber-Physical Systems?

A **Cyber-Physical System (CPS)** integrates computing and communication technologies with physical machines and processes.

It enables a machine or system to:

- sense its surroundings;
- collect real-time data;
- analyse the information;
- take decisions; and
- respond automatically to changing conditions.

Thus, CPS connects the **digital world** with the **physical world**.

Examples

- Driverless vehicles navigating roads
- Smart factories adjusting production automatically
- Medical devices monitoring patients continuously
- Smart buildings regulating lighting and temperature
- Cleaning robots and fitness trackers

Core Components of CPS

Component	Function
Sensors	Collect data from the physical environment
Computing system	Processes and analyses the data
Communication network	Transfers data between connected devices
Software and AI	Supports decision-making
Actuators	Carry out the required physical response

CPS differs from ordinary automation because it continuously observes, analyses and responds to real-world conditions.

National Mission on Interdisciplinary Cyber-Physical Systems

The **Department of Science and Technology (DST)** implements NM-ICPS.

Key Facts

- **Approved:** 2018
- **Duration:** Nine years
- **Financial outlay:** ₹3,660 crore
- **Technology Innovation Hubs:** 25
- **Implementing department:** Department of Science and Technology

The Mission connects academia, industry, government and international organisations. It covers the entire innovation process—from research and development to product creation, commercialisation and start-up incubation.

Major Objectives

- Build indigenous CPS capabilities.
- Develop technologies of national importance.
- Create specialised human resources.
- Establish interdisciplinary Centres of Excellence.
- Translate research into commercially useful products.
- Promote entrepreneurship and start-ups.
- Address critical national challenges through technology.

Technology Innovation Hubs

NM-ICPS has established **25 Technology Innovation Hubs (TIHs)** at leading academic institutions. These hubs operate as **Section 8 companies**.

Their work covers four major areas:

- technology development;
- human-resource and skill development;
- entrepreneurship and start-up incubation; and
- international collaboration.

The hubs also work with government ministries to identify national problems and develop practical technological solutions.

Technology Translation Research Parks

In 2025, four high-performing TIHs were upgraded and supported as **Technology Translation Research Parks (TTRPs)**.

- Their purpose is to accelerate the validation, deployment and commercialisation of promising technologies.

Institution	Specialised domain
IIT Kanpur	Cybersecurity
IISc Bengaluru	Robotics and AI systems
IIT (ISM) Dhanbad	Mining technologies
IIT Indore	Digital healthcare

Achievements of NM-ICPS

As of August 2026, the Mission had:

- enabled **1,146 technologies**;
- contributed to **1,329 technology products**;
- awarded **5,824 CHANAKYA fellowships**;
- trained more than **2.46 lakh professionals**;
- incubated **1,136 start-ups and spin-offs**;
- contributed to over **24,000 jobs**; and
- established **200 international collaborations**.

Its technologies cover agriculture, healthcare, mining, cybersecurity, communication and positioning.



CHANAKYA Fellowship Programme

CHANAKYA stands for **Comprehensive and Holistic Advancement of National Knowledge Yield and Analytics**.

The programme supports:

- undergraduate students;
- postgraduate students;
- doctoral researchers; and
- postdoctoral researchers.

It funds research projects addressing real-world CPS challenges through specialised Technology Innovation Hubs.

BharatGen: Indigenous AI for CPS

- **BharatGen**, supported under NM-ICPS, is developing sovereign artificial-intelligence capabilities suited to Indian languages and contexts.
- It is led by **IIT Bombay** through a consortium of academic institutions and covers text, speech and vision-language technologies.

Major Models

Model	Purpose
Param-2	Foundation model with 17 billion parameters; supports all 22 Scheduled Indian languages
Shrutam	Speech-to-text model supporting 12 Indian languages
Sooktam	Text-to-speech model supporting 12 Indian languages
Patram	Multilingual access to complex Indian documents under the DocBodh framework
Ayur Param	AI model for Ayurveda
Agri Param	AI model for agriculture
Legal Param	AI model for the Indian legal domain

BharatGen can improve human-machine interaction and enable locally relevant decision-making in healthcare, agriculture and governance.

Major Applications of CPS

Healthcare

- The Drishti CPS Foundation at IIT Indore has developed **CharakDT**, a digital twin of the human body. It simulates organs such as the lungs, eyes and heart to study disease progression and test treatments virtually.
- A **digital twin** is a virtual copy of a physical object, process or system. It uses real-time sensor data to represent and analyse how the physical system behaves.

Agriculture

IIT Bombay has developed an **Agri-IoT Farm Management System** that monitors:

- soil conditions;
- weather; and
- farm-level microclimate.

It supports the efficient use of water and fertilisers while improving agricultural productivity.

Mining

- The **TEXMiN hub** at IIT (ISM) Dhanbad has developed drones capable of transmitting data up to **50 kilometres**. They allow real-time monitoring while reducing workers' exposure to hazardous mining locations.

Advanced Communication

- IIIT Bengaluru has developed an indigenous **5G-Advanced ORAN Massive MIMO Radio Unit (32TR RU)**.
- It can support reliable, high-speed and cost-effective 5G connectivity, particularly in underserved and remote regions.

Cybersecurity

- The IHUB NTIHAC Foundation at IIT Kanpur is developing technologies to secure CPS and critical infrastructure.

Its major initiatives include:

- an **IT-OT Security Operations Centre** for continuous monitoring; and
- crypto-forensic tools to assist law-enforcement agencies in investigating cryptocurrency-related crimes.

Mobility and Autonomous Systems

- The TiHAN Foundation at IIT Hyderabad has established **India's first dedicated proving ground for autonomous navigation**. It tests aerial and ground-based autonomous vehicles before deployment.
- The IISc Bengaluru-based robotics hub has developed the **iRASTE application**, which identifies accident-prone locations and provides real-time alerts to drivers. It is being piloted in Nagpur.

Significance for India

- **Technological self-reliance:** Reduces dependence on imported critical technologies.
- **Research commercialisation:** Connects laboratories with industry and markets.
- **Improved public services:** Supports smarter healthcare, agriculture, transport and infrastructure.
- **Industrial modernisation:** Enables intelligent factories, mining and communication systems.
- **Start-up growth:** Converts research ideas into products and enterprises.
- **Skilled employment:** Creates specialised capabilities in AI, robotics and cybersecurity.
- **National security:** Strengthens protection of connected critical infrastructure.
- **Linguistic inclusion:** BharatGen makes intelligent systems accessible in Indian languages.

Challenges

- High research, testing and deployment costs
- Shortage of specialised interdisciplinary skills
- Cyberattacks against connected critical infrastructure
- Privacy risks arising from continuous data collection
- Lack of common technical and safety standards
- Limited transfer of research from laboratories to markets
- Dependence on imported sensors, chips and advanced components
- Digital connectivity gaps in remote areas

- Difficulty in assigning liability when autonomous systems fail

Way Forward

- Develop common standards for safety, interoperability and accountability.
- Adopt security-by-design for all critical CPS infrastructure.
- Strengthen domestic production of sensors, chips and communication equipment.
- Expand testing facilities and regulatory sandboxes.
- Improve coordination among research institutions, industry and government.
- Support start-ups through patient capital and public procurement.
- Develop interdisciplinary courses combining engineering, AI and cybersecurity.
- Establish strong data-protection and ethical-governance mechanisms.
- Expand CPS applications in agriculture, healthcare and disaster management.
- Promote multilingual and locally relevant solutions through BharatGen.

Conclusion

Cyber-Physical Systems are transforming machines into intelligent and responsive networks. Through NM-ICPS, TIHs, TTRPs and BharatGen, India is building an indigenous ecosystem that connects research, talent, enterprise and public needs. Secure and inclusive deployment of CPS can support a technology-driven and self-reliant **Viksit Bharat**.

Nancy Grace Roman Space Telescope: Mapping the Invisible Universe

Source: The Indian Express

Relevance: GS Paper III—Science and Technology, Space Technology and Awareness in Space

Important Keywords

For Prelims:

- Nancy Grace Roman | Lagrange Point 2 | Wide Field Instrument | Coronagraph | Infrared Telescope | Exoplanet | Gravitational Lensing

For Mains:

- Dark Matter | Dark Energy | Cosmic Expansion | Three-dimensional Cosmic Map | Space-based Astronomy | Big-data Astronomy | International Scientific Cooperation

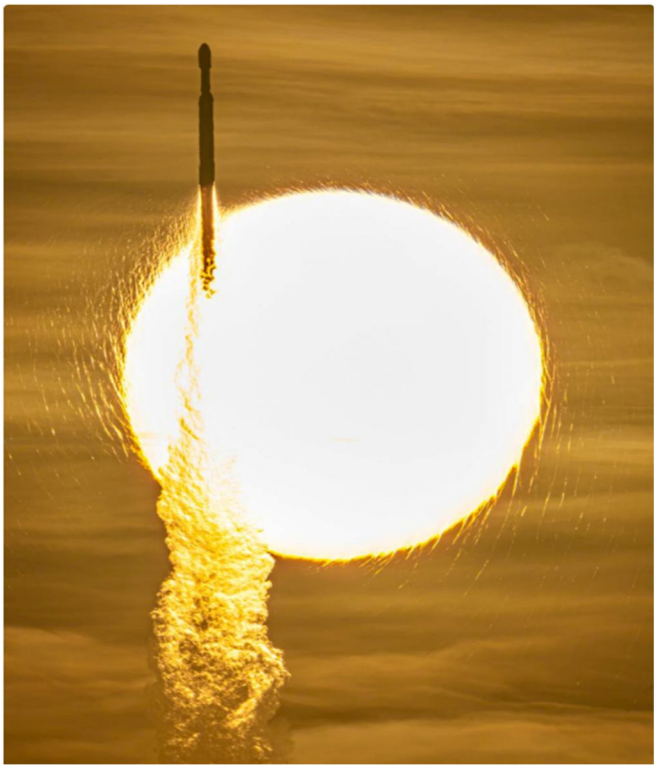
Why in News?

NASA launched the **Nancy Grace Roman Space Telescope** aboard a SpaceX rocket on **August 30, 2026**.The next-generation infrared telescope will survey vast regions of space to study some of the universe's greatest mysteries, including **dark matter, dark energy and exoplanets**.It is named after **Nancy Grace Roman**, NASA's first Chief Astronomer, who is popularly known as the **"Mother of Hubble."**

About the Roman Space Telescope

- The Roman Space Telescope is a wide-field space observatory designed to study the structure, composition and evolution of the universe.
- Its scientific capabilities lie between those of

the **Hubble Space Telescope** and the **James Webb Space Telescope (JWST)**. While Hubble and JWST can examine selected objects in great detail, Roman is designed to survey much larger areas of the sky rapidly.



Key Facts

- **Space agency:** National Aeronautics and Space Administration
- **Launch date:** August 30, 2026
- **Launch vehicle:** SpaceX rocket
- **Type:** Infrared space telescope
- **Operational location:** Sun–Earth Lagrange Point 2
- **Mass:** Approximately 8,000 kg
- **Size:** Comparable to a tour bus
- **Mission duration:** Five years
- **Daily data transmission:** Around 1.4 terabytes
- **Expected total data:** Up to 20 petabytes
- **Major instruments:** Wide Field Instrument and Coronagraph

Scientific Objectives

The telescope will seek to:

- study the distribution of dark matter;
- investigate the role of dark energy in cosmic expansion;
- discover and examine exoplanets;
- map galaxies and galaxy clusters;
- observe gravitational lensing;
- study the formation and evolution of cosmic structures; and
- image faint objects located close to bright stars.

What Is Dark Matter?

- Dark matter is an invisible form of matter that neither emits nor reflects detectable electromagnetic radiation.

Scientists infer its existence through its gravitational effects on:

- stars;
- galaxies;
- galaxy clusters; and
- the path of light moving through space.

- Ordinary matter—such as stars, planets, gases and living organisms—is estimated to constitute only around **5% of the universe**. Dark matter is believed to account for approximately **27%**.
- Dark matter is often described as an invisible cosmic "glue" because its gravity helps hold galaxies together.

How Will Roman Study Dark Matter?

The telescope will observe the distribution of galaxies and measure how their light is distorted by gravity. These observations can help scientists:

- map the location of dark matter;
- understand its distribution across the

universe;
- examine its role in the formation of galaxies; and
- study its relationship with early star formation.

What Is Dark Energy?

- Dark energy is the term used for an unknown phenomenon believed to be causing the accelerated expansion of the universe.
- It is estimated to constitute approximately **68% of the universe**. Unlike gravity, which attracts matter, dark energy is understood as having a repulsive effect on the large-scale expansion of space.

How Will Roman Study Dark Energy?

The telescope will survey large numbers of galaxies across vast cosmic distances. By observing their distribution and changes over time, scientists can examine:

- the rate at which the universe expanded in different periods;
- how dark energy may have influenced that expansion;
- whether its effects have remained constant; and
- how galaxies and galaxy clusters evolved.

Its wide-field capability will enable scientists to collect observations on a scale difficult to achieve with earlier space telescopes.

Search for Exoplanets

- **Exoplanets** are planets located outside the Solar System. They generally orbit stars or stellar remnants.
- More than 6,000 exoplanets have already been identified. However, these represent only a small fraction of the planets that may exist in the Milky Way.
- The Roman telescope's ability to examine large areas of the sky may help discover many more exoplanets and improve understanding of:
  - planetary formation;
  - different types of planetary systems;
  - the frequency of planets in the galaxy;
  - planets orbiting at large distances from their stars; and
  - the possible conditions required for life.

Its observations could contribute to the broader scientific question of whether life exists elsewhere in the universe.

What Is Gravitational Lensing?

Gravitational lensing occurs when the gravity of a massive object, such as a galaxy or galaxy cluster, bends the path of light travelling from a more distant object.

The foreground object acts like a natural lens. It can:

- distort the image of the distant object;
- magnify otherwise faint objects;
- produce multiple images; and
- reveal the presence of invisible matter.

Roman will measure subtle distortions in the shapes of galaxies caused by gravitational lensing. These measurements will help scientists map dark matter and produce a three-dimensional picture of galaxies and galaxy clusters.

Where Will the Telescope Operate?

- The Roman Space Telescope will operate near the **Sun–Earth Lagrange Point 2 (L2)**, located approximately **1.2 million kilometres from Earth**, according to the provided report.
- A Lagrange point is a region where the

gravitational forces of two large celestial bodies and the orbital motion of a smaller object create relatively stable conditions.

Advantages of L2

- It provides a relatively stable observing environment.
- The Sun and Earth remain broadly in the same direction.
- It supports stable optical and thermal performance.
- The telescope gets a largely unobstructed view of the universe.
- It reduces the need for frequent major orbital adjustments.
- Protective equipment can shield the telescope from solar heat and light.

The James Webb Space Telescope also operates in the L2 region.

Major Scientific Instruments

Wide Field Instrument

The **Wide Field Instrument (WFI)** is a **300-megapixel infrared camera**. It can:

- capture an area of the sky about 1.5 times larger than the apparent size of the full Moon in a single observation;
- survey large regions of the universe;
- detect distant galaxies and stars;
- support dark-matter and dark-energy studies; and
- process images significantly faster than Hubble.

The telescope is expected to process images approximately **1,000 times faster than the Hubble Space Telescope**.

Its wide field of view will allow scientists to combine detailed observations with large-scale surveys.

Coronagraph

- A coronagraph blocks the intense light of a star so that astronomers can observe faint objects located nearby.
- The process is similar to using a protective shield to block bright sunlight and view objects around it more clearly.

Roman's advanced coronagraph will attempt to:

- suppress the glare of nearby stars;
- detect faint reflected light from orbiting planets;
- directly image selected exoplanets;
- study dusty disks surrounding stars; and
- test technologies required for future planet-imaging missions.

The instrument may help scientists observe older, colder and fainter objects that are otherwise hidden by bright starlight.

Roman, Hubble and James Webb Telescopes

Hubble Space Telescope

- Hubble has operated since 1990 and is known for detailed observations of selected astronomical objects. Its relatively narrow field of view makes it highly effective for deep, focused imaging.

James Webb Space Telescope

- JWST, launched in 2021, is designed mainly for highly sensitive infrared observations. It examines early galaxies, star formation, planetary atmospheres and distant cosmic objects in remarkable detail.

Roman Space Telescope

- Roman combines high-quality imaging with a much wider field of view. Its strength lies in rapidly surveying large parts of the sky and identifying patterns across enormous

populations of galaxies, stars and planets.

Thus:

- **Hubble** provides detailed views of smaller areas;
- **JWST** conducts deep and sensitive infrared observations; and
- **Roman** performs large-scale, wide-field cosmic surveys.

These telescopes are complementary rather than direct substitutes.

Data Collection and Transmission

Roman is expected to transmit approximately **1.4 terabytes of scientific data every day**.

Ground stations located in:

- New Mexico;
- Australia; and
- Japan

will receive the data.

The telescope may produce up to **20 petabytes of information** during its five-year mission.

This vast data volume will require:

- advanced storage systems;
- high-speed communication networks;
- powerful computing facilities;
- automated data processing;
- artificial intelligence-based analysis; and
- international scientific collaboration.

Significance of the Mission

Understanding the Universe

- Roman may improve knowledge of dark matter and dark energy, which together are believed to constitute most of the universe.

Large-scale Cosmic Mapping

- Its wide-field surveys can create a detailed three-dimensional map of galaxies and galaxy clusters.

Expansion of Exoplanet Science

- The mission can increase the number and diversity of known exoplanets and support the search for planetary systems resembling the Solar System.

Technological Demonstration

- The coronagraph will test advanced methods for directly imaging faint planets near bright stars.

Complementing Existing Telescopes

- Roman can identify scientifically important objects across wide regions. Hubble, JWST and ground-based observatories can then conduct detailed follow-up studies.

Growth of Data-driven Astronomy

Its extensive datasets will create opportunities for scientists worldwide to conduct new studies long after the observations are collected.

Challenges

- **Complex operations:** Managing a large telescope far from Earth requires precise navigation and monitoring.
- **Limited servicing options:** Repairing instruments near L2 is more difficult than servicing objects in low-Earth orbit.
- **Large data volume:** Processing and storing up to 20 petabytes will require advanced computing infrastructure.
- **Image interpretation:** Gravitational-lensing and dark-energy measurements demand extremely accurate data analysis.
- **Coronagraph performance:** Detecting a faint planet beside a bright star requires exceptional control of light and optical stability.
- **Communication dependence:** Continuous scientific output depends on reliable links with ground stations.

- **Mission lifespan:** The telescope must achieve its major objectives within its expected five-year operational period.
- **Scientific uncertainty:** The mission may map the effects of dark matter and dark energy without directly identifying their fundamental nature.

Way Forward

- Coordinate Roman observations with Hubble, JWST and ground-based telescopes.
- Develop open and accessible scientific data archives.
- Strengthen global cooperation in data processing and astronomical research.
- Apply artificial intelligence and machine learning to analyse large datasets.
- Conduct systematic follow-up observations of newly discovered exoplanets.
- Use the coronagraph's performance to improve future direct-imaging telescopes.
- Build greater computing and storage capacity for data-intensive astronomy.
- Support universities and young researchers in using mission data.
- Maintain long-term monitoring of galaxies, supernovae and gravitational-lensing events.
- Convert Roman's findings into more precise models of cosmic expansion and structure formation.

Conclusion

The Nancy Grace Roman Space Telescope represents a major advance in wide-field space astronomy. Its ability to observe vast regions rapidly will complement the detailed capabilities of Hubble and the James Webb Space Telescope.By mapping galaxies, measuring gravitational lensing and discovering exoplanets, Roman may deepen scientific understanding of both the visible and invisible universe. Although it may not immediately solve every mystery, it can provide the large and precise datasets required to investigate dark matter, dark energy and the evolution of the cosmos.

EOS-05: India's First Imaging Satellite from Geosynchronous Orbit

Source: The Indian Express

Relevance: **UPSC GS Paper III Space Technology, Earth Observation, Disaster Management and National Security**

Important Key Words

Prelims:

- EOS-05 | GSLV-F17 | SDSC-SHAR | Sub-GTO | LEO | VLEO | SSO | MEO | GSO | GEO | Cryogenic Upper Stage | Station-Keeping

Mains:

- Persistent Earth Observation | Disaster Early Warning | Agricultural Monitoring | Geospatial Intelligence | Maritime Domain Awareness | Space-Based Governance

Why in News?

- **ISRO** successfully launched **EOS-05** aboard **GSLV-F17** on **4 September 2026**.
- It is India's **first imaging satellite from geosynchronous orbit**.
- GSLV-F17 placed the satellite in the intended **Sub-Geosynchronous Transfer**

Orbit, from where it will reach its operational orbit using onboard propulsion.

About EOS-05

EOS-05 is a state-of-the-art **Earth-observation spacecraft** designed to provide persistent and high-frequency imaging of large geographical regions.

Feature	Details
Satellite type	Earth Observation
Payload mass	Approximately **2,367 kg**
Launch vehicle	GSLV-F17
Launch pad	Second Launch Pad
Launch centre	Satish Dhawan Space Centre-SHAR, Sriharikota
Initial orbit	Sub-Geosynchronous Transfer Orbit
Distinct feature	India's first imaging satellite from geosynchronous orbit

Official Sub-GTO Parameters

- **Nominal perigee:** 170 km
- **Nominal apogee:** 28,934 km
- **Inclination:** 19.28°
- **Launch azimuth:** 104°

These parameters were specified in ISRO's official mission brochure.

About GSLV-F17

GSLV-F17 was the **19th flight** of India's Geosynchronous Satellite Launch Vehicle.

Important Specifications

- **Height:** 51.7 metres
- **Lift-off mass:** 420.5 tonnes
- **Number of stages:** Three
- **Payload fairing:** Four-metre-diameter ogive composite version

Three Stages of GSLV-F17

- **First stage—GS1:** S139 solid core with four L40H liquid strap-ons
- **Second stage—GS2:** GL40HT liquid stage
- **Third stage—GS3:** CUS15 cryogenic upper stage

The cryogenic stage uses **liquid hydrogen and liquid oxygen**. Cryogenic propulsion provides the high velocity required to place heavy satellites into transfer orbits.



GSLV Mk II:

- It is an Indian three-stage launch vehicle with four liquid strap-ons.
- It is designed mainly to launch heavier satellites into transfer orbits.
- Its published capacity is approximately:
  - **2,250 kg to GTO**; and
  - **6,000 kg to LEO**.
- The first GSLV flight took place on **18 April 2001**.
- Its indigenously developed cryogenic stage was inducted from the **GSLV-D5 mission in January 2014**.



Because EOS-05 weighs about 2,367 kg, it was placed in a lower-energy **Sub-GTO**, instead of a standard GTO. This allowed the GSLV to carry the heavier spacecraft, which subsequently uses its own propulsion to reach the final orbit.

What is a Satellite Orbit?

An **orbit** is the curved path followed by a satellite around Earth under the influence of gravity.

The choice of orbit determines:

- geographical coverage;
- image resolution;
- revisit time;
- communication delay;
- fuel requirement; and
- mission application.

Low Earth Orbit

- Located approximately **160–2,000 km** above Earth.
- Satellites generally complete an orbit in **90–120 minutes**.
- Proximity to Earth allows high-resolution imaging and low communication delay.
- However, a satellite observes a particular location only briefly during each pass.
- The **International Space Station** is located in LEO.

As of September 4, 2026, approximately **15,562 active payload satellites** were reported in LEO. An April 2026 ISRO report placed India's operational LEO satellites at **22**.

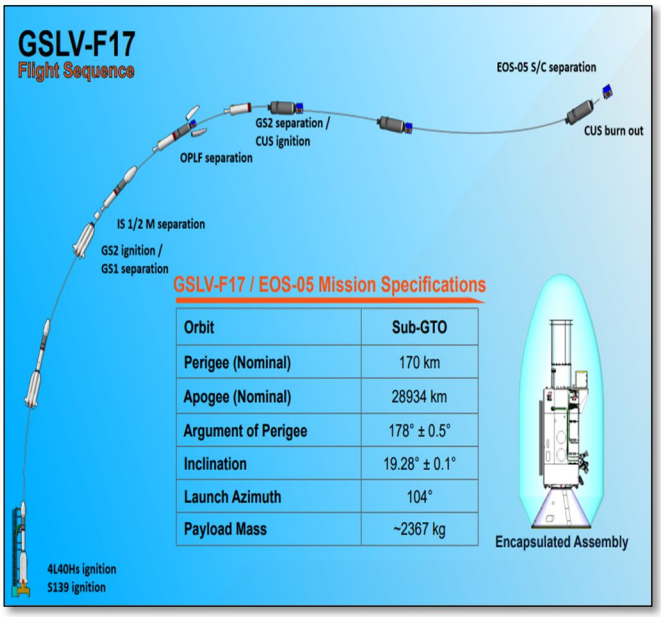
Very Low Earth Orbit

VLEO is the lower part of LEO.

- It permits sharper imaging because satellites are closer to Earth.
- Greater atmospheric drag increases fuel use and can reduce mission life.

