Krishna Pradeep's 21st Century IAS

Since : 2003

Producing Next Generation Leaders for Good Governance

A/C Campus

UPSC and State PSC

CURRENT AFFAIRS

National and International Issues

CURRENT AFFAIRS

AUGUST - 2026

https://t.me/kpiasacademy/6154

TOPICS

Polity & Governance 3

- Government school closures in india: rationalisation, exclusion and the right to education 3
- Supreme Court Judges' Strength Increased: Pendency and Judicial Capacity Reform 7
- GI Tags: Scaling Traditional Wealth into Global Brands 9
- Supreme Court Order on Mining Around Ramsar Wetlands: Judicial Safeguard for Wetland Conservation 15
- e-Courts Mission Mode Project: Digital Transformation of India's Judiciary 22
- PM MITRA Mega Textile Parks: Integrated Textile Manufacturing and India's 5F Vision 27
- Creamy Layer for SC/ST Quotas: Centre's Opposition, Constitutional Position and Social Justice Debate 31
- GOBARdhan Scheme: Turning Organic Waste into Clean Energy and Rural Income 35
- Bharat Taxi: India's First Cooperative-Based Ride-Hailing Platform 40
- India's Makhana Sector: From Traditional Crop to Global Superfood 44
- Vande Mataram, National Honour and the Right to Dissent 49
- FSSAI Crackdown on Food Claims: From Bourn Vita to "100% Pure" 53

International Relations 57

- Makkah Joint Defence Agreement: West Asian Security Shift and India's Strategic Concerns 57
- India's Campaign for UNSC Seat 2028-29: Diplomacy, Representation and Global Power Politics 61
- India–Uzbekistan Relations Elevated to a Comprehensive Strategic Partnership 65
- UNCCD COP17: Shifting from Drought Relief to Proactive Resilience 70

Economy 76

- Subhas Chandra Bose: The Paradox of a Revolutionary's Theory and Praxis 76
- Nature-Based Solutions and Climate-Resilient Agriculture: Securing India's Food Future 76
- India as the World's Leading Ship Recycling Nation: Circular Economy, Maritime Industry and Green Compliance 80
- Natural Farming: India's Path to Resilient, Low-Input and Climate-Smart Agriculture 84
- India's Coconut Sector: From "Kalpavriksha" to Global Prominence 88
- Solar Irrigation and Groundwater: Designing PM-KUSUM 2.0 for Sustainable Agriculture 92
- Regenerative Agriculture: Rebuilding Farming Systems for a Resilient India 96
- UPI: Transforming India's Digital Payment Landscape 102
- MMDR Amendment Act, 2026: Towards a Uniform Mineral Taxation Framework 107

Environment & Ecology, DM 113

- India's Solar Growth Enters a New Era: Policy Push for Clean Energy Transition 113
- Environmental Performance Index 2026: India's Low Rank and the Debate on Environmental Governance 117
- Roads Reimagined: India's Electric Vehicle Ecosystem and the Clean Mobility Transition 122
- India's Energy Journey: Expanding Capacity, Strengthening Energy Security and Building a Cleaner Future 126
- Forest Fires in India: Himalayan Vulnerability, Monitoring Gaps and Disaster Preparedness 132
- Small River Rejuvenation Framework: Restoring India's Local River Systems 137

S & T, Internal Security 144

- Naxal-Free India: Integrated Strategy Against Left-Wing Extremism 144
- Critical Minerals: Foundation of India's Strategic Power and Industrial Security 149
- Strengthening India's Space Sovereignty 155
- NASA's Moon Base Programme: India's Role in the New Lunar Race 159
- Gaganyaan's Thermal Shield: Protecting the Crew During Re-entry 163
- India's Defence Strength: Powering National Security through Self-Reliance 169
- Generative Biology: When Artificial Intelligence Begins to Design Viruses 174

Public Health 181

- National Animal Disease Control Programme (NADCP) 181

History, Art & Culture 183

- Revitalising India's Cultural Heritage 183

Polity & Governance

Government School Closures in India: Rationalisation, Exclusion and the Right to Education

Source: The Hindu

Relevance: **UPSC GS Paper II**

Education, Governance, Social Justice, Welfare of Vulnerable Sections

Important Keywords

Prelims Keywords:

- RTE Act | Neighbourhood School | UDISE+ | NITI Aayog | School Management Committee

Mains Keywords:

- School rationalisation | Equity in education | Public education access | Gendered dropout risk | Centre-State accountability

Why in News?

A recent **NITI Aayog report** stated that around **94,000 government schools** were closed over the past decade, averaging nearly **25 schools a day**. This has contributed to a decline of **2.26 crore students** in government school enrolment. The share of government schools in total enrolment has fallen from **71% in 2005** to **49.24% in 2024-25**.

Why are Government Schools Shutting Down?

- Government schools are being closed or merged across States mainly in the name of **school rationalisation**.
- School rationalisation generally means merging schools with low enrolment and shifting students to another nearby school. The **National Education Policy 2020** supports rationalisation, but it also cautions that the idea of **neighbourhood schools** should not be endangered.
- The problem is that these closures cannot be explained only through demographic change, migration or urbanisation. In several States, closures appear as coordinated administrative decisions affecting children who have the least capacity to travel longer distances or shift to private schools.

National Trend in Government School Closures

Government data tabled in the Lok Sabha shows a clear decline in public schooling infrastructure.

Indicator	Earlier Position	Later Position
Government schools nationally	**11.07 lakh in 2014-15**	**10.17 lakh in 2023-24**
Approximate decline		**Nearly 89,000 schools**
Private schools	**2.88 lakh**	**3.31 lakh**

nationally		
Government school enrolment share	**71% in 2005**	**49.24% in 2024-25**

This indicates that while government schools declined, private schools expanded during the same period.

Worst-Affected States

1. Uttar Pradesh

- Uttar Pradesh witnessed one of the sharpest declines. Government schools fell from around **1.63 lakh to 1.38 lakh** in a single year, a drop of more than **25,000 schools**.

2. Madhya Pradesh

- Madhya Pradesh's government schools fell from around **1.22 lakh in 2018-19** to **99,411** the next year, a decline of nearly **22,600 schools** in twelve months.

The State's own School Education Department found serious exclusion indicators:

- **7.37 lakh children** had no school records.
- **11.38 lakh children** were in the **"Drop Box"** category, meaning at imminent risk of dropping out.
- **1.23 lakh children** were already recorded as dropouts.
- **1.55 lakh children** had left school due to family displacement or migration.
- More than **3,500 government schools** recorded zero new admissions.
- Another **6,500 schools** recorded fewer than 10 admissions.
- In **Jhabua and Shivpuri**, around **29,000 children** were in the Drop Box category.

This shows that school closure is closely linked with invisibilisation of children from the education system.

3. Jammu and Kashmir

- In Jammu and Kashmir, more than **4,300 schools** were closed or merged under rationalisation. UDISE+ figures show the State's school count falling from **23,167 in 2020-21** to **18,785 by 2022-23**.
- Reports also noted nearly **13,000 vacant teaching posts**. In several areas, children now travel **4–6 km daily** to reach a functioning school, weakening the neighbourhood school mandate under the **Right to Education Act**.

Impact on Children's Access to Education

- Government schools are not used equally by all social classes. They are disproportionately used by children from **poor households, Scheduled Castes, Scheduled Tribes, minorities, backward communities and rural families**.

When a nearby school shuts down, children face:

- longer travel distance
- higher transport cost
- reduced safety
- greater dropout risk
- loss of learning continuity
- dependence on unaffordable private schools
- weaker community monitoring of schools

Thus, rationalisation may appear efficient on paper, but on the ground it can reduce real access to education.

Who Bears the Biggest Burden?

1. Poor Rural Children

- Poor families often cannot afford transport or private schooling. For them, the nearest government school is not just one option; it is often the only accessible option.

2. Girls

- Girls are usually the first to be withdrawn when the school is no longer nearby. Distance increases concerns around safety,

mobility and household responsibilities.

3. SC, ST and Minority Children

- A 2019 National Sample Survey-based analysis found that access to free education declined unevenly, with **Muslim, Scheduled Caste and Scheduled Tribe households** disproportionately marginalised from nearby schools.

4. Migrant and Displaced Families

- Children from families migrating for work are at higher risk of being excluded from school records and becoming dropouts.

5. Children in Multi-Grade Classrooms

- In several merged or under-resourced schools, a single teacher may have to handle multiple classes together. This affects learning quality and violates the spirit of **RTE staffing and quality norms**.

Centre-State Responsibility

- The Union government has argued that education is on the **Concurrent List**, and therefore States are responsible for school closures.However, this does not fully absolve the Centre.
- The **Right to Education Act** is a Central law, and its mandate on **free, compulsory and neighbourhood schooling** is a national responsibility. The Centre also influences State school education through Central funding, NEP-linked conditions and national policy frameworks.
- both Centre and States are responsible for ensuring that rationalisation does not weaken children's access to public education.

Why the RTE Act Has Fallen Short

The **Right to Education Act, 2009**, in force since **2010**, guarantees free and compulsory education for children aged **6–14 years**.
However, several limitations remain.

1. Weak Protection of Neighbourhood Schools

- The Act recognises neighbourhood schooling, but large-scale school mergers have weakened this principle.

2. Limited Focus on Quality

- The RTE creates access-based entitlements, but it does not sufficiently guarantee the quality of education inside classrooms.

3. Weak Enforcement Capacity

- Children cannot assert their own legal rights. Poor and rural parents often lack the legal and institutional capacity to challenge school closures.

4. School Management Committees Remain Weak

- SMCs were meant to give parents and communities a formal voice, but they are often inactive or not regularly convened.

5. Power Imbalance

- The Act assumes that families can hold the State accountable, but poor households often lack the power to do so.

6. Staffing and Learning Gaps

- Teacher vacancies and multi-grade teaching weaken the quality of education, even where schools formally remain open.

Constitutional Provisions on Education in India

Article	Provision
Fundamental Rights	
21A	Right to compulsory education
28	Freedom as to attendance at religious instruction or religious worship in certain educational institutions
30	Right of minorities to establish and

	administer educational institutions
	Directive Principles of State Policy
41	Right to work, to education and public assistance in certain cases
45	Provision for free and compulsory education for children Provision for early childhood care and education to children below the age of six years
Fundamental Duties	
51A	Duty of a parent or guardian to provide opportunities for education to his child or ward between the age of six and fourteen years
Part XVII – Official Language	
350A	**Facilities for instruction in the mother tongue at the primary stage** • It shall be the endeavour of every State to provide adequate facilities for instruction in the mother tongue at the primary stage of education to children belonging to linguistic minority groups. • The President may issue such directions to any State as he considers necessary or proper for securing the provision of such facilities.

Way Forward

1. Protect the Neighbourhood School Principal

- Rationalisation should not be allowed if it forces young children to travel long distances.

2. Social Impact Assessment Before Closure

- Before closing or merging a school, States should assess impact on **girls, SC/ST children, minorities,** children **with disabilities and migrant families**.

3. Strengthen School Mapping

- Children outside school records must be identified through UDISE+, local surveys and door-to-door campaigns.

4. Ensure Safe Transport Where Mergers are Unavoidable

- If a school is merged, free and safe transport must be guaranteed, especially for girls and younger children.

5. Fill Teacher Vacancies

- School access without teachers cannot fulfil the RTE promise.

6. Revive School Management Committees

- SMCs should be regularly convened and consulted before any school closure or merger.

7. Centre-State Monitoring Mechanism

- The Centre should monitor whether State-level rationalisation violates RTE norms.

8. Treat Public Schools as Social Infrastructure

- Government schools should not be judged only by enrolment numbers. Their role in social justice, gender equality and rural access must be recognised.

Conclusion

Government school closures show that administrative rationalisation can become educational exclusion if not carefully planned. A school that appears "unviable" in official records may be the only accessible institution for a poor child, a girl, or a tribal household. India must ensure that rationalisation does not weaken the constitutional promise of education. The future of public education depends on protecting **neighbourhood schools, teacher availability, social equity and accountable governance**.

Supreme Court Judges' Strength Increased: Pendency and Judicial Capacity Reform

Source: The Hindu

Relevance: **UPSC GS Paper II: Judiciary, Constitutional Bodies, Justice Delivery, Separation of Powers, Governance**

Important Keywords

Prelims Keywords:

- Article 124(1) | Article 123 | Puisne Judge | Constitution Bench | Supreme Court (Number of Judges) Act, 1956

Mains Keywords:

- Judicial pendency | Speedy justice | Judicial capacity building | Access to justice | Case management reforms

Why in News?

The **Lok Sabha passed the Supreme Court (Number of Judges) Amendment Bill, 2026**, which seeks to increase the sanctioned strength of the Supreme Court from **34 to 38 judges**, including the **Chief Justice of India**. The Bill replaces an ordinance issued earlier in 2026 and now awaits consideration in the **Rajya Sabha**.

What is the Supreme Court (Number of Judges) Amendment Bill, 2026?

The Bill amends the **Supreme Court (Number of Judges) Act, 1956**.

Key Provisions

- It increases the number of **puisne judges** from **33 to 37**.
- Including the **Chief Justice of India**, the total sanctioned strength becomes **38 judges**.
- This is the first increase in Supreme Court strength since **2019**, when the strength was raised from **31 to 34 judges**.

Meaning of Puisne Judge

A **puisne judge** means an ordinary judge of the Supreme Court other than the **Chief Justice of India**.

Constitutional Basis for Increasing Supreme Court Strength

Article 124(1): Establishment of Supreme Court

- **Article 124(1)** establishes the **Supreme Court of India**.
- It states that the Supreme Court shall consist of:
  - the **Chief Justice of India**, and
  - such number of other judges as **Parliament may prescribe by law**.
- The Constitution does **not permanently fix** the number of Supreme Court judges.
- Parliament has the power to regulate the strength of Supreme Court judges by ordinary law.
- Therefore, increasing the number of Supreme Court judges does **not require a constitutional amendment**.

Supreme Court (Number of Judges) Act, 1956

About the Act

- The **Supreme Court (Number of Judges) Act, 1956** regulates the sanctioned strength of Supreme Court judges.
- It was enacted under **Article 124(1)** of the Constitution.
- It has been amended several times to meet rising litigation and judicial workload.

2026 Amendment

The 2026 Bill amends this Act to raise the strength of the Supreme Court to **38 judges including the CJI**.

Why Was the Increase Needed?

1. Rising Pendency in Supreme Court

- As on **1 January 2026**, around **92,101 cases** were pending before the Supreme Court.

2. Gap Between Institution and Disposal

- In **2025**, the Supreme Court received **75,410 fresh cases**, but disposed of **65,615 cases**. This shows that cases were being filed faster than they were being decided.

3. Need for Speedy Justice

- The government stated that increasing judicial strength is necessary to ensure **speedy and effective justice**.

4. Constitution Bench Requirement

- The Supreme Court also has to decide cases involving substantial constitutional questions. These require **Constitution Benches** of at least **five judges**, which are difficult to form regularly when the daily case burden is high.

How Will Additional Judges Help?

1. More Benches

- Additional judges will allow the Supreme Court to constitute more benches and hear more cases simultaneously.

2. Faster Disposal

- An increase in judicial strength can help reduce the gap between case institution and disposal.

3. Regular Constitution Benches

- The Chief Justice of India can form **Constitution Benches** more frequently without disturbing regular hearings.

4. Reduced Workload

- More judges can reduce pressure on existing judges and improve the quality of adjudication.

Evolution of Supreme Court Strength

Year	Sanctioned Strength Including CJI
1950	8 judges
1956	11 judges
1960	14 judges
1978	18 judges
1986	26 judges
2009	31 judges
2019	34 judges
2026	38 judges

Is Increasing Judges Enough?

Increasing the number of judges is a **necessary but incomplete reform**.