Major Types of Satellite Orbits

Orbit	Approximate altitude	Major advantage	Major application
LEO	160–2,000 km	High resolution and low latency	Earth observation and communication
MEO	2,000–35,786 km	Wider coverage with moderate latency	Navigation
GSO/GEO	Around 35,786 km	Persistent regional coverage	Communication, weather and imaging



Sun-Synchronous Orbit

A **Sun-Synchronous Orbit** is usually a near-polar LEO in which a satellite crosses a location at nearly the same local solar time.

Similar lighting conditions make it useful for:

- mapping;
- agriculture;
- forest monitoring;
- environmental observation; and
- comparison of images over time.

Medium Earth Orbit

- Extends from approximately **2,000 km to below 35,786 km**.
- Provides wider coverage than LEO with less signal delay than GEO.
- Mainly used for global navigation systems.
- **Galileo**, the European navigation system, comprises a constellation of 30 satellites.

Geosynchronous Orbit

A geosynchronous satellite has an orbital period equal to Earth's rotation period—approximately **23 hours and 56 minutes**.

- It returns to the same position in the sky at the same time every day.
- Its orbit may be circular or elliptical.
- It may also be inclined.
- Therefore, it does not necessarily appear permanently stationary.

Geostationary Orbit

A geostationary orbit is a special type of geosynchronous orbit.

It must be:

- circular;
- directly above the equator;
- moving from west to east;
- at zero-degree inclination; and
- matched with Earth's rotation.

Therefore, the satellite appears fixed over one location. India was reported to have **31 operational satellites in geostationary orbit**.

Geosynchronous and Geostationary Orbits

Geosynchronous Orbit	Geostationary Orbit
May be circular or elliptical	Must be circular
May be inclined	Must have zero inclination
Satellite may appear to move	Satellite appears stationary
Broad orbital category	Special subset of geosynchronous orbit

What is a Geosynchronous Transfer Orbit?

A **Geosynchronous Transfer Orbit** is a temporary, highly elliptical orbit used to move a satellite towards its final geosynchronous or geostationary orbit.

Orbital-Raising Process

1. The rocket places the satellite in GTO or Sub-GTO.
2. The satellite separates from the launch vehicle.
3. Its onboard propulsion raises the lower point of the orbit.
4. The orbit is gradually circularised.
5. The inclination is corrected to reach the operational orbit.

This method reduces the fuel and energy required from the launch vehicle.

Why is EOS-05 Significant?

- **Persistent observation:** Provides frequent imaging of large regions, unlike the periodic passes of a single LEO satellite.
- **Disaster management:** Supports real-time monitoring of cyclones, floods, landslides and forest fires.
- **Agriculture:** Helps assess crop health, drought, irrigation and agricultural stress.
- **Natural resources:** Monitors forests, water bodies, coasts and land-use changes.
- **Maritime security:** Strengthens observation of India's coastal and maritime regions.
- **Strategic awareness:** Supports monitoring of borders and critical infrastructure.
- **Geospatial economy:** Provides high-frequency data for mapping, insurance, logistics and private geospatial services.
- **Technological capability:** Demonstrates ISRO's ability to place a spacecraft heavier than the standard GSLV GTO capacity into a carefully selected Sub-GTO.

What are the Limitations?

- High altitude generally produces lower spatial resolution than LEO imaging.
- Orbit raising and station-keeping consume onboard fuel.
- The orbit is disturbed by the gravity of the Sun and Moon, Earth's uneven gravitational field and solar-radiation pressure.
- High-frequency observation produces large data volumes requiring rapid processing.
- High-altitude missions involve greater launch and operational costs.

Conclusion

EOS-05 strengthens India's Earth-observation architecture through persistent imaging of large regions. When combined with high-resolution LEO satellites, it can improve disaster response, agriculture, environmental governance and strategic awareness. The mission also demonstrates India's growing capability in launch-vehicle optimisation, cryogenic technology and space-based governance.

Data Centres in India: Infrastructure for the Digital Age

Source: Press Information Bureau

Relevance: UPSC GS Paper III: Digital infrastructure, information technology, Artificial Intelligence and cybersecurity

Important Key Words

Prelims

- **Data Centre**, **National Informatics Centre**, cloud computing, servers, **HDD**, **SSD**, **UPS**, **HVAC**, virtualisation, load balancer, database server, **API**, fibre-optic network, **IndiaAI Mission**, **Semicon India Programme**, **India Semiconductor Mission**, **ECMS**, **PLI Scheme 2.0 for IT Hardware**, **BIS**, **BEE**, **ECBC 2017**, **ECSBC 2024**, **PUE**, **WUE**, **CUE**, **CER**, **Green Energy Corridor**, **SHANTI Act**

Mains

- Digital Public Infrastructure, data sovereignty, sovereign digital infrastructure, cybersecurity, digital trust, green data centres, technological self-reliance, energy efficiency, water security, cloud infrastructure, Artificial Intelligence ecosystem, investment promotion and sustainable digitalisation

Why in News?

- India's data-centre capacity has increased from approximately **375 MW in 2020** to **1.57 GW in August 2026**.
- Installed capacity is projected to reach nearly **8 GW by 2030**, supported by the growth of cloud computing, Artificial Intelligence, digital payments and e-Governance.

What is a Data Centre?

A **data centre** is a secure facility containing computing, storage and networking equipment. It stores, processes, manages and distributes large volumes of digital information.

Data centres support several essential services, including:

- Online banking and digital payments
- Government portals and e-Governance
- Cloud computing
- E-commerce and online communication
- Artificial Intelligence applications
- Healthcare, education and business platforms
- Storage and processing of government and commercial data

Modern data centres are designed to operate continuously. Therefore, they require uninterrupted electricity, efficient cooling, high-speed connectivity, physical security and protection against cyberattacks.

What are the Major Components of a Data Centre?

Power Infrastructure

Data-centre equipment requires an uninterrupted electricity supply.

- **Uninterruptible Power Supply:** Provides immediate backup during a power interruption.
- **Backup generators:** Maintain operations during prolonged power cuts.
- **Electrical distribution systems:** Deliver electricity safely to different parts of the facility.

- **Redundant power systems:** Ensure that failure in one component does not interrupt the entire service.

Cooling Infrastructure

Servers generate considerable heat during continuous operation. Excessive heat can damage equipment and reduce efficiency.

- Heating, Ventilation and Air Conditioning systems regulate temperature and airflow.
- Advanced airflow management prevents the formation of hot zones.
- Liquid-cooling technologies transfer heat more efficiently than conventional air cooling.
- Modern facilities increasingly use closed-loop systems to reduce water consumption.

Information Technology Infrastructure

- **Servers** process information and run digital applications.
- **Storage systems** hold digital information.
- **Hard Disk Drives** provide high-volume storage.
- **Solid-State Drives** provide faster data access without moving mechanical parts.

Networking Infrastructure

- Routers and high-speed switches allow information to move within the data centre and between the facility and external networks.
- **Fibre-optic connections** enable the rapid transmission of large volumes of data over long distances.

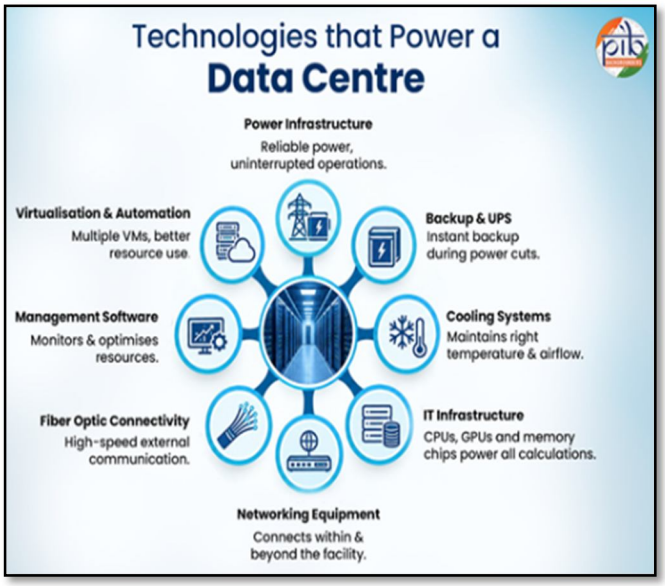
Security Systems

Data centres require both physical and digital security.

- Physical security protects buildings, equipment and access points.
- Cybersecurity systems protect networks and information from malware, unauthorised access and data theft.
- Backup and disaster-recovery systems help restore services after a failure or cyberattack.

Management Software

- Management software monitors power, cooling, storage and computing resources.
- **Virtualisation** allows a single physical server to operate several virtual machines. This improves the use of available computing capacity.
- Automation tools distribute workloads, identify operational problems and support preventive maintenance.

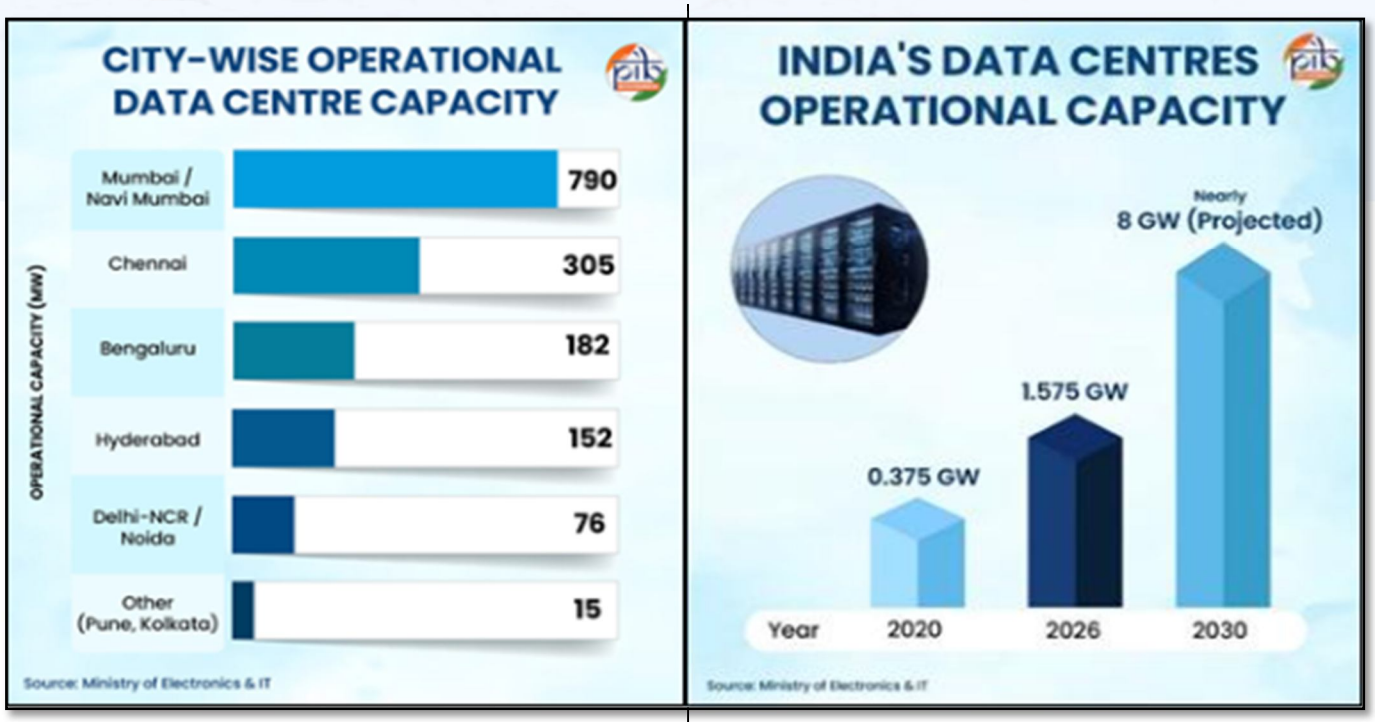


How Does a Data Centre Process a Digital Request?

- When a person opens an application, checks a bank balance or accesses a government document, the request travels through a network to a data centre.

Security Verification

- The security layer checks whether the request is safe and authorised. It protects the system from suspicious or harmful activity.



Load Distribution

- A **load balancer** directs the request to an available server. It prevents one server from becoming overloaded while others remain underused.

Application Processing

- The application server identifies the information or service requested by the user.
- When communication with another application is required, it uses an **Application Programming Interface**. An API enables different software systems to exchange information.

Data Retrieval

- The database server retrieves the required information from storage and returns it to the application server.

Response to the User

- The processed information travels through the network and reaches the user's device. This entire process may be completed within **one to two seconds**.
- The operational sequence can be understood as:
- **Connect → Receive → Secure → Process → Store or Retrieve → Respond**

What is the Status of Data Centres in India?

- India's data-centre ecosystem has expanded along with digital banking, online public services, cloud computing and Artificial Intelligence.

Government Data Centres

The **National Informatics Centre** has established National Data Centres at:

- Delhi
- Pune
- Hyderabad
- Bhubaneswar

NIC has also established **37 smaller data centres** in different State capitals. These facilities support

government departments through round-the-clock operations, system management and technical personnel.

Investment

- Investments currently underway: Nearly **USD 70 billion**
- Additional announced projects: Approximately **USD 90 billion**

This expansion indicates growing investor confidence in India's cloud computing, digital services and Artificial Intelligence markets.

What Policy Support is Available?

Infrastructure Status

The **Union Budget 2022–23** included data centres in the **Harmonised List of Infrastructure**.

Infrastructure status allows data-centre projects to access:

- Easier institutional credit
- Long-term project finance
- Better financing conditions
- Greater investor participation

It places data centres alongside other important infrastructure sectors such as power, transport and telecommunications.

Tax Incentive for Foreign Cloud Companies

The **Union Budget 2026–27** introduced a tax holiday for eligible foreign cloud-service providers until **2047**.

The incentive:

- Covers notified foreign companies;
- Applies from **2026–27 to 2046–47**; and
- Supports global cloud operations using data-centre infrastructure located in India.

The measure is intended to attract international cloud companies and encourage them to use India as a major data-processing and storage destination.

Which Schemes Support the Data Centre Ecosystem?

- Data centres depend on semiconductors, servers, networking equipment, Artificial Intelligence systems and reliable electricity. Several government programmes support this wider ecosystem.

Semicon India Programme

The second phase of the **Semicon India Programme—Semicon 2.0** was approved in July 2026.

- Implemented under the India Semiconductor Mission
- Financial outlay: ₹1,27,500 crore
- Objective: Build a trusted and resilient semiconductor ecosystem

Domestic semiconductor manufacturing can reduce dependence on imported chips used in servers, storage systems and networking equipment.

IndiaAI Mission

The **IndiaAI Mission** has a total budgetary outlay of **₹10,371.92 crore**.

- It aims to develop a comprehensive Artificial Intelligence ecosystem through computing capacity, datasets, innovation, skills and responsible AI development. The expansion of AI applications will further increase demand for high-performance data centres.

Electronics Components Manufacturing Scheme

- Financial support for the **Electronics Components Manufacturing Scheme** has been increased from **₹22,000 crore to ₹40,000 crore**.
- The scheme supports domestic production of electronic components required for computing and digital infrastructure.

PLI Scheme 2.0 for IT Hardware

The **Production Linked Incentive Scheme 2.0 for IT Hardware** supports the domestic manufacturing of:

- Servers
- Laptops and tablets
- Personal computers
- Related IT hardware

It seeks to attract investment, reduce import dependence and integrate India into global electronics supply chains.

Why are Energy and Water Planning Important?

- Data centres consume significant quantities of electricity because their computing and cooling systems must operate continuously.

The **Central Electricity Authority** estimates that electricity demand from data centres could reach approximately **17 GW by 2031–32**.

- Unplanned expansion can increase pressure on electricity grids and local water resources. Therefore, India must promote energy-efficient and water-efficient facilities.

Renewable Energy and Clean Power

The government is promoting cleaner power for data centres through:

- Green Energy Open Access Rules
- Green Energy Corridor Scheme
- National Green Hydrogen Mission
- National Programme on High-Efficiency Solar PV Modules
- Solar Park Scheme

These initiatives can help data-centre operators obtain reliable renewable electricity and reduce their carbon footprint.

SHANTI Act and Nuclear Energy

The **Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India Act** seeks to strengthen the clean-power ecosystem.

It supports reliable nuclear electricity for emerging energy-intensive sectors, including Artificial Intelligence and data centres. It also enables the future deployment of:

- **Small Modular Reactors**
- **Micro Nuclear Reactors**

These technologies could provide stable low-carbon power close to major digital infrastructure clusters.

Efficiency Standards for Data Centres

- The **Bureau of Indian Standards** has constituted the **LITD 31 Technical Committee** for cloud computing, information technology and data centres.
- BIS standards cover important efficiency indicators.

Power Usage Effectiveness

- **PUE** measures how efficiently a data centre uses electricity. It compares the total electricity consumed by the facility with the electricity used directly by computing equipment.
- A lower PUE generally indicates better energy efficiency.

Water Usage Effectiveness

- **WUE** measures the amount of water consumed in relation to the computing work performed by a data centre.

Carbon Usage Effectiveness

- **CUE** measures the carbon emissions associated with the electricity consumed by computing equipment.

Cooling Efficiency Ratio

- **CER** measures how efficiently the cooling system removes heat in relation to the electricity it consumes.

Building and Resource-Efficiency Codes

The **Bureau of Energy Efficiency** has notified:

- **Energy Conservation Building Code, 2017**
- **Energy Conservation and Sustainable Building Code, 2024**

These codes prescribe energy-efficiency and water-conservation standards for buildings, including provisions relevant to data-centre infrastructure.

Advanced Cooling and Water Management

The water requirement of a data centre depends mainly on the cooling technology used. Extraction of groundwater for industrial purposes is regulated through guidelines issued by the **Ministry of Jal Shakti**.

Artificial Intelligence infrastructure generates greater heat and is encouraging the adoption of advanced cooling systems, such as:

- Direct-to-chip liquid cooling
- Immersion cooling
- Adiabatic cooling
- Closed-loop liquid cooling

Closed-loop systems reuse cooling fluid and can reduce dependence on freshwater.

What is the Strategic Significance of Data Centres?

Foundation of the Digital Economy

- Data centres enable digital payments, banking, e-commerce, cloud services, online education and Artificial Intelligence. Their reliability directly affects economic activity.

Better e-Governance

- Government portals require secure and continuous data-processing capacity. Strong domestic data centres improve the reliability of online certificates, welfare platforms, tax systems and public databases.

Data Sovereignty

- Domestic data-centre capacity allows important data to be stored and processed within India's jurisdiction. This strengthens regulatory oversight and reduces excessive dependence on foreign infrastructure.

Employment and Investment

- Data-centre development generates demand for construction, electrical equipment, cooling technology, cybersecurity, networking, maintenance and skilled IT services.

Technological Self-Reliance

- Data centres support domestic capabilities in semiconductors, cloud computing, Artificial Intelligence, telecommunications and advanced electronics.

Disaster Resilience

- Redundant systems, backup facilities and geographically distributed data centres help maintain digital services during natural disasters, power disruptions and cyberattacks.

What are the Major Challenges?

- **High Energy Consumption:** Continuous computing and cooling operations place additional pressure on electricity grids.
- **Water Stress:** Water-intensive cooling systems may compete with domestic, agricultural and industrial needs, particularly in water-scarce cities.
- **Carbon Emissions:** Dependence on fossil-fuel-based electricity can increase the environmental footprint of digitalisation.
- **Cybersecurity Threats:** Data centres are attractive targets for ransomware, espionage, sabotage and data theft.
- **Import Dependence:** India continues to depend on imported advanced chips, servers and specialised cooling equipment.
- **Land and Connectivity Requirements:** Large facilities need suitable land, reliable

power, high-speed fibre networks and proximity to major digital markets.

- **Regional Concentration:** Excessive concentration in a few metropolitan centres can create infrastructure pressure and disaster-related risks.
- **Data Governance:** Expansion must be supported by clear rules regarding privacy, accountability, data localisation and cross-border data flows.
- **Electronic Waste:** Frequent replacement of servers and storage equipment can increase e-waste unless circular-economy practices are adopted.

Conclusion

Data centres are no longer merely storage facilities; they are strategic infrastructure supporting India's digital economy, governance and national security. Their expansion can promote investment, innovation and technological self-reliance. However, rapid growth must be balanced with cybersecurity, data protection and efficient use of energy and water. Sustainable and secure data centres can become a foundational pillar of **Viksit Bharat 2047**.

India's Semiconductor Future: Building Capabilities from Silicon to Systems

Source: PIB

Relevance: **UPSC GS Paper III: Science and technology, indigenisation, industrial policy and infrastructure**

Important Keywords

Prelims:

- Semiconductor, silicon, transistor, integrated circuit, wafer, fabrication plant, semiconductor node, photolithography, **ATMP**, **OSAT**, **Semicon 1.0**, **Semicon 2.0**.

Mains:

- Technological self-reliance, strategic autonomy, supply-chain resilience, advanced manufacturing, import dependence, domestic value addition, research and development, high-value employment.

Why in News?

The Union Cabinet approved **Semicon 2.0** in July 2026 to deepen India's semiconductor capabilities across the complete chip value chain.

India also organised **SEMICON India 2026** at **Yashobhoomi, New Delhi**, from September 17 to 19. The event, themed **"Silicon to Systems: Building the Ecosystem,"** brought together industry leaders, policymakers, investors, academic institutions and start-ups.

What Is a Semiconductor?

A semiconductor is a material whose ability to conduct electricity can be controlled.

Materials can broadly be understood as:

- **Conductors:** Materials such as copper that allow electricity to flow easily.
- **Insulators:** Materials that strongly resist the flow of electricity.
- **Semiconductors:** Materials whose electrical behaviour can be controlled according to technological requirements.

Semiconductors can switch, amplify, sense or control electrical signals. This makes them the basic building blocks of modern electronic equipment.

From Sand to a Packaged Chip

The transformation of ordinary silica sand into a semiconductor chip involves several precise stages.

Stage 1: Silicon Purification

- Silica is processed to obtain extremely pure silicon. Semiconductor manufacturing requires material with a high level of purity.

Stage 2: Ingot Formation

- The purified silicon is grown into a cylindrical silicon ingot.

Stage 3: Wafer Preparation

- The ingot is sliced into thin wafers. These wafers are polished to create smooth surfaces suitable for circuit fabrication.

Stage 4: Circuit Fabrication

The wafer undergoes hundreds of controlled operations inside a fabrication plant. Important processes include:

- **Deposition:** Addition of thin layers of material to the wafer
- **Photolithography:** Transfer of circuit patterns onto the wafer using light
- **Etching:** Removal of selected material to create circuit structures
- **Ion implantation:** Introduction of specific elements to modify electrical properties

These processes are repeated across several layers to create transistors, connections and other components.

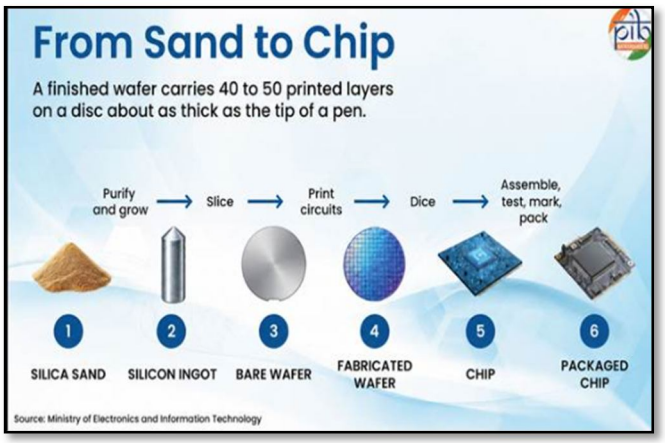
A completed wafer may carry around **40–50 printed layers** on a disc approximately as thick as the tip of a pen.

Stage 5: Dicing

- The fabricated wafer is cut into individual dies. Each functional die forms the central part of a semiconductor chip.

Stage 6: Packaging and Testing

- The die is assembled inside a protective package. Packaging allows the chip to communicate with other components of an electronic system.
- Testing determines whether the completed device meets the required performance and quality standards.



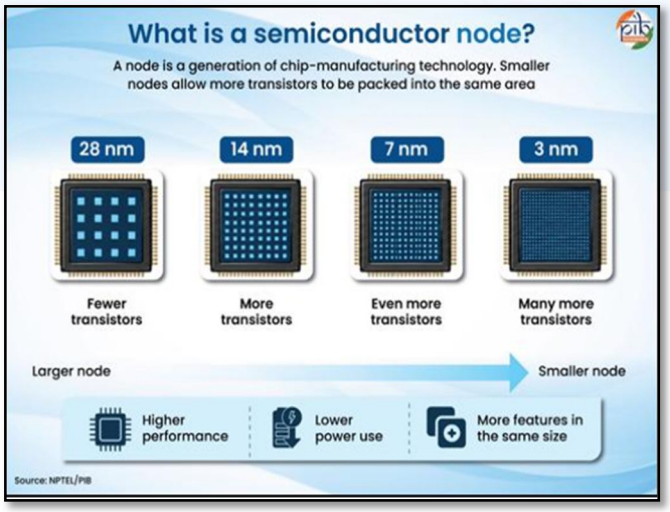
What Is a Semiconductor Node?