Why It Is Necessary

- It improves the Court's institutional capacity.
- It enables more benches and faster disposal.
- It helps in regular hearing of constitutional matters.

Why It Is Not Sufficient

Judicial pendency is also caused by:

- delays in judicial appointments
- vacancies in High Courts and subordinate courts
- frequent adjournments
- rising number of appeals
- weak case management
- large volume of government litigation

The backlog across all courts in India has crossed **5.5 crore cases**, with most pending in lower courts. Hence, reforms must cover the entire judicial system.

Challenges in Reducing Judicial Pendency

1. Low Judge-Population Ratio

- The **India Justice Report 2025** noted that India has around **15.9 judges per million population**, while the Law Commission had recommended **50 judges per million**.

2. High Pendency in Lower Courts

- In many States, a large number of cases in subordinate courts are pending for more than **three years**.

3. High Court Backlog

- Across High Courts, many cases remain pending for more than **five years**, delaying final justice.

4. Government as a Major Litigant

- A large number of cases involve government departments, increasing the burden on courts.

5. Procedural Delays

- Frequent adjournments, poor listing and weak case-flow management slow down justice delivery.

Way Forward

1. Fill Judicial Vacancies

- Appointments in the Supreme Court, High Courts and subordinate courts must be completed in time.

2. Strengthen Lower Judiciary

- Since most cases are pending in district and subordinate courts, their infrastructure, staff and technology support must improve.

3. Better Case Management

- Scientific listing, strict adjournment control and prioritisation of old cases are needed.

4. Reduce Government Litigation

- Government departments should avoid unnecessary appeals and strengthen administrative dispute resolution.

5. Use Technology

- E-courts, digital filing, virtual hearings and AI-based case categorisation can improve efficiency.

6. Promote Alternative Dispute Resolution

- Mediation, arbitration and Lok Adalats can reduce the burden on regular courts.

Conclusion

The increase in Supreme Court strength from **34 to 38 judges** is an important step towards strengthening judicial capacity and improving disposal of cases. It can help the Court form more benches and hear Constitution Bench matters more regularly. However, pendency is a systemic challenge and cannot be solved only by increasing judges at the apex court. India needs timely judicial appointments, stronger lower courts, better case management, technology-enabled courts and reduction of unnecessary government litigation. Speedy justice requires not only **more judges**, but also a more **efficient, accessible and accountable justice delivery system**.

GI Tags: Scaling Traditional Wealth into Global Brands

Source: PIB

Relevance: **UPSC GS Paper II: Intellectual Property Rights, WTO-TRIPS, Government Policies**

Important Keywords

Prelims Keywords:

- Geographical Indication Tag | GI Act, 1999 | GI Registry Chennai | Darjeeling

Tea | TRIPS Agreement

Mains Keywords:

- Heritage economy | Traditional knowledge protection | Rural livelihoods | Export-led growth | Vocal for Local

Why in News?

The Government of India has highlighted the growing role of **Geographical Indication (GI) tags** in protecting India's cultural heritage and converting traditional products into **global brands**. GI tags are being promoted as tools of **rural development, export promotion, tourism integration, intellectual property protection and Aatmanirbhar Bharat**.

What is a GI Tag?

- A **Geographical Indication tag** is a form of **intellectual property right** given to products that originate from a specific geographical region and have qualities, reputation or characteristics linked to that place.
- For example, a **Banarasi saree** is not merely a textile product. It represents the weaving tradition, zari work and inherited craftsmanship of Banaras. A GI tag certifies that the saree is genuinely made in Banaras using traditional methods, thereby protecting both the product and the weaver's skill.

Why GI Tags Matter for India?

1. Protection of Traditional Knowledge

- GI tags protect regional products from **imitation, misuse and unauthorised commercialisation**. This is important for crafts and agricultural products that depend on inherited local knowledge.

2. Better Income for Producers

- By certifying origin and authenticity, GI tags improve the market value of products. As per the Ministry of Textiles, GI recognition can raise rural artisans' incomes by **20–30%**.



3. Consumer Trust

- GI tags act as a **seal of authenticity**. They help consumers distinguish genuine products from fake or mass-produced imitations.

4. Premium Market Access

- GI products can access high-value domestic and international markets because consumers increasingly value **authenticity, tradition and craftsmanship**.

5. Cultural Preservation

- GI recognition helps preserve **local traditions, indigenous craftsmanship and regional identity** for future generations.

6. Rural Development

- GI tags support **artisans, farmers, weavers and producer groups** by improving visibility, bargaining power and access to premium markets.



Legal and Institutional Framework

International Framework

Geographical Indications are recognised internationally under:

- **Paris Convention for the Protection of Industrial Property**
- **WTO Agreement on Trade-Related Aspects of Intellectual Property Rights – TRIPS**

Indian Framework

India protects GI products through the **Geographical Indications of Goods (Registration and Protection) Act, 1999**.

GI Rules and Timeline

- GI Rules were notified in **2002**.
- The legal framework became operational in **2003**.
- GI registrations started in **2004–05**.
- The GI Rules were amended in **2025**.

GI Registry

- The registration and protection of GI products are overseen by the **Geographical Indications Registry, Chennai**, which has **all-India jurisdiction**.

2025 Amendment

- The 2025 amendment reduced the fee for GI applications and related processes by **80%**. The renewal fee was reduced from **₹3,000 to ₹500**.

Registration, Validity and Revocation

Who Can Apply?

The following can apply for GI registration:

- **Association of producers**
- **Organisation**
- **Authority established by law**

The applicant must be a legal entity and must represent the interests of the producers of the concerned product.

What Cannot Be Registered as GI?

A GI cannot be registered if it:

- is a **generic product name** no longer protected in its country of origin;
- misleads consumers about geographical origin;
- offends religious sentiments;
- contains scandalous, offensive or obscene matter;
- violates any law in force;
- is not eligible for legal protection.

Validity and Renewal

- A GI registration is valid for **10 years**.
- It can be renewed from time to time.

Can a GI Tag be Revoked?

Under **Section 27 of the GI Act**, a GI registration may be revoked, cancelled or varied.

Grounds for Revocation

A GI may be cancelled if:

- it was obtained through fraud or misrepresentation;
- it is no longer protected in its country of origin;
- it has fallen into disuse;
- its use is likely to deceive consumers;
- it violates any law;
- it contains scandalous or obscene matter.

India's GI Ecosystem

India's GI ecosystem has expanded significantly.

Important Facts for Prelims

Fact	Details
Total GI products	India has **over 800 registered GI products**
GI since 2014	**607 GIs** granted since 2014
First GI product	**Darjeeling Tea** from West Bengal
Early GI examples	**Aranmula Kannadi** from Kerala, **Pochampalli Ikat** from Telangana
Authorised users	Increased from **365 to 29,000** in the last 10 years
Export destinations	UK, Italy, UAE, Bahrain, Qatar, USA, South Korea

Key Sectors and Leading States

India has GI-tagged products across **handicrafts, agriculture, manufactured goods, food products and natural products**.

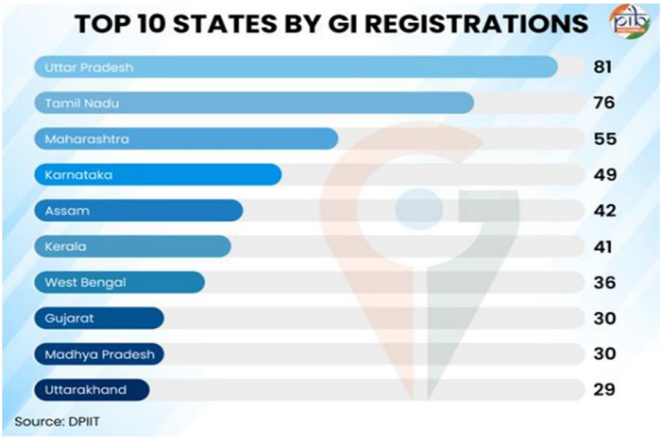
Sector	Status / Examples
Handicrafts	**445 handicraft products** and **27 product logos** registered; examples: Pashmina, Baluchari Saree, Banaras Gulabi Meenakari
Agriculture	**251 products** covering cereals, fruits, vegetables, spices and non-basmati rice
Manufactured Goods	**64 products** such as Nashik Valley Wine and Kannauj Perfume
Food Products	**66 products** such as Bardhaman Mihidana, Sitabhog, Kendrapara Rasabali and Tirupati Laddu
Natural Products	**5 products** including Makrana Marble, Chunar Balua Patthar, Lac of Purulia, Panna Diamond and Ambaji White Marble

Leading States

As of December 2025:

- **Uttar Pradesh:** 81 GI-tagged products
- **Tamil Nadu:** 76 GI-tagged products
- **Maharashtra:** 55 GI-tagged products

This shows that GI tags are becoming tools of **State-level cultural branding and regional economic development**.





GI Tags as Rural Economic Assets

1. Banarasi Saree

- GI certification helps genuine Banarasi sarees gain recognition, prevents imitation and improves returns for weavers.

2. Channapatna Toys

- **Channapatna toys** received GI recognition in **2006**. The tag applies only to wooden toys made in Karnataka's Channapatna region using traditional lacquerware art.

3. Muzaffarnagar Jaggery

- The GI tag strengthened the identity of **Muzaffarnagar Jaggery** as a premium product. In **2025**, **Brijnandan Agro Farmer Producer Company** exported **30 metric tonnes** of jaggery to Bangladesh. This improved export opportunities and income prospects for its **545 members**.

Government Initiatives Promoting GI Products

The Government is promoting GI products through **financial assistance, market access, export promotion, legal protection, tourism integration and dedicated retail platforms**.

1. PM Ekta Mall / Unity Mall

- Promotes **One District One Product**, GI-tagged products and handicrafts.
- An allocation of **₹5,000 crore** was made for establishing these malls across States in FY 2023–24.

2. One Station One Product

- Railway stations provide dedicated stalls for regional products.
- It gives direct market access to **artisans, weavers, farmers and producer groups**.

3. GI Trails and Tourism Integration

GI clusters are being integrated into tourism circuits. This promotes **experiential tourism** and direct rural retail.

Examples include:

- **Pochampally Ikat weaving village tour**
- **Darjeeling tea estate trail**
- **Muga Silk Trail in Assam**

In June 2026, the **Muga Silk Trail** was announced in Assam along with a **Silk Tourism Park** and **Muga Utsav festivals**.

4. MSME Innovative Scheme

Under the **IPR component of the MSME Innovative Scheme**, eligible applicants can get reimbursement for GI registration.

- Up to **100% reimbursement**
- Maximum limit of **₹2 lakh per registered GI**

5. Financial Assistance for GI Protection

The **Office of the Development Commissioner (Handicrafts)** provides support for GI protection.

- Up to **₹1.5 lakh** for enforcing GI rights
- Support for legal expenses
- Assistance under **National Handloom Development Programme** and **National Handicrafts Development Programme**

As of June 2026, **104 GI-registered handloom products** and **53 registrations** were supported under Handloom Marketing Assistance.

GI Tags, Exports and FTAs

APEDA's Export Promotion

The **Agricultural and Processed Food Products Export Development Authority** supports GI agricultural products through:

- quality improvement
- capacity building
- infrastructure support
- market promotion
- opening new export markets

Recent Export Examples

Market	GI Product	Key Impact
Maldives	Karnataka GI fruits	**40–50% higher returns** for farmers
Canada	Salem Sago	Expanded demand and better incomes
UK and Italy	Joha Rice	New export markets and better price realisation

Dubai	Tezpur Litchi	Around **10% higher prices** for growers

FTA Linkage

Free Trade Agreements increase the value of GI products by reducing trade barriers and securing formal protection.

- After the **India–Oman CEPA**, **3 metric tonnes of Indi Lime** from Karnataka were exported to Oman in December 2025.
- **New Zealand** has committed to enabling registration of Indian GI products such as Darjeeling Tea, Basmati Rice and region-specific handicrafts.
- India and the **European Union** continue negotiations on a dedicated GI agreement.



Promotional Events and Global Visibility

GI products are being promoted through exhibitions, fairs, awareness programmes and international events.

Domestic Promotion

GI products have been showcased through:

- craft fairs
- Dilli Haat events
- GI promotion programmes
- **GI & Beyond: Virasat se Vikas Tak**
- World Food India 2025
- Tribal Business Conclave 2025
- India AI Impact Summit 2026

They are also displayed at **Varanasi, Delhi and Mumbai airports**, and in **Delhi Metro**.

International Promotion

Indian GI products have been promoted overseas through events such as:

- **Autumn Fair International 2024, Birmingham**
- **Bazaar Berlin 2024, Germany**

Challenges in Scaling GI Products

1. Low Awareness Among Producers

- Many artisans and farmers are unaware of GI registration, authorised user status and legal benefits.

2. Imitation and Misuse

- Fake GI-like products reduce consumer trust and hurt genuine producers.

3. Weak Branding and Packaging

- Many GI products lack modern packaging, digital marketing and brand identity.

4. Limited Authorised Users

- Even genuine producers may not be formally registered as authorised users, reducing direct benefits.

5. Quality Standardisation

- Export markets require consistent quality, traceability and certification.

6. Market Access Gaps

- GI recognition alone cannot increase income unless linked with **retail platforms, e-commerce, tourism and exports**.

Way Forward

1. Expand GI Registration

- India should identify more traditional, tribal, agricultural and craft-based products for GI registration.

2. Increase Authorised Users

- More genuine producers must be registered as authorised users so that benefits reach local communities.

3. Strengthen Enforcement

- Strict action is needed against fake branding, imitation and unauthorised commercial use.

4. Improve Branding and Packaging

- GI products need better design, packaging, storytelling, quality certification and digital promotion.

5. Link GI with Exports

- APEDA, MSME Ministry and State agencies should connect GI products with global buyers.

6. Promote GI Tourism

- GI Trails can convert craft clusters and agricultural regions into tourism and rural retail hubs.

7. Use FTAs Strategically

- India should secure GI protection in trade agreements, especially with the **EU, New Zealand and other premium markets**.

Conclusion

GI tags are not merely legal certificates; they are instruments of **heritage protection, rural development, cultural branding and export-led growth**. By protecting regional identity and empowering artisans, farmers and producer groups, GI tags can transform traditional products into global brands. With a target of **10,000 GI registrations by 2030**, India has an opportunity to build a strong **heritage economy** that connects **tradition with markets, culture with livelihoods and local products with global value chains**.

Supreme Court Order on Mining Around Ramsar Wetlands: Judicial Safeguard for Wetland Conservation

Source: The Hindu

Relevance: **UPSC GS Paper II: Judiciary, Governance, Centre-State Relations**

Important Keywords

Prelims Keywords:

- Ramsar Sites | Asan Wetland Conservation Reserve | NBWL | Wetlands Rules 2017 | Eco-Sensitive Zone

Mains Keywords:

- Wetland conservation | Judicial environmental governance | Mining regulation | Ecological character | Precautionary principle

Why in News?

The **Supreme Court** has clarified that its earlier direction requiring prior approval before mining within a **10-km radius** of the **Asan Wetland Conservation Reserve** in Uttarakhand would apply, for the sake of parity, to **wetland conservation reserves across the country**. This clarification is significant because Ramsar sites and wetland conservation reserves do not have a clearly defined statutory mining buffer under existing wetland rules.

What Did the Supreme Court Clarify?

The Supreme Court clarified that the principle laid down in the **Asan Wetland Conservation Reserve**

case is not limited only to Uttarakhand.

The earlier direction required that **no mining activity** should be carried out within a **10-km radius** of the Asan reserve unless prior permission is obtained from:

- the **Standing Committee of the National Board for Wildlife**, and/or
- the **Ministry of Environment, Forest and Climate Change**.



The latest clarification means that similar safeguards may apply to other **wetland conservation reserves** across India. the Court also directed the **NBWL Standing Committee** or **MoEFCC** to determine whether the Asan wetland extends into Himachal Pradesh. If it extends into Himachal Pradesh, the 2024 directions would apply there. If not, mining proposals would be governed by the applicable statutory framework.

Background of the Asan Wetland Case

The **Asan Wetland Conservation Reserve** is located at the confluence of the **Asan and Yamuna rivers** in **Uttarakhand**.

Feature	Details
Wetland	Asan Wetland Conservation Reserve
Location	Uttarakhand
River Confluence	Asan and Yamuna rivers
Ramsar Status	Designated in **2020**
Ecological Importance	Migratory waterbirds and aquatic biodiversity

In its interim order of **February 14, 2024**, the Supreme Court held that the wetland's Ramsar status required higher scrutiny of activities that could affect its ecological character.

What are Ramsar Sites?

- **Ramsar sites** are wetlands of international importance.
- They are designated under the **Ramsar Convention on Wetlands**, adopted in **1971** at Ramsar, Iran.
- India became a party to the Convention in **1982**.
- Ramsar designation recognises the ecological importance of a wetland and requires the country to maintain its **ecological character**.
- India currently has **101 Ramsar sites**, the highest among Asian countries.
- **Glaw Lake in Arunachal Pradesh** became India's **101st Ramsar site** in August 2026.

Ramsar Sites in India – State-wise List 2026

S.No.	Ramsar Site	State / UT
1	Kolleru Lake	Andhra Pradesh
2	Deepor Beel	Assam
3	Kanwar (Kabar) Taal	Bihar
4	Nagi Bird Sanctuary	Bihar
5	Nakti Bird Sanctuary	Bihar

S.No.	Ramsar Site	State / UT
6	Nanda Lake	Goa
7	Khijadia WLS	Gujarat
8	Nalsarovar BS	Gujarat
9	Thol Lake	Gujarat
10	Wadhvana Wetland	Gujarat
11	Bhindawas WLS	Haryana
12	Sultanpur NP	Haryana
13	Chandra Taal	Himachal Pradesh
14	Pong Dam Lake	Himachal Pradesh
15	Renuka Lake	Himachal Pradesh
16	Ranganathittu BS	Karnataka
17	Magadi Kere Conservation Reserve	Karnataka
18	Ankasamudra Bird Conservation Reserve	Karnataka
19	Aghanashini Estuary	Karnataka
20	Ashtamudi Wetland	Kerala
21	Sasthamkotta Lake	Kerala
22	Vembanad-Kol Wetland	Kerala
23	Bhoj Wetland	Madhya Pradesh
24	Sakhya Sagar	Madhya Pradesh
25	Sirpur Wetland	Madhya Pradesh
26	Yashwant Sagar	Madhya Pradesh
27	Tawa Reservoir	Madhya Pradesh
28	Lonar Lake	Maharashtra
29	Nandur Madhameshwar	Maharashtra
30	Thane Creek	Maharashtra
31	Loktak Lake	Manipur
32	Pala Wetland	Mizoram
33	Ansupa Lake	Odisha
34	Bhitarkanika Mangroves	Odisha
35	Chilika Lake	Odisha
36	Hirakud Reservoir	Odisha
37	Satkosia Gorge	Odisha
38	Tampara Lake	Odisha
39	Beas CnR	Punjab
40	Harike Wetland	Punjab
41	Kanjli Wetland	Punjab
42	Keshopur-Miani CmR	Punjab
43	Nangal WLS	Punjab
44	Ropar Wetland	Punjab

S.No.	Ramsar Site	State / UT
45	Keoladeo National Park	Rajasthan
46	Sambhar Lake	Rajasthan
47	Chitrangudi BS	Tamil Nadu
48	Gulf of Mannar Marine BR	Tamil Nadu
49	Kanjirankulam BS	Tamil Nadu
50	Karikili BS	Tamil Nadu
51	Koonthankulam BS	Tamil Nadu
52	Pallikaranai Marsh Reserve Forest	Tamil Nadu
53	Pichavaram Mangrove	Tamil Nadu
54	Point Calimere WLS & BS	Tamil Nadu
55	Suchindram Theroor Wetland Complex	Tamil Nadu
56	Udhayamarthandapuram BS	Tamil Nadu
57	Vaduvur BS	Tamil Nadu
58	Vedanthangal BS	Tamil Nadu
59	Vellode BS	Tamil Nadu
60	Vembannur Wetland Complex	Tamil Nadu
61	Karaivetti Bird Sanctuary	Tamil Nadu
62	Longwood Shola Reserve Forest	Tamil Nadu
63	Nanjarayan Bird Sanctuary	Tamil Nadu
64	Kazhuveli Bird Sanctuary	Tamil Nadu
65	Rudrasagar Lake	Tripura
66	Hokera Wetland	UT of Jammu & Kashmir
67	Hygam Wetland CnR	UT of Jammu & Kashmir
68	Shallbugh Wetland CnR	UT of Jammu & Kashmir
69	Surinsar-Mansar Lakes	UT of Jammu & Kashmir
70	Wular Lake	UT of Jammu & Kashmir
71	Tso Kar	UT of Ladakh
72	Tsomoriri	UT of Ladakh
73	Bakhira WLS	Uttar Pradesh
74	Haiderpur Wetland	Uttar Pradesh
75	Nawabganj BS	Uttar Pradesh
76	Parvati Arga BS	Uttar Pradesh
77	Saman BS	Uttar Pradesh
78	Samaspur BS	Uttar Pradesh
79	Sandi BS	Uttar Pradesh
80	Sarsai Nawar Jheel	Uttar Pradesh
81	Sur Sarovar (Keetham Lake)	Uttar Pradesh
82	Upper Ganga River (Brijghat to Narora)	Uttar Pradesh
83	Asan Barrage	Uttarakhand

S.No.	Ramsar Site	State / UT
84	East Kolkata Wetlands	West Bengal
85	Sundarban Wetland	West Bengal
86	Sakkarakottai Bird Sanctuary	Tamil Nadu
87	Therthangal Bird Sanctuary	Tamil Nadu
88	Khecheopalri Wetland	Sikkim
89	Udhwa Lake	Jharkhand
90	Khichan (Phalodi)	Rajasthan
91	Menar (Udaipur)	Rajasthan
92	Gokul Jalashay	Bihar
93	Udaipur Jheel	Bihar
94	Gogabeel Lake	Bihar
95	Siliserh Lake	Rajasthan
96	Kopra Jalashay	Chhattisgarh
97	Patna Bird Sanctuary	Uttar Pradesh
98	Chhari-Dhand	Kutch (Gujarat)
99	Shekha Jheel Bird Sanctuary	Uttar Pradesh
100	Jai Prakash Narayan Bird Sanctuary	Uttar Pradesh
101	Glaw Lake	Arunachal Pradesh

Do Ramsar Sites Have a Statutory Mining Buffer?

- A Ramsar designation does **not automatically create a separate statutory protection regime** under Indian law.
- Neither the **Ramsar Convention** nor the **Wetlands (Conservation and Management) Rules, 2017** prescribe a fixed statutory buffer zone around Ramsar sites for mining.
- This means there is no general rule under the Wetlands Rules that mining is automatically prohibited within a specific distance from every Ramsar site.
- The Supreme Court's direction is therefore important because it creates a **judicial safeguard** for mining activities near wetland conservation reserves.

Wetlands Rules: 2010 vs 2017

Aspect	Wetlands Rules, 2010	Wetlands Rules, 2017
Regulation Model	More centralised and detailed	Decentralised through State Wetland Authorities
Prohibited Activities	Listed activities such as reclamation, new industries, dumping of solid waste and harmful activities	Removed explicit list of prohibited activities
Zone of Influence	Required prior	Greater responsibility

	approval for activities within the wetland's zone of influence	shifted to States
Environmental Scrutiny	EIA required for specified projects	Depends on applicable legal and State-level framework
Current Status	Replaced by 2017 Rules	Constitutional validity under challenge before Supreme Court

Petitioners have argued that the 2017 framework weakens protections available under the 2010 Rules and excludes many artificial wetlands recognised under the Ramsar Convention.

Mining Restrictions Near Protected Areas

Mining restrictions near wetlands differ from restrictions near national parks, wildlife sanctuaries and forests.

1. National Parks and Wildlife Sanctuaries

- Mining inside national parks and wildlife sanctuaries is prohibited under the **Wildlife Protection Act, 1972**.
- The Supreme Court has also held that mining is impermissible within **one kilometre** of every national park and wildlife sanctuary unless a larger **Eco-Sensitive Zone** has already been notified.

2. Eco-Sensitive Zones

- If a larger ESZ has been notified around a protected area, the larger notified buffer prevails.

3. Forest Areas

- Mining in forest areas requires prior approval of the Union government under the **Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980**.

4. Environmental Clearance

- Mining projects generally require environmental clearance under the **Environment Impact Assessment Notification,** 2006.

5. Wetland Conservation Reserves

- In the case of wetland conservation reserves, the Supreme Court's Asan direction requires prior approval before mining within a **10-km radius**, but this operates as a judicial safeguard rather than a statutory buffer under the Wetlands Rules.

Significance of the Supreme Court Clarification

1. Strengthens Wetland Protection

- The order gives additional protection to wetland conservation reserves where statutory buffer rules are unclear.

2. Applies Precautionary Principle

- Wetlands are fragile ecosystems. Prior approval ensures that mining proposals are examined before ecological damage occurs.

3. Protects Ramsar Ecological Character

- Ramsar sites are internationally recognised for ecological importance. Activities affecting their ecological character require stricter scrutiny.

4. Improves Regulatory Oversight

- Requiring approval from NBWL or MoEFCC introduces higher-level environmental review.

5. Creates Parity Across States

- The clarification prevents uneven protection

where one wetland receives judicial safeguard while similar wetlands elsewhere remain exposed.

6. Addresses Gaps in Wetland Rules

- Since the 2017 Rules do not prescribe a fixed mining buffer, the Court's direction fills an important regulatory gap.

Challenges and Concerns

1. Legal Ambiguity

- The direction applies to wetland conservation reserves, but Ramsar sites as a category still do not have a statutory buffer zone.

2. Federal Concerns

- Wetland management under the 2017 Rules is largely decentralised through State Wetland Authorities. Judicial directions may require better Centre-State coordination.

3. Impact on Mining Projects

- Mining proposals near wetland conservation reserves may now face additional scrutiny and delays.

4. Need for Clear Mapping

- Authorities must clearly map wetland boundaries and zones of influence to avoid disputes.

5. Ecological Character Assessment

- Scientific assessment is needed to determine how mining affects hydrology, bird habitats, aquatic biodiversity and sediment flow.

6. Enforcement Capacity

- Legal safeguards are effective only when backed by monitoring, field inspections and compliance mechanisms.

Way Forward

1. Notify Clear Wetland Boundaries

- All wetland conservation reserves and Ramsar sites should have scientifically demarcated boundaries.

2. Define Zones of Influence

- Instead of relying only on fixed-distance rules, authorities should identify ecological zones based on hydrology, biodiversity and land-use patterns.

3. Strengthen State Wetland Authorities

- State Wetland Authorities need technical capacity, funding and monitoring systems.

4. Improve Mining Scrutiny

- Mining projects near wetlands should undergo cumulative impact assessment, not only project-wise clearance.

5. Harmonise Legal Frameworks

- Wetland Rules, Wildlife Protection Act, EIA framework and forest laws should work together to avoid regulatory gaps.

6. Ensure Local Participation

- Local communities, fisherfolk, farmers and bird experts should be involved in wetland conservation planning.

7. Strengthen Compliance Monitoring

- Use satellite imagery, GIS mapping and field audits to monitor illegal mining and land-use change around wetlands.

Conclusion

The Supreme Court's clarification on mining near wetland conservation reserves is an important step in strengthening wetland protection. It does not create a universal statutory buffer for all Ramsar sites, but it adds a judicial safeguard by requiring prior approval for mining within a **10-km radius** of wetland conservation reserves. This is significant

because India's wetlands face pressure from mining, urbanisation, encroachment and pollution. The larger lesson is that wetland conservation needs clear legal standards, scientific mapping, strong State Wetland Authorities and accountable project clearances. Protecting wetlands is not only about biodiversity; it is also about water security, flood regulation, climate resilience and sustainable development.

e-Courts Mission Mode Project: Digital Transformation of India's Judiciary

Source: PIB

Relevance: **UPSC GS Paper II: Judiciary, Governance, e-Governance, Access to Justice**

Important Keywords

Prelims Keywords:

- e-Courts Mission | National Judicial Data Grid | NSTEP | e-Sewa Kendras | eSCR Portal

Mains Keywords:

- Access to justice | Judicial transparency | Digital governance | Paperless courts | AI in judiciary

Why in News?

The **e-Courts Mission Mode Project** has been highlighted as a major digital governance reform that has transformed India's judiciary from a paper-heavy system into a more **accessible, transparent, trackable and technology-enabled justice delivery system**. The project is now in **Phase III**, which focuses on **paperless courts, digitisation, virtual hearings, interoperability and AI-based judicial support**.

About e-Courts Mission Mode Project

The **e-Courts Mission Mode Project** was launched in **2007** to digitise court processes and make justice delivery faster, affordable and more transparent.

- India's judiciary traditionally depended heavily on paper records and physical court visits. This increased travel costs, delayed access to documents and made court processes difficult for litigants. The e-Courts Mission seeks to solve these problems by using digital platforms for filing, tracking, hearings, payments, record management and judicial administration.

Phases of e-Courts Mission

Phase	Period	Major Focus
Phase I	**2011–2015**	Computerisation of over **14,000 courts** and creation of basic network infrastructure
Phase II	**2015–2023**	Citizen-centric services such as **NJDG, e-Filing, e-Sewa Kendras** and expanded video conferencing
Phase III	**2023–2027**	Paperless courts, large-scale digitisation, virtual hearings, interoperability, AI, analytics and OCR

Phase III aims to move the judiciary towards **digital, paperless and intelligent courts**.

Major Achievements under Phase III

Component	Achievement
Fully functional e-Sewa Kendras	**1,806** established across court complexes
Infrastructure for paperless courts	**474 courts** equipped

Virtual courts infrastructure	**538 courts** equipped
e-Filing implementation	**4,519 courts**
Video Conferencing facilities	**7,553 establishments**, including courts, jails and hospitals
Solar facilities for ICT infrastructure	**1,626 court complexes**
NSTEP facility	**6,895 courts**
Court websites migrated to S3WAAS	**734 court sites**
Additional hardware support	**18,380 courts**
ICJS integration	Implemented by **all High Courts**
Training programmes	**2,372 trainings** held

National Judicial Data Grid

The **National Judicial Data Grid** was launched under Phase II. It is an online public dashboard that tracks court orders, judgments and case details in real time.

NJDG Tracks

- pending and disposed cases
- case categories
- stage of proceedings
- reasons for delay
- duration of delay
- data across Supreme Court, High Courts and District Courts

Significance

NJDG improves **transparency, accountability, judicial planning and monitoring**. By making pendency data public, it helps identify bottlenecks in the justice delivery system.

e-Filing and Digital Payments

Earlier, lawyers and citizens had to physically file complaints, replies, applications and other documents. The **e-Filing system** allows documents to be filed online from anywhere.

Key Services under e-Filing

- online filing of petitions and applications
- e-signing of documents
- online payment of court fees
- online submission of Vakalatnamas
- video recording of oaths
- dashboards for advocates and litigants
- ready-made templates for pleadings
- portfolio management for cases

Remote Hearings and Virtual Courts

Video conferencing has made court access easier for litigants, lawyers, witnesses, prisoners, police officials and experts.

Major Developments

- **7,553 establishments** have video conferencing facilities.
- Over **4.18 crore remote hearings** have been conducted.
- Livestreaming of court proceedings is operational in **11 High Courts**.
- **31 Virtual Courts** handle online adjudication of traffic challans.
- Virtual Courts have received **11.33 crore challans**, amounting to **₹1,135.79 crore**.