- A semiconductor node identifies a generation of chip-manufacturing technology.
- Earlier node labels such as **90 nanometres, 45 nanometres and 28 nanometres** were closely related to specific physical measurements. Today, they mainly serve as names for different generations of manufacturing processes.

A smaller node can make it possible to place more transistors within the same chip area. This may provide:

- higher processing performance;
- lower power consumption;
- greater transistor density; and
- more features within the same chip size.

However, a smaller node does not automatically guarantee a better chip. Performance also depends on circuit design, materials, packaging and the purpose for which the chip is developed.



Advanced and Mature Nodes

- **Advanced nodes** support high-performance computing and leading-edge processors.

Mature nodes remain essential for:

- automobiles;
- industrial electronics;
- telecommunications;
- power systems; and
- consumer products.

India is developing capabilities ranging from established nodes towards more advanced technologies.

Applications of Semiconductors

Semiconductors are used across almost every modern sector.

Digital Technologies

- They support artificial intelligence, data centres, cloud computing, the Internet of Things and advanced communication systems.

Telecommunications

- Mobile phones, network equipment and 5G and 6G systems depend on semiconductor components.

Transport

- Automobiles, electric vehicles and autonomous vehicles require chips for control systems, sensors, batteries and safety functions.

Healthcare

- Medical equipment uses semiconductor devices for screening, diagnosis, monitoring and data processing.

Industry

- Robotics, automation, precision machinery and advanced manufacturing depend on specialised chips.

Strategic Sectors

- Defence systems, satellites, launch vehicles, unmanned aerial vehicles and naval and airborne systems require secure and reliable semiconductor supplies.

Global Semiconductor Value Chain

- The semiconductor value chain is highly specialised. No single country controls all its stages.

Different countries possess strengths in:

- chip design;
- fabrication;
- manufacturing equipment;
- specialised materials;
- memory chips;
- assembly; and
- packaging.

Taiwan, South Korea, Japan, China and the United States dominate global semiconductor manufacturing.

Taiwan accounts for:

- more than **60% of global chip production**; and
- nearly **90% of advanced-chip production**.

This geographical concentration creates supply risks during geopolitical tensions, industrial disruptions and other international crises.

The global semiconductor market grew at a compound annual growth rate of **6.5% between 2014 and 2024**. It is projected to grow at approximately **8.5% over the next five to ten years**.

Why Does India Need a Domestic Semiconductor Ecosystem?

Growing Demand

India's semiconductor demand is projected to reach:

- **$110 billion by FY2030**; and
- more than **$200 billion by FY2035**.

The growth of electronics, telecommunications, electric mobility, artificial intelligence and digital services will further increase chip requirements.

Import Dependence

- India currently imports around **90–95% of the chips it consumes**.
- Nearly **$150 billion** was spent on semiconductor-product imports between FY2017 and FY2025. Such imports grew at a compound annual rate of approximately **23%**.
- If the trend continues, annual semiconductor imports could reach **$240 billion by 2035**.

Economic Security

- A domestic ecosystem can reduce the foreign-exchange burden associated with rising imports and retain a larger share of semiconductor-related economic activity within India.

National Security

- External dependence creates vulnerabilities in defence, telecommunications, space and other critical systems. Domestic capabilities can provide more reliable access to strategic chips.

Technological Competitiveness

- Chip capabilities are necessary for innovation in artificial intelligence, advanced communication, autonomous systems and high-performance computing.

Societal Development

- Domestic capacity can support wider access to modern electronic services, including affordable 5G and 6G connectivity.

India's Existing Semiconductor Capabilities

India possesses a strong base in semiconductor design and engineering.

- The country employs nearly **20% of the global semiconductor chip-design workforce**.
- It hosts approximately **7% of the world's semiconductor-domain Global Capability Centres**.
- More than one lakh engineers have received access to advanced chip-design tools.
- Academic institutions and start-ups are increasingly participating in chip development.

The **Semiconductor Laboratory at Mohali** has provided an institutional foundation for developing specialised chips required for strategic purposes.

Semiconductors in India's Strategic Missions

The Semiconductor Laboratory develops flight-grade and radiation-resistant devices capable of functioning under extreme space conditions.

Its important contributions include:

- an Indian-made camera chip used in the

Chandrayaan-3 lander;

- the **Vikram processor** used in satellite launch vehicles and rockets;
- radiation-hardened analogue-to-digital converter chips used in **Aditya-L1**; and
- flight-grade chips for satellites and launch vehicles.

These applications show India's existing capacity to design semiconductor components for specialised national missions.

Semicon 1.0: Laying the Foundation

- The Government approved **Semicon 1.0** in December 2021 with an outlay of **₹76,000 crore**.

The programme focused on creating the initial foundation for semiconductor and display manufacturing.

Major Components

- Scheme for setting up semiconductor fabs
- Scheme for setting up display fabs
- Support for compound semiconductors
- Support for silicon photonics and sensor facilities
- Incentives for ATMP and OSAT plants
- **Design Linked Incentive Scheme**

Major Achievements

Manufacturing Units

Twelve semiconductor manufacturing units were approved with a combined investment exceeding **₹1.64 lakh crore**.

They include:

- one silicon fab;
- one silicon-carbide fab;
- one Gallium Nitride Micro-LED Display Fab; and
- nine ATMP/OSAT units.

The units are located in Gujarat, Assam, Uttar Pradesh, Odisha, Punjab and Andhra Pradesh. Five have commenced commercial production.

Chip Design

Twenty-four chip-design projects, valued at approximately **₹900 crore**, were approved.

Advanced design tools were made available to over **one lakh engineers** from 500 organisations, including:

- 400 academic institutions; and
- 100 start-ups.

These organisations developed more than **300 chip designs**.

Semicon 2.0: Building the Complete Ecosystem

- Semicon 2.0 was approved with an outlay of **₹1,27,500 crore**.
- The programme seeks to expand India's capabilities beyond fabs and packaging by developing all major parts of the chip value chain.

Six Pillars of Semicon 2.0

Design

- Development of strategic and commercial chips for Indian and international markets.

Machines and Materials

- Creation of capabilities in manufacturing equipment, specialised gases, chemicals and other essential materials.

Fabrication Facilities

- Establishment of additional silicon, compound-semiconductor and display facilities.

Packaging

- Expansion of conventional and advanced ATMP and OSAT capabilities.

Research

- Support for advanced nodes, emerging technologies and domestic semiconductor innovation.

Talent

Development of engineers, technicians, operators and researchers required by the semiconductor industry.

Semicon 1.0 and Semicon 2.0

Semicon 1.0	Semicon 2.0
Established the initial ecosystem	Seeks to complete the value chain
Focused mainly on fabs and packaging	Adds materials, machines, research and talent
Expanded manufacturing and design	Deepens long-term technological capability
Created foundational capacity	Targets a globally competitive ecosystem

Supporting Government Policies

National Policy on Electronics, 2019

- It established the broad framework for **Electronics System Design and Manufacturing**, including chipsets and other electronic components.

SPECS, 2020

- The **Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors** provides capital-expenditure-linked incentives for components, sub-assemblies and semiconductor manufacturing.

Modified Electronics Manufacturing Clusters Scheme, 2020

- **EMC 2.0** supports common infrastructure, world-class facilities and plug-and-play manufacturing environments.

PLI for Large-Scale Electronics Manufacturing, 2020

- It promotes domestic manufacturing and investment in mobile phones and electronic components.

PLI 2.0 for IT Hardware, 2023

- It supports the domestic production of laptops, tablets, all-in-one computers and servers.

Electronics Components Manufacturing Scheme, 2025

- The scheme promotes component manufacturing and higher domestic value addition. Its outlay was enhanced to **₹40,000 crore** in the 2026–27 Budget.

Mobile Phone Manufacturing Scheme, 2026

- It seeks to deepen the mobile-manufacturing supply chain, increase domestic value addition and support Indian mobile brands.

Research, Development and Innovation Scheme

- It supports eligible semiconductor research projects under Semicon 2.0.

Foreign Direct Investment

- India permits **100% FDI in electronics manufacturing**, facilitating global investment, technological collaboration and value-chain integration.

International Semiconductor Partnerships

India has established semiconductor cooperation with:

- the United States;
- Japan;

- the European Union;
- Singapore; and
- the Netherlands.

During the German Chancellor's visit in January 2026, India and Germany signed a Joint Declaration of Intent on a semiconductor ecosystem partnership.

- India also joined **Pax Silica** during the India AI Impact Summit in February 2026.
- These partnerships complement domestic capacity by supporting technology cooperation, investment and integration with global value chains.

Significance for India

Supply-Chain Resilience

Domestic capabilities can reduce India's exposure to disruptions in geographically concentrated production networks.

Strategic Autonomy

- Reliable access to domestically designed and manufactured chips can strengthen critical systems in space, defence, telecommunications and digital infrastructure.

Domestic Value Addition

- Manufacturing more stages of the chip within India can retain investment, production and technical knowledge within the national economy.

High-Value Employment

- Research, design, fabrication, equipment manufacturing and packaging can generate specialised employment for engineers, researchers, operators and technicians.

Global Competitiveness

- India can combine its large chip-design workforce with expanding manufacturing capacity and trusted international partnerships.

Major Challenges

- Semiconductor manufacturing is among the world's most complex industrial activities.
- India's domestic fabrication capacity remains at an early stage.
- Advanced production is concentrated in a small number of countries.
- The complete ecosystem requires simultaneous progress in design, materials, machinery, fabs, packaging, research and talent.
- Manufacturing requires a high degree of precision and sustained technological development.
- The sector needs patience and consistent long-term policy support.

Conclusion

India's semiconductor journey is progressing from design strength and strategic applications towards complete domestic manufacturing. Semicon 1.0 established the initial foundation, while Semicon 2.0 expands the mission to equipment, materials, research and talent. Long-term implementation can reduce import dependence, strengthen technological security and position India as a trusted participant in the global semiconductor ecosystem.

Doppler Weather Radar: Strengthening India's Weather Forecasting and Early-Warning Capacity

Source: The Indian Express

Relevance: UPSC GS Paper III: Science and Technology; Disaster Management

Important Key Words

Prelims

- Doppler Weather Radar (DWR), Doppler Effect, radio waves, phase shift, precipitation, S-band, C-band, X-band, India Meteorological Department (IMD), Mission Mausam, Ministry of Earth Sciences (MoES), IITM, NCMRWF, INCOIS, NCPOR, NIOT, GIS, Earth-system models

Mains

- Weather-ready India, climate-smart governance, multi-hazard early warning, disaster-risk reduction, last-mile connectivity, climate resilience, precision forecasting, observation infrastructure, technology-enabled governance

Why in News?

- India's **51st Doppler Weather Radar** was inaugurated at **Sambalpur in Odisha** on September 17, 2026. It will strengthen weather monitoring and early warnings across western Odisha and parts of neighbouring States. With this commissioning, Odisha now has three DWRs—at **Sambalpur, Gopalpur and Paradip**. India plans to install **40 more radars** under **Mission Mausam**.

What is a Doppler Weather Radar?

A **Doppler Weather Radar** is a remote-sensing instrument used to detect precipitation and measure the movement of weather systems.

Unlike an ordinary radar, which mainly locates an object, a DWR provides information about both:

- The **position and distance** of atmospheric targets such as raindrops; and
- Their **direction and speed of movement** towards or away from the radar.

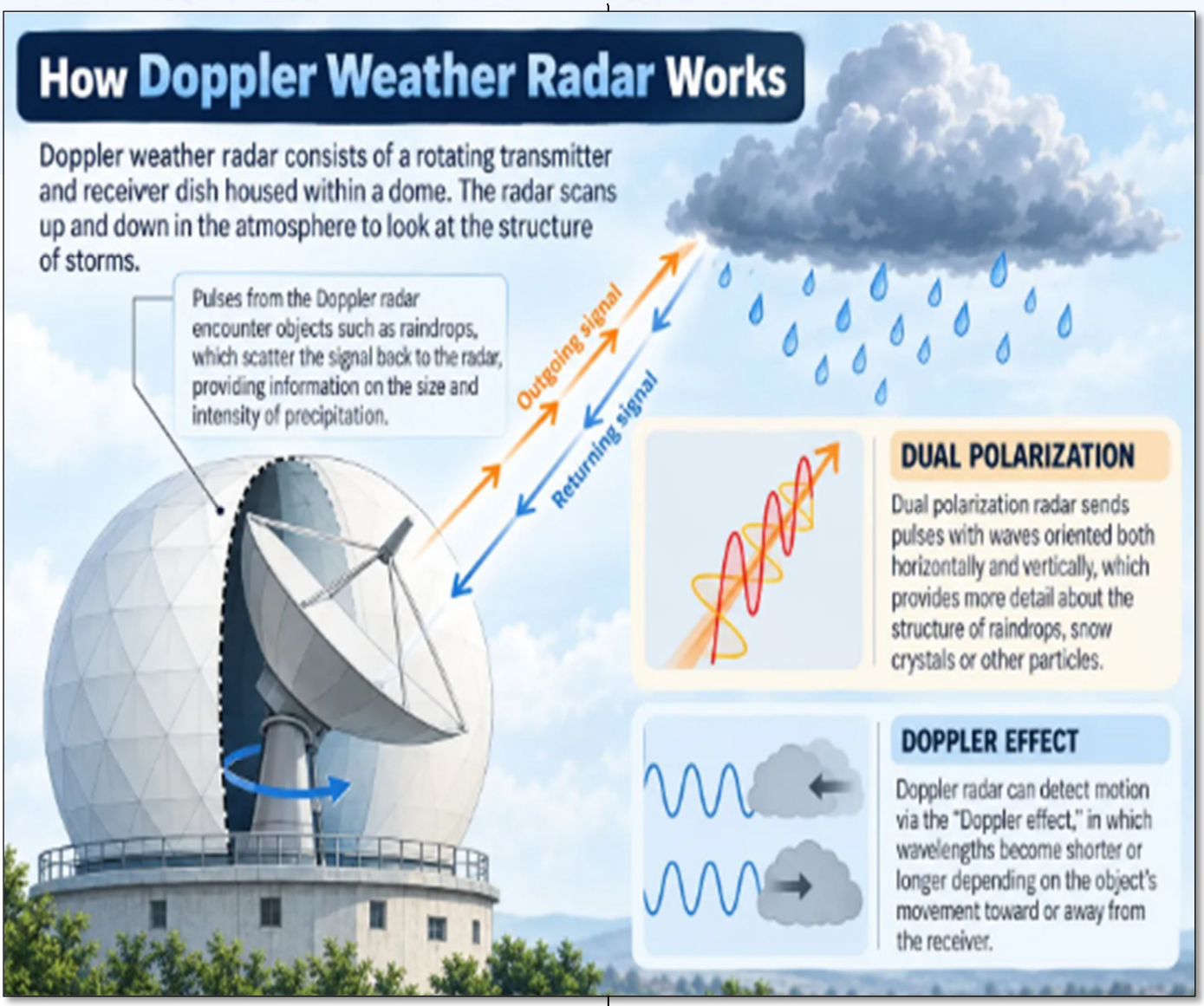
This makes DWRs particularly valuable for tracking thunderstorms, cyclones, cloud bands and intense rainfall.

What is the Doppler Effect?

- The **Doppler Effect** refers to the apparent change in the frequency of a wave when there is relative movement between its source and the observer.
- For example, the whistle of an approaching train appears to have a higher pitch because the sound waves are compressed. As the train moves away, the waves stretch and the pitch becomes lower.
- Doppler Weather Radars apply the same principle to reflected radio waves. The phenomenon is named after **Christian Doppler**, a 19th-century Austrian physicist.

How Does a Doppler Weather Radar Work?

A radar antenna transmits short pulses of radio waves into the atmosphere. When these waves encounter raindrops, ice particles, hailstones or clouds, part of their energy is scattered back



towards the radar.

The returned signal provides the following information:

- **Size and intensity:** Larger or denser targets return more energy, helping estimate precipitation intensity.
- **Distance:** The time taken by a radio pulse to travel to the target and return indicates its distance from the radar.
- **Direction of movement:** A change in the phase or frequency of the returned signal reveals whether precipitation is moving towards or away from the radar.
- **Speed:** The size of the phase shift helps calculate the radial velocity of the target.

Radar observations are updated approximately every **10 minutes**, enabling forecasters to monitor the formation, direction and changing intensity of weather systems almost in real time.

According to the **US National Weather Service**, a DWR transmits signals for only a little over **seven seconds in an hour** and spends the remaining **59 minutes and 53 seconds** receiving and analysing returned signals.

Types of Doppler Weather Radars Used in India

The **India Meteorological Department (IMD)** commonly uses three frequency bands:

Radar band	Major application
X-band	Detection of localised thunderstorms and lightning-producing systems
C-band	Monitoring rainfall and tracking cyclonic systems
S-band	Deep coastal surveillance and long-range cyclone monitoring

Together, these radars track cloud bands and weather systems and estimate rainfall over a coverage area of about **500 km**, depending on radar type and atmospheric conditions.

Why are Doppler Weather Radars Important?

Accurate Weather Monitoring

- DWRs provide high-resolution information on the location, movement and intensity of precipitation. This improves **nowcasting**, or very short-range forecasting of rapidly developing weather.

Early Warning of Extreme Events

They help identify and track:

- Cyclones and associated rainfall
- Thunderstorms
- Lightning-producing systems
- Cloudbursts and intense rainfall
- Hailstorms
- Sudden changes in wind patterns

Disaster-Risk Reduction

- Timely radar information enables governments to issue warnings, evacuate vulnerable populations and prepare emergency services before hazardous weather reaches populated areas.

Sectoral Benefits

Reliable forecasts support decision-making in:

- **Agriculture:** Crop planning, irrigation and harvesting
- **Aviation:** Safer flight operations
- **Defence:** Operational planning
- **Water resources:** Reservoir and flood management
- **Energy:** Demand and renewable-energy forecasting
- **Urban governance:** Drainage and transport management
- **Tourism and fisheries:** Weather-based safety advisories

Sambalpur Doppler Weather Radar

The commissioning of the radar at **Sambalpur** expands India's meteorological observation infrastructure.

Its principal benefits include:

- Improved monitoring of thunderstorms, lightning and heavy rainfall in **western Odisha**.
- Better meteorological data for adjoining areas of **southern Jharkhand, northern Chhattisgarh, northern Andhra Pradesh and West Bengal**.
- Stronger regional early-warning systems in areas vulnerable to extreme weather.
- Improved coordination between weather agencies and disaster-management authorities.

With Sambalpur, the national DWR network has increased to **51 radars**.

Mission Mausam

About the Mission

- **Mission Mausam** was launched on **January**

14, 2025, during celebrations marking the **150th foundation day of the India Meteorological Department**.

- The Union Cabinet had approved the Mission in September 2024 with an allocation of **₹2,000 crore for two years**. Its broader objective is to make India a **"weather-ready" and "climate-smart" nation**.

Implementing Institutions

The Mission is primarily implemented by three institutions under the **Ministry of Earth Sciences**:

- **India Meteorological Department**
- **Indian Institute of Tropical Meteorology**
- **National Centre for Medium-Range Weather Forecasting**

They are supported by other institutions, including:

- **Indian National Centre for Ocean Information Services**
- **National Centre for Polar and Ocean Research**
- **National Institute of Ocean Technology**

Major Components

Mission Mausam provides for:

- Deployment of next-generation radars and satellite systems with advanced sensors.
- Installation of **40 additional Doppler Weather Radars**.
- Use of high-performance supercomputers.
- Development of improved Earth-system and weather models.
- A **GIS-based automated decision-support system** for real-time data sharing.
- Expansion of research and capacity in atmospheric sciences, weather surveillance, forecasting and weather management.

Areas Covered

The Mission seeks to improve forecasts relating to:

- Monsoon behaviour
- Cyclones and extreme weather
- Air quality
- Rainfall, hail, fog and lightning
- Weather and climate information across different spatial and temporal scales

It also seeks to strengthen research into weather interventions, including the possibility of enhancing or suppressing rainfall, hail and fog under suitable conditions.

Significance for India

India is highly vulnerable to cyclones, floods, lightning, heatwaves and extreme rainfall. Rapid urbanisation and climate change have increased the exposure of people, infrastructure and economic activity to such events.

An expanded DWR network under Mission Mausam can:

- Reduce the loss of life through timely warnings.
- Improve location-specific forecasts.
- strengthen preparedness among States and local bodies.
- Support climate-resilient agriculture and infrastructure.
- Enable real-time sharing of weather information.
- Improve the delivery of warnings to citizens and last-mile users.

Thus, weather radars are not merely scientific instruments; they form a vital part of India's disaster-management and climate-adaptation infrastructure.

Challenges

- Gaps in Radar Coverage: Mountainous, coastal and remote regions may not receive uniform radar coverage, reducing the accuracy of local forecasts.

- Terrain-Related Limitations: Hills, buildings and other physical barriers can block radar signals and create observation gaps.
- High Installation and Maintenance Costs: Doppler Weather Radars require significant investment, regular calibration, technical maintenance and uninterrupted power supply.
- Shortage of Skilled Personnel: Trained meteorologists, radar engineers and data scientists are needed to interpret large volumes of weather data accurately.
- Integration of Weather Data: Radar information must be effectively combined with data from satellites, ocean buoys, automatic weather stations and ground observatories.
- Forecasting Localised Events: Sudden cloudbursts, lightning and small-scale thunderstorms can develop rapidly, making precise prediction difficult.
- Last-Mile Communication Gaps: Accurate forecasts may not save lives if warnings fail to reach farmers, fishers, local authorities and vulnerable communities on time.
- Impact of Climate Change: Changing rainfall patterns and increasing extreme-weather events make weather prediction more complex.

Way Forward

- Expand the Radar Network: Install the proposed Doppler Weather Radars under Mission Mausam, with priority given to disaster-prone and poorly covered regions.
- Adopt Multi-Source Forecasting: Integrate radar, satellite, oceanic and ground-based observations to improve forecast accuracy.
- Strengthen Technical Capacity: Train more meteorologists, engineers and data specialists in radar operation, maintenance and weather modelling.
- Improve Impact-Based Forecasting: Warnings should explain not only the expected weather event but also its likely effects on people, agriculture, transport and infrastructure.
- Ensure Last-Mile Connectivity: Disseminate alerts through mobile applications, SMS, local administrations, community radio and regional-language communication networks.
- Promote Institutional Coordination: Strengthen coordination among the IMD, disaster-management authorities, State governments and local bodies.
- Use Advanced Technologies: Apply artificial intelligence, high-performance computing, GIS and improved Earth-system models for faster and more location-specific forecasting.
- Regularly Evaluate Warning Systems: Conduct periodic reviews to assess whether forecasts are timely, accurate and accessible to vulnerable communities.

Conclusion

The Sambalpur Doppler Weather Radar represents an important expansion of India's weather-observation network. Combined with **Mission Mausam**, it can strengthen forecasting, disaster preparedness and climate-resilient planning. However, technological capability must be supported by reliable maintenance, institutional coordination and effective last-mile communication. A comprehensive early-warning system will help protect lives, livelihoods and infrastructure while advancing climate-smart governance.

India's Deep-Ocean Exploration and Polymetallic Nodules

Source: The Indian Express

Relevance: GS Paper III: Critical Minerals, Blue Economy, Energy Security, Science and Technology and Environmental Conservation

Important Keywords

Prelims Keywords

- Polymetallic Nodules | Polymetallic Sulphides | Composite Licence | UNCLOS | International Seabed Authority | EEZ | NCPOR | Deep Ocean Mission | Samudra Manthan | Sagar Manthan ORV

Mains Keywords

- Critical-mineral Security | Blue Economy | Deep-ocean Exploration | Common Heritage of Mankind | Underwater Domain Awareness | Marine Biodiversity | Energy Security

Why in News?

The Ministry of Mines has notified two offshore mineral blocks near Great Nicobar Island for granting composite licences to explore polymetallic nodules and crusts. The development has brought India's critical-mineral security, blue economy, deep-ocean research and marine environmental protection into focus.

Newly Notified Offshore Blocks

West Sewell Ridge-01

- It is located off Great Nicobar Island in the Andaman Sea and covers **1,000 square kilometres**.

Sewell Rise-01

- It is located in the southern part of Sewell Rise near Great Nicobar Island and covers **632 square kilometres**.

Combined Area

- The two blocks together cover **1,632 square kilometres** and have been notified for composite licences covering polymetallic nodules and crusts.

What is a Composite Licence?

- A composite licence does not immediately permit mining.
- The successful bidder must undertake further exploration and establish the mineral potential of the block before proceeding towards mining operations.