Nyaya Shruti, launched in 2024 under ICJS, enables accused persons, witnesses, police officials, prosecutors, experts and prisoners to appear or testify virtually.

Connecting Police, Courts, Prisons and Forensics

The e-Courts Mission is not limited to courts. It is also linking the wider criminal justice system.

Important Digital Justice Platforms

Platform	Purpose
ICJS	Connects police, courts, prisons, forensics and prosecution
CCTNS	Digitises police processes from FIR to charge-sheet
ITSSO	Tracks investigation of sexual offences against women and children
e-Sakshya	Captures and manages digital evidence securely
e-Summons	Generates and transmits electronic summons
MedLEaPR	Handles medico-legal and postmortem reports digitally
e-Forensic	Supports digital forensic case handling
e-Prison	Manages prison and prisoner data
e-Prosecution	Links police and prosecution workflows
NAFIS	Enables fingerprint matching through a national biometric database

This integration improves coordination among different pillars of the criminal justice system.

Seamless Tracking of Judicial Business

Digital platforms now allow lawyers, litigants and judges to track case-related information without repeated physical visits to courts.

Major Services

- case status tracking
- cause lists
- judicial updates
- SMS and email alerts
- multilingual e-Courts Services Portal
- mobile apps

The **e-Courts Services App** helps litigants and lawyers access case status, cause lists and court services. The **JustIS App** helps judges organise, monitor and manage judicial work digitally.

GPS-Tracked Summons through NSTEP

The **National Service and Tracking of Electronic Processes** enables bailiffs to serve summons and notices electronically.

Key Features of NSTEP

- centralised digital platform
- GPS-enabled web and mobile application
- real-time tracking of summons
- faster service across districts and States
- greater transparency in process delivery

NSTEP replaces slow paper-based summons delivery with a more accountable and trackable system.

Citizen Assistance through e-Sewa Kendras

e-Sewa Kendras are citizen-friendly assistance centres located within court complexes. They help bridge the digital divide by assisting litigants who may not be comfortable using digital platforms on their own.

Services Provided

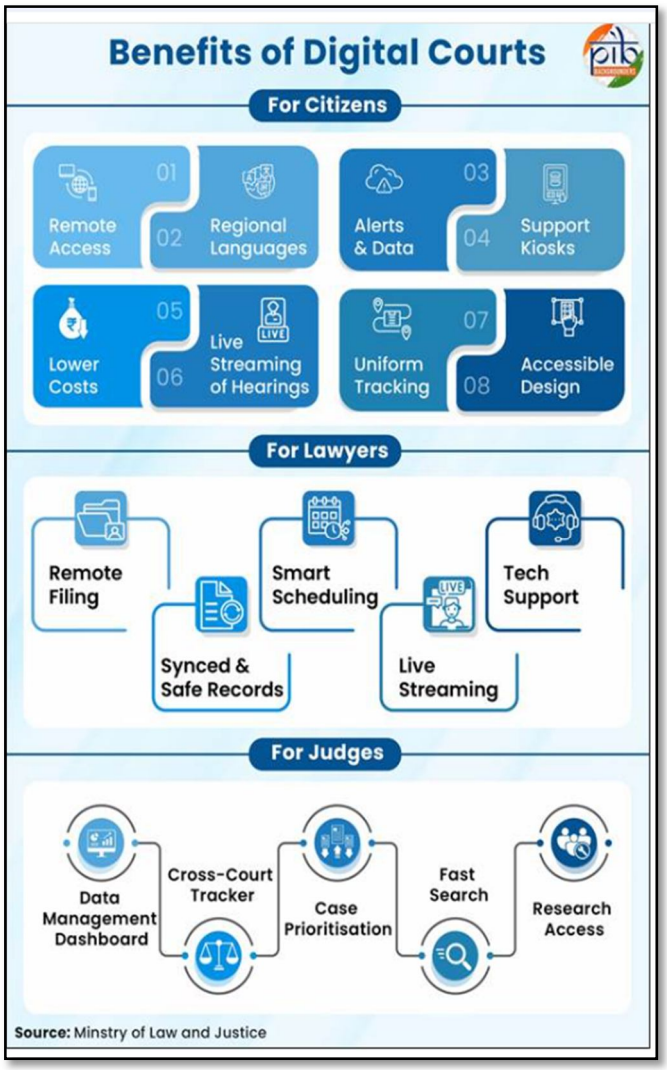
- case status and next hearing date
- certified copy applications
- e-filing assistance
- scanning and uploading documents
- e-signatures
- e-stamp purchase
- e-payments
- Aadhaar-based digital signatures
- downloading e-Courts mobile app
- joining video-conference hearings
- traffic challan disposal through Virtual Courts
- judgment and order copies through digital channels
- guidance on judges' leave schedules
- free legal aid guidance

- eMulakat appointments for prison visits

Network of e-Sewa Kendras

As of **30 June 2026**, there were:

- **49 e-Sewa Kendras** across High Courts
- **2,535 e-Sewa Kendras** across District Courts



AI-Assisted Judicial Processes

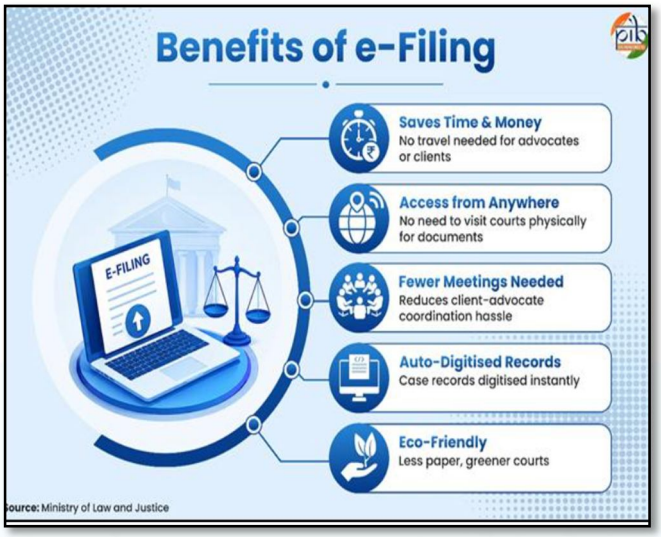
- Under Phase III, the e-Courts Mission is moving towards **AI and Machine Learning-based judicial support**.
- Out of the total **₹7,210 crore** Phase III outlay, **₹53.57 crore** has been earmarked for AI and Machine Learning applications in High Courts through 2027.

Major AI-Based Initiatives

Initiative	Purpose
AI-assisted transcription	Transcribes oral arguments in Constitution Bench matters
LegRAA	Supports judges in legal research and document analysis
Digital Courts 2.1	Provides single-window paperless court management
ASR-SHRUTI	Voice-to-text conversion
PANINI	Translation and dictation support for orders and judgments
eSCR translations	Translation of judgments into Indian languages
AI filing scrutiny tool	Identifies defects in e-filed petitions and extracts case metadata

Through the **eSCR portal**, judgments are being translated into **18 Indian languages**. Over **83,000 translations**, including **36,344 in Hindi**, had been completed by March 2025.

An AI tool developed with **IIT Madras** can automatically identify defects in e-filed petitions and extract case metadata. Prototype access has been provided to **200 Advocates-on-Record**.



Significance of e-Courts Mission

1. Access to Justice
- Digital filing, remote hearings and e-Sewa Kendras reduce the need for physical court visits, saving time and cost.

2. Transparency
- NJDG and case-tracking platforms make pendency, orders and case status visible to the public.

3. Speed and Efficiency
- e-Filing, e-Summons, digital payments and video hearings reduce procedural delays.

4. Paperless Judiciary
- Digitisation of records and paperless court platforms reduce dependence on physical files.

5. Criminal Justice Integration
- ICJS improves coordination between police, courts, prisons, prosecution and forensic institutions.

6. Language Inclusion
- Multilingual portals and translated judgments make the judicial system more accessible to citizens.

7. AI-Based Support
- AI can assist in transcription, translation, legal research, filing scrutiny and case management.

Challenges

1. Digital Divide
- Many litigants may lack digital literacy, internet access or devices.

2. Infrastructure Gaps
- Reliable connectivity, hardware maintenance and power supply are essential for digital courts.

3. Cybersecurity Risks
- Court records, evidence and judgments require strong data protection and cyber safeguards.

4. AI Accountability
- AI tools must assist judges but cannot replace judicial reasoning or human discretion.

5. Language and Translation Accuracy
- Judicial translations must be accurate because even small errors can affect legal understanding.

6. Training Needs
- Judges, lawyers, clerks, police and litigants need regular training to use digital systems effectively.

Way Forward

1. Strengthen Digital Literacy
- e-Sewa Kendras should be expanded and staff should be trained to assist first-time digital users.

2. Upgrade Court Infrastructure
- Courts need reliable internet, hardware, power backup and cybersecurity systems.

3. Ensure Data Protection
- Judicial data must be protected through encryption, secure access systems and audit trails.

4. Improve AI Governance
- AI tools should remain assistive, transparent and accountable, with human oversight at every stage.

5. Expand Multilingual Access
- Translation quality should be improved so that judgments and orders become accessible in regional languages.

6. Integrate Justice Institutions
- ICJS should be strengthened to ensure smooth data flow among police, courts, prisons and forensic labs.

7. Monitor Outcomes
- Digital reforms should be assessed based on reduced pendency, faster service delivery and improved citizen satisfaction.

Conclusion

The **e-Courts Mission Mode Project** has transformed India's judiciary into a more digital, transparent and citizen-friendly system. By enabling e-Filing, remote hearings, NJDG, e-Sewa Kendras, NSTEP, ICJS integration and AI-assisted processes, it reduces dependence on physical court visits and improves access to judicial services. However, technology alone cannot solve judicial delays. Its success depends on infrastructure, cybersecurity, digital literacy, human oversight and institutional reform. As Phase III progresses through 2027, the e-Courts Mission can become a major step towards faster, affordable and inclusive justice delivery.

PM MITRA Mega Textile Parks: Integrated Textile Manufacturing and India's 5F Vision

Source: PIB.

Relevance: UPSC GS Paper II: Government Policies, Industrial Development, Employment Generation

UPSC GS Paper III: Textile Sector, Manufacturing, Infrastructure, Exports, MSMEs

Important Keywords

Prelims Keywords:

- PM MITRA Parks | 5F Vision | Special Purpose Vehicle | Competitiveness Incentive Support | Textile Value Chain

Mains Keywords:

- Integrated manufacturing | Textile exports | Employment generation | Industrial infrastructure | Economies of scale

Why in News?

The Ministry of Textiles informed the Lok Sabha that the Government has approved **7 PM Mega Integrated Textile Region and Apparel Parks** with a total scheme outlay of **₹4,445 crore** for the period **2021-22 to 2027-28**.

The Government stated that **MoUs have been signed with all seven States**, **100% land has been acquired or made available**, **environmental clearances have been received**, and **DPRs worth ₹13,537 crore** have been finalised. Investment interest worth **₹68,590 crore** has been received from PM MITRA States.

What is PM MITRA?

- **PM MITRA** stands for **PM Mega Integrated Textile Region and Apparel**.
- It is a scheme to create **large-scale, integrated and modern textile industrial parks** covering the complete textile value chain.
- The idea is to provide common infrastructure, plug-and-play facilities, logistics, worker support and industrial services in one location.
- The scheme aims to make India's textile industry more competitive by reducing logistics cost, improving scale, attracting investment and generating employment.

Objectives of the Scheme

1. Integrated Textile Ecosystem

- PM MITRA seeks to bring spinning, weaving, processing, dyeing, printing, garmenting and exports closer within a single industrial ecosystem.

2. Large-Scale Industrial Infrastructure

- The parks will provide developed factory sites, roads, water, power, waste-water systems, Common Effluent Treatment Plants and testing facilities.

3. Employment Generation

- Each PM MITRA Park is expected to generate around **3 lakh jobs**, including **1 lakh direct** and **2 lakh indirect** employment opportunities.

4. Global Competitiveness

- By creating economies of scale, the scheme aims to help Indian textile companies become global champions.

5. Investment Promotion

- The parks are expected to attract large domestic and foreign investments in textile manufacturing and apparel exports.

Location of the Seven PM MITRA Parks

State	Location	Park Type
Tamil Nadu	Virudhnagar	Greenfield
Telangana	Warangal	Brownfield
Gujarat	Navsari	Greenfield
Karnataka	Kalaburagi	Greenfield
Madhya Pradesh	Dhar	Greenfield
Uttar Pradesh	Lucknow	Greenfield
Maharashtra	Amravati	Brownfield

- **Greenfield:** Government selects a new area and develops roads, power, water, factories, warehouses and textile-processing facilities **from scratch**.
- **Brownfield:** An area already has textile industries and infrastructure. The government **expands and modernises** it by adding better roads, common processing facilities, warehouses, etc.

Current Progress of PM MITRA Parks

State	Park Type	Land Available / Acquired	Investment Interest	State Expenditure Incurred
Madhya Pradesh	Greenfield	**2,158 acres**	**₹19,846 crore**	**₹94.06 crore**
Tamil Nadu	Greenfield	**1,052 acres**	**₹2,067.90 crore**	**₹34.80 crore**
Gujarat	Greenfield	**1,000 acres**	**₹13,094 crore**	**₹196.22 crore**
Karnataka	Greenfield	**1,142 acres**	**₹1,700 crore**	**₹95.39 crore**
Uttar Pradesh	Greenfield	**1,000 acres**	**₹5,354 crore**	**₹220.69 crore**
Telangana	Brownfield	**1,020 acres**	**₹3,800 crore**	**₹123.93 crore**
Maharashtra	Brownfield	**1,327 acres**	**₹12,000 crore**	**₹32.21 crore**

Overall Status

- MoUs signed with all States.
- Full land availability achieved for all seven sites.
- Environmental clearances received for all parks.
- Joint Venture Agreements signed for all **5 Greenfield sites**.
- SPVs incorporated for all **5 Greenfield sites**.
- DPRs worth **₹13,537 crore** finalised for all seven States.
- Investment interests worth **₹68,590 crore** received so far.

Infrastructure Components

PM MITRA Parks will contain both **core infrastructure** and **support infrastructure**.

Core Infrastructure

Component	Purpose
Incubation Centre	Supports new firms, startups and design-led innovation
Plug-and-Play Facility	Allows units to start production faster
Developed Factory Sites	Reduces project setup time
Roads, Power and Water	Provides basic industrial infrastructure
Waste-Water System	Supports environmental compliance
Common Processing House	Enables shared processing facilities
Common Effluent Treatment Plant	Helps manage textile pollution
Design and Testing Centres	Improves product quality and competitiveness

Support Infrastructure

Component	Purpose
Workers' Hostels and Housing	Supports labour welfare
Logistics Park	Reduces transport cost
Warehousing	Improves storage and supply chain efficiency
Medical Facilities	Provides health support for workers
Training and Skill Centres	Builds skilled manpower for textile units

Land Use Pattern

PM MITRA Parks will follow a planned land-use model.

Area Use	Share of Park Area
Manufacturing Activity	**50%**
Utilities	**20%**
Commercial Development	**10%**

This land-use pattern is intended to balance production, common services and commercial activities within the park.

Implementation Model

PM MITRA Parks will be developed through a **Special Purpose Vehicle**.

Key Features

- The SPV will be owned by the **State Government and Government of India**.
- It will operate in **Public Private Partnership mode**.
- The State Government will have majority ownership in the SPV.
- A **Master Developer** will be selected through objective criteria jointly developed by the Centre and State.
- The Master Developer will develop the industrial park and maintain it during the concession period.

The SPV will receive part of the lease rental from developed industrial sites. This revenue can be used for further expansion of the textile park, skill development and worker welfare.

Competitiveness Incentive Support

The Government of India will provide **₹300 crore for each PM MITRA Park** to incentivise manufacturing units.

This support is called **Competitiveness Incentive Support**.

Main Features

- It is meant for newly established units in PM MITRA Parks.
- It will be paid up to **3% of turnover**.
- It supports units during the early stage before they achieve viability.
- It helps reduce the initial business risk of textile manufacturing units.

This incentive can encourage firms to invest in large-scale textile manufacturing within the parks

5F Vision and Textile Value Chain

PM MITRA is inspired by the Prime Minister's **5F Vision**.

5F Component	Meaning
Farm	Cotton and other raw material production
Fibre	Conversion of raw material into fibre
Factory	Textile manufacturing and processing
Fashion	Apparel design and garmenting
Foreign	Export to international markets

The **Farm to Fibre to Factory to Fashion to Foreign** approach links agriculture, manufacturing, design and exports into one integrated value chain.

Significance of PM MITRA Parks

1. Boost to Textile Manufacturing

- Large integrated parks can reduce fragmentation in the textile sector and create modern industrial clusters.

2. Employment Generation

- With each park expected to generate around **3 lakh jobs**, the scheme can support labour-intensive manufacturing.

3. Export Competitiveness

- Integrated infrastructure, testing centres, logistics parks and scale can help Indian textiles compete better in global markets.

4. Regional Industrial Development

- The seven parks are spread across different States, promoting balanced regional growth.

5. Support to MSMEs

- Plug-and-play infrastructure and common facilities can help smaller textile units reduce capital burden.

6. Environmental Management

- Common Effluent Treatment Plants and waste-water systems can support cleaner textile processing.

7. Women's Employment Potential

- Textile and apparel sectors traditionally create significant employment opportunities for women, especially in garmenting and allied services.

Challenges

1. Timely Execution

- Large industrial parks require quick completion of infrastructure, clearances and investor onboarding.

2. Land and Local Livelihood Concerns

- Even when land is available, local communities must be included through fair compensation, jobs and welfare measures.

3. Environmental Compliance

- Textile processing involves water use, dyes and effluents. Strong monitoring of CETPs is essential.

4. Global Competition

- India faces competition from countries with large-scale textile exports and low production costs.

5. Skill Gap

- Modern textile parks need trained workers in design, machinery, processing, logistics and quality control.

6. MSME Inclusion

- The parks should not become only large-company zones; smaller units and local entrepreneurs must also benefit.

Way Forward

1. Complete Infrastructure on Time

- Roads, power, water, CETPs, logistics and

factory sites should be made operational quickly.

2. Strengthen Skill Development

- Training centres should focus on modern textile machinery, apparel design, quality control, exports and digital production systems.

3. Promote MSME Linkages

- Local MSMEs, weavers, garment units and service providers should be connected to the parks through vendor networks.

4. Ensure Environmental Safeguards

- CETPs, water recycling and waste-management systems must be monitored through transparent compliance mechanisms.

5. Attract Anchor Investors

- Large anchor units can bring supply chains, employment and export networks to each park.

6. Use Scheme Converge₹nce

- PM MITRA should be linked with logistics, skilling, MSME, export promotion and State industrial policies.

7. Build Global Branding

- India should use the parks to promote itself as a reliable textile manufacturing and apparel export hub.

Conclusion

The **PM MITRA Mega Textile Parks** scheme is a major step towards transforming India's textile sector from fragmented production to integrated, large-scale and globally competitive manufacturing. By combining core infrastructure, worker facilities, plug-and-play systems, SPV-based implementation and **Competitiveness Incentive Support**, the scheme can attract investment and generate employment. However, its success will depend on timely execution, environmental safeguards, MSME inclusion, skill development and export-oriented planning. If implemented effectively, PM MITRA can convert India's traditional textile strength into a modern industrial and export advantage.

Creamy Layer for SC/ST Quotas: Centre's Opposition, Constitutional Position and Social Justice Debate

Source: Indian Express

Relevance: **UPSC GS Paper II: Constitution, Reservation Policy, Social Justice, Judiciary, Welfare of Vulnerable Sections**

Important Keywords

Prelims Keywords:

- Creamy Layer | Indra Sawhney Case | Articles 341 and 342 | Davinder Singh Judgment | Article 32

Mains Keywords:

- Historical disadvantage | Sub-categorisation | Social justice | Separation of powers | Reservation equity

Why in News?

The **Union government** has opposed petitions in the **Supreme Court** seeking the introduction of the **creamy layer concept** in **Scheduled Caste and Scheduled Tribe reservations**.The Centre has argued that the historical disadvantages faced by

SCs and STs cannot be treated as ordinary economic backwardness. It has also maintained that any change in reservation policy must be based on a **holistic review, empirical data and legislative mandate**, not judicial direction.

What is Creamy Layer?

- **Creamy layer** refers to relatively advanced individuals within a reserved category who are excluded from reservation benefits.
- The concept was developed for **OBC reservations** after the **Indra Sawhney judgment, 1992**. It is based on the idea that socially and economically advanced sections among OBCs should not corner benefits meant for genuinely backward groups.

Creamy layer identification generally considers factors such as:

- parents holding senior constitutional or government posts
- high-ranking service positions
- income and wealth thresholds
- social and educational advancement

At present, the creamy layer rule applies to **OBCs**, not to **SC/ST reservations**.

What is Sub-Categorisation?

- **Sub-categorisation** means dividing an existing reserved category into smaller internal groups to ensure fairer distribution of reservation benefits.
- It does not remove any community from the reservation list. Instead, it reorganises the existing quota so that communities that are more backward within a reserved category are not crowded out by relatively better-represented groups.

Creamy Layer vs Sub-Categorisation

Aspect	Creamy Layer	Sub-Categorisation
Basic idea	Excludes advanced individuals from reservation benefits	Divides quota among internal groups
Focus	Individual or family-level advancement	Group-level unequal access
Effect	Removes certain persons from availing quota	Redistributes benefits within the quota
Current application	Mainly OBCs	Used for OBCs, SCs and STs in some contexts
Purpose	Prevent advanced individuals from cornering benefits	Ensure benefits reach the most deprived groups
SC/ST debate	Opposed by Centre	Allowed in principle by Supreme Court

Background: From Indra Sawhney to Davinder Singh

1. Indra Sawhney Judgment, 1992

- The Supreme Court upheld OBC reservations and introduced the **creamy layer principle** for OBCs. The Court held that advanced sections within OBCs should be excluded to ensure that benefits reach the intended backward sections.
- However, the judgment confined creamy layer exclusion to **OBCs** and did not apply it to SC/ST reservations.

2. Earlier State-Level Sub-Categorisation

- Even before the national OBC classification, several States recognised internal inequalities among backward communities. States such as **Andhra Pradesh, Tamil Nadu and Maharashtra** divided backward class quotas into smaller shares to ensure equitable representation.

3. Davinder Singh Judgment, 2024

- In **August 2024**, a seven-judge Constitution Bench of the Supreme Court recognised **heterogeneity** and **graded backwardness** within SC/ST communities. It allowed State governments to undertake **sub-categorisation within SC/ST lists** so that the most disadvantaged communities could receive fair access to reservation benefits.
- However, some observations in the judgment suggested that the government may consider creamy layer exclusion for SC/STs. This triggered fresh petitions before the Supreme Court.

Centre's Position Before the Supreme Court

- The Centre has opposed the demand to introduce creamy layer exclusion in SC/ST quotas.
- The petition before the Supreme Court argued that affluent families within SC/ST categories are monopolising reservation benefits and causing "elite capture". It sought income-based preferences across reserved categories.

The Centre rejected this approach and argued that:

- SC/ST disadvantage is not merely economic.
- SCs face historical disadvantage rooted in **untouchability**.
- STs are identified through **distinct cultures, geographical isolation and backwardness**.
- Reservation for SC/STs aims at **social equality, justice and inclusive participation in public life**.
- Discrimination against SCs and STs does not operate only on the basis of income.

Why Centre Opposes Creamy Layer for SC/STs

1. Historical Disadvantage is Different from Economic Backwardness

- The Centre has argued that SC/ST reservations are rooted in historical oppression, social stigma, untouchability, exclusion and geographical isolation. These disadvantages may continue even when an individual or family gains some economic mobility.

2. SC/ST Reservation Serves a Broader Social Justice Purpose

- The objective is not only poverty alleviation but also representation, dignity, equality and participation in public institutions.

3. Economic Criteria Alone May Be Insufficient

- A purely income-based test may fail to capture caste stigma, social discrimination and structural exclusion.

4. Parliament Has the Final Authority

- The Centre has maintained that any exclusion affecting SC/ST lists or reservation entitlements must be decided by Parliament.

5. Courts Cannot Direct a Policy Change Merely Because an Alternative Seems Better

- The government has argued that courts cannot compel the executive to adopt a particular reservation policy simply on the ground that another option appears fairer or wiser.

Legal and Constitutional Basis of Centre's Argument

1. **Article 32 and Maintainability:** The Centre has argued that the petition is not maintainable under **Article 32** because it does not demonstrate a violation of fundamental rights.
2. **Articles 341 and 342:** Under **Articles 341 and 342**, the President notifies the initial lists of Scheduled Castes and Scheduled Tribes. Once notified, any inclusion or exclusion from these lists can be done only by an **Act of Parliament**.
3. **Indra Sawhney Case, 1992:** The Centre has relied on the position that creamy layer exclusion was introduced for OBCs and has no automatic relevance to SC/ST reservations.
4. **Ashoka Kumar Thakur Case, 2008:** The Centre referred to the ruling that the creamy layer principle does not apply to SCs and STs.
5. **E.V. Chinnaiah Case, 2005:** The Centre cited the principle that if a situation ever arises requiring exclusion of creamy layer within SCs, the legislative step must come from **Parliament**.

Reservation policy involves social data, political 6. Separation of Powers

- judgment and legislative design. Therefore, the Centre argues that courts should not replace Parliament or the executive in framing policy.

Where Creamy Layer Applies and Where Sub-Categorisation is Used

Creamy Layer Application

Category	Position
OBCs	Creamy layer exclusion applies after Indra Sawhney
EWS	Uses income and asset exclusion criteria, though not called creamy layer in the same sense
SC/STs	Creamy layer exclusion does not currently apply

Sub-Categorisation Usage

Sub-categorisation has been used more widely than creamy layer exclusion.

Examples include:

- SC sub-categorisation debates in States such as **Telangana, Haryana and Punjab**
- ST quota sub-categorisation in some States such as **Mizoram**
- OBC sub-categorisation by several State governments
- Minimum representation for **PVTGs** within ST quota in Eklavya Model Residential School admissions

Significance of the Debate

1. **Internal Equity Within Reservation:** The debate highlights whether benefits are reaching the most disadvantaged sections within reserved categories.
2. **Protection of Constitutional Safeguards:** It raises concern that creamy layer exclusion may dilute protections meant for historically oppressed communities.
3. **Limits of Income-Based Reservation:** The issue shows that economic weakness and social discrimination are not identical.
4. **Federal Dimension:** States seek flexibility to address local caste realities through sub-categorisation.
5. **Judicial-Executive Balance:** The issue tests the boundary between judicial review and policy-making.

Challenges

1. **Lack of Updated Empirical Data:** Reliable data is needed to determine who is being crowded out and which communities remain under-represented.
2. **Risk of Social Fragmentation:** Internal categorisation can create tensions within reserved communities.
3. **Complexity of Measuring Social Disadvantage:** Caste stigma, untouchability and exclusion cannot be captured by income alone.
4. **Implementation Difficulty:** Sub-categorisation requires clear criteria, legal clarity and administrative capacity.
5. **Politicisation of Reservation:** Reservation debates often become politically polarised, making consensus difficult.

Way Forward

1. Evidence-Based Review

- Any change in reservation policy should be preceded by a **holistic review** and socio-economic data on reserved category beneficiaries.

2. Protect SC/ST Safeguards

- Reform must not weaken the constitutional purpose of SC/ST reservations, which is rooted in historical discrimination.

3. Use Sub-Categorisation Carefully

- Sub-categorisation may be used where evidence shows that certain communities are consistently excluded from benefits.

4. Clarify Legal Boundaries

- Parliament, States and courts should clearly define the limits of sub-categorisation and creamy layer exclusion.

5. Strengthen Support Beyond Quotas

- Scholarships, hostels, coaching, anti-discrimination enforcement and quality schooling are necessary to make reservation effective.

6. Ensure Social Consensus

- Major reservation reforms require consultation with affected communities, State governments and constitutional bodies.

Conclusion

The debate on creamy layer in SC/ST reservations is not simply about income-based exclusion. SC/ST reservations are rooted in histories of untouchability, social stigma, exclusion, geographical isolation and under-representation. While the **Davinder Singh judgment** has allowed sub-categorisation to address unequal access within SC/ST groups, the Centre has opposed creamy layer exclusion on constitutional, social and institutional grounds. The balanced approach is to protect the core purpose of SC/ST reservations while using data-backed sub-categorisation and targeted welfare to ensure that the most disadvantaged communities are not crowded out. Social justice must be made more effective, not diluted.

GOBARdhan Scheme: Turning Organic Waste into Clean Energy and Rural Income

Source: Indian Express

Relevance: **UPSC GS Paper II: Government Schemes, Rural Development, Sanitation, Cooperative Federalism**

UPSC GS Paper III: Energy Security, Environment, Waste Management, Circular Economy, Agriculture

Important Keywords

Prelims Keywords:

- GOBARdhan | Compressed Biogas | Anaerobic Digestion | SATAT | Circular Economy

Mains Keywords:

- Energy security | Waste-to-energy | Rural income | Clean energy transition | Sustainable waste management

Why in News?

The Union Cabinet has approved **GOBARdhan**, the **National Circular Bioenergy Scheme**, with an outlay of **₹23,731 crore** for implementation over **10 years from 2026-27 to 2035-36**.

The scheme aims to boost **Compressed Biogas production** in India by nearly **10 times** and make CBG projects commercially viable through assured offtake, stable pricing, capital subsidies, credit support and pipeline infrastructure.

About GOBARdhan Scheme

GOBARdhan stands for **Galvanising Organic Bio-Agro Resources Dhan**. It is to be implemented by the **Ministry of Petroleum and Natural Gas**.

The scheme seeks to convert India's organic waste resources into useful economic and energy assets. These include:

- agricultural residue
- cattle dung
- press mud
- municipal organic waste
- other biomass resources

The broader objective is to convert the waste burden into **clean fuel, organic manure, rural income and national economic value**.

What is Compressed Biogas?

- **Biogas** is produced from organic waste. It generally contains **55-65% methane**, **35-44% carbon dioxide**, and small traces of gases such as hydrogen sulphide, nitrogen and ammonia.
- In its raw form, biogas can be used for cooking, lighting, motive power and electricity generation. When biogas is purified and upgraded to nearly **98% methane**, and compressed at high pressure, it becomes **Compressed Biogas**.
- CBG has properties similar to **Compressed Natural Gas**. Therefore, it can be used in transport, industry and commercial sectors, either as a replacement for CNG or by blending with CNG.

How CBG is Produced?

CBG production is based on **anaerobic digestion**, where organic matter is broken down in the absence of oxygen.

The process involves four stages:

1. Hydrolysis

- Complex organic matter is broken into simpler molecules.

2. Acidogenesis

- These simpler molecules are converted into volatile fatty acids.

3. Acetogenesis

- Acetic acid, carbon dioxide and hydrogen are produced.

4. Methanogenesis

- Methane-rich biogas is generated.
- The biogas is then purified, upgraded and compressed to produce CBG suitable for fuel use.

Why CBG is Strategically Important for India?

1. Reduces Import Dependence

- India depends on imports for a large part of

its natural gas requirement. Domestic CBG production can reduce this dependence and improve energy security.

2. Supports Clean Energy Transition

- CBG is a renewable fuel produced from waste. It can support India's transition from fossil fuels to cleaner energy sources.