Great Nicobar Island

- Great Nicobar is situated at the southern end of the Andaman and Nicobar Island group in the Bay of Bengal.
- It is also the site of a proposed **₹72,000-crore infrastructure project** comprising a transshipment port, airport, gas-and-solar power plant and two greenfield coastal cities.
- The project has faced criticism over its possible impact on coral reefs, leatherback turtle nesting sites, Nicobar megapode nesting mounds and the ancestral lands of the Great Nicobarese Scheduled Tribe community.

What are Polymetallic Nodules?

- Polymetallic nodules are mineral deposits found on the deep-ocean floor.
- They contain several valuable metals, including **nickel, cobalt, manganese, copper and rare-earth elements**.
- They develop through **autogenetic crystallisation** around a crystalline nucleus on the deep seabed.

- Their economic value arises from the concentration of multiple critical minerals within a single deposit.

Distribution of Polymetallic Nodules

The International Seabed Authority identifies three major areas with abundant polymetallic nodules:

- **Clarion–Clipperton Fracture Zone:** Located off the west coast of Mexico in the Pacific Ocean.
- **Central Indian Ocean Basin:** An important area for India's deep-sea mineral interests.
- **Peru Basin:** Located in the south-eastern Pacific Ocean.

Why are Polymetallic Nodules Important?

Electric Mobility

- Nickel, cobalt and manganese are important for batteries used in electric vehicles.

Renewable Energy

- Critical minerals are required for renewable-energy systems and energy-storage technologies.

Advanced Manufacturing

- Copper, rare-earth elements and other metals are used in electronics and high-technology manufacturing.

Supply Diversification

- Deep-sea deposits can provide an additional source of critical minerals and reduce dependence on limited land-based sources.

Polymetallic Sulphides

- Polymetallic sulphides are another category of deep-seabed mineral deposits.
- They contain metals such as **copper, zinc, lead, iron, silver and gold**.
- Although both are sources of valuable minerals, polymetallic sulphides are distinct from polymetallic nodules.

India's ISA Exploration Contracts

2025 Contract

- India signed a contract with the **International Seabed Authority (ISA)** in September 2025 for exclusive polymetallic sulphide exploration rights in an Indian Ocean ridge area.

2016 Contract

- India's earlier contract, signed in 2016, covers the **Central Indian Ridge and Southwest Indian Ridge**.
- It covers the largest area allocated in the international seabed for polymetallic sulphide exploration.

India's Position

- India became the **first country to possess two ISA contracts for polymetallic sulphide exploration**.
- These contracts have scientific, economic and strategic importance.

Role of NCPOR

- The Goa-based **National Centre for Polar and Ocean Research** is responsible for India's polymetallic sulphide exploration.
- It begins with geophysical and hydrographic surveys in the licensed areas.

Importance of Deep-ocean Exploration

Blue Economy

- India has an **11,098-km coastline**, giving it significant potential to use ocean resources for economic growth.
- Deep-ocean exploration can support fisheries, aquaculture, tourism, coastal livelihoods and blue trade.

Mineral Resources

- The deep ocean contains deposits of minerals required for clean-energy and high-technology industries.

Food and Biological Resources

- The oceans contain fisheries and biodiversity resources that may support food security and nutraceutical development.

Fuel and Gas Hydrates

- Deep-ocean regions contain fuels, hydrocarbons and gas hydrates with potential importance for energy security.

Undersea Cables

- Undersea cables laid on the ocean floor form a critical part of global telecommunications.
- Mapping the seabed and maintaining awareness of underwater infrastructure are important for communication security.

Maritime Security

- Deep-sea mapping and underwater domain awareness strengthen India's maritime and strategic interests.

Scientific Research

- Ocean exploration improves understanding of marine biodiversity, seabed geology and ocean processes.

UN Ocean Science Decade

- The United Nations has declared **2021–2030** as the **Decade of Ocean Science for Sustainable Development**.
- It promotes scientific knowledge for the conservation and sustainable use of oceans.

Regulatory Framework

Offshore Areas within India

- Domestic offshore mineral development is governed by the **Offshore Areas Mineral (Development and Regulation) Act, 2002**.
- The government maintains that the law contains safeguards for ecological balance, biodiversity and the interests of fishermen.

Exclusive Economic Zone

- Under the **United Nations Convention on the Law of the Sea (UNCLOS)**, a country's Exclusive Economic Zone extends up to **200 nautical miles**, or approximately 370 km, from its coastal baseline.
- A coastal country has exclusive rights over living and non-living resources in the waters and seabed within its EEZ.

International Seabed

- UNCLOS governs the high seas and the international ocean floor beyond national jurisdiction.
- The seabed and its mineral resources beyond national jurisdiction are treated as the **common heritage of mankind**.
- These resources must be managed through economic benefit-sharing, support for scientific research and protection of the marine environment.

International Seabed Authority

- The ISA regulates mineral-related activities on the international seabed.
- India's polymetallic sulphide exploration rights in international waters operate through contracts with the ISA.

India's Deep-ocean Initiatives

Deep Ocean Mission

- The Ministry of Earth Sciences launched the **Deep Ocean Mission** in 2021 with an outlay of **₹4,077 crore**.
- It seeks to strengthen India's capabilities in deep-ocean research and exploration.

Samudra Manthan Scheme

- The Union Cabinet approved the **Samudra Manthan Scheme**, or **National Offshore Exploration Scheme**, in August 2026.
- It is a Central Sector Scheme of the **Ministry of Petroleum and Natural Gas**.

- It has an outlay of **₹84,084 crore** for implementation up to **2030-31**.
- It focuses specifically on offshore oil and gas exploration and should not be confused with deep-seabed mineral exploration.

Objectives

- Support exploratory drilling in deep-sea and ultra-deep-sea areas.
- Fund offshore seismic-data acquisition.
- Create common infrastructure for producing discovered hydrocarbons.
- Establish oil-and-gas manufacturing and services zones.
- Reduce dependence on imported energy.

Expected Outcomes

- The scheme is expected to support reserve accretion of more than **600 million tonnes of oil and oil-equivalent gas**.
- Subject to successful exploration, it aims to increase domestic oil and gas production from around **62 mtoe to 80 mtoe annually**.
- It also aims to expand India's hydrocarbon-resource base from **1,600 mtoe to 2,200 mtoe**.

Financial Support

- The government will provide support of up to **50% of the drilling cost or ₹675 crore per well**, whichever is lower.

Components of the Samudra Manthan Scheme

Offshore Seismic Data

- **₹28,534 crore** has been allocated for acquiring and processing modern offshore seismic data.

Deepwater Exploration Wells

- **₹43,200 crore** has been allocated for drilling 60 deepwater exploration wells.
- Government support can cover up to 50% of the eligible drilling cost or ₹675 crore per well, whichever is lower.

Common Offshore Infrastructure

- **₹10,000 crore** has been allocated for common offshore infrastructure hubs to facilitate commercialisation of discoveries.

Manufacturing and Services Zones

- **₹2,000 crore** has been allocated for oil-and-gas manufacturing and services zones to promote domestic manufacturing and localisation of critical equipment.

Sagar Manthan Ocean Research Vessel

- Garden Reach Shipbuilders and Engineers Limited launched the indigenous **Sagar Manthan Ocean Research Vessel** on September 9.
- It is being constructed for NCPOR under the Ministry of Earth Sciences.

Technical Features

Length: 89.5 metres | Width: 18.8 metres | Gross tonnage: 5,900 tonnes | Speed: Up to 14 knots at 90% maximum continuous rating

Significance

- Critical-Mineral Security: Diversifies access to minerals needed for batteries, renewable energy and advanced manufacturing.
- Energy Security: Increases domestic offshore oil and gas production and reduces import dependence.
- Scientific Capability: Strengthens deep-ocean research through ISA contracts, NCPOR surveys, the Deep Ocean Mission and *Sagar Manthan*.
- Blue Economy: Supports fisheries, aquaculture, tourism, livelihoods and blue trade.
- Maritime Security: Improves seabed mapping and underwater domain awareness.
- Domestic Manufacturing: Promotes

localisation of offshore equipment, technology and services.

Challenges

- Environmental Uncertainty: Limited knowledge makes the long-term impact on deep-sea ecosystems difficult to predict.
- Biodiversity Loss: Exploration and mining may disturb seabed habitats and marine organisms.
- Sensitive Ecosystems: Activities near Great Nicobar may affect coral reefs, turtles and Nicobar megapode nesting sites.
- Community Concerns: Projects may affect fishermen and the ancestral lands of the Great Nicobarese community.
- Technological and Financial Constraints: Operations require specialised technology, skilled personnel and substantial investment.
- Regulatory Compliance: Exploration beyond national jurisdiction must comply with UNCLOS and ISA rules.
- Commercial Uncertainty: Exploration may not result in commercially viable discoveries.

Way Forward

- Precautionary Approach: Conduct detailed environmental assessments before exploration or mining.
- Scientific Research: Expand seabed mapping, biodiversity studies and long-term monitoring.
- Community Participation: Consult fishing communities and the Great Nicobarese Scheduled Tribe.
- Indigenous Technology: Develop domestic research vessels, sensors and offshore equipment.
- Regulatory Compliance: Follow domestic laws, UNCLOS and ISA regulations.
- Exploration–Mining Separation: Establish mineral potential and complete regulatory requirements before mining.
- Benefit-Sharing: Manage international seabed resources according to the common heritage of mankind principle.
- Skill Development: Train marine scientists, engineers, environmental experts and technicians.

Conclusion

Deep-ocean exploration can strengthen India's critical-mineral, energy, scientific and maritime capabilities. However, it must advance through rigorous research, transparent regulation, environmental safeguards and protection of coastal and indigenous communities.

Cyber Fraud Vulnerability in India: Connectivity, Exposure and Financial Risk

Source: **The Hindu**

Relevance: **UPSC GS Paper III: Cybersecurity, internal security, digital economy and cybercrime**

Important Keywords

Prelims:

- NCRB | Cybercrime | Financial Fraud | Social Engineering | Data Theft | Device Hacking | Cyberbullying | Online Sexual Harassment | Digital Footprint | Lokniti-CSDS | Common Cause

Mains:

- Digital Vulnerability | Cybersecurity

Awareness | Trust-based Manipulation | Digital Inclusion | Institutional Impersonation | Under-reporting | Victim Protection | Cyber Resilience | Digital Privacy

Why in News?

- **NCRB data** show that cybercrime cases increased by **17.9%**, from **86,420 in 2023 to 1,01,928 in 2024**.Cybercrime increased even as overall registered crime declined by **6%** during the same period.A Lokniti-CSDS and Common Cause study of **8,306 citizens across 16 States** found that greater internet usage was associated with higher scam exposure.

What Does the Data Reveal?

Cybercrime Moving Against the National Trend

- **Rapid Increase:** Registered cybercrime cases rose by 17.9% nationally in 2024.
- **Overall Crime Decline:** Total registered crime declined by 6% during the same period.
- **Distinct Crime Pattern:** Cybercrime is increasing despite the broader decline in recorded crime.

Recorded Cases Do Not Show the Complete Picture

- **Under-reporting:** Many victims do not formally report cyber fraud because of embarrassment, limited awareness, small financial losses or uncertainty about the complaint process.
- **Invisible Layer:** Official crime statistics capture only registered cases and may not reflect the true scale of attempted fraud.
- **Survey Evidence:** The Lokniti-CSDS and Common Cause study examined both scam exposure and actual victimisation.

Study Coverage

The study surveyed:

- **8,306 citizens**;
- across **16 States**;
- and examined citizens' exposure to scam calls and messages, actual victimisation and the social profile of those affected.

The analysis formed part of the **Status of Policing in India Report 2026**.

What is the Scale of Scam Exposure?

Fraudsters approach citizens through messages and calls based on common digital activities, personal relationships and fear of institutions.

Common Types of Scam Calls

- **Fake Delivery Calls:** 33% frequently received calls about deliveries they had never ordered.
- **Investment Scams:** 31% frequently encountered calls promising high investment returns.
- **Bank Impersonation:** 27% frequently received calls from persons claiming to be bank officials and seeking account details.
- **Illegal-Activity Claims:** 23% received calls claiming that their phones were linked to illegal activities.
- **Friend-in-Distress Scams:** 23% received calls from unknown numbers claiming to be friends urgently requiring money.
- **Police or Authority Impersonation:** About one-fifth frequently received calls claiming that a friend or relative was in danger or involved in a crime.

However, the survey also found that roughly **half to six in ten respondents** had never received such calls. Scam exposure is therefore widespread but not uniform.

How Does Internet Usage Affect Vulnerability?

High Internet Usage

Among respondents with high online usage:

- **18**% fell in the high scam-exposure category;
- **28**% fell in the moderate-exposure category;
- together, more than **46**% reported moderate or high scam exposure.

Non-Internet Users

Among respondents who did not use the internet:

- only **5**% reported high exposure;
- **14**% reported moderate exposure.

Main Inference

- **Greater Digital Footprint:** People spending more time online create more digital interactions, accounts and transaction records.
- **Higher Visibility:** Greater online activity provides fraudsters with more opportunities to identify and contact potential victims.
- **Connectivity-related Risk:** Digital participation creates benefits but also increases the number of points through which fraudsters can approach individuals.

Thus, scam exposure is closely connected with the extent of an individual's participation in the digital ecosystem.

How Do Fraudsters Exploit Digital Footprints?

Modern cyber fraud does not depend only on sophisticated hacking. Fraudsters increasingly use **social engineering**, which involves manipulating human emotions and trust.

Aspiration

- **Investment Scams:** Promises of unusually high returns exploit the desire for quick wealth.
- Victims may be pressured to act quickly before verifying the investment.

Familiarity

- **Delivery Scams:** Fraudsters use the widespread practice of online shopping to make fake delivery calls appear genuine.
- Frequent e-commerce users may consider such calls routine.

Institutional Trust

- **Bank Impersonation:** Fraudsters pretend to be bank officials to obtain personal and account information.
- The credibility of the banking institution is used to make the demand appear legitimate.

Fear of Authority

- **Fake Police Calls:** Victims may be told that their phone, bank account or family member is connected with a crime.
- Fear and urgency reduce the victim's ability to independently verify the claim.

Personal Relationships

- **Friend or Relative Scams:** Fraudsters pretend to be known persons requiring emergency financial assistance.
- Emotional concern is used to bypass normal caution.

Deception Through Familiar Situations

The effectiveness of such fraud lies in making an unfamiliar criminal demand appear connected to a familiar:

Person | Institution | Transaction | Emergency | Social relationship

How Many Scam Encounters Cause Actual Harm?

The study found that **13% of respondents** had been direct victims of cybercrime during the previous two to three years.

Nature of Cybercrime Experienced

Among cybercrime victims:

- **Financial Fraud:** 54%
- **Device Hacking:** 13%
- **Personal Data Theft:** 11%
- **Cyberbullying or Social-Media Abuse:** 7%
- **Online Sexual Harassment:** 4%

Dominance of Financial Fraud

Financial fraud formed the largest category of cyber victimisation. This reflects the growing use of digital platforms for:

- banking;
- payments;
- investment;
- online shopping;
- and person-to-person transfers.

However, cybercrime also extends beyond financial loss to privacy violations, social abuse and sexual harassment.

Who is Most Vulnerable to Financial Fraud?

Vulnerability to financial fraud is not restricted to individuals with low education or limited digital awareness.

Economic Status

Among surveyed cybercrime victims:

- **Wealthiest Respondents:** 57% experienced financial fraud.
- **Economically Disadvantaged Respondents:** 47% experienced financial fraud.

Educational Status

- **Respondents Without Formal Education:** 40% experienced financial fraud.
- **College Graduates:** 59% experienced financial fraud.

Why Are Wealthier and Educated Users More Exposed?

- **Greater Digital Participation:** They may use online banking, investment, shopping and payment applications more frequently.
- **Higher Transaction Value:** Fraudsters may target individuals believed to possess greater financial resources.
- **Larger Digital Footprint:** Multiple accounts and platforms create additional opportunities for contact and deception.
- **Reporting Differences:** Better-educated respondents may also be more likely to recognise and report fraud.

Vulnerability is Multidimensional

The data do not suggest that economically disadvantaged or less-educated citizens are safe.

Instead:

- high online users face greater scam exposure;
- wealthier and educated users may be targeted for larger financial gains;
- disadvantaged victims may suffer greater hardship even from smaller losses;
- and different groups may be vulnerable to different forms of cybercrime.

Cyber fraud has therefore become less a consequence of individual carelessness and more a risk associated with deep digital connectivity.

What is the Extent of Financial Loss?

More than **eight in ten cybercrime victims** reported some financial loss.

Distribution of Losses

- **Up to ₹1,000:** 8%
- **₹1,001–₹5,000:** 25%
- **₹5,000–₹20,000:** About 29%
- **Above ₹20,000:** 23%

Impact of Losses

- **High-value Losses:** Nearly one-fourth of

victims lost more than ₹20,000.

- **Household Impact:** Even smaller losses can significantly affect low-income households.
- **Cumulative Harm:** Repeated fraud, recovery delays and emotional distress can increase the actual cost beyond the amount stolen.

Significance

- **Digital-Economy Risk:** Increasing cyber fraud can weaken public trust in digital banking, e-commerce and online public services.
- **Social-Engineering Threat:** The data show that fraud prevention cannot depend only on technical cybersecurity.
- **Targeted Criminality:** Fraudsters select victims based on online activity, social position and perceived financial resources.
- **Inclusive Cybersecurity:** Awareness programmes must cover digitally active, educated and wealthy users as well as disadvantaged groups.
- **Data-Protection Concern:** Hacking and personal-data theft can enable repeated fraud and identity misuse.
- **Governance Challenge:** The increase in cybercrime despite declining overall crime requires specialised prevention, investigation and victim-support systems.

Challenges

- **Under-reporting:** Official statistics may underestimate the true scale of cyber fraud.
- **Rapidly Changing Methods:** Fraudsters regularly modify calls, messages and impersonation techniques.
- **Social Engineering:** Fear, trust, urgency and aspiration are difficult to address through technical measures alone.
- **Expanding Digital Footprint:** Greater online participation creates more opportunities for profiling and targeting.
- **Institutional Impersonation:** Fraudsters misuse the credibility of banks, police and delivery companies.
- **Unequal Impact:** The same financial loss may have more serious consequences for low-income households.
- **Low Awareness:** Citizens may not verify unsolicited calls or understand how personal information can be misused.
- **Data Vulnerability:** Personal-data theft can support identity fraud and repeated targeting.
- **Psychological Harm:** Cyberbullying, abuse and sexual harassment can cause lasting emotional damage.
- **Victim Blaming:** Treating fraud as mere carelessness may discourage victims from reporting incidents.

Way Forward

- **Targeted Awareness:** Cybersecurity campaigns should address frequent internet users, investors, online shoppers, senior citizens and low-income households.
- **Recognise Social Engineering:** Training should explain how fraudsters exploit fear, urgency, trust and personal relationships.
- **Verification Culture:** Citizens should independently verify delivery, bank, police and emergency claims through official channels.
- **Digital Hygiene:** Users should avoid sharing account details, passwords, PINs and verification codes through unsolicited calls or messages.

- **Strengthen Reporting:** Complaint systems should be simple, accessible and sensitive to victims.
- **Rapid Financial Response:** Banks and digital-payment providers should strengthen real-time fraud detection, transaction alerts and quick account-freezing mechanisms.
- **Platform Accountability:** Digital platforms should detect fraudulent advertisements, fake profiles and impersonation attempts.
- **Data Minimisation:** Institutions should collect and retain only necessary personal data and strengthen protection against breaches.
- **Specialised Capacity:** Investigators require training in digital evidence, financial trails, social-media abuse and device forensics.
- **Victim-Centred Approach:** Cybercrime responses should provide financial guidance, privacy protection and psychological support.
- **Evidence-Based Policy:** NCRB data and large-scale citizen surveys should be used together to understand both reported and unreported cybercrime.

Conclusion

India's expanding digital ecosystem has improved access to finance, commerce and public services, but it has also created new opportunities for fraud. The evidence shows that vulnerability is shaped by the level of online participation, socio-economic position and the ability of fraudsters to manipulate trust and fear. Building cyber resilience therefore requires technical safeguards, citizen awareness, responsible data practices, rapid victim support and stronger institutional coordination.

Govt. Policies & Welfare

Decentralised Grain Storage Plan in the Cooperative Sector, Strengthening Food Security and Rural Cooperatives

Source: PIB

Relevance: **GS Paper II—Government Policies and Cooperatives; GS Paper III—Agriculture, Food Security, Storage Infrastructure and Agricultural Marketing**

Important Keywords

Prelims:

- PACS | NCDC | NABARD | FCI | AIF | AMI | SMAM | PMFME | WDRA | National Food Security Act, 2013

Mains:

- Decentralised Storage | Cooperative-led Development | Post-harvest Infrastructure | Distress Sale | Scheme Convergence | Agricultural Value Chain | Food Security

Why in News?

India's **Decentralised Grain Storage Plan in the Cooperative Sector**, launched as a pilot project in May 2023, has expanded substantially.

- By July 2026, **1,012 PACS or cooperative societies** had been identified.
- Godowns had been completed in **313 PACS**, creating more than **1.80 lakh metric tonnes (LMT)** of storage capacity.
- The plan integrates storage, procurement, processing and distribution infrastructure at the village level.

What is the Decentralised Grain Storage Plan?

The Decentralised Grain Storage Plan is a cooperative-led initiative designed to develop integrated agricultural infrastructure through **Primary Agricultural Credit Societies (PACS)**.

- It seeks to establish storage facilities closer to agricultural production centres by converging several existing government schemes. The **National Cooperative Development Corporation (NCDC)** is its implementing agency.
- PACS are village-level cooperative institutions that primarily provide short-term agricultural credit and related financial services to rural borrowers. Under the plan, their role is being expanded to include storage, procurement, processing, machinery rental and food distribution.
- The initiative was rolled out as a pilot project on **31 May 2023**.

Why Does India Need Decentralised Grain Storage?

India's expanding agricultural production and

food-security obligations require a reliable and geographically distributed storage network.

According to the Third Advance Estimates for 2025-26:

- Foodgrain production was estimated at **376.563 million tonnes**.
- This was about **18.8 million tonnes**, or **5.3%**, higher than the previous year's production of 357.732 million tonnes.
- India's food-security system under the **National Food Security Act, 2013** covers approximately **80 crore people**.

Although centralised warehouses operated by the Food Corporation of India and State agencies remain important, excessive dependence on distant storage facilities can increase transportation costs and delay procurement and distribution.

Local storage is necessary to reduce post-harvest losses, preserve grain quality and allow farmers to store produce until market conditions improve.

What are the Objectives of the Plan?

The plan seeks to:

- reduce foodgrain wastage and strengthen national food security;
- create storage facilities closer to farms and procurement centres;
- enable farmers to avoid distress sales and secure better prices;
- reduce transportation costs among procurement centres, warehouses and Fair Price Shops;
- diversify the economic activities of PACS;
- improve farmers' access to processing, machinery and marketing facilities;
- generate new income sources for cooperative societies; and
- strengthen rural employment and agricultural value chains.

How Does Scheme Convergence Support the Plan?

The plan does not operate as a completely separate subsidy programme. It brings together assistance available under four existing schemes:

- **Agriculture Infrastructure Fund (AIF):** Provides financing and interest-subvention support for creating and upgrading post-harvest infrastructure.
- **Agricultural Marketing Infrastructure Scheme (AMI):** Provides a back-ended capital subsidy for constructing foodgrain storage facilities.
- **Sub-Mission on Agricultural Mechanisation (SMAM):** Supports Custom Hiring Centres and access to agricultural machinery.
- **Pradhan Mantri Formalisation of Micro Food Processing Enterprises Scheme (PMFME):** Promotes the formalisation and expansion of micro food-processing units.

This convergence enables PACS to function as integrated rural service centres instead of remaining limited to agricultural credit.

What Facilities Can Be Created at the PACS Level?

The plan permits the development of several complementary facilities:

- **Warehouses and silos:** Silo-based storage units of 50 MT, 100 MT and 200 MT capacity can be developed.
- **Procurement centres:** PACS can procure foodgrains on behalf of State agencies and the FCI.
- **Primary processing units:** Facilities can undertake cleaning, sorting and drying to improve the quality and marketability of produce.

- **Custom Hiring Centres:** PACS can purchase tractors, harvesters, tillers and other machinery for rental to farmers.
- **Fair Price Shops:** Cooperatives can distribute foodgrains and sell locally processed food products.

Together, these facilities connect agricultural production with storage, processing, procurement and distribution.

How are PACS Selected?

PACS are identified and approved by the **District Cooperative Development Committees (DCDCs)** in accordance with the prescribed Standard Operating Procedure, called the *Margdarshika*.

Selection is based primarily on the local demand for storage. The prescribed land conditions include:

- PACS should preferably own the required land.
- The land should not be waterlogged.
- It should not fall within a forest area.
- Consent of PACS members is required before using cooperative land.
- If the land is leased, the lease period should exceed **20 years**.