3. Protects Against Global Supply Shocks

- International gas prices and supply routes can be affected by geopolitical tensions. Domestic CBG can reduce vulnerability to such external shocks.

4. Uses Existing Gas Infrastructure

- Since CBG is chemically similar to natural gas, it can be integrated into existing CNG and PNG systems.

5. Strengthens Rural Economy

- Farm residue, cattle dung and biomass can become sources of income for farmers, cooperatives, rural entrepreneurs and MSMEs.

How the New Framework Supports Commercial Viability

The main problem with CBG projects has not been technology alone. The bigger challenges have been feedstock supply, high capital cost, weak offtake and limited distribution infrastructure.

The new GOBARdhan framework addresses these issues through:

1. Assured Offtake

City Gas Distribution entities will procure CBG to meet blending obligations in CNG and PNG segments.

The blending obligation is:

- **3% in 2026-27**
- **4% in 2027-28**
- **5% from 2028-29 onwards**

This creates a predictable demand for CBG producers.

2. Stable Administered Price

- The scheme introduces a stable administered CBG price of **₹2,110 per MMBTU**. This gives producers long-term revenue certainty.

3. Capital Assistance

- Eligible greenfield CBG projects will receive capital assistance of up to **₹2 crore per tonne per** day of installed capacity. Brownfield projects expanding capacity will also be eligible.

4. Pipeline Infrastructure

- The scheme supports cluster-based and standalone pipeline infrastructure to connect CBG plants with trunk pipelines and city gas distribution networks.

5. Credit Guarantee Support

- A dedicated credit guarantee mechanism will help MSME-based CBG projects access institutional credit with lower collateral pressure.
- Together, these measures aim to move CBG from a pilot-project model to a **bankable energy industry**.

Government Initiatives for CBG Sector

The government has already supported the CBG sector through several initiatives.

1. SATAT Initiative

- **Sustainable Alternative Towards Affordable Transportation** was launched to promote CBG as an alternative transport fuel.

2. Market Development Assistance Scheme

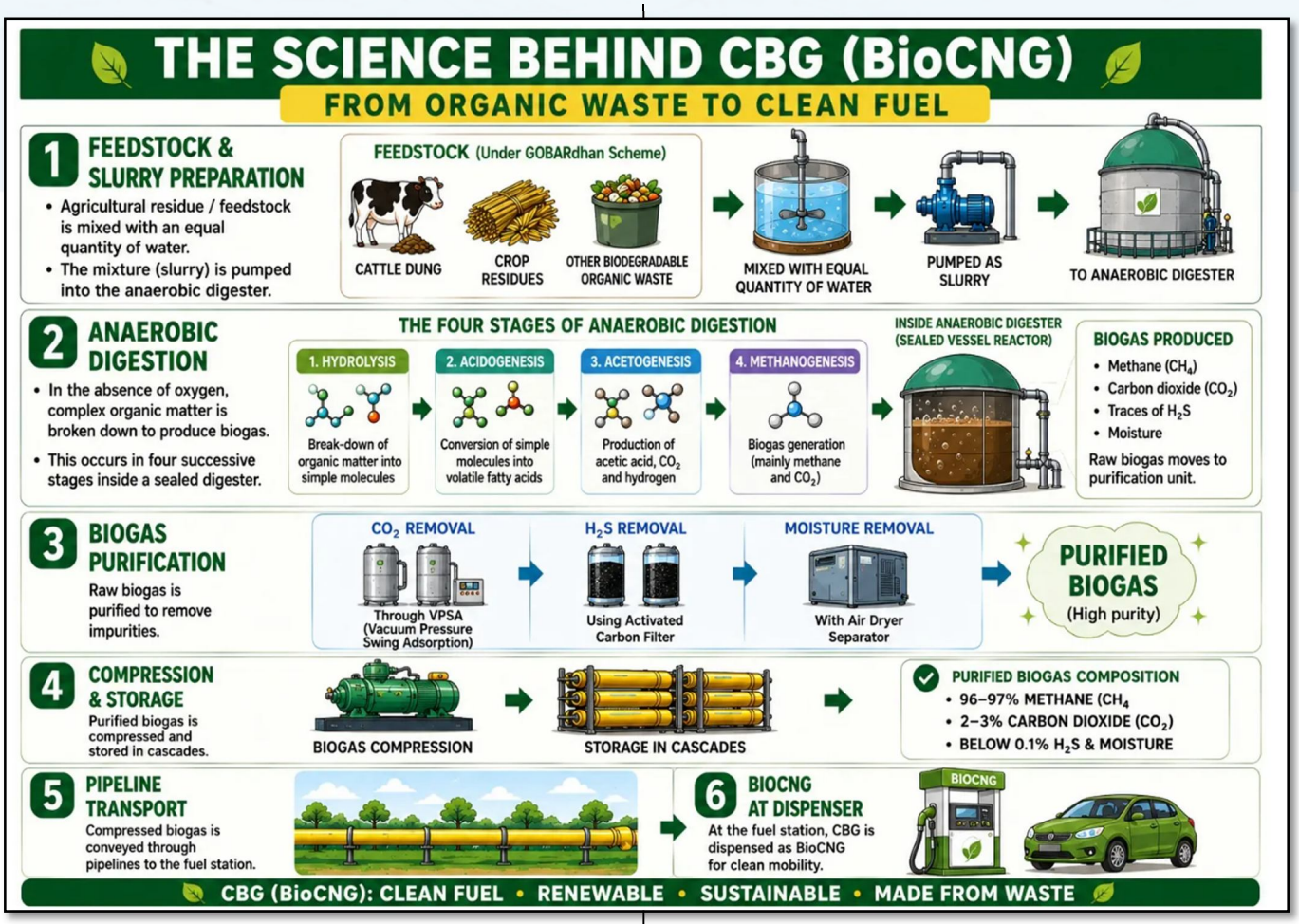
It supports the organic manure value chain linked with CBG plants.

3. Biomass Aggregation Machinery Scheme

- It supports the collection and aggregation of biomass feedstock.

4. Development of Pipeline Infrastructure Scheme

- It strengthens the connectivity needed for transporting CBG.



5. National Bioenergy Programme

- It provides Central Financial Assistance for CBG plants.
- These initiatives have helped commission over **200 CBG plants** and demonstrated the potential of CBG across feedstocks and regions.

Waste-to-Energy Technologies:

Waste-to-energy refers to technologies that convert non-recyclable waste into usable forms of energy such as heat, electricity, gas or fuel.

There are two broad types:

1. Thermochemical Technologies

These use heat to convert waste into energy.

- **Incineration** burns waste at high temperature and is suitable for mixed municipal waste with high calorific value.
- **Pyrolysis** breaks down waste in the absence of oxygen and produces char, pyrolysis oil and syngas.
- **Gasification** converts carbon-rich waste into syngas or producer gas containing gases such as hydrogen, carbon monoxide and methane.

2. Biochemical Technologies

These use microorganisms to break down biodegradable waste.

- **Anaerobic digestion** is suitable for organic waste such as kitchen waste, garden waste, cattle dung and agricultural residue. It produces biogas.
- **Landfilling with gas recovery** captures

landfill gas, but landfilling is environmentally problematic because of toxic gases and long-term pollution risk.

GOBARdhan mainly uses the biochemical route of **anaerobic digestion** to produce CBG from organic waste.

Significance

1. Energy Security
- Domestic CBG production can reduce dependence on imported natural gas.

2. Waste Management
- The scheme can reduce the burden of agricultural residue, cattle dung and municipal organic waste.

3. Rural Income
- Farmers, cooperatives and rural entrepreneurs can earn from supplying feedstock and managing CBG-linked activities.

4. Organic Manure Production
- The by-products of CBG plants can support organic manure use and improve soil health.

5. Climate Benefits
- CBG can reduce methane emissions from unmanaged organic waste and support cleaner fuel use.

6. Circular Economy
- The scheme converts waste into fuel, manure and income, making resource use more efficient.

Challenges

1. Feedstock Supply Chain
- Reliable collection of cattle dung, crop residue and municipal organic waste is difficult without local organisation.

2. High Initial Cost
- CBG plants require investment in plant machinery, feedstock aggregation, purification and compression systems.

3. Market Linkage
- Without assured offtake, producers may face uncertainty in selling CBG.

4. Pipeline Connectivity
- Lack of pipeline infrastructure can increase evacuation cost and reduce commercial viability.

5. Quality Standards
- CBG must meet required methane purity and fuel standards to be used in the gas network.

6. Local Governance Capacity
- Panchayats, municipalities and cooperatives need capacity to support feedstock supply and waste segregation.

Way Forward

1. Strengthen Feedstock Aggregation
- Village-level and cluster-level systems should collect cattle dung, crop residue and organic waste reliably.

2. Link Farmers with CBG Plants
- Farmers should receive fair payment for biomass and access to organic manure produced from CBG plants.

3. Ensure Timely Offtake
- City gas distribution entities must implement blending obligations consistently.

4. Expand Pipeline Networks
- Pipeline connectivity should be improved to lower transportation cost and increase plant utilisation.

5. Support MSMEs and Cooperatives
- Credit guarantee and capital assistance should reach small developers, rural entrepreneurs, cooperatives and women-led enterprises.

6. Promote Waste Segregation
- Urban local bodies must strengthen source

segregation so that clean organic waste can be used for biogas production.

7. Build Technical Capacity

- Training is needed for plant operators, local governments, lenders and entrepreneurs.

Conclusion

GOBARdhan is a strategic attempt to convert India's organic waste into energy security, rural income and climate benefits. Its success will depend not only on producing more CBG but also on solving commercial bottlenecks such as feedstock supply, offtake assurance, pricing, credit and pipeline infrastructure. If implemented well, the scheme can connect farmers, municipalities, MSMEs and city gas networks into a circular bioenergy ecosystem. It can make waste a productive resource and help India move towards cleaner, more resilient and locally generated energy.

Bharat Taxi: India's First Cooperative-Based Ride-Hailing Platform

Source: PIB

Relevance: **UPSC GS Paper II: Governance, Cooperatives, Welfare of Workers, Digital Public Infrastructure**

Important Keywords

Prelims Keywords:

- Bharat Taxi | Multi-State Cooperative Societies Act, 2002 | Sahkar se Samriddhi | e-Shram Portal | Digital India

Mains Keywords:

- Cooperative urban mobility | Platform economy reform | Worker ownership | Social security | Inclusive digital economy

Why in News?

Bharat Taxi, India's first cooperative-led ride-hailing platform, has gained attention as a new model of urban mobility that combines **digital technology**, **driver ownership** and **cooperative governance**.As of **25 July 2026**, Bharat Taxi had nearly **8 lakh registered Sarathis** and around **41 lakh registered customers** across several cities. The platform aims to expand across India by **2029**.

About Bharat Taxi

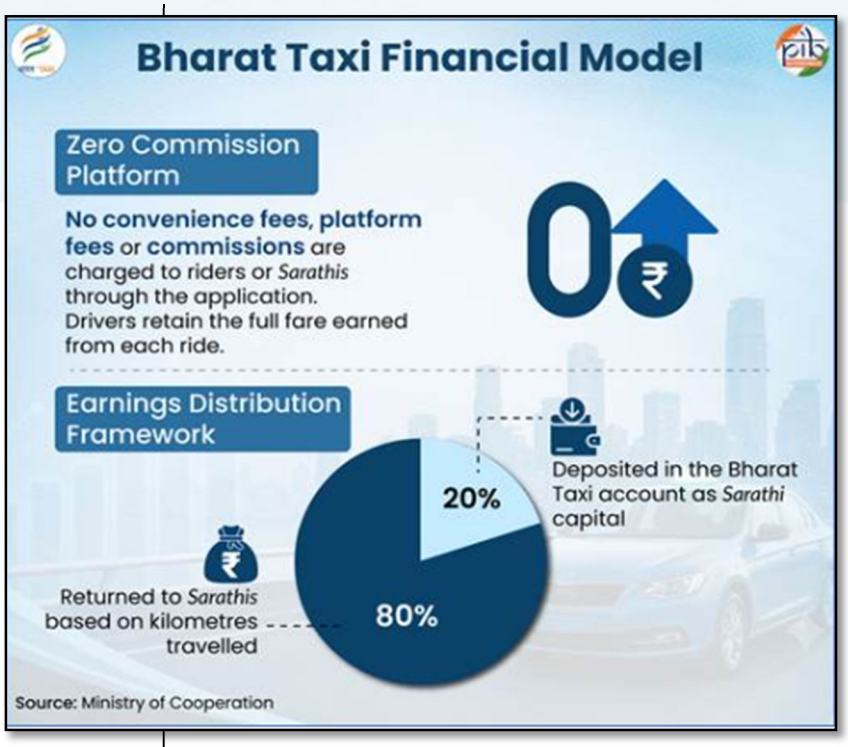
- **Bharat Taxi** is India's first **cooperative-based ride-hailing platform**. It was established on **6 June 2025** under the **Multi-State Cooperative Societies Act, 2002**.
- The platform is based on the idea of **"Saarthi Hi Maalik"**, meaning the driver is not merely a service provider but also a stakeholder in the platform.
- It reflects the broader vision of **"Sahkar se Samriddhi"**, which seeks to use cooperatives for economic participation, employment generation and inclusive growth.

Foundation and Cooperative Ownership Model

- Bharat Taxi was formed by eight national-level cooperative institutions:
  - National Cooperative Development Corporation
  - IFFCO
  - NABARD
  - KRIBHCO
  - Gujarat Cooperative Milk Marketing Federation / Amul

- NAFED
- National Dairy Development Board
- National Cooperative Export Limited

- The platform places drivers, called **Sarathis**, within a cooperative framework. Sarathis can become member-owners by subscribing to the cooperative's share capital.
- Shares are valued at **₹100 each**, and a Sarathi can obtain ownership rights by purchasing shares worth **₹500**.
- The cooperative model also provides representation to Sarathi members in the **Board of Directors**, ensuring that drivers' interests are reflected in decision-making.



Zero-Commission Financial Model

- Bharat Taxi follows a **zero-commission and surge-free pricing model**.
- Unlike conventional ride-hailing platforms, it does not charge drivers a commission on every ride. Instead, it follows a subscription-based cooperative model, allowing drivers to retain full fare earnings.
- Passengers pay the applicable fare based on distance, time and market conditions. The app does not charge additional convenience fees, platform fees or surge pricing.

Under the scheme:

- **20% of cooperative earnings** are credited to Bharat Taxi as Sarathis' capital
- **80% is distributed among Sarathis** based on kilometres travelled
- **7% service charge** is levied only at Bharat Taxi-operated airport prepaid booths

This model aims to create a fairer earnings structure for drivers while keeping fares transparent for passengers.

Growing Footprint Across India

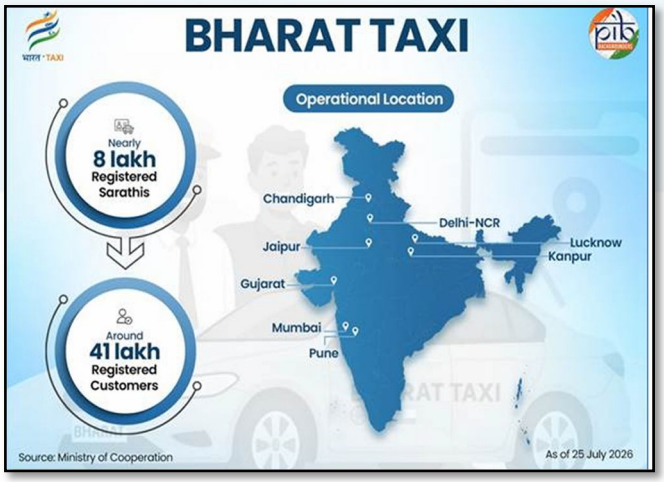
As of **25 July 2026**, Bharat Taxi had:

- nearly **8 lakh registered Sarathis**
- around **41 lakh registered customers**

The service is operational in:

- Delhi-NCR
- Gujarat
- Lucknow
- Chandigarh
- Mumbai
- Jaipur
- Kanpur
- Pune

Operations are planned in **Ranchi, Patna, Guwahati, Bhopal, Kolkata, Indore and Nagpur** in the coming months. The platform aims for nationwide expansion by **2029**.