These conditions seek to ensure long-term operational viability and prevent investments in unsuitable locations.

What is the Institutional Framework?

Implementation involves coordination at multiple levels:

- **National Cooperative Development Corporation:** Implementing agency.
- **Inter-Ministerial Committee:** Monitors the plan's overall implementation at the national level.
- **National-Level Coordination Committee:** Coordinates among participating institutions and agencies.
- **State Cooperative Development Committees:** Facilitate implementation and coordination at the State level.
- **District Cooperative Development Committees:** Identify PACS and coordinate execution at the district level.
- **PACS:** Develop and operate the facilities at the grassroots level.

The framework combines central supervision with decentralised implementation.

What Financial Support is Available?

Several measures have been introduced to improve the financial viability of projects:

- The subsidy under the AMI scheme has been increased from **25% to 33.33%**.
- The margin-money requirement has been reduced from **20% to 10%**.
- Cost norms for godown construction have been revised.
- A **3% interest subvention** is available under the AIF.
- NABARD provides a special refinancing facility.
- The combined assistance can reduce the effective loan interest rate for eligible PACS to **1%**.

Under the AMI scheme, **NABARD** serves as the subsidy-channelising agency. State Cooperative Banks and District Central Cooperative Banks sanction and disburse loans to PACS.

The **Food Corporation of India** has also been authorised to provide assured hiring of eligible godowns, subject to prescribed conditions. This can provide cooperatives with predictable rental income.

What Progress Has Been Achieved?

The pilot phase covered **11 PACS across 11 States** and created **9,750 MT** of storage capacity.

The participating States were Maharashtra, Uttar Pradesh, Gujarat, Rajasthan, Madhya Pradesh, Uttarakhand, Tamil Nadu, Telangana, Assam, Karnataka and Tripura.

By July 2026:

- **1,012 PACS or cooperative societies** had been identified;
- godown construction had been completed in **313 PACS**; and
- more than **1.80 LMT** of storage capacity had been created.

This indicates the plan's transition from pilot implementation to wider expansion.

Nerpingalai PACS: A Case Study

Nerpingalai PACS in Amravati, Maharashtra, constructed a **3,000-MT warehouse** with assistance under the AMI and AIF schemes.

- Around **300 farmers** stored nearly **32,000 bags of soybeans** in the warehouse.
- The society provided approximately **₹4.50 crore as advances** against stored produce.
- NABARD refinancing helped reduce the effective interest rate to **1%**.
- The PACS was expected to earn around **₹7.68 lakh annually from rent** and nearly **₹54 lakh from interest income**.
- The project also generated local employment.
- The case demonstrates how local storage can provide liquidity to farmers, reduce distress sales and strengthen the financial base of cooperatives.

How Does the Plan Benefit Farmers and Cooperatives?

Benefits for Farmers

- Storage near farms lowers transportation expenses.
- Farmers can delay sales during periods of low market prices.
- Advances against stored produce provide immediate liquidity.
- Cleaning, sorting and drying enhance product quality.
- Machinery rental reduces the cost of farm mechanisation.
- Local procurement centres improve access to government procurement.

Benefits for PACS

- Storage rent, processing charges and interest income diversify revenue.
- PACS become multipurpose agricultural service institutions.
- Increased economic activity can strengthen cooperative membership.
- Assured hiring by the FCI can improve project viability.
- New facilities generate rural employment.

Wider Benefits

- The plan can reduce foodgrain wastage, improve buffer-stock management, strengthen the Public Distribution System and promote more balanced rural development.

What Quality and Transparency Measures are Prescribed?

Storage structures must conform to the standards prescribed by the **Warehousing Development and Regulatory Authority**.

The principal requirements include:

- construction suited to local environmental conditions;

- use of durable and corrosion-resistant materials;
- adequate ventilation to prevent spoilage;
- adherence to safety and design specifications;
- regular inspections and quality audits; and
- uniform branding through the prescribed logo and colour scheme.

PACS members are expected to monitor implementation. Project Management Consultants must provide updates on construction and expenditure, improving transparency and accountability.

Challenges

Limited managerial capacity: Some PACS may lack professional expertise in warehouse management, processing and marketing.

- **Financial viability:** Low utilisation of warehouses or delays in assured hiring could affect repayment capacity.
- **Regional imbalance:** Storage facilities may expand faster in States with stronger cooperative institutions.
- **Quality maintenance:** Poor ventilation, pest control or maintenance can result in grain losses despite the creation of new capacity.
- **Land constraints:** Suitable land may not be available to all PACS, while long-term leases can be difficult to secure.
- **Coordination difficulties:** Convergence among multiple schemes, ministries, banks and implementing agencies may cause delays.
- **Digital and logistical gaps:** Storage infrastructure must be connected with procurement, market-information and transport systems.
- **Governance concerns:** Weak audits or local elite capture may reduce equitable access for small and marginal farmers.

Way Forward

- Provide PACS with professional training in warehousing, accounting, quality control and commodity management.
- Conduct district-level storage-gap assessments before approving new facilities.
- Integrate warehouses with electronic procurement, market-information platforms and negotiable warehouse receipts.
- Ensure adequate access for small, marginal, tenant and women farmers.
- Introduce scientific pest control, moisture monitoring and regular third-party quality audits.
- Develop processing and value-addition facilities according to locally produced crops.
- Publish project-wise information on costs, capacity, utilisation and financial performance.
- Link storage facilities with railways, roads, mandis, Fair Price Shops and food-processing clusters.
- Encourage renewable energy, water conservation and climate-resilient warehouse designs.
- Strengthen cooperative governance through member participation, social audits and transparent decision-making.

Conclusion

The Decentralised Grain Storage Plan can address critical gaps in India's post-harvest infrastructure by locating storage, processing and procurement

facilities closer to farmers. Its scheme-convergence model reduces the need for an entirely new administrative structure, while its cooperative foundation gives PACS an expanded role in rural development.Its success, however, will depend not merely on the number of godowns constructed but, on their utilisation, scientific management and accessibility to small farmers. Strong cooperative governance, professional capacity and transparent monitoring are therefore essential for transforming decentralised storage into a durable pillar of food security and farmer prosperity.

India's E-Waste Challenge: Balancing Cost with Long-Term Value

Source: The Hindu

Relevance: **GS Paper II—Government Policies; GS Paper III—Environmental Pollution, Critical Minerals, Circular Economy and Resource Security**

Important Keywords

Prelims:

- E-Waste | Urban Mining | Extended Producer Responsibility | CPCB | Basel Convention | Right to Repair | Critical Minerals | Battery Waste

Mains:

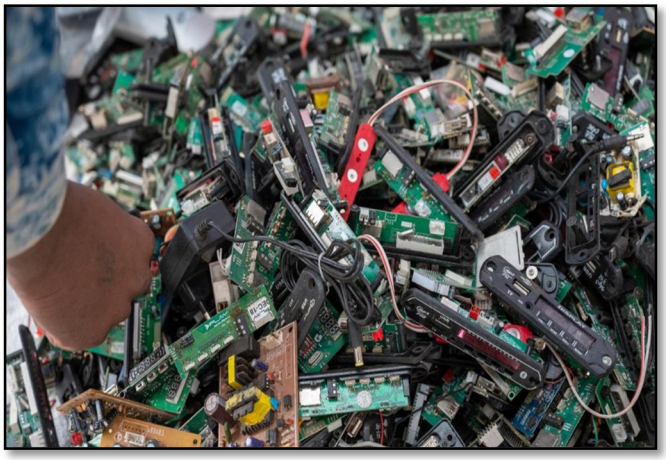
- Circular Economy | Life-Cycle Costing | Value-Based Procurement | Resource Security | Informal Recycling | Strategic Balance Sheet | Data Security

Why in News?

India's rapid digitisation and frequent replacement of computers, servers, batteries and electronic devices are producing large quantities of e-waste.

The immediate financial value obtained by selling discarded equipment often receives greater attention than its long-term strategic value. The need is to evaluate e-waste decisions through two balance sheets:

- the **immediate financial balance sheet**, covering cost, resale value and short-term savings; and
- the **long-term strategic balance sheet**, covering resource security, public health, environmental sustainability, data protection and industrial capability.



What is E-Waste?

Electronic waste, or e-waste, refers to discarded electrical and electronic products that have become obsolete, damaged or unwanted.

It includes:

- computers, laptops, mobile phones, printers and routers;
- televisions, cameras and entertainment devices;
- refrigerators, air conditioners and washing machines;
- batteries, solar panels and inverters;
- electric tools, lighting equipment and medical devices; and

- servers, storage systems and telecommunications equipment.

E-waste is different from ordinary municipal waste because it contains both valuable and hazardous materials.

Valuable materials	Hazardous materials
Copper, aluminium, iron and tin	Lead, mercury and cadmium
Gold, silver and palladium	Brominated flame retardants
Lithium, cobalt and nickel	Refrigerants and toxic chemicals
Rare-earth elements	Persistent organic pollutants

India generated approximately **13.98 lakh tonnes of e-waste in 2024-25**, compared with 12.54 lakh tonnes in 2023-24. India is generally identified as the world's third-largest e-waste-generating country after China and the United States.

What is Urban Mining?

Urban mining is the recovery of valuable raw materials from discarded products, buildings, vehicles, industrial machinery and other human-made stocks.

In the context of e-waste, it involves extracting:

- gold, silver and palladium from circuit boards;
- copper and aluminium from wires and electronic equipment;
- lithium, cobalt, nickel and manganese from batteries; and
- rare-earth elements from electronic and energy technologies.

Urban mining reduces dependence on conventional mining by treating cities, industries and waste streams as secondary sources of raw materials.

It involves a long chain of activities:

Collection → Segregation → Secure data destruction → Refurbishment → Dismantling → Material recovery → Scientific disposal

Each stage requires technology, trained workers, environmental safeguards and supply-chain traceability.

What are the Two Balance Sheets Behind E-Waste Decisions?

Immediate Financial Balance Sheet

The first balance sheet records measurable and short-term outcomes such as:

- purchase or replacement cost;
- resale value of discarded equipment;
- processing and transportation costs; and
- savings achieved through the lowest-priced service provider.

This balance sheet closes when the transaction is completed.

Long-Term Strategic Balance Sheet

The second balance sheet records consequences that continue long after the transaction. These include:

- domestic availability of critical minerals;
- reduced dependence on imported raw materials;
- environmental damage or protection;
- public-health expenditure;
- cybersecurity and data protection;
- development of advanced recycling technologies;
- employment and industrial capacity; and
- national supply-chain resilience.

A recycler offering the highest resale value may not necessarily provide secure data destruction, efficient mineral recovery or environmentally safe processing. Therefore, the cheapest immediate option may impose a much higher social and economic cost later.

Pollution may return as healthcare expenditure, while failure to recover minerals may increase import dependence and manufacturing costs.

Why is E-Waste Generation Increasing in India?

- **Rapid digitisation:** Expanding internet access, digital payments and online services have increased the use of electronic devices.
- **Growing electronics consumption:** Falling prices and rising incomes have made electronic appliances more widely available.
- **Short product life cycles:** Technological changes encourage frequent replacement of devices.
- **Planned obsolescence:** Non-removable batteries, unavailable spare parts and costly repairs make replacement easier than repair.
- **Institutional replacement:** Governments and companies periodically replace large numbers of computers, servers and networking systems.
- **Expansion of new technologies:** Electric vehicles, renewable-energy systems, data centres and smart infrastructure create new waste streams.
- **Consumer marketing:** Exchange offers, discounts and repeated product launches promote a "buy-use-discard" culture.
- **Weak refurbishment systems:** Limited access to authorised repair and refurbishment facilities results in premature disposal.

Why is Scientific E-Waste Management Important?

Environmental Protection

- Unsafe dismantling, acid leaching and open burning can release lead, mercury, cadmium and toxic fumes into the air, soil and groundwater.
- Scientific recycling prevents hazardous substances from entering ecosystems and reduces the need for environmentally damaging virgin mining.

Public Health

- Workers in informal recycling units frequently handle toxic materials without protective equipment. Long-term exposure may damage the nervous, respiratory and reproductive systems.
- Children living or working near informal recycling centres are particularly vulnerable to lead and mercury exposure.

Critical-Mineral Security

- Modern electronics, batteries and renewable-energy systems depend on minerals such as lithium, cobalt, nickel and rare-earth elements. Recovering these materials can reduce import dependence and improve supply-chain resilience.
- The value of India's annual e-waste stream has been estimated at nearly **₹51,000 crore**, but only a limited share of its technically recoverable value is presently captured.

Data Security

Discarded computers, servers, hard drives and mobile phones may retain:

- personal photographs;
- financial information;
- health records;
- corporate data; and
- confidential government information.

Unscientific resale or dismantling can result in identity theft, financial fraud, corporate espionage and national-security risks. Certified data destruction must therefore form an essential part of e-waste disposal.

Climate Benefits

- Recycling metals generally requires less energy than mining and processing virgin ores. It can reduce greenhouse-gas emissions, ecosystem destruction and water use associated with conventional mining.

Industrial Development

Investment in urban mining can encourage domestic capabilities in:

- precision dismantling;
- battery recycling;
- mineral refining;
- material separation;
- robotics; and
- advanced metallurgical processes.

Thus, e-waste management is not merely a sanitation activity; it is also a component of industrial and strategic policy.

What are India's E-Waste Management Rules and Initiatives?

E-Waste (Management) Rules, 2022

- The rules came into force on **1 April 2023** and cover 106 categories of electrical and electronic equipment, including solar photovoltaic equipment.
- They seek to ensure the environmentally sound collection, recycling and disposal of e-waste.

Extended Producer Responsibility

- Under **Extended Producer Responsibility (EPR)**, producers are responsible for meeting prescribed recycling targets.
- They fulfil their obligations by purchasing EPR certificates from registered recyclers. The recycling target is:
  - **70% during 2025-26 and 2026-27**; and
  - **80% from 2027-28 onwards**.

EPR seeks to shift part of the environmental responsibility from consumers and governments to producers.

Battery Waste Management Rules, 2022

These rules cover portable, automotive, industrial and electric-vehicle batteries.

They:

- mandate collection and recycling through EPR;
- prohibit disposal of waste batteries in landfills; and
- prohibit their destruction through incineration.

Right to Repair Initiative

The Right to Repair framework promotes access to:

- repair manuals;
- spare parts;
- diagnostic tools; and
- information about authorised service providers.

It can increase product life, lower consumer costs and reduce premature disposal.

Hazardous and Other Wastes Rules, 2016

- These rules govern the handling, recycling, transportation and transboundary movement of hazardous waste.
- India is also a party to the **Basel Convention**, which regulates the transboundary movement and disposal of hazardous wastes.

Centre of Excellence on E-Waste Management

The Centre for Materials for Electronics Technology in Hyderabad develops indigenous technologies for recovering valuable materials from:

- printed circuit boards;
- lithium-ion batteries;
- permanent magnets; and
- solar cells.

Challenges

- **Dominance of informal recycling:** Waste pickers and scrap dealers provide effective collection but often lack safe equipment and pollution-control technology.
- **Weak collection networks:** Consumers may not have convenient access to authorised collection centres.
- **Paper compliance:** EPR certificates may not always represent actual collection and recycling.
- **Low advanced-recovery capacity:** Many facilities recover common metals but lack the technology to extract critical and rare-earth minerals efficiently.
- **Short-term procurement decisions:** Organisations often select recyclers based only on resale value or lowest cost.
- **Data-security risks:** Devices may be sold or dismantled without certified erasure of sensitive information.
- **Unsafe working conditions:** Informal workers face exposure to toxic chemicals, sharp components and battery fires.
- **Limited repairability:** Product designs, restricted spare parts and short software-support periods encourage replacement.
- **Regional disparities:** Recycling facilities are concentrated in a few States and large cities.
- **Illegal imports:** Used and end-of-life electronics may enter India under the label of reusable or refurbished equipment.
- **Public awareness gaps:** Many consumers mix e-waste with household waste or sell it to unauthorised collectors.

Way Forward?

- **Adopt life-cycle costing:** Consider repair, energy use, recycling, environmental damage and disposal costs instead of only the purchase or resale price.
- **Use value-based procurement:** Select recyclers based on traceability, data security, recovery efficiency and environmental compliance.
- **Integrate informal workers:** Train waste pickers, provide safety equipment and connect them with authorised recyclers.
- **Strengthen EPR:** Digitally verify collection, recycling and EPR certificates to prevent paper compliance.
- **Expand formal collection:** Establish convenient take-back and drop-off centres and introduce deposit-refund incentives.
- **Promote repair and reuse:** Ensure access to spare parts, repair manuals and longer software support.
- **Invest in urban mining:** Develop advanced facilities to recover critical minerals and precious metals.
- **Ensure data security:** Make certified data erasure and an auditable chain of custody compulsory.

Conclusion

India must treat e-waste as both an environmental challenge and a source of critical minerals. Life-cycle costing, effective EPR, safe recycling and urban mining can transform it into a strategic resource while reducing health, security and environmental risks.

Vibrant Villages Programme: Strengthening India's Borders Through Inclusive Development

Source: PIB

Relevance: **GS Paper II — Government Policies and Interventions; GS Paper III — Border Management, Infrastructure and Inclusive Development**

Important Keywords

For Prelims:

- VVP-I, VVP-II, Ministry of Home Affairs, Kibithoo, Nathanpur, Centrally Sponsored Scheme, Central Sector Scheme, Village Action Plans, PMGSY-IV, Border Area Development Programme, ITBP.

For Mains:

- Border Development, Development–Security Linkage, Reverse Migration, Sustainable Livelihoods, Scheme Convergence, Community Participation, Border Tourism, Women and Youth Empowerment.

Why in News?

The **Vibrant Villages Programme (VVP)** is expanding infrastructure, essential services and livelihood opportunities in selected villages along India's international land borders.Through **VVP-I and VVP-II**, it seeks to reduce out-migration, strengthen border communities and support national security.

Background

- India shares land borders with **Bangladesh, China, Pakistan, Nepal, Myanmar, Bhutan and Afghanistan**. Bangladesh accounts for its longest international land border.
- Many frontier villages have remained isolated because of difficult terrain, weak connectivity, inadequate services and limited employment. These conditions have encouraged out-migration, leaving some strategically important areas sparsely populated.
- Launched in **2023**, VVP promotes comprehensive development by recognising border settlements as the nation's **"first villages"**.

Why Border Communities Matter

- Local residents understand the terrain and can report unusual movements. Their continued presence supports the work of border-guarding forces.
- The source cites local residents reporting suspicious movement during the **1999 Kargil intrusion** as an example of their contribution to national security.

Earlier Initiative: Border Area Development Programme

- The **Border Area Development Programme (BADP)** was launched in **1986–87**, initially along the western border, and later expanded to other border areas.
- According to the source, BADP is now in its **sunset phase**, meaning it is being phased out. VVP builds on this experience through focused village development and the delivery of applicable government schemes.

Objectives of the Programme

- Improve infrastructure and access to essential services.

- Create sustainable employment and local income opportunities.
- Reduce distress-driven out-migration.
- Encourage residents to remain in or return to their villages.
- Empower women and young people.
- Promote local culture, tourism and entrepreneurship.
- Strengthen border security through prosperous and confident communities.

VVP-I and VVP-II

The two phases share a common objective but differ in their geographical focus and funding design.

Feature	VVP-I	VVP-II
Scheme type	Centrally Sponsored Scheme	Central Sector Scheme, fully funded by the Centre
Focus	Selected northern-border villages	Selected villages along other international land-border areas
Launch location	Kibithoo, Arunachal Pradesh	Nathanpur, Assam
Outlay	₹4,800 crore	₹6,839 crore
Scheme period	2022–23 to 2026–27	Up to 2028–29
Village coverage	662 priority villages	1,954 identified villages

The combined outlay is **₹11,639 crore**.

VVP-I: Northern Border Villages

VVP-I was announced in the **Union Budget 2022–23** and launched at **Kibithoo in Anjaw district, Arunachal Pradesh**.

It covers selected villages in:

- Arunachal Pradesh.
- Himachal Pradesh.
- Sikkim.
- Uttarakhand.
- Ladakh.

Kibithoo is among India's easternmost inhabited villages. Its strategic location, association with the **1962 India–China War**, difficult terrain and development needs explain its importance.

Road connectivity receives a major share of VVP-I's allocation.

VVP-II: Wider Geographical Coverage

- VVP-II was approved in **2025** and launched at **Nathanpur in Cachar district, Assam**, in **2026**.
- It covers selected villages across **15 States and two Union Territories**.
- **States:** Arunachal Pradesh, Assam, Bihar, Gujarat, Manipur, Meghalaya, Mizoram, Nagaland, Punjab, Rajasthan, Sikkim, Tripura, Uttarakhand, Uttar Pradesh and West Bengal.
- **Union Territories:** Jammu and Kashmir, and Ladakh.
- **Important distinction:** VVP-II excludes northern-border blocks already covered under VVP-I. The exclusion applies to those blocks, rather than to an entire State or Union Territory.
- VVP-II also places special emphasis on **preventing and controlling trans-border crime** through stronger border communities.

Major Development Interventions

Connectivity and Basic Services

The programme supports:

- All-weather roads and bridges.
- Drinking water and reliable electricity.
- Mobile and internet connectivity.

- Healthcare and educational infrastructure.
- SMART classrooms and multipurpose community centres.

These facilities improve access to services, markets and economic opportunities.

Sustainable Livelihoods

Livelihood support includes:

- Skill development and social entrepreneurship.
- Cooperatives and **Self-Help Groups (SHGs)**.
- **Farmer Producer Organisations (FPOs)**.
- Financial inclusion and local value chains.
- **One-block-one-product enterprises**.
- Opportunities for women and young people.

VVP-I follows a **hub-and-spoke model** for livelihood development. Under this approach, a central facility or market supports activities in surrounding settlements.

Tourism and Cultural Activities

The programme promotes border tourism through:

- Tourism circuits and tourist centres.
- Viewpoints and trekking routes.
- Adventure tourism.
- Eco-tourism and eco-resorts.
- Local cultural activities.

These initiatives seek to create employment while drawing attention to the region's natural and cultural heritage.

Implementation Mechanism

Village Action Plans

Implementation is guided by **Village Action Plans**, which identify interventions according to:

- Local development needs.
- State-specific conditions.
- Border-specific challenges.

They help district administrations organise activities across departments.

Scheme Convergence

- **Convergence** means coordinating different government schemes to meet a village's development needs.
- For example, all-weather roads are being developed under **PMGSY-IV**, administered by the **Ministry of Rural Development**.

Scheme Saturation

- **Saturation** means ensuring that every eligible household receives the benefits applicable to it under existing scheme norms.
- It does not mean removing eligibility requirements.

Institutional Coordination

- The **Ministry of Home Affairs (MHA)** is the nodal ministry. It coordinates with State governments, district administrations, Central departments and border-guarding forces.
- A **High-Powered Committee chaired by the Cabinet Secretary** may recommend relaxation of scheme guidelines to address the special circumstances of border villages.

Progress and Impact

Infrastructure Development

- The source reports progress in sanctioning road, bridge and public-service projects. These aim to connect previously unconnected villages and improve access to markets and services.
- However, **project approval and project completion are different stages**. The lasting benefit depends on completed facilities remaining functional.

Tourism and Service Delivery

- Tourism projects include trekking routes, viewpoints, tourist centres and eco-tourism facilities.
- Health camps, veterinary camps, awareness drives and skill-training activities are also extending services to remote communities.

Signs of Reverse Migration

- The source reports residents returning to border villages in **Kurung Kumey, Dibang Valley and Shi-Yomi districts of Arunachal Pradesh**.
- **Reverse migration** means people returning to their places of origin after moving elsewhere.

Local Procurement by Security Forces

- In Arunachal Pradesh, the **Indo-Tibetan Border Police (ITBP)** directly procures **milk, vegetables, eggs and grains** from vibrant villages.
- This creates a dependable market for local producers and strengthens community links with border-guarding forces.

Youth Participation

- Under the **Viksit Vibrant Village Programme**, volunteers have participated in community service, cultural exchange and grassroots development in border villages of Ladakh, Himachal Pradesh and Uttarakhand.

Significance

Development–Security Linkage

- Better living conditions help sustain frontier populations. Resident communities, in turn, support local awareness and cooperation with security forces.

Reduction in Regional Disparities

- Improved services help narrow the development gap between remote villages and better-connected regions.

Economic Self-Reliance

- Tourism, local enterprises and assured markets can diversify household incomes and reduce dependence on migration.

Women and Youth Empowerment

- SHGs, skill development and entrepreneurship create opportunities for groups that may otherwise have limited access to employment.

Better Governance

- Village Action Plans and scheme convergence encourage coordinated service delivery rather than disconnected departmental activities.

National Integration

- Cultural exchange and youth participation help build connections between frontier communities and the wider country.

Challenges

The conditions described in the source indicate several implementation challenges:

- **Difficult terrain:** Construction and service delivery are more demanding in remote areas.
- **Limited economic opportunities:** Infrastructure must be accompanied by viable livelihoods.
- **Out-migration:** Families need dependable services and incomes to remain.
- **Coordination requirements:** Several departments must work towards common village priorities.
- **Sustained functionality:** Roads, water systems and public facilities require maintenance.

Way Forward

- Prioritise completion and maintenance of essential infrastructure.
- Strengthen community participation in Village Action Plans.
- Connect local products with dependable markets.
- Support women, youth, cooperatives and SHGs.
- Develop tourism suited to local environmental and cultural conditions.
- Track improvements in household income, service access and population retention.
- Maintain coordination between communities, administrations and border-guarding forces.

Conclusion

The Vibrant Villages Programme links border development with national security. Reliable services and sustainable livelihoods can help frontier communities remain prosperous and resilient. Its success will depend on translating projects into lasting improvements in everyday life.

PM SHRI Schools: India's Push for Future-Ready Model Schools

Source: PIB

Relevance: **UPSC GS Paper II: Education, governance, welfare schemes and human resource development**

Important Key Words

Prelims

- PM SHRI | Pradhan Mantri Schools for Rising India | NEP 2020 | Centrally Sponsored Scheme | Ministry of Education | KVS | NVS | NCERT | UDISE+ | Challenge Mode | School Quality Assessment Framework | DIKSHA | 5+3+3+4 Structure | KGBV | DIET | PM POSHAN

Mains

- Human Capital Formation | Inclusive Education | Equity in Schooling | Learning Outcomes | Competency-based Education | Digital Pedagogy | Teacher Capacity Building | Green Schools | School Governance | Foundational Literacy and Numeracy

Why in News?

The **Pradhan Mantri Schools for Rising India (PM SHRI)** scheme has made major progress since its launch on **7 September 2022**. As of **July 2026**, **13,092 schools** have been selected across **36 States and Union Territories**, covering around **90%** of the target of more than **14,500 schools**.The scheme is important because it seeks to develop selected existing schools as **model institutions** aligned with the vision of the **National Education Policy 2020**.

What is PM SHRI?

- **PM SHRI** stands for **Pradhan Mantri Schools for Rising India**.
- It is a **Centrally Sponsored Scheme** implemented by the **Department of School Education and Literacy, Ministry of Education**.
- The scheme aims to qualitatively strengthen existing schools and develop them as **exemplar institutions**. These schools are expected to demonstrate the effective implementation of **NEP 2020** at the school level.

- PM SHRI schools are envisioned as safe, stimulating and welcoming learning spaces. They are supported by quality infrastructure, appropriate learning resources and diverse learning experiences.

Why was PM SHRI Needed?

India has one of the largest school education systems in the world, with **14.71 lakh schools** serving more than **24.69 crore students**. Such a large system requires reforms that improve not only access, but also quality, equity and learning outcomes.

- The **NEP 2020** provides the broader framework for transforming school education. PM SHRI translates this policy vision into institutional practice by upgrading selected schools into model schools.
- The scheme represents a shift from an **infrastructure-centric model** to a **holistic school transformation model**. It focuses on infrastructure, pedagogy, inclusion, sustainability, technology, teacher development and student well-being.

What are the Major Features of PM SHRI?

- **NEP 2020 Alignment:** PM SHRI schools showcase the key components of **NEP 2020**, including competency-based learning, flexibility, inclusion and holistic development.
- **Exemplar School Model:** These schools act as model institutions for neighbouring schools through mentoring, handholding, collaboration and clustering.
- **Holistic Development:** The scheme focuses not only on cognitive development, but also on creativity, leadership, socio-emotional skills, life skills and responsible citizenship.
- **Inclusive Learning Environment:** PM SHRI schools aim to provide equitable and joyful education to students from diverse backgrounds and varied learning abilities.
- **Future-ready Skills:** Students are exposed to **21st-century skills**, digital learning, STEM-based education and links with local entrepreneurial ecosystems.
- **Green School Orientation:** The scheme promotes sustainable and environment-friendly school practices as part of school quality.

What is the Financial and Institutional Coverage?

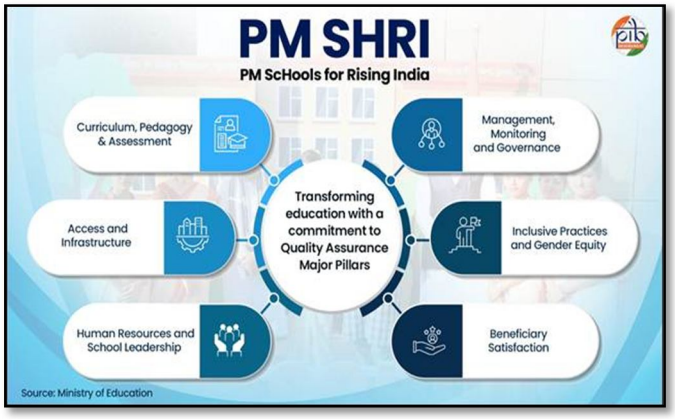
- PM SHRI is being implemented over **five years from 2022–23 to 2026–27**.
- The total project cost is **₹27,360 crore**, including a central share of **₹18,128 crore**. The central share of approved **Project Approval Board outlay** increased from **₹2,520 crore in 2023–24** to **₹5,224 crore in 2026–27**, showing an increase of around **107%**.
- As of **July 2026**, **13,092 schools** have been selected. This is around **90%** of the envisaged target. The scheme is expected to directly benefit more than **20 lakh students**.
- The selected schools cover **725 districts** and **8,340 blocks or urban local bodies**. They include institutions under **KVS**, **NVS** and **NCERT**.
- Among the selected schools, **1,305** are primary schools, **3,102** upper primary schools, **3,141** secondary schools and **5,544** higher secondary schools. The network also includes **80 KGBVs**, **913 KVS schools**, **620 NVS schools** and **4 NCERT schools**.

What are the Six Pillars of PM SHRI?

PM SHRI is based on six major pillars drawn from the vision of **NEP 2020**.

Pillar	Focus Area
Curriculum, Pedagogy and Assessment	Competency-based, learner-centred and outcome-oriented education
Access and Infrastructure	Safe, inclusive, functional and barrier-free school infrastructure
Human Resources and School Leadership	Teacher capacity building and strong principal leadership
Management, Monitoring and Governance	Institutional planning, quality monitoring and accountability
Inclusive Practices and Gender Equity	Equal learning opportunities for all students
Beneficiary Satisfaction	Satisfaction of students, parents and community stakeholders

These pillars show that PM SHRI focuses on the complete school ecosystem, not merely buildings or physical facilities.



How are PM SHRI Schools Selected?

PM SHRI schools are selected through **Challenge Mode**, where schools compete for support to become exemplar schools. The selection process has three stages.

- **Stage 1: MoU with States and UTs:** States and Union Territories sign an MoU with the Centre, committing to provide support for selected schools to achieve PM SHRI standards.
- **Stage 2: Identification of Eligible Schools:** Eligible schools are identified using prescribed minimum benchmarks and indicators available through **UDISE+** data.
- **Stage 3: Challenge Method:** Eligible schools compete based on specified criteria. Their claims are verified through physical inspection by States, UTs, KVS or NVS authorities.

Final selection is done by an Expert Committee headed by the Secretary, School Education and Literacy, Ministry of Education.

Urban schools must score at least **70%**, while rural schools must score at least **60%** under the Challenge Method.

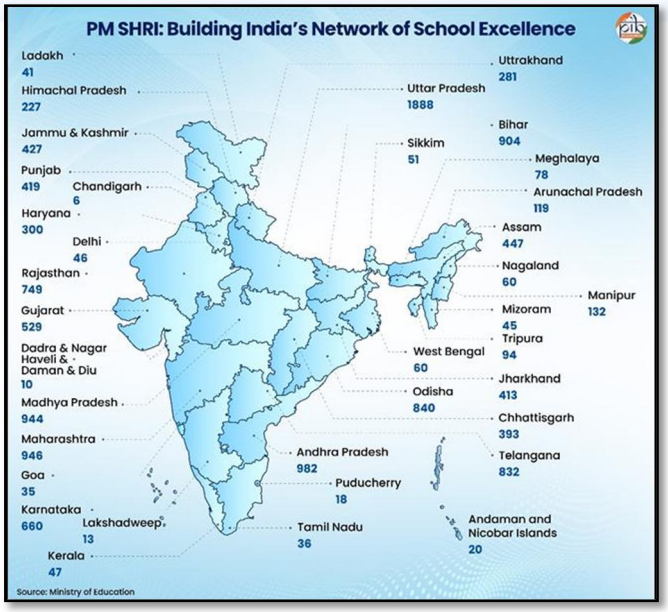
What are the Minimum Quality Benchmarks?

Schools must meet basic minimum standards before selection.

Important requirements include:

- Pucca building
- Barrier-free access
- Safety measures
- Separate toilets
- Drinking water
- Hand-washing facilities
- Electricity
- ID cards for teachers
- Library or sports facilities
- Enrolment above State average at elementary and senior secondary levels

The assessment also covers infrastructure, learning outcomes, pedagogy, **PM POSHAN**, vocational education, green initiatives and stakeholder commitment.



How does PM SHRI Transform School Education?

- **Competency-based Learning:** PM SHRI schools follow the **National Curriculum Framework** or State Curriculum Framework based on the **5+3+3+4 structure** under NEP 2020.
  - This promotes understanding, application, creativity and critical thinking instead of rote learning.
- **Experiential Pedagogy:** The scheme promotes bagless days, internships with local artisans, study of local arts and crafts, celebration of cultural events and preservation of indigenous knowledge.
  - Such methods connect school learning with real life and local culture.
- **Equity and Multilingualism:** PM SHRI promotes mother tongue, local or regional language as the medium of teaching and learning, especially in early grades.
  - According to UDISE+ 2025–26 data, PM SHRI schools have **6,102 Sanskrit teachers**, **1,994 Urdu teachers** and **9,152 regional language teachers**.
- **Technology-enabled Learning:** The scheme supports ICT facilities, smart classrooms, internet connectivity, digital platforms and STEM-based programmes.
  - Platforms such as **DIKSHA** provide digital resources and support interactive learning.
- **Holistic Student Development:** PM SHRI integrates academics with sports, arts, extracurricular activities and life-skills education.
  - This helps develop leadership, creativity, socio-emotional competencies and adaptability.
- **Teacher Capacity Building:** PM SHRI supports professional development through **DIETs**.
  - Financial assistance of up to **₹3 lakh per DIET** is provided for capacity-building programmes, and up to **₹2,500 per teacher** is provided for training subject teachers, principals, special educators, ICT teachers and master trainers.
- **School Leadership Development:** Principals are trained in educational leadership, school management and competency-based pedagogical planning.
  - Teachers receive training in Holistic Progress Card, school safety, mental health, first-level counselling and ICT integration.

What is the Significance of PM SHRI?

- **Operationalisation of NEP 2020:** PM SHRI converts the broad vision of NEP 2020 into school-level practice.
  - It brings competency-based learning, inclusion, digital education and holistic development into institutional practice.
- **Human Capital Formation:** By improving learning outcomes and future-ready skills, the

scheme supports the development of capable and confident learners.
    - This contributes to India's long-term social and economic development.
- **Equity in Education:** PM SHRI promotes access for rural, underserved & diverse communities.
    - Its focus on multilingual learning and inclusive practices helps reduce educational disparities.
- **Systemic Reform through Mentorship:** PM SHRI schools are expected to mentor neighbouring schools through collaboration and clustering.
    - This can create a ripple effect beyond selected schools.
- **Technology and Green Education:** The scheme integrates digital pedagogy and sustainable practices.
    - This aligns school education with future skill needs and environmental responsibility.

Way Forward?

- **Outcome-based Monitoring:** The scheme should track learning outcomes, classroom practices, inclusion and student well-being.
    - Infrastructure improvement should be linked with measurable educational outcomes.
- **Continuous Teacher Development:** Training should be practical, regular and linked to classroom needs.
    - DIETs must play a stronger role in mentoring teachers and school leaders.
- **Local-language Digital Resources:** Digital content should be available in mother tongue and regional languages.
    - This will strengthen foundational literacy and inclusive learning.
- **Institutionalised Mentorship:** PM SHRI schools should have structured mechanisms to guide neighbouring schools.
    - Cluster-based collaboration can spread good practices beyond selected schools.
- **Community Participation:** Parents, local bodies and school management committees should be involved in monitoring and school improvement.
    - This can improve accountability and local ownership.

Conclusion

PM SHRI is an important reform for transforming Indian school education in line with **NEP 2020**. It moves beyond infrastructure to focus on learning outcomes, inclusion, digital pedagogy, teacher capacity and holistic development. If implemented effectively, PM SHRI schools can become models for wider education reform and help build an equitable, skilled and future-ready India.

9th Rashtriya Poshan Maah 2026

Source: Press Information Bureau

Relevance: UPSC GS Paper II: Welfare schemes for women and children

Important Keywords

Prelims

- Rashtriya Poshan Maah, Mission Poshan 2.0, POSHAN Abhiyaan, ICDS, Anganwadi Centres, Supplementary Nutrition Programme, PMMVY, Poshan Tracker, ECCE, RBSK

Mains

- Lifecycle approach to nutrition, first 1,000 days, dietary diversity, community participation, behavioural change, nutrition

governance, early childhood development and social accountability

Why in News?

The **9th Rashtriya Poshan Maah** was launched on September 9, 2026, at the **Rudraksh International Cooperation and Convention Centre in Varanasi**. Under the theme **"Hamari Anganwadi, Hamari Jimmedari"**, the campaign places Anganwadi Centres at the centre of community action for nutrition, caregiving and early childhood development.

Background

- Malnutrition affects physical growth, learning capacity, maternal health and future productivity. Addressing it requires coordinated action on food, health, sanitation, caregiving and social protection.
- The Government launched **POSHAN Abhiyaan** in March 2018 as a multi-ministerial convergence mission. It combines technology-based monitoring with community mobilisation and behavioural change.
- In the **Union Budget 2021–22**, major nutrition interventions were integrated under **Mission Poshan 2.0**, administered by the **Ministry of Women and Child Development**.

The mission brings together:

1. **POSHAN Abhiyaan:** Digital monitoring, behavioural change and Jan Andolan.
2. **Anganwadi Services/ICDS:** Supplementary nutrition, hot cooked meals and early childhood care.
3. **Scheme for Adolescent Girls:** Nutritional support for eligible adolescent and out-of-school girls.

Rashtriya Poshan Maah is observed every September to mobilise communities around the objectives of Mission Poshan 2.0.



About the 9th Rashtriya Poshan Maah

- The 2026 campaign recognises Anganwadi Centres as the foundation of India's community-based childcare and nutrition system.
- Its central theme calls upon families, local governments, community organisations and frontline workers to take collective responsibility for Anganwadi functioning.

The campaign is organised around five priorities:

- Dietary diversity and adequate protein
- Fresh and diverse hot cooked meals
- Community ownership and accountability
- Nutrition and early stimulation
- Ten years of the Pradhan Mantri Matru Vandana Yojana

Five Priority Themes

Dietary Diversity and Adequate Protein

- A balanced diet should include cereals and millets, pulses, fruits, vegetables, nuts, seeds, milk products and appropriate animal-source foods.

The campaign promotes affordable and locally available nutrition through:

- Recipe demonstrations at Anganwadi Centres
- Poshan Melas displaying local foods
- Awareness about plant- and animal-based protein
- Use of seasonal produce from **Poshan Vatikas**
- Counselling on complementary feeding

The objective is to move beyond calorie intake and improve the overall quality of household diets.

Fresh Hot Cooked Meals

The **Supplementary Nutrition Programme** provides nutrition support through Hot Cooked Meals and Take-Home Rations.

The campaign seeks to improve Hot Cooked Meals through:

- Weekly menu rotation
- Use of millets, pulses and seasonal vegetables
- Hygienic food preparation
- Quality testing in collaboration with **FSSAI**
- Community tasting sessions involving parents, Panchayats and Self-Help Groups

Fresh and acceptable meals can improve regular attendance and utilisation of Anganwadi services.

Community Ownership and Accountability

- The Ministry issued guidelines for **Anganwadi Management Committees** on June 23, 2026.
- Chaired by the Anganwadi Supervisor, these committees are expected to promote participatory oversight of nutrition and early childhood services.

Important measures include:

- Activation of AMCs at Anganwadi Centres
- At least one committee meeting during Poshan Maah
- Display of Supplementary Nutrition Programme menu boards
- Monitoring of meal quality, quantity and menu compliance
- Periodic social audits with Mothers' Committees

Visible menu boards allow families to understand daily meals and beneficiary entitlements.

Nutrition and Early Stimulation

- Nutrition and responsive caregiving during the **first 1,000 days** are crucial for brain development. Undernutrition during this period can cause lasting cognitive, physical and socio-emotional effects.
- The revised **Home Visit Scheduler** contains a structured package covering **34 developmental milestones for children aged up to three years**.

The campaign promotes:

- Caregiver counselling through home visits
- Early identification of developmental delays
- Referral to health facilities and **Rashtriya Bal Swasthya Karyakram teams**
- Implementation of **Navchetna** and **Aadharshila** curricula
- Age-appropriate learning and school readiness

This approach connects what a child eats with how the child learns and develops.

Ten Years of PMMVY

- The 2026 campaign commemorates ten

years of the **Pradhan Mantri Matru Vandana Yojana**, India's maternity-benefit programme.

- PMMVY supports maternal nutrition and health-seeking behaviour through income support during pregnancy.

The proposed campaign activities include:

- Saturation drives to identify eligible beneficiaries
- Faster verification and Direct Benefit Transfers
- Monitoring through PMMVY dashboards
- Awareness about eligibility, benefits and instalments
- Release of an implementation toolkit
- Dissemination of information in regional languages

Nutrition as a Jan Andolan

- POSHAN Abhiyaan treats nutrition as a **Jan Andolan**, or people's movement, rather than only a government programme.

Community mobilisation seeks to improve behaviour related to:

- Maternal nutrition
- Infant and young child feeding
- Antenatal care
- Hand hygiene
- Growth monitoring
- Institutional healthcare
- Healthy household diets

Poshan Pakhwada 2026

- The two-week **Poshan Pakhwada** has been observed annually since 2018.
- Its eighth edition was held from April 9 to 23, 2026, under the theme **"Maximising Brain Development in the First Six Years of Life."**
- Scientific evidence indicates that more than **85% of brain development occurs by six years of age**, with the most rapid development taking place during the first 1,000 days.

Progress of Community Mobilisation

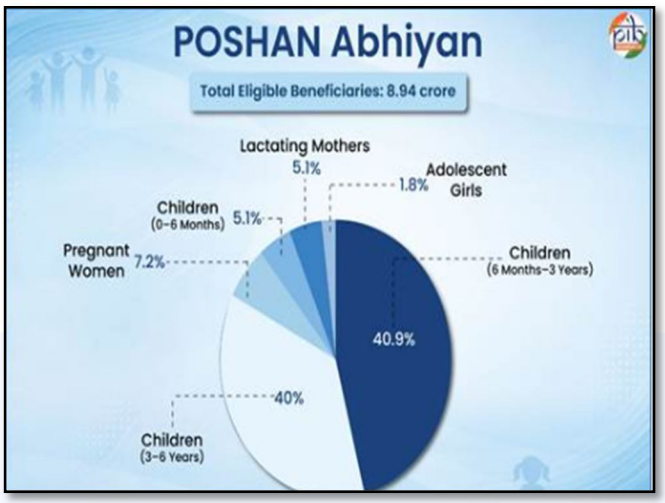
- The eighth Rashtriya Poshan Maah was launched in 2025 from **Dhar, Madhya Pradesh**, along with the **Swasth Nari, Sashakt Parivar Abhiyaan**.
- It focused on maternal nutrition, infant and young child feeding, early childhood education and reduction in excessive sugar and oil consumption. About **14.33 crore activities** were conducted in convergence with more than 20 Ministries.

Poshan Tracker

Launched on **March 1, 2021**, the **Poshan Tracker** is the principal digital platform for monitoring Anganwadi infrastructure and service delivery.

It records:

- Opening of Anganwadi Centres
- Attendance of children
- Growth-monitoring activities
- Early childhood education activities
- Services for pregnant and lactating women
- Coverage of children and adolescent girls



Nutrition Infrastructure

As of July 31, 2026:

- India had nearly 13.99 lakh Anganwadi Centres.
- About 13.30 lakh Anganwadi Workers served at the grassroots.
- The network covered approximately 8.94 crore beneficiaries.
- More than 7.2 crore children aged six months to six years received services.
- Pregnant and lactating women together accounted for nearly 1.1 crore beneficiaries.

Significance

Lifecycle Approach

- The programme addresses nutrition from adolescence and pregnancy to infancy and early childhood, helping to break the intergenerational cycle of malnutrition.

Integration of Nutrition and Learning

- Connecting nutrition with early stimulation recognises that cognitive development depends on both adequate food and responsive caregiving.

Localisation of Diets

- Use of millets, pulses, seasonal vegetables and Poshan Vatika produce can make nutritious diets culturally acceptable and affordable.

Social Accountability

- AMCs, Mothers' Committees and menu boards allow communities to monitor entitlements and service quality.

Technology-Based Governance

- The Poshan Tracker enables near real-time monitoring, beneficiary identification and administrative review.

Women's Welfare

- PMMVY combines income support with maternal health and nutrition, particularly during pregnancy and the first 1,000 days.

Challenges

- Poverty and food-price pressures restrict access to diverse diets.
- Protein-rich foods may remain unaffordable for vulnerable households.
- Anganwadi infrastructure and basic facilities vary across States.
- Vacancies and heavy workloads can reduce the quality of frontline services.
- Digital reporting may increase paperwork for Anganwadi Workers.
- Errors in beneficiary data can result in exclusion from services.
- Meal quality and Take-Home Ration standards are uneven.
- Social norms can lead to women eating last or receiving inadequate nutrition.
- Coordination among health, sanitation, education and food departments remains difficult.
- Awareness campaigns alone cannot overcome structural food insecurity.

Way Forward

- Upgrade Anganwadi buildings with safe kitchens, drinking water and sanitation.
- Fill frontline vacancies and provide continuous training to workers.
- Procure diverse foods locally through Panchayats, farmer groups and SHGs.
- Conduct independent testing of meals and Take-Home Rations.
- Use Poshan Tracker data for corrective action rather than only reporting.
- Strengthen convergence with healthcare, immunisation, sanitation and social-

protection programmes.

- Institutionalise AMC meetings and community social audits.
- Ensure PMMVY saturation through simplified enrolment and timely transfers.
- Provide nutrition counselling in local languages.
- Monitor child-development milestones alongside height and weight.

Conclusion

Rashtriya Poshan Maah 2026 expands nutrition policy from food distribution to dietary quality, early learning and community accountability. Strengthened Anganwadi Centres, reliable data and timely maternal support can help convert public awareness into lasting improvements in human development.

Swachhata Hi Seva 2026: Making Cleanliness a Collective Responsibility

Source: PIB

Relevance: UPSC GS Paper II: Government Policies and Citizen Participation

Important Key Words

Prelims

- Swachh Bharat Mission, SBM-G, SBM-U, Swachhata Hi Seva, ODF Plus, GOBARdhan, Cleanliness Target Units, SafaiMitra, FACES, Swachhata App

Mains

- Jan Bhagidari, behavioural change, circular economy, source segregation, sanitation-worker welfare, resource recovery, community ownership, Whole-of-Government approach

Why in News?

Swachhata Hi Seva 2026 is being conducted from **September 17 to October 2, 2026**, under the theme **"Swachhata Mein Sahbhag; Swachh Bharat, Viksit Bharat."**The campaign emphasises collective ownership of cleanliness, youth participation, sanitation-worker welfare, waste-management responsibilities and public awareness of the **Solid Waste Management Rules, 2026**.

What is the Swachh Bharat Mission?

- The **Swachh Bharat Mission (SBM)** was launched on **October 2, 2014** as a nationwide sanitation movement.
- Its logo represents the spectacles of **Mahatma Gandhi**, reflecting his emphasis on cleanliness. The logo helped create a common identity for the national cleanliness campaign.

The Mission has two components:

Component	Area of focus
Swachh Bharat Mission-Grameen	Rural sanitation, toilet access and usage, solid waste management and liquid waste management
Swachh Bharat Mission-Urban	Urban sanitation, public spaces, waste management and sanitation infrastructure

The Mission initially focused on access to toilets and the elimination of open defecation. It has since expanded into a wider movement covering:

- Waste collection and segregation
- Solid and liquid waste management
- Visual cleanliness
- Behavioural change
- Sanitation-worker welfare

- Citizen participation

Progress under Swachh Bharat Mission

Rural Sanitation

Rural India was declared **Open Defecation Free in 2019**.