Services and Digital Features

- Bharat Taxi provides multiple ride options through its application.

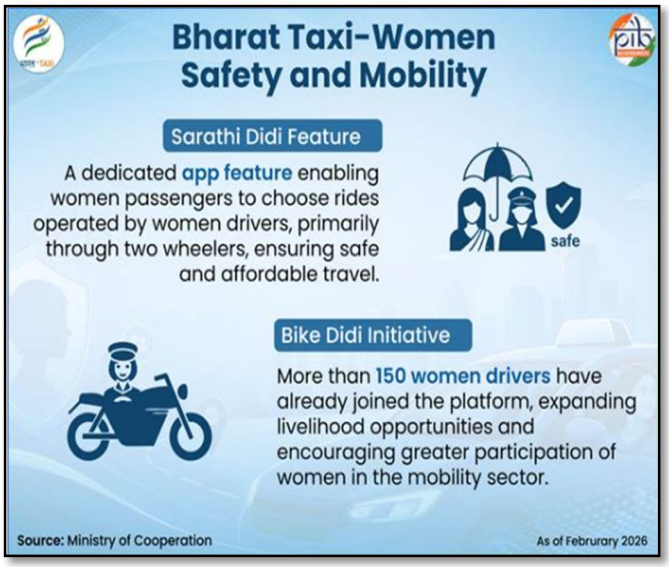
Available ride categories include:

- Bike Taxi
- Auto
- Economy Cab
- Premium Sedan
- XL Cab / SUV
- Rentals
- Out-station travel
- Scheduled rides

- Passengers can book rides through the app, while drivers can register as Sarathis through the app or website by submitting required documents.
- The platform also operates prepaid booths at selected airports for direct ride booking.

Women-Centric Mobility and Safety

- Bharat Taxi has introduced the **Sarathi Didi** feature to improve safety and accessibility for women commuters. It allows women passengers to choose rides operated by women drivers.
- The platform has also launched the **Bike Didi** initiative to encourage women's participation in the transport sector. As of February 2026, more than **150 women drivers** had joined under this initiative.
- These features support both **women's safety** and **women's livelihood generation** in the urban mobility sector.



Safety and Secure Travel

Bharat Taxi includes several safety features:

- police integration
- control-room monitoring
- KYC verification of drivers
- periodic background checks
- safety training
- live ride tracking
- SOS support
- driver ratings

Safety ratings are regularly reviewed to ensure that only trained and verified drivers remain active on the platform.

Digital Integration and Partnerships

Bharat Taxi has signed an MoU with the **National e-Governance Division** under the **Digital India** framework.

This enables integration with national digital platforms such as:

- **DigiLocker**

- **UMANG**
- **API Setu**

These integrations support paperless onboarding, secure digital verification, interoperable digital operations and cashless payments.

Bharat Taxi has also partnered with institutions such as **Delhi Traffic Police, Delhi Metro Rail Corporation, Airport Authority, IFFCO Tokio Insurance, State Bank of India and Paytm**.

Social Security for Sarathis

Sarathis are facilitated to register on the **e-Shram portal**, which creates a national database of unorganised workers.

- After registration, Sarathis and their families can become eligible for free medical treatment up to **₹5 lakh** under **Ayushman Bharat – Pradhan Mantri Jan Arogya Yojana**.

Additional welfare support includes:

- personal accident insurance of **₹5 lakh** through IFFCO Tokio at nominal rates
- advisory support for long-term driver welfare
- group health insurance support through Paytm partnership

This is significant because platform workers often face income insecurity and lack of formal social protection.

Significance of Bharat Taxi

1. Cooperative Alternative to Platform Capitalism

- Bharat Taxi offers a driver-owned model in a sector generally dominated by private app-based platforms.

2. Better Earnings for Drivers

- The zero-commission model allows Sarathis to retain full ride earnings, improving income security.

3. Democratic Governance

- Drivers participate as cooperative members and have representation in the Board of Directors.

4. Transparent Pricing for Passengers

- Surge-free pricing and advance fare estimates improve predictability and consumer trust.

5. Social Security for Gig Workers

- Linkage with e-Shram, AB-PMJAY and insurance support can improve welfare of urban platform workers.

6. Women's Participation

- Sarathi Didi and Bike Didi promote safe mobility and employment opportunities for women.

7. Digital Public Infrastructure Use

- Integration with DigiLocker, UMANG and API Setu shows how public digital systems can support cooperative business models.

Challenges

Bharat Taxi's success will depend on service reliability, technology performance, driver onboarding, passenger trust and competition with established ride-hailing platforms.

- Maintaining zero-commission sustainability while ensuring app quality, customer support, safety monitoring and insurance benefits will require strong financial planning.
- The platform must also ensure that cooperative governance remains transparent and participatory as it expands nationally.

Way Forward

1. Strengthen Driver Participation

- Sarathis should be actively involved in local-level governance and feedback mechanisms.

2. Ensure Reliable Service Quality

- Timely rides, fair pricing, grievance

redressal and passenger safety must remain central.

3. Expand Women-Led Mobility

- Sarathi Didi and Bike Didi should be scaled with training, safety support and financial assistance.

4. Deepen Social Security Coverage

- All registered Sarathis should be linked with e-Shram, health insurance, accident insurance and welfare schemes.

5. Improve Digital Infrastructure

- App performance, payment systems, live tracking and control-room integration must be strengthened.

6. Build City-Level Partnerships

- Partnerships with airports, metro systems, traffic police and urban local bodies can improve last-mile connectivity.

Conclusion

Bharat Taxi represents an important experiment in India's digital platform economy. By combining **cooperative ownership**, **zero-commission earnings**, **digital public infrastructure**, **social security** and **inclusive mobility**, it offers a possible alternative to conventional ride-hailing models. Its long-term success will depend on operational efficiency, transparent governance, passenger trust and sustained welfare support for Sarathis. If implemented effectively, Bharat Taxi can become a model for cooperative urban mobility under the vision of **Sahkar se Samriddhi**.

India's Makhana Sector: From Traditional Crop to Global Superfood

Source: PIB

Relevance: **Prelims: Makhana, National Makhana Board, NRCM and Central Sector Scheme**

Important Keywords

Prelims:

- *Euryale ferox*, aquatic crop, National Makhana Board, NRCM, HSN Code

Mains:

- Value-chain development, premiumisation, processing, export diversification, farmer collectivisation

Why in News?

India's makhana sector is expanding due to rising demand for healthy, plant-based foods. The government has established the **National Makhana Board** and approved a **₹476.03-crore Central Sector Scheme for the Development of Makhana** for 2025–26 to 2030–31.



About Makhana

- Makhana, scientifically known as ***Euryale ferox***, is an aquatic crop cultivated mainly in shallow ponds, lakes and wetlands.
- Its edible part is the seed. After roasting and popping, it is consumed as **fox nut**.

India is the world's largest producer, supported by:

- Suitable agro-climatic conditions
- Traditional cultivation knowledge
- Expanding domestic demand

- Growth of branded products
- Participation of startups and FPOs

Makhana has evolved from a traditional food of Bihar into a nationally consumed health snack and internationally marketed superfood.

Production and Geographical Distribution

Makhana cultivation is concentrated mainly in:

- Bihar
- West Bengal
- Assam

Bihar's Dominant Position

Bihar accounts for nearly **three-fourths of India's production** and supplies around **80–85% of global makhana**.

Major cultivation areas include:

- **Kosi basin:** Supaul, Saharsa and Madhepura
- **Mithila region**
- **Seemanchal region**

Domestic Market

India produces more than **0.6 lakh MT of makhana annually**. Around 40% is estimated to be exported, while the remaining quantity is consumed domestically.

The domestic market grew by **17–18% annually between 2021–22 and 2024–25**, driven by:

- Health awareness
- Premium branding
- Entry of organised companies
- Expansion of retail networks
- Demand for packaged snacks

The market is projected to reach **₹11,000–12,000 crore by 2029–30**.

Price and Supply Trends

Production volumes increased by only **4–5% between FY2022 and FY2025**, while average prices rose from:

- Around **₹500 per kg during 2020–22**
- To nearly **₹1,250 per kg in 2025**

The rise reflected strong demand, premiumisation and a limited supply response.

Export Performance

- Before 2025, makhana was included under general **Harmonised System of Nomenclature codes**, making product-specific export data unavailable.
- In 2025, the **Directorate General of Foreign Trade** introduced separate HSN codes for popped makhana and other makhana products.

During 2025–26, India exported:

- **7,264.89 MT** of makhana products
- Products worth **₹192.96 crore**

Major Export Markets

Country	Export Share	Average Unit Price
United States	40%	$19.5/kg
Canada	20%	$15.8/kg
UAE	17%	$13.3/kg
United Kingdom	10%	$20/kg
Germany	Limited share	$26/kg
Nepal	Limited share	$21.6/kg
Australia	Limited share	$21/kg

The US, Canada and UAE together account for **77% of exports**. However, Germany, Nepal and Australia offer higher unit prices despite receiving smaller volumes.

This creates scope to diversify towards premium-paying markets while retaining high-volume destinations.



National Makhana Board

The establishment of the **National Makhana Board** was announced in the Union Budget 2025–26. It was formally launched in Bihar on **September 15, 2025**. The Board seeks to strengthen and modernise the complete makhana value chain through support for:

- Cultivation
- Processing
- Farmer organisation
- Value addition
- Branding
- Marketing
- Quality control
- Exports

The initiative recognises makhana as an important crop for farmer incomes, rural industries and agricultural trade.

Central Sector Scheme for Development of Makhana

The scheme has a total allocation of **₹476.03 crore** for 2025–26 to 2030–31.

Annual Allocations

- **2025–26:** ₹30 crore
- **2026–27:** ₹90 crore

Major Objectives

- Promote research and innovation
- Improve quality-seed availability
- Strengthen farmers' skills
- Modernise harvesting practices
- Upgrade post-harvest operations
- Encourage value addition
- Improve branding and marketing
- Expand exports
- Strengthen quality-control systems

Makhana Value Chain

1. Farm-Level Production

Activities include:

- Pond preparation
- Seed broadcasting
- Crop management
- Underwater seed collection
- Manual harvesting

This stage remains labour-intensive, skill-dependent and only partially mechanised.

2. Primary Processing

Mostly undertaken at the household or village level, it involves:

- Cleaning and drying
- High-temperature roasting
- Popping
- Polishing
- Sorting
- Grading

Larger and better-quality popped makhana receives higher market prices.

3. Secondary Processing

Value-added products include:

- Flavoured makhana
- Ready-to-eat snacks
- Makhana flour
- Packaged products

This segment offers considerable potential for enterprise creation and employment.



Secondary Processing and Value Addition



National Research Centre for Makhana

The **National Research Centre for Makhana** supports research, technology development and capacity building.

Major Contributions

- Developed high-yielding makhana varieties
- Developed thornless water chestnut varieties
- Introduced water-efficient farming systems
- Promoted integrated cultivation
- Developed makhana-cum-fish farming
- Distributed **15,824.1 kg of high-yielding seed**
- Trained more than **3,000 farmers between 2012 and 2023**
- Provided technical support to **24 enterprises**

Training has covered:

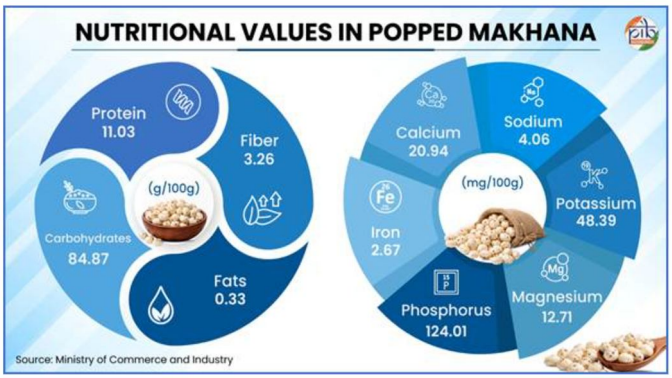
- Efficient water use
- Cropping systems
- Nutrient management
- Processing
- Marketing

Mechanisation Support

NRCM has developed and licensed:

- Seed washer
- Seed grader
- Primary roasting machine
- Popping machine
- Popped-makhana grader
- Technologies for value-added products

A proposed train-the-trainers approach with agricultural universities seeks to improve extension support across cultivation, grading, processing, packaging and branding.



Significance

Farmer Income

- Higher demand, improved varieties and premium markets can raise returns from makhana cultivation.

Rural Employment

- Harvesting, popping, grading, packaging and product development generate labour and enterprise opportunities.

Food Processing

- Flavoured snacks, flour and ready-to-eat products expand the value captured within producing regions.

Export Potential

- India's global production leadership provides a strong foundation for developing a premium superfood export category.

Wetland-Based Livelihoods

- Makhana cultivation supports communities using ponds, lakes and other shallow water bodies.

FPO and Startup Growth

Farmer organisations and new enterprises can improve aggregation, branding and market access.

Major Challenges

- Labour-intensive underwater harvesting
- Limited mechanisation
- Traditional household-level processing
- Slow growth in production relative to demand
- Sharp increase in prices
- Concentration of exports in three markets
- Uneven quality and grading
- Limited penetration of branded products in smaller markets
- Need for better seed supply and post-harvest technology

Way Forward

- Expand improved varieties and quality-seed production.
- Promote field-system and water-efficient cultivation.
- Scale mechanised harvesting, roasting, popping and grading.
- Strengthen FPOs for aggregation and collective marketing.
- Develop common processing and packaging facilities.
- Improve quality-control and product standardisation.
- Support startups producing diversified makhana products.
- Target premium-paying export destinations.
- Expand extension services through the train-the-trainers model.
- Link research, production, processing and branding through the National Makhana Board.

Conclusion

India's makhana sector is moving from traditional wetland cultivation towards an organised food-processing and export industry. Research, mechanisation, farmer collectivisation and premium-market development can help convert India's production leadership into higher rural incomes and stronger global competitiveness.

Vande Mataram, National Honour and the Right to Dissent

Source: The Hindu

Relevance: **UPSC: GS Paper II—Fundamental Rights, constitutional values and judicial judgments**

Important Keywords

Prelims:

- National Anthem, National Song, Section 3, Section 3A, freedom to remain silent, fundamental duties

Mains:

- Compelled patriotism, conscientious objection, respectful dissent, constitutional tolerance, individual liberty

Why in News?

The **Prevention of Insults to National Honour (Amendment) Act, 2026** amended Section 3 of the **Prevention of Insults to National Honour Act, 1971**.

It extends to the National Song, *Vande Mataram*, the same legal protection previously available to the National Anthem, *Jana Gana Mana*. It penalises intentional prevention or disruption of its singing but does not make participation compulsory.

About Vande Mataram

- *Vande Mataram* means **"Mother, I Bow to Thee"**.
- It was composed by **Bankim Chandra Chatterjee**.
- It was first published in the literary journal *Bangadarshan* on **November 7, 1875**.
- It was later included in the novel ***Anandamath***, published in 1882.
- Rabindranath Tagore set it to music and sang it at the **1896 session of the Indian National Congress in Calcutta**.
- It became an important symbol of resistance during the freedom struggle.
- It was used as a political slogan on **August 7, 1905**, during the Swadeshi movement.

Historical and Constitutional Status

Congress Decision of 1937

- The opening stanzas describe the motherland through pastoral imagery such as water, fruits, cooling breezes and fertile fields.
- The later stanzas contain devotional references to the Hindu goddesses Durga, Lakshmi and Saraswati. Objections were also raised about the context of the song in *Anandamath*.
- In October 1937, the Congress Working Committee decided that only the **first two stanzas** would be sung at official gatherings. These stanzas were considered secular in imagery and free from references to deities.