As of September 17, 2026:

Indicator	Achievement
ODF Plus villages	More than **5.69 lakh**
ODF Plus Model villages	More than **5.25 lakh**
Villages with solid-waste management	More than **5.38 lakh**
Villages with liquid-waste management	More than **5.65 lakh**
Individual household toilets constructed	**12.22 crore**
Operational GOBARdhan plants	**1,314 in 585 districts**
Household-level biogas plants	**98,273**

Urban Sanitation

Indicator	Achievement
Wards with complete door-to-door waste collection	**95,478**
Wards with complete source segregation	**83,963**
Waste-to-compost plants	**3,254**
Waste-to-energy plants	**60**
Sewage treatment plants	**1,112**
Faecal sludge treatment plants	**1,131**
Public sanitation facilities	**68,339**

The public sanitation facilities include:

- **37,766 public toilets**
- **25,512 community toilets**
- **5,061 urinals**

These achievements show the Mission's transition from toilet construction to comprehensive and sustainable sanitation systems.

What is an ODF Plus Village?

- An **ODF Plus village** sustains its open-defecation-free status while managing solid and liquid waste and maintaining visual cleanliness.

ODF Plus villages are classified into three progressive stages:

Stage	Requirement
Aspiring	Manages either solid waste or liquid waste
Rising	Manages both solid and liquid waste
Model	Manages both waste streams, maintains visual cleanliness and displays ODF Plus messages

The classification encourages villages to move gradually from basic sanitation to complete waste management and visible cleanliness.

What is Swachhata Hi Seva?

- **Swachhata Hi Seva (SHS)** is an annual public-participation campaign conducted since **2017**.
- It is organised before **Swachh Bharat Diwas**, observed on October 2. It provides a dedicated period for citizens, institutions and governments to undertake collective cleanliness activities.
- The campaign is based on **Jan Bhagidari**, which means public participation in governance and community development.

Important Related Terms

- **Shramdaan:** Voluntary and selfless contribution of labour for community welfare.
- **Swachhagrahis:** Trained sanitation workers or volunteers who promote cleanliness at the gram panchayat level.
- **Nigrani Samitis:** Community groups that persuade people to avoid open defecation and follow sanitation practices.
- **SafaiMitras:** Sanitation workers involved in cleaning, solid-waste management and used-water management.

Swachhata Hi Seva 2026

SHS 2026 follows both a **Whole-of-Government** and a **Whole-of-Society** approach.

Whole-of-Government Approach

- Different ministries, departments, State governments, local bodies and public institutions coordinate their sanitation activities.

Whole-of-Society Approach

- Citizens, students, youth organisations, NGOs, sanitation workers, educational institutions and community groups participate collectively.
- The campaign also creates awareness about the **Solid Waste Management Rules, 2026**, particularly the responsibilities of citizens, institutions and waste generators.

Five Activity Pillars of SHS 2026

1. Transformation of Cleanliness Target Units and Public Places

- **Cleanliness Target Units (CTUs)** are neglected garbage points and difficult-to-clean locations requiring special intervention.

The campaign seeks to transform these areas through:

- Waste removal
- Beautification
- Mapping of cleaned locations
- Long-term maintenance
- Prevention of renewed dumping

The campaign covers:

- Markets
- Schools
- Hospitals
- Transport hubs
- Parks
- Water bodies
- Public and community toilets

Citizens can report garbage and sanitation-related grievances through the **Swachhata App**. Identified sites can subsequently be mapped on the SHS 2026 portal.

FACES Assessment

Public and community toilets will be assessed through **FACES parameters**:

- F – Functional
- A – Accessible
- C – Clean
- E – Eco-friendly
- S – Safe

2. Swachh Paathshala—Yuva for Swachhata

- Students and young people have been given a dedicated role in the campaign.
- Students from Classes 6 to 12 will participate in **Swachhata Gyan Yatras** to sanitation and waste-management facilities.

Schools are encouraged to organise discussions on:

- Waste management
- Water conservation

- Personal hygiene
- Handwashing
- Menstrual hygiene
- Safe drinking water



The objective is to build sanitation awareness at an early age and create long-term behavioural change.

3. SafaiMitra Suraksha, Seva Evam Samman Shivirs

Special camps will be organised for sanitation workers and their families.

They will provide:

- Health services
- Safety equipment
- Welfare-scheme linkages
- Recognition of sanitation workers
- Support for workers' families

The pillar recognises that sustainable sanitation depends upon the health, dignity and safety of sanitation workers.

4. Jan Bhagidari for Swachhata

Citizens and institutions are encouraged to take responsibility for everyday cleanliness.

Major activities include:

- Awareness about the Solid Waste Management Rules, 2026
- Demonstrations of four-way waste segregation
- Promotion of home composting
- Campaigns against littering
- Campaigns against single-use plastics
- Swachhata rallies and human chains
- Public cleanliness pledges
- Collection of reusable household items

Swachh Parv, Harit Parv

Festivals occurring during the campaign period are encouraged to follow:

- Plastic-free practices
- Eco-friendly decorations
- Proper waste segregation
- Post-festival cleaning
- Environmentally responsible celebrations

5. Swachhata Se Samriddhi

This pillar connects cleanliness with economic value, resource recovery and the circular economy.

It promotes the principles of:

- Reduce
- Reuse
- Recycle

Important activities include:

- **Kabaad Se Jugaad:** Creating useful products from discarded materials.
- **Kabaad Se Kala:** Producing art from waste materials.

The initiative shows that waste can become a resource when it is properly segregated, reused and recycled.

Special Activities

Ek Din, Ek Ghanta, Ek Saath

- On **October 1, 2026**, simultaneous cleanliness activities will be organised across the country.



- Citizens, institutions, youth groups and NGOs are encouraged to participate together for one hour.

Special Meetings on October 2

On **Swachh Bharat Diwas**:

- Special Gram Sabhas will discuss SHS activities and the Solid Waste Management Rules, 2026.
- Urban local bodies will conduct Special Council Meetings.

These meetings seek to convert campaign activities into continuing local action.

Evolution of Swachhata Hi Seva

The campaign has gradually expanded from voluntary cleaning to sustainable waste management and behavioural change.

Year	Main focus
2017	Beginning of the people-led cleanliness movement and large-scale shramdaan
2018	Strengthening Jan Bhagidari and declaring sanitation as everyone's responsibility
2019	Plastic-waste collection, segregation and reduction of single-use plastics
2020	Campaign not conducted because of the COVID-19 pandemic
2021	Sustaining ODF status, ODF Plus activities and liquid-waste management
2022	Visual cleanliness, waste segregation and the 4R principle
2023	"Garbage-Free India," public-space transformation and SafaiMitra welfare
2024	"Swabhav Swachhata, Sanskaar Swachhata"—cleanliness as a habit and value
2025	"Swachhotsav"—clean and environmentally responsible community celebrations
2026	"Swachhata Mein Sahbhag"—collective ownership and sustained participation

Major Milestones in the Campaign's Evolution

SHS 2017: Beginning of a People-Led Movement

The first campaign was launched on **September 15, 2017**. It promoted voluntary participation and the Swachhata pledge.

At that time:

- **4.82 crore toilets** had been constructed since 2014.
- **2.38 lakh villages** had become ODF.
- Toilet coverage had increased from **42% in 2014 to 64% in 2017**.
- **2.46 crore children** participated in a national painting competition.

SHS 2019: Focus on Plastic Waste

The campaign promoted alternatives such as cloth and jute bags and organised plastic-waste collection and segregation.

During this period:

- Six States discouraged or banned single-use plastic.
- Similar action was taken by **171 districts**.

SHS 2021: Comprehensive Cleanliness

The campaign focused on sustaining ODF achievements and accelerating ODF Plus activities.

Important actions included:

- More than **60 lakh participants**
- Over **1.5 lakh shramdaan activities**
- More than **43,000 Gram Sabha resolutions** against single-use plastic
- Construction of household and community soak pits for liquid-waste management

SHS 2022: Visual Cleanliness

The campaign promoted the **4R principle**:

- Refuse
- Reduce
- Reuse
- Recycle

More than **9.81 crore people** participated in sanitation-related shramdaan.

SHS 2023: Garbage-Free India

The campaign recorded large-scale action to clean:

- Beaches
- Riverbanks and waterfronts
- Legacy waste sites
- Tourist destinations
- Public spaces
- Water bodies
- Garbage-vulnerable sites

It also organised SafaiMitra welfare camps and brought youth into the campaign through the **Indian Swachhata League 2.0**.

SHS 2024: Cleanliness as Behaviour

The theme **"Swabhav Swachhata, Sanskaar Swachhata"** connected cleanliness with habits and social values.

The campaign transformed neglected residential areas, roadsides and markets. It also promoted:

- Swachh Bharat Cultural Fests
- Swachh Food Streets
- Waste-to-Art activities
- Tree plantation
- SafaiMitra welfare

SHS 2025: Swachhotsav

The campaign brought sanitation practices into community celebrations.

Its five pillars covered:

- Transformation of CTUs
- Clean public spaces
- SafaiMitra welfare
- Clean and green festivities
- Advocacy for Swachhata

The campaign cleaned **15.75 lakh CTUs** and **5.89 lakh public spaces**. It also promoted eco-friendly pandals, post-festival cleanliness and Swachhata Rangolis.

Significance of SHS 2026

Behavioural Change

- The campaign seeks to make cleanliness a

regular habit rather than an occasional activity.

Citizen Ownership

- Jan Bhagidari makes citizens active partners in sanitation instead of treating cleanliness as the government's responsibility alone.

Youth Participation

- School-based activities can create a generation that understands waste segregation, hygiene and environmental responsibility.

Dignity of Sanitation Workers

- Health camps, safety equipment and welfare linkages recognise the essential role of SafaiMitras.

Circular Economy

- Reuse, recycling, composting and waste-to-art activities reduce waste while recovering economic and social value.

Sustainable Public Spaces

- The transformation and continued maintenance of CTUs can prevent cleaned areas from returning to their earlier condition.

Local Institutional Participation

- Gram Sabhas and urban local bodies can convert national campaign goals into village- and city-level action.

Viksit Bharat

- Clean surroundings, efficient waste management, healthy communities and responsible citizenship support the wider objective of a developed India.

Challenges

Sustaining Behavioural Change

- Public participation may decline after the campaign period ends.

Source Segregation

- Waste processing becomes difficult when households and institutions fail to separate waste correctly.

Maintenance of Transformed Sites

- Cleanliness Target Units may again become dumping points without regular monitoring.

Sanitation-Worker Safety

- Workers require continuous access to protective equipment, health services and welfare benefits.

Infrastructure Management

- Waste-treatment plants, toilets, drainage systems and sanitation facilities require regular operation and maintenance.

Uneven Local Capacity

- Local bodies differ in financial resources, technical skills and waste-processing infrastructure.

Moving Beyond Symbolic Participation

- Short cleanliness drives must be followed by systematic collection, processing, recycling and safe disposal.

Way Forward

Make Swachhata a Year-Round Activity

- Local bodies and communities should continue cleanliness activities beyond the annual campaign period.

Strengthen Source Segregation

- Households and institutions should be trained in four-way segregation and proper waste disposal.

Ensure Long-Term CTU Maintenance

- Every transformed location should have a responsible institution, monitoring system and maintenance plan.

Protect SafaiMitras

- Health check-ups, safety equipment,

welfare linkages and dignity at work should become permanent features of sanitation governance.

Deepen Youth Engagement

- Swachhata Gyan Yatras and school discussions should be integrated with continuing sanitation education.

Promote Circularity

- Home composting, reuse, recycling, Kabaad Se Jugaad and Kabaad Se Kala should be expanded.

Use Digital Monitoring

- The Swachhata App and SHS portal should be used to identify problems, monitor their resolution and map transformed locations.

Strengthen Local Review

- Gram Sabhas and urban council meetings should periodically review waste management, public toilets and cleanliness infrastructure.

Maintain Whole-of-Society Participation

- Government departments, schools, citizen groups, NGOs and businesses must share responsibility for sustained sanitation.

Conclusion

Swachhata Hi Seva 2026 represents the transition of Swachh Bharat from infrastructure creation to community ownership and sustained behavioural change. Its focus on youth, sanitation workers, source segregation, public spaces and resource recovery gives sanitation a wider social and environmental meaning. The long-term success of the campaign will depend on whether cleanliness continues beyond the campaign period and becomes an everyday civic responsibility.

Accountable Lottery Regulation in India

Source: The Hindu

Relevance: **GS Paper II: Government policies and interventions | Centre–State relations | Federalism**

Important Keywords

Prelims:

- Entry 40 | Entry 34 | Lotteries (Regulation) Act, 1998 | Lotteries (Regulation) Rules, 2010 | Actionable Claim | Res Extra Commercium | Section 115BB

Mains:

- Accountable Regulation | Harm Reduction | Regressive Burden | Destination-State Consent | Public-Operator Model | Shadow Economy | Cooperative Federalism | Regulatory Autonomy



Why in News?

The debate over lottery regulation has gained attention amid concerns that blanket prohibition may redirect demand towards illegal lotteries, *matka*, *satta* and offshore betting platforms. The issue is whether strict regulation can reduce lottery-related harm while ensuring consumer protection, fiscal accountability and control over illegal markets.

Constitutional and Statutory Framework Governing Lotteries?

Constitutional Distribution of Powers

- **Union List—Entry 40:** Gives Parliament legislative competence over lotteries organised by the Union or State governments.
- **State List—Entry 34:** Gives State legislatures power over betting and gambling.
- **Entry 62 after GST:** Before the 101st Constitutional Amendment, Entry 62 gave States wider taxation powers over betting, gambling and lotteries. Lottery taxation is now largely governed through GST.

Lotteries (Regulation) Act, 1998

The Act defines a lottery as a scheme in which prizes are distributed by chance among persons purchasing tickets.

- **Section 3—General Prohibition:** Prohibits lotteries unless they are organised by a State government according to the Act.
- **Section 4—Conditions for State Lotteries:** Requires State responsibility over ticket printing, draw procedures, prize structures and authorised distribution. Tickets may be sold directly or through authorised distributors and agents.
- **Section 5—Power of States:** Allows a State to prohibit the sale of lotteries organised by other States, subject to the Supreme Court's interpretation.
- **Section 6—Union Government's Power:** Authorises the Union Government to prohibit lotteries that violate the Act.

Lotteries (Regulation) Rules, 2010

- **Online Lottery Regulation:** The Rules prescribe secure software, authorised distribution and proper maintenance of records.
- **Prohibited Practices:** They restrict unauthorised sales and improper mixing of paper and online lottery systems.
- **State-Level Restrictions:** Punjab and Nagaland have also restricted unauthorised online and WhatsApp-based lottery sales

Taxation of Lotteries

- **GST Treatment:** Lotteries are classified as specified actionable claims. An actionable claim is a legally recognised claim to a benefit, such as a conditional claim to prize money.
- **GST Rate:** From September 22, 2025, lottery, betting, gambling, casinos, horse racing and online money gaming attract 40% GST
- **Income Tax:** Lottery winnings are taxed at 30% under Section 115BB of the Income-tax Act, 1961, along with the applicable cess.
- **Tax Deduction at Source:** TDS is deducted under Section 194B before the prize is paid. Such winnings are reported under "Income from Other Sources", without ordinary deductions.

What is the Judicial Position on Lotteries?

State of Bombay v. R.M.D. Chamarbaugwala, 1957

- **Res Extra Commercium Doctrine:** The Supreme Court treated gambling as an activity outside ordinary trade and commerce.
- **Constitutional Effect:** Lottery and gambling operators cannot claim complete protection under Article 19(1)(g), dealing with freedom of trade, or Article 301, dealing with freedom of trade and commerce across India.

B.R. Enterprises v. State of Uttar Pradesh, 1999

- **All-or-Nothing Rule:** The Supreme Court

held that a State cannot operate its own lottery while prohibiting lotteries organised by other States.

- **Complete Withdrawal Required:** A State can exclude outside lotteries only after abandoning its own lottery and becoming completely lottery-free.
- **Regulatory Consequence:** Tamil Nadu in 2003 and Karnataka in 2007 chose total prohibition, thereby giving up the possibility of operating their own accountable public lotteries.

Skill Lotto Solutions v. Union of India, 2020

- **Actionable Claims as Goods:** The Supreme Court held that lotteries, betting and gambling are actionable claims that legally qualify as goods under GST law.
- **Taxation Validity:** The judgment upheld the taxation of lottery supplies under the GST framework.

What Does the Experience of Prohibition Show?

Historical Experience in the United States

The United States imposed alcohol prohibition through the Eighteenth Amendment and the Volstead Act between 1920 and 1933.

- **Demand Remained Intact:** The ban suppressed legal supply but failed to eliminate public demand.
- **Expansion of Organised Crime:** Bootlegging created a profitable black market controlled by violent syndicates.
- **Institutional Corruption:** Illegal supply networks corrupted enforcement agencies and public institutions.
- **Fiscal Loss:** Governments lost excise revenue while enforcement costs increased.

The Twenty-First Amendment repealed prohibition, recognising that a regulated and taxed market could create fewer harms than an unenforceable ban.

Relevance for India

- **Administrative Limitations:** Indian States experimenting with prohibition have also faced smuggling, illegal markets and enforcement difficulties.
- **Policy Lesson:** Prohibition may appear morally desirable but can become counterproductive when persistent demand shifts towards criminal networks.

What are the Key Concerns Regarding Lotteries?

Harms Caused by Lotteries

- **Regressive Socio-Economic Burden:** Lotteries disproportionately attract low-income households, encouraging them to spend scarce income on highly uncertain rewards.
- **Compulsive Gambling:** Rapid draws and instant-win games can encourage repeated participation and addictive behaviour.
- **Loss-Chasing:** Participants may continue buying tickets to recover previous losses, leading to debt and family distress.
- **Distorted Risk Perception:** Large jackpots receive extensive publicity, while the extremely low probability of winning receives less attention.
- **Credit-Based Sales:** Buying tickets with borrowed money can deepen household indebtedness.
- **Opaque Odds:** Participants may not receive clear information about winning probabilities, total ticket numbers, prize distribution and unclaimed prizes.
- **Manipulative Advertising:** Promotional

campaigns may present lotteries as an easy solution to poverty or financial insecurity.

Problems Created by Blanket Prohibition

- **Expansion of the Shadow Economy:** Bans may push participants towards smuggled tickets, *matka*, *satta*, single-digit rackets and offshore portals.
- **Absence of Consumer Protection:** Illegal operators function without age checks, financial audits, secure prize funds or effective fraud remedies.
- **Use of Mule Accounts:** Cash agents, proxy identities and mule bank accounts make illegal transactions and criminal proceeds difficult to trace.
- **Loss of Public Revenue:** Governments lose lottery surplus and GST revenue while spending more on enforcement.
- **Destruction of Livelihoods:** Bans affect small vendors, persons with disabilities, widows, women's self-help groups and low-income sellers.

Class Asymmetry in State Paternalism

- **Unequal Treatment of Financial Risk:** Affluent citizens can legally participate in intraday trading, leveraged derivatives and crypto-assets under disclosure-based regulation.
- **SEBI Findings:** A large majority of individual futures-and-options traders incur losses, yet financial-market participation is regulated rather than prohibited.
- **Relevant Difference:** Securities markets involve skill, investment, hedging and price discovery, while lotteries depend mainly on chance.
- **Policy Question:** The comparison raises the issue of whether the State should regulate risk and punish fraud rather than impose selective prohibition.

Advertising Regulation Gap

- **Non-Statutory Oversight:** The Advertising Standards Council of India is a self-regulatory body rather than a statutory regulator.
- **Enforcement Limitation:** Its advertising code does not possess the same legal force as statutory restrictions, creating accountability gaps.

What Models of Lottery Regulation are Followed Globally?

Controlled Legality

- **International Norm:** Nearly four-fifths of countries permit lotteries under regulated conditions rather than imposing complete prohibition.
- **Limited Prohibition:** Blanket bans mainly exist in strict Sharia-based jurisdictions such as Saudi Arabia, Iran and Brunei, and in closed ideological regimes such as Cuba.
- **Welfare Allocation:** Lottery surplus is commonly directed towards education, health care, sports, welfare and infrastructure.

Public-Operator Model

Nearly 70% of lottery jurisdictions reportedly follow this model.

- **Public Control:** A government department, statutory authority or State-owned company operates the lottery.
- **Limited Private Role:** Private companies provide technology, printing or retail services.
- **Public Accountability:** The government remains responsible for draws, prize funds and financial management.

- **Reduced Intermediary Capture:** Direct public operation limits the ability of marketing agents to retain excessive profits.

Concession Model

- **Private Operation:** A private concessionaire manages the lottery under a government licence.
- **State Regulation:** The State retains regulatory authority and specifies revenue-sharing and operational conditions.
- **Principal Risk:** Weak oversight may lead to concessionaire capture, where private operators gain excessive control over profits and policy.

Multi-Jurisdictional Pooling

Federal countries allow constituent units to cooperate voluntarily while retaining regulatory autonomy.

Examples include:

Powerball—United States | Lotto 6/49—Canada | Australian Lottery Blocs | DLTB—Germany

These arrangements allow participating jurisdictions to pool players, prizes, technology and costs.

Destination-Jurisdiction Consent

Authorisation in one jurisdiction does not automatically give an operator the right to sell tickets in another.

Cross-border sales require:

- consent of the destination jurisdiction; or
- participation in a cooperative agreement.

What is the Position of State Lotteries in India?

- A Lok Sabha reply of March 14, 2023 identified nine States operating lotteries:
- **Arunachal Pradesh | Goa | Kerala | Maharashtra | Mizoram | Nagaland | Punjab | Sikkim | West Bengal**

Regulatory Disparity

- **Direct Control over Domestic Lotteries:** A State can supervise its own ticket printing, draws, prize funds, agents and accounts.
- **Indirect Control over Outside Lotteries:** It has limited authority to audit another State's draw procedures, private agents and technology.
- **Local Enforcement Burden:** Despite limited control, the destination State must handle fraud, complaints and illegal sales within its territory.

How Does Kerala's Public-Operator Model Work?

- **Departmental Operation:** Kerala directly supervises lottery design, distribution, draws and prize payments.
- **Revenue Generation:** In 2023-24, Kerala earned ₹2,883.80 crore—₹1,129.71 crore as net lottery revenue or surplus and ₹1,754.09 crore as State GST.
- **Welfare Allocation:** Lottery surplus supports health care and welfare, including healthcare assistance through the Karunya framework.
- **Livelihood Distribution:** The system supports registered small vendors, persons with disabilities, self-help groups and cooperatives.
- **Policy Relevance:** Kerala provides a useful, though not universally applicable, model of publicly operated lotteries.

What are the Challenges in Establishing Accountable Regulation?

- **Conflict of Interest:** The government may simultaneously act as operator, regulator and revenue beneficiary.

- **Fiscal Dependence:** States may avoid restrictions that could reduce lottery revenue.
- **Weak Regulatory Capacity:** Some States may lack technical auditors, trained personnel and secure digital systems.
- **Problem Gambling:** Legal operation does not automatically prevent addiction, indebtedness or loss-chasing.
- **Digital Jurisdiction:** Offshore applications can operate beyond the effective control of individual States.
- **Money Laundering:** Cash transactions, proxy purchases and mule accounts may conceal illegal proceeds.
- **Inter-State Disputes:** Different State policies may create disagreements over online sales, taxation and enforcement.
- **Intermediary Capture:** Large private marketing agents may influence distribution, retain excessive profits or weaken State control.

What Measures are Needed for Accountable Lottery Regulation?

End the All-or-Nothing Rule

- **Amend Section 5:** Parliament should allow a State to exclude outside lotteries regardless of whether it operates its own lottery.
- **Uniform Treatment:** A State must either permit all legally compliant outside lotteries or exclude all of them.

Introduce a New Section 4A

- **Cooperative Lotteries:** Two or more States should be allowed to establish a common lottery through mutual agreement.
- **Resource Pooling:** Participating States could share players, prizes, technology, regulation and operational costs.
- **Protection of Smaller States:** This would provide smaller States access to larger markets without imposing compulsory access on other States.

Separate Operation from Regulation

- **Independent Statutory Authority:** The department operating a lottery should not act as its own regulator and auditor.
- **Independent Oversight:** The authority should supervise agents, prize funds, advertisements, draw procedures and consumer complaints.

Mandate Technical Audits

- **Third-Party Examination:** Lottery software, Random Number Generators and draw machines should undergo regular independent audits.
- **System Integrity:** Audits should verify that outcomes cannot be manipulated and that draw records remain secure.

Introduce Consumer Safeguards

- **Purchase Limits:** Daily or monthly limits can reduce compulsive participation and loss-chasing.
- **Credit-Sale Prohibition:** Tickets should not be sold on credit.
- **Product Restrictions:** Rapid-draw and instant scratch games that encourage repeated participation should be restricted.
- **Self-Exclusion:** Participants should be allowed to voluntarily block themselves from future purchases.

Strengthen Advertising Regulation

- **Mandatory Disclosure:** Advertisements should clearly communicate the low probability of winning.
- **Prohibited Claims:** Lotteries should not be

promoted as a guaranteed route out of poverty.

- **Protection of Vulnerable Groups:** Advertisements should not target children or financially distressed households.

Establish Unified Digital Enforcement

- **Inter-Agency Coordination:** MeitY, FIU-IND and State authorities should jointly act against illegal offshore platforms.
- **Financial Enforcement:** Authorities should block unauthorised payment gateways, trace mule accounts and freeze funds connected with illegal gambling.

Ensure Revenue Transparency

Annual public reports should disclose:

Ticket Sales | Prizes Paid | Unclaimed Prizes | Agent Commissions | GST | Operating Costs | Net Surplus | Welfare Expenditure

Dedicate Revenue to Welfare

- **Revenue Hypothecation:** A defined share of lottery surplus should be reserved for health care, education, welfare, sports and gambling-addiction rehabilitation.
- **Public Accountability:** Welfare allocation should be independently audited and publicly disclosed.

Conclusion

India must move beyond the binary choice between blanket prohibition and unrestricted gambling. Lotteries create genuine social and financial risks, particularly for poorer households, but prohibition may strengthen criminal and unregulated markets. A system based on destination-State consent, independent oversight, consumer safeguards, responsible advertising, digital enforcement and transparent welfare use of revenue can reduce harm while preserving accountability.

Literacy for All: Strengthening India's Journey Towards Viksit Bharat

Source: PIB

Relevance: UPSC GS Paper II: Education, social justice, government policies and human-resource development

Important Keywords

Prelims:

- Full Literacy | PLFS 2025 | UDISE+ 2025-26 | ASER Rural | RTE Act 2009 | NEP 2020 | ULLAS | FLNAT | NIPUN Bharat | Samagra Shiksha | PM SHRI | DIKSHA | PM e-VIDYA | PM POSHAN | PM Vidyalaxmi | SDG 4

Mains:

- Foundational Literacy and Numeracy | Adult Education | Lifelong Learning | Gender Gap | Learning Outcomes | Digital Divide | Human Capital | Inclusive Education | Future-ready Workforce | Viksit Bharat 2047

Why in News?

- India's overall literacy rate reached **81.1%**, according to the **Periodic Labour Force Survey 2025**.Ten States and Union Territories declared themselves fully literate between **2024 and 2026**.Programmes such as **ULLAS**, **NIPUN Bharat** and **Samagra Shiksha** are expanding literacy beyond reading and writing to include numeracy, digital literacy, financial awareness and lifelong learning.

What is Literacy?

Government Definition

The **Department of School Education and Literacy**, Ministry of Education, defines literacy as the ability to:

- read, write and compute with comprehension;
- identify, understand, interpret and create information;
- and apply critical life skills such as digital and financial literacy.

A State or Union Territory achieving a literacy rate of **95%** is considered fully literate.

UNESCO Definition

UNESCO defines literacy as the ability to read, write and use numbers, along with the ability to use digital material to solve problems in an information- and technology-rich environment.

Literacy is:

- a fundamental human right;
- an essential component of the right to education;
- a foundation for equality, justice and inclusion;
- and a prerequisite for exercising other human rights.

Changing Meaning of Literacy

Modern literacy includes:

Reading with comprehension | Numeracy | Digital literacy | Financial literacy | Critical thinking | Problem-solving | Lifelong learning

Literacy must enable individuals to understand information and apply it in daily life rather than merely read simple words or sign their names.

How has India Progressed in Literacy?

Progress Since Independence

- **1947:** Overall literacy was approximately **14%**, while female literacy was about **8%**.
- **1951–2011:** Overall literacy increased from **18.32% to 74.04%**.
- **Male Literacy:** Increased from **27.15% to 82.14%**.
- **Female Literacy:** Increased from **8.86% to 65.46%**.

Rural–Urban Progress

- **Urban Literacy:** Increased from **34.59% in 1951 to 84.1% in 2011**.
- **Rural Literacy:** Increased from **12.10% to 67.8%**.
- **Rural Female Literacy:** Between 2001 and 2011, it grew by **26%**, compared with **10%** for rural males.

These improvements reflect greater school access and social awareness, though geographical and gender inequalities persist.

What Does PLFS 2025 Reveal?

According to the **Periodic Labour Force Survey 2025**:

- **Overall Literacy Rate:** 81.1%.
- **Urban Literacy—Seven Years and Above:** 89%.
- **Urban Literacy—Five Years & Above:** 88%.
- **Rural Literacy—Seven Years & Above:** 77.4%.
- **Rural Literacy—Five Years & Above:** 76.4%.

Gender-wise Literacy Among Persons Aged Seven Years and Above

- **Urban Males:** 93.1%
- **Urban Females:** 84.8%
- **Rural Males:** 84.8%
- **Rural Females:** 70.3%

Major Findings

- **Rural–Urban Divide:** Rural literacy

remains considerably lower than urban literacy.

- **Gender Gap:** Female literacy, particularly in rural areas, remains below male literacy.
- **Need for Targeting:** National averages must be supported by interventions for rural women and disadvantaged communities.

What is the Status of School Education?

According to the **UDISE+ Report 2025-26**, more than **24.72 crore students** were enrolled in Indian schools.

Gross Enrolment Ratio

Gross Enrolment Ratio is total enrolment at an educational stage expressed as a percentage of the population in the corresponding official age group.

- **Foundational Stage:** 42.8%
- **Preparatory Stage:** 91.7%
- **Middle Stage:** 89.6%
- **Secondary Stage:** 71.7%

The fall at the secondary stage indicates that many students do not continue education beyond the middle level.

Dropout Rates

- **Preparatory Stage:** 1.8%
- **Middle Stage:** 3.6%
- **Secondary Stage:** 7%

Poverty, child labour, early marriage, distance from schools and inadequate infrastructure can contribute to dropout.

Retention Rates

- **Foundational Stage:** 98.5%
- **Preparatory Stage:** 91.1%
- **Middle Stage:** 83.7%
- **Secondary Stage:** 51.9%

The sharp decline at the secondary level shows that initial enrolment does not necessarily lead to school completion.

Transition Rates

Transition rate is the percentage of students successfully moving from one stage to the next.

- **Foundational to Preparatory:** 99.2%
- **Preparatory to Middle:** 93.8%
- **Middle to Secondary:** 88.3%

What Does ASER Reveal About Learning Outcomes?

The **Annual Status of Education Report–Rural** is a nationwide rural household survey conducted by the NGO **Pratham**.

Coverage

The survey examines:

- pre-primary children aged three to five years;
- elementary-level children aged six to 14 years;
- and older children aged 15 to 16 years.

It assesses:

- school enrolment;
- attendance;
- basic reading;
- arithmetic ability;
- and early-childhood education.

ASER 2024 Findings

- **Government-School Reading Levels:** The reading performance of Class III children was the highest since the survey began 20 years ago.
- **Class III Reading Ability:** The share of Class III government-school students able to read a Class II text increased from **16.3% in 2022 to 23.4% in 2024**.
- **Pre-pandemic Comparison:** The corresponding figure was **20.9% in 2018**.
- **Overall Class III Reading:** Across government and private schools, the

proportion increased from **20.5% in 2022 to 27.1% in 2024**, close to the **27.3% recorded in 2018**.

- **Class V Reading:** The proportion of Class V students able to read a Class II text increased from **42.8% in 2022 to 48.7% in 2024**.
- **Arithmetic Improvement:** Basic arithmetic performance also improved across government and private schools.
- **Pre-school Enrolment:** The proportion of children aged three to five enrolled in some form of pre-school increased in 2024 compared with 2018 and 2022.

What is the Status of Higher Education?

Enrolment

Higher-education enrolment increased from:

- **3.42 crore in 2014-15** to
- **4.50 crore in 2023-24**.

Gross Enrolment Ratio

Higher-education GER increased from:

- **23.7% in 2014-15** to
- **30% in 2023-24**.

NEP 2020 aims to increase higher-education GER to **50% by 2035**.

Higher-Education Out-turn

Higher-education out-turn refers to the number of students passing out of higher-education institutions in an academic year.

It increased from:

- **88.28 lakh in 2014-15** to
- **more than 1.09 crore in 2023-24**.

Inclusive Access

The rising participation of:

Women | Scheduled Castes | Scheduled Tribes | Other disadvantaged groups

reflects an expansion of educational access and equity.

What are the Major Government Policies and Initiatives?

Right to Education Act, 2009

The **Right of Children to Free and Compulsory Education Act, 2009** made education a fundamental right for children aged **six to 14 years**.

Key Provisions

- free and compulsory elementary education;
- minimum standards for schools;
- equitable access to education;
- prohibition of discrimination;
- and protection against corporal punishment.

The Act shifted elementary education from a welfare objective to an enforceable right.

National Education Policy 2020

NEP 2020 provides a comprehensive framework for education reform.

Key Priorities

- foundational literacy and numeracy;
- multilingualism;
- holistic development;
- vocational education;
- technology-enabled learning;
- teacher training;
- professional development;
- and twenty-first-century skills.

It seeks to create a skilled, adaptable and future-ready workforce.

ULLAS

ULLAS—Understanding of Lifelong Learning for All in Society, also called the **New India Literacy Programme**, is a Centrally Sponsored Scheme aligned with NEP 2020.

Target Group

- Adults aged **15 years and above**;
- especially those who missed formal schooling.

Components

- foundational literacy and numeracy;
- critical life skills;
- digital and financial literacy;
- vocational skills;
- basic education;
- continuing education;
- and lifelong learning.

Vision

- **Jan Jan Saakshar:** Literacy for every person.
- **Kartavya Bodh:** Literacy promotion as a social duty.
- **Janbhagidari:** Community participation and volunteerism.

Implementation

- District- and block-level surveyors conduct door-to-door surveys.
- Non-literate adults and potential volunteer teachers are identified.
- Volunteers may include teachers, civil-society workers, ASHA workers and Anganwadi workers.
- Learners are connected with voluntary teachers and registered on the ULLAS platform.
- Instruction is provided through face-to-face and online modes.
- Learners appear for the **Foundational Literacy and Numeracy Assessment Test**, followed by certification.

ULLAS App

- Available on Android and iOS;
- provides teaching material in **27 languages**.

Fully Literate States and Union Territories

Ten States and Union Territories declared themselves fully literate between 2024 and 2026: **Ladakh | Mizoram | Goa | Tripura | Himachal Pradesh | Chandigarh | Andaman and Nicobar Islands | Sikkim | Uttarakhand | Jammu and Kashmir**

NIPUN Bharat

National Initiative for Proficiency in Reading with Understanding and Numeracy was launched in **July 2021** under **Samagra Shiksha**.

- **Objective:** Universal foundational literacy and numeracy by 2026-27.
- **Learning Goal:** Every child should acquire foundational skills by Grade 2.
- **Age Group:** Children aged three to eight years.

Samagra Shiksha

Samagra Shiksha is an integrated school-education programme aligned with **SDG 4**.

It subsumed:

- **Sarva Shiksha Abhiyan**;
- **Rashtriya Madhyamik Shiksha Abhiyan**;
- **Teacher Education Scheme**.

Focus Areas

- inclusive and equitable education;
- learning outcomes;
- foundational education;
- teacher development;
- vocational integration;
- and school effectiveness.

PM SHRI

Pradhan Mantri Schools for Rising India seeks to strengthen more than **14,500 exemplar schools**.

It focuses on:

- implementation of NEP 2020;
- holistic development;
- inclusive and joyful learning;

- multilingual requirements;
- and diverse academic abilities.

The scheme covers existing elementary, secondary and senior-secondary schools run by Union, State and local governments.

Digital India and DIKSHA

DIKSHA—Digital Infrastructure for Knowledge Sharing provides digital content and educational resources to teachers and students.

It supports:

- digital classrooms;
- teacher resources;
- remote access;
- technology-enabled education;
- and reduction of geographical barriers.

PM e-VIDYA

PM e-VIDYA combines digital, online and on-air education.

It uses:

- online platforms;
- digital resources;
- television;
- radio;
- and multimodal learning.

It is expected to benefit nearly **25 crore school-going children**.

PM POSHAN

Pradhan Mantri Poshan Shakti Nirman provides one hot cooked meal to:

- The scheme supports nutrition, 11.20 crore students;
- in Bal Vatikas and Classes I to VIII;
- across 10.36 lakh government and government-aided schools;
- on all school days.

attendance, enrolment, concentration and retention.

Beti Bachao, Beti Padhao

The initiative promotes girls' education and seeks to address gender disparities by:

- raising awareness about the value of girls;
- encouraging school participation;
- and promoting an inclusive educational environment.

PM Vidyalaxmi

PM Vidyalaxmi is a Central Sector Scheme that provides financial support for higher education.

Major Provisions

- Students admitted to **Quality Higher Education Institutions** are eligible for collateral-free and guarantor-free education loans.
- The Union Government provides a **75% credit guarantee** for loans up to **₹7.5 lakh**.
- Students with annual family income up to **₹8 lakh**, who are not covered by another scholarship or interest-subvention scheme, receive **3% interest subvention**.
- The interest benefit applies to loans up to **₹10 lakh** during the moratorium period.

The scheme seeks to ensure that financial constraints do not prevent deserving students from pursuing higher education.

Significance of Literacy for Viksit Bharat

- **Human-Capital Formation:** Literacy creates a skilled, productive and adaptable workforce.
- **Economic Growth:** It improves employability, innovation, entrepreneurship, GDP and per-capita income.
- **Women's Empowerment:** Female literacy strengthens health, financial independence, decision-making and political participation.

- **Social Inclusion:** Literacy improves access to welfare, banking, health services, legal remedies and public institutions.
- **Digital Inclusion:** It enables citizens to access online learning, digital payments and e-governance services.
- **Democratic Participation:** Literate citizens can make informed electoral choices and understand their rights and duties.
- **Environmental Sustainability:** Education supports green jobs, circular-economy practices and responsible consumption.
- **SDG Linkages:** Literacy directly advances **SDG 4** and creates multiplier effects across poverty reduction, gender equality, health and decent work.

Challenges

- **Equity and Inclusion:** Socio-economic, gender, caste and regional disparities continue to limit equal access.
- **Quality Disparities:** Learning opportunities vary between rural and urban areas, States, and government and private schools.
- **Learning-Outcome Gap:** Enrolment does not always ensure reading comprehension or numerical ability.
- **Secondary Dropout:** Poverty, child labour, early marriage and inadequate infrastructure contribute to attrition.
- **Teacher Constraints:** Shortages, uneven qualifications, limited training and low motivation affect educational quality.
- **Digital Divide:** Unequal access to devices, electricity, internet and digital skills limits e-learning.
- **Adult-Learner Barriers:** Work responsibilities, migration, poverty and lack of confidence reduce participation.
- **Administrative Delays:** Bureaucratic procedures may slow implementation and reduce scheme effectiveness.
- **Volunteer Dependence:** ULLAS requires continuous recruitment, training and motivation of voluntary teachers.
- **Language Diversity:** Educational material must remain available in regional and tribal languages.
- **Data Differences:** Surveys may use different definitions, age categories and measurement methods.

Way Forward

- **Targeted Support:** Focus on rural women, tribal groups, migrants, persons with disabilities and low-literacy districts.
- **Foundational Learning:** Identify and address reading and numeracy gaps during the early years.
- **Teacher Development:** Improve recruitment, continuous training, motivation and classroom support.
- **Secondary Retention:** Expand scholarships, transport, hostels, counselling and safe infrastructure.
- **Learning-Based Evaluation:** Measure comprehension, arithmetic and practical skills rather than enrolment alone.
- **Digital Inclusion:** Expand affordable connectivity, devices and community digital-learning centres.
- **Adult-Friendly Learning:** Provide flexible schedules, local learning centres and livelihood-linked content.
- **Volunteer Support:** Train, mentor and recognise ULLAS voluntary teachers.
- **Local-Language Material:** Expand educational resources in regional and tribal

languages.

- **Life-Skill Integration:** Combine literacy with financial awareness, health, digital safety and vocational education.
- **Administrative Reform:** Simplify procedures and improve Centre–State and inter-departmental coordination.
- **Reliable Monitoring:** Use PLFS, UDISE+, FLNAT, ASER and local surveys to identify and address educational gaps.

Conclusion

India's literacy journey represents major progress in nation-building, but universal literacy requires more than higher enrolment or formal certification. Literacy must enable individuals to comprehend information, use technology, manage finances, acquire employable skills and participate meaningfully in society. Effective implementation of **RTE**, **NEP 2020**, **ULLAS**, **NIPUN Bharat** and related programmes can make a literate, skilled and empowered population the foundation of an inclusive and sustainable **Viksit Bharat 2047**.

Physical Geography

Nepal Flash Floods: A Shared Himalayan Disaster Beyond Borders

Source: The Hindu

Relevance: GS Paper I – Physical Geography and Natural Disasters | GS Paper II – India and its Neighbourhood | GS Paper III – Disaster Management

Important Keywords

For Prelims:

- Rock–Ice Avalanche | Debris Flood | GLOF | Moraine | Cryosphere | Bhote Koshi | Gandak | NGRMP

For Mains:

- Cascading Hazards | Transboundary Rivers | Regional Early-Warning System | Himalayan Vulnerability | Disaster Diplomacy | Climate Resilience

Why in News?

A massive **rock–ice collapse near the Nepal–China border** on August 26, 2026 generated a debris-laden flash flood that devastated parts of Nepal, Tibet and downstream areas.Preliminary estimates indicated **579 deaths in Nepal**, nearly **2,000 missing persons** and more than **93,000 people requiring assistance**. Indian nationals, including Kailash Mansarovar pilgrims, were also reported missing.The disaster highlights the need for India, Nepal and China to cooperate on Himalayan hazard monitoring, early warnings and emergency response.

What Triggered the Disaster?

The event initially appeared to be a **4.4-magnitude earthquake**. However, the United States Geological Survey later concluded that the recorded seismic activity was caused by the collapse itself rather than a tectonic earthquake.

The disaster unfolded through a cascading process:

1. A massive slab of glacier and underlying rock became detached.
2. The material plunged about one kilometre into the valley.
3. Ice, rock, mud and water mixed into a high-energy debris flow.
4. The flood travelled downstream, destroying settlements and infrastructure.

The collapse was later registered as producing seismic energy equivalent to an earthquake of about **magnitude 5.2**.

Was It a GLOF?

The event should not automatically be classified as a conventional **Glacial Lake Outburst Flood (GLOF)**.

- A GLOF is the sudden release of water from a glacial lake after the failure or overtopping of its natural dam, which may be made of ice, moraine or bedrock.

Conventional GLOF	Nepal disaster
Begins with failure of a glacial-lake barrier	Began with a massive rock–ice collapse
Stored lake water is released	Ice and rock transformed into a debris flood
Water is the main moving medium	Water, rock, ice, mud and debris moved together
May be triggered by rain, avalanche or earthquake	Precise trigger remains under investigation

The event is more accurately described as a **rock–ice collapse-triggered debris flood**. It shows that Himalayan disaster planning must cover several connected cryospheric hazards rather than focusing only on glacial lakes.

Regional Impact

Nepal

- Villages and towns were swept away.
- Bridges, roads, communication networks and hydropower stations were destroyed.
- Around **475 MW of electricity-generating capacity** was lost.
- Rescue efforts were complicated by damaged transport and communication links.

China

- The disaster severely damaged **Gyirong Port**, a major gateway between Nepal and China in the Tibet Autonomous Region.
- The port, upgraded as an international-standard land gateway at a cost of **$175.8 million**, was buried under sediment and debris. Roads, electricity and communication links on the Chinese side were also disrupted.

India

The floodwaters entered river systems connected with the **Gandak, Kosi and Ganga**, placing Bihar and Uttar Pradesh on alert.

- Communities near vulnerable embankments were evacuated.
- Surveillance was strengthened at the Valmikinagar Barrage.
- Maharajganj and Kushinagar districts increased preparedness.
- NDRF teams were deployed along the Bihar–Uttar Pradesh border.
- India activated humanitarian assistance and dispatched more than **47.5 tonnes of relief material**, including medicines, food and tents, to Nepal.

Why Is the Himalayan Region Highly Vulnerable?

Geological Factors

- The Himalayas are young fold mountains created by the continuing collision of the Indian and Eurasian plates. Their fractured rocks, steep slopes and active faults make them prone to earthquakes and landslides.

Climatic Factors

- Intense monsoon rainfall, cloudbursts and rapid snowmelt can saturate slopes, increase river discharge and produce flash floods.

Cryospheric Changes

Rising temperatures accelerate:

- glacier retreat;
- glacial-lake formation;
- permafrost thaw;
- snow and ice melt; and
- instability of high-altitude rock slopes.

When permafrost thaws, ice that binds rock and soil weakens, increasing the risk of rockfalls and ice–rock avalanches.

High Sediment Load

- Himalayan rivers carry large quantities of sediment. This can raise riverbeds, block channels and create temporary dams whose sudden failure produces destructive floods.

Human Activities

- Unscientific road cutting, hydropower construction, blasting, debris dumping, unplanned urbanisation and tourism beyond carrying capacity increase the natural fragility of mountain slopes.

Cascading Hazards

Himalayan disasters often occur as connected events:

- earthquake → landslide → river blockage → flash flood;
- extreme rainfall → slope failure → debris flow;
- avalanche → glacial-lake overtopping → GLOF.

India's Measures Against Himalayan Hazards

National GLOF Risk Mitigation Programme

The **National Glacial Lake Outburst Flood Risk Mitigation Programme** covers Arunachal Pradesh, Himachal Pradesh, Sikkim and Uttarakhand.

With an outlay of **₹150 crore**, it supports:

- hazard assessment;
- lake monitoring;
- early-warning systems;
- community preparedness; and
- structural mitigation.

Satellite Monitoring

- The Central Water Commission, supported by NRSC-ISRO, monitors Himalayan glacial lakes and water bodies through remote sensing. Monitoring was expanded from 2025 to **2,843 water bodies**, including **2,485 glacial lakes**.

Warning Infrastructure

- Automatic weather stations, lake-level sensors, discharge gauges, cameras, sirens and satellite communication systems are being developed for vulnerable areas.

NDMA Guidelines

- The **NDMA Guidelines on Management of GLOFs, 2020** cover hazard zonation, lake monitoring, controlled drainage, warning dissemination, evacuation and recovery.

Hydropower and Dam Safety

- GLOF studies are required for new dams located in catchments containing glacial lakes. Dam-break analysis, emergency action plans and the **Dam Safety Act, 2021** seek to prevent cascading infrastructure failures.

Community Preparedness

- Aapda Mitra, Yuva Aapda Mitra, SDRF and NDRF programmes train volunteers in warnings, evacuation, first aid and search-and-rescue operations.

Landslide Mitigation

- A **₹1,000-crore National Landslide Risk Mitigation Project** supports slope stabilisation, drainage improvement, retaining structures and hazard mapping in 15 landslide-prone States.

Why Is Regional Cooperation Necessary?

Transboundary Nature of Rivers

A flood originating in Tibet or Nepal can enter India within hours. National borders cannot contain the movement of water, debris or sediment.

Real-Time Data Sharing

Downstream regions require timely information on:

- rainfall;
- river discharge;

- glacial-lake levels;
- seismic activity;
- landslide blockages; and
- emergency dam releases.

Joint Monitoring

- Many high-risk glaciers and lakes are located in remote border regions. Joint satellite observation, field surveys and automatic sensors can improve hazard detection.

Common Early-Warning Systems

- Warnings generated upstream must reach downstream authorities and communities without delay. National systems should therefore be interoperable.

Coordinated Disaster Response

- Major Himalayan disasters can overwhelm a single country's rescue, medical and logistical capacity. Joint exercises and pre-arranged humanitarian corridors can speed up relief.

Confidence Building

- Transparent hydrological data can reduce suspicion that floods were caused by deliberate dam releases or the withholding of upstream information.

Challenges

- Geopolitical mistrust among India, Nepal and China
- Absence of a permanent trilateral disaster-management mechanism
- Limited access to remote high-altitude regions
- Gaps in last-mile warning communication
- Different technical standards and data formats
- Inadequate cumulative assessment of roads and hydropower projects
- Weak enforcement of land-use regulations
- Difficulty in forecasting compound and cascading hazards

Way Forward

- Establish an **India–Nepal–China Himalayan Disaster Cooperation Mechanism**.
- Create a real-time transboundary data-sharing protocol.
- Develop a shared inventory of glaciers, glacial lakes and unstable slopes.
- Install solar-powered sensors on lakes, glaciers and rock faces.
- Use AI to combine satellite, weather, seismic and river-flow data.
- Develop digital twins of vulnerable Himalayan river basins.
- Conduct joint emergency simulations and rescue exercises.
- Establish drone corridors for relief delivery when roads collapse.
- Introduce geofenced alerts and digital tracking for pilgrims and tourists.
- Apply basin-wide environmental assessment to roads, dams and tunnels.
- Strengthen community-based warning, evacuation and resilient construction.

Conclusion

The Nepal disaster demonstrates that Himalayan hazards are interconnected and transboundary. India, Nepal and China cannot manage them through isolated national responses. Political differences must be separated from disaster cooperation so that scientific information, early warnings and emergency assistance can move freely across borders.