Constituent Assembly Statement

On January 24, 1950, Constituent Assembly President Dr. Rajendra Prasad stated that:

- *Jana Gana Mana* would be the National Anthem; and
- *Vande Mataram*, because of its historic role in the freedom struggle, would be honoured equally and accorded equal status.

However:

- *Vande Mataram* was not made the National Anthem;
- it was not declared a co-anthem; and
- the Constitution does not expressly refer to a "National Song".

Its status rests on the 1950 statement and subsequent convention.

Prevention of Insults to National Honour Act, 1971

The Act was enacted on **December 23, 1971** and extends to the whole of India. It provides statutory protection to:

- the Indian National Flag;
- the Constitution of India; and
- the National Anthem.

Section 2: National Flag and Constitution

Section 2 penalises public acts such as:

- burning;
- mutilating;
- defacing;
- defiling;
- disfiguring;
- destroying; or
- trampling upon

the National Flag or the Constitution.

The punishment may extend to three years' imprisonment, a fine or both.

Lawful Criticism Protected

- Comments criticising the Constitution, the National Flag or government measures do not constitute an offence when they seek a lawful amendment or alteration.
- Thus, lawful criticism is distinguished from physical desecration or intentional disrespect.

Original Section 3: National Anthem

Before the 2026 amendment, Section 3 punished anyone who intentionally:

- prevented the singing of the National Anthem; or
- caused disturbance to an assembly singing it.

The punishment could extend to three years' imprisonment, a fine or both.

Section 3A: Repeat Offences

- Section 3A was added in 2003. A person convicted for a second or subsequent offence under Sections 2 or 3 faces a mandatory minimum imprisonment of **one year**.

Why Was the 2026 Amendment Proposed?

- The 1971 Act expressly protected the National Anthem but contained no corresponding provision for *Vande Mataram*.
- The Statement of Objects and Reasons recalled Dr. Rajendra Prasad's declaration that the song should be honoured equally with *Jana Gana Mana* because of its historic role in the freedom struggle.
- The amendment sought to remove this gap by including the National Song within Section 3.

Legislative Process

The Amendment Bill was:

- introduced in the Rajya Sabha on July 24, 2026;
- passed by the Rajya Sabha on July 29;
- passed by the Lok Sabha on July 30; and
- subsequently given presidential assent.

Major Provisions of the Amendment

Amendment of Section 3

Clause 2 substituted the existing Section 3 with a provision covering both:

- the National Anthem—*Jana Gana Mana*; and
- the National Song—*Vande Mataram*.

Prohibited Conduct

A person commits an offence if the person intentionally:

1. prevents the singing of the National Anthem or National Song; or

Feature/Provision	*The Prevention of Insults to National Honour Act, 1971 (Original Act)*	*The Prevention of Insults to National Honour (Amendment) Bill, 2026*
Scope of Protection under Section 3	Specific legal protection solely to the Indian National Anthem (Jana Gana Mana).	Expands the scope of Section 3 to include both the National Anthem and the National Song (Vande Mataram).
Prohibited conduct	Penalises whoever intentionally prevents the singing of the Indian National Anthem, or causes disturbance to any assembly engaged in such singing.	Penalises whoever intentionally prevents the singing of the National Anthem **or the National Song**, or causes disturbance to any assembly engaged in such singing.
Punishment	Imprisonment for a term which may extend to three years, or with fine, or with both.	The punishment remains unchanged.
Repeat convictions	Under Section 3A (added in 2003), anyone convicted a second or subsequent time for an offense under Section 2 or 3 is punishable with imprisonment for a minimum term of **one year.**	The enhanced penalty of a minimum one-year imprisonment remains in effect. Repeat offenders who intentionally disrupt the singing of *Vande Mataram* will now also face this mandatory minimum one-year prison sentence.

2. causes disturbance to an assembly engaged in such singing.

Punishment

The amendment retains the existing punishment:

- imprisonment of up to three years;
- a fine; or
- both.

For a repeat conviction, Section 3A prescribes a minimum imprisonment of one year.

Amendment at a Glance

What Does the Amendment Not Mandate?

The amendment does not:

- compel anyone to sing *Vande Mataram*;
- require all six stanzas to be sung;
- prescribe a mandatory version;
- require active participation from every person present; or
- criminalise respectful silence.

Its protection operates only when a rendition is taking place and someone intentionally prevents or disturbs it.

Constitutionally protected conduct	Punishable conduct
Respectfully remaining silent	Intentionally stopping the singing
Declining to sing on grounds of conscience	Deliberately disturbing the assembly
Permitting others to participate peacefully	Obstructing an ongoing rendition

Constitutional Concerns Regarding the Later Stanzas

- The first two stanzas describe the motherland through nature-based imagery. The later stanzas identify the motherland with Durga, Lakshmi and Saraswati and use devotional language.
- Compulsory recitation of the complete song may create concerns for citizens whose religious beliefs prohibit participation in the worship of other deities. However, the amendment creates no such compulsion because it neither prescribes the number of stanzas nor requires anyone to participate.

Constitutional Protection of Individual Conscience

Article 19(1)(a): Freedom of Expression

- Article 19(1)(a) protects freedom of speech and expression. The Supreme Court has held that this freedom also includes the **right to remain silent**.

Article 25: Freedom of Conscience

Article 25 protects:

- freedom of conscience; and
- the right freely to profess, practise and propagate religion.

Therefore, a genuine refusal to participate in an activity considered inconsistent with one's faith may receive constitutional protection.

Article 26: Religious Autonomy

- Article 26 protects the right of religious denominations to manage their religious affairs, subject to constitutional limitations.

Article 51A: Fundamental Duties

- Article 51A lays down Fundamental Duties, including respect for national symbols. However, Fundamental Duties cannot override the Fundamental Rights guaranteed under Part III of the Constitution.

Bijoe Emmanuel v. State of Kerala, 1986

Background

Three students belonging to the Jehovah's Witnesses faith stood respectfully during the National Anthem but did not sing it because of their religious beliefs.

They:

- remained silent;
- showed no disrespect; and
- did not disturb other students.

They were nevertheless expelled from school.

Supreme Court's Decision

The Supreme Court reversed the Kerala High Court's decision and held that compelling the children to sing violated:

- **Article 19(1)(a):** freedom of expression, including silence; and
- **Article 25(1):** freedom of conscience.

Principles Established

The judgment clarified that:

- respect does not necessarily require active participation;
- peaceful silence is different from insult;
- sincere conscientious objection is protected;
- Fundamental Duties cannot override Fundamental Rights; and
- constitutional tolerance protects minority beliefs.

Application to Vande Mataram

The reasoning in *Bijoe Emmanuel* applies to the National Song.

A person may:

- decline to sing;
- remain respectfully silent; and
- allow others to continue singing.

Such conduct does not amount to intentional prevention or disturbance. The constitutional protection is particularly relevant when an objection concerns the devotional content of the later stanzas.

Present Legal Position

1. *Vande Mataram* has an honoured national status based on the 1950 Constituent Assembly statement and convention.
2. Section 3 protects its performance against intentional prevention and disruption.
3. The law does not make singing compulsory.
4. It does not require all six stanzas or prescribe a mandatory version.
5. Respectful silence remains protected under Articles 19 and 25.
6. Criminal liability arises from intentional

obstruction, not mere non-participation.

Significance

Equal Statutory Protection

- The amendment removes the earlier difference between the legal protection given to the National Anthem and the National Song.

Protection of Peaceful Assemblies

- It prevents deliberate obstruction of assemblies singing either national composition.

Balance between Honour and Liberty

- The provision protects national honour without expressly compelling individual participation.

Recognition of Constitutional Dissent

The legal framework distinguishes peaceful non-participation from intentional disruption.

Major Concerns

- "Disturbance" may receive an excessively broad interpretation.
- Respectful silence could be incorrectly treated as disrespect.
- The law does not specify the protected version of the song.
- Promotion of all six stanzas may create religious concerns.
- The legislation received limited parliamentary scrutiny.
- Incorrect enforcement may create indirect pressure to participate.

Way Forward

- Clearly distinguish intentional disruption from peaceful silence.
- Issue implementation guidelines protecting conscientious objection.
- Avoid using criminal law to compel participation.
- Apply Section 3 consistently with Articles 19 and 25.
- Follow the principles laid down in *Bijoe Emmanuel*.
- Promote respect for national symbols through tolerance and constitutional awareness.

Conclusion

The 2026 amendment extends legal protection to *Vande Mataram* without making its singing compulsory. It punishes intentional prevention and disruption, not respectful silence. Constitutional patriotism requires the protection of national honour alongside freedom of expression, religious pluralism and individual conscience.

FSSAI Crackdown on Food Claims: From Bourn Vita to "100% Pure"

Source: The Hindu

Relevance: **UPSC GS Paper II: Governance, Regulatory Bodies, Consumer Protection, Public Health**

Important Keywords

Prelims Keywords:

- FSSAI | Food Labelling | Misleading Advertisement | 100% Claim | E-commerce Food Listings

Mains Keywords:

- Consumer protection | Public health regulation | Food safety governance | Nutrition claims | Digital marketplace accountability

Why in News?

The **Food Safety and Standards Authority of India** has intensified scrutiny of food labels, advertisements and online product listings.

The issue came into focus after **Mondelez India withdrew health and nutrient-comparison claims** related to **Bournvita** following FSSAI action. The regulator has issued more than **150 notices** to food companies in recent months over **misleading advertisements, false claims and labelling non-compliance**.

- Companies mentioned in the regulatory scrutiny include major packaged food and beverage firms such as **Nestlé India, PepsiCo, Coca-Cola India, Abbott India, Red Bull India, Danone India, Mondelez India, Ferrero India and Kenvue**.

What is the Core Issue?

The issue is not only whether a food product contains permitted ingredients. The larger question is whether a company can legally and scientifically justify the claims it makes on:

- product labels
- advertisements
- e-commerce listings
- promotional banners
- online product descriptions

FSSAI is focusing on whether claims such as **"healthy," "pure," "immunity-boosting," "energy," "nutrient-rich"** or **"100%"** may mislead consumers.

Why Bournvita Matters

- **Bournvita** is a familiar malted drink brand in India.
- It is sensitive from a regulatory perspective because its marketing has historically been linked with **children's nutrition**.
- In **2023**, it came under public scrutiny over **sugar content** and claims about nutritional benefits.
- The latest regulatory action does not automatically mean that Bournvita is unsafe.
- The issue is whether specific **health claims** or **nutrient-comparison claims** were adequately supported by evidence.

Mondelez India has now withdrawn the claims flagged by FSSAI and removed related advertisements from e-commerce platforms.

Food Safety vs Misleading Claim

It is important to distinguish between two issues:

1. Food Safety

- This deals with whether a product contains permitted ingredients and meets safety standards.

2. Food Claims

- This deals with how the product is presented to consumers.
- A product may be safe for consumption, but its advertisement may still be misleading if it exaggerates health benefits or creates an unsupported impression.

Meaning of "100%" and Pure Claims

FSSAI is also concerned about absolute-sounding claims such as **"100%"**.

- In **May 2025**, FSSAI advised food businesses to stop using **"100%"** on food labels, packaging and promotional material.

Reason

Such words may create a **false sense of absolute purity or superiority**.

The concern is not limited to one product category. It applies to food products where terms such as:

- **100%**
- **pure**
- **natural**

- **healthy**
- **immunity-boosting**
- **energy**

may influence consumer choice before the consumer examines the nutrition panel or ingredient list.

Why E-commerce is Under Scrutiny

FSSAI's enforcement is no longer limited to physical product packaging in shops.
The regulator is also looking at:

- e-commerce product pages
- online banners
- marketplace listings
- food delivery platforms
- restaurants and food-service establishments

This is important because online descriptions may carry claims that are different from the physical package.
For many consumers, the purchase decision is now shaped by an online image, banner or description rather than by reading the label in a shop.

Examples of Corrective Action

1. Mondelez India

- Withdrew health and nutrient-comparison claims around **Bournvita**.
- Removed related advertisements from e-commerce platforms.

2. Amway India

- Removed **"100%"** from its **"100% Pure Coconut Oil"** packaging and promotion.
- Dropped the **"Energy Drink"** descriptor from its caffeinated **XS products**.

3. Juza Foods

- Agreed to withdraw claims related to:
  - immunity
  - stronger bones
  - comparative calcium benefits from its baby-food products.

These examples show that FSSAI is targeting both **nutrition claims** and **absolute purity claims**.

What FSSAI is Trying to Change

FSSAI wants food businesses to move from broad marketing language to **evidence-backed claims**.
The regulator is pushing companies to ensure that:

- health claims are scientifically supported
- nutrient comparisons are not misleading
- words like "pure" and "100%" do not create false impressions
- online and offline product claims remain consistent
- consumers are not misled by promotional language

This is also linked with broader concerns about **obesity, unhealthy diets and consumer awareness**.

Significance

1. Consumer Protection

- The crackdown protects consumers from exaggerated or misleading claims.

2. Public Health

- It supports better food choices at a time when India faces rising concerns over obesity and unhealthy diets.

3. Regulatory Accountability

- It shows that food companies must justify claims with evidence.

4. Digital Marketplace Regulation

- By including e-commerce listings, FSSAI is adapting food regulation to changing consumer behaviour.

5. Transparency in Food Marketing

- It encourages companies to use clearer and more responsible food communication.

Challenges

- Consumers may already have been exposed to misleading claims for years.

- Removing a claim from one platform may not remove it everywhere.
- Online listings can change rapidly.
- Monitoring thousands of digital product pages is difficult.
- Companies may use indirect marketing language to create similar impressions.
- Consumers may not always read nutrition labels carefully.
- Corrective action after notice may be temporary unless routine compliance improves.

Way Forward

1. Evidence-Based Claims

- All health and nutrition claims should be supported by scientific evidence.

2. Stronger Monitoring

- FSSAI should continuously monitor labels, advertisements and e-commerce listings.

3. Uniform Online and Offline Compliance

- Claims on packaging and online product pages should be consistent.

4. Clear Consumer Awareness

- Consumers should be educated to check ingredient lists and nutrition panels.

5. Accountability of Platforms

- E-commerce platforms should be made responsible for misleading claims displayed on their pages.

6. Routine Compliance

- Food companies should treat claim verification as regular compliance, not only as a response to notices.

Conclusion

FSSAI's action against misleading food claims marks an important shift in food regulation. The focus is no longer limited to whether a product is safe; it also includes how the product is marketed to consumers. In a growing packaged-food and e-commerce market, words such as **"pure," "healthy," "immunity," "energy"** and **"100%"** can strongly influence buying behaviour. Therefore, evidence-based labelling, strict digital monitoring and consumer awareness are essential for protecting public health and consumer rights.

International Relations

Makkah Joint Defence Agreement: West Asian Security Shift and India's Strategic Concerns

Source: Indian Express

Relevance: **UPSC GS Paper II: International Relations, India and West Asia, India's Neighbourhood, Global Groupings**

Important Keywords

Prelims Keywords:

- Makkah Joint Defence Agreement | Pakistan | Saudi Arabia | Türkiye | Collective Defence

Mains Keywords:

- West Asian security architecture | Strategic balancing | Pakistan–Türkiye axis | Indian Ocean security | Defence diplomacy

Why in News?

Saudi Arabia, Türkiye and Pakistan signed the **Makkah Joint Defence Agreement** in August 2026. The agreement states that an **armed attack on any one of the three countries will be treated as an attack on all three**. This has drawn attention because it brings together **Saudi financial power**, **Türkiye's defence-industrial capability** and **Pakistan's military strength**.

What is the Makkah Joint Defence Agreement?

- The **Makkah Joint Defence Agreement** is a trilateral defence arrangement between **Saudi Arabia, Türkiye and Pakistan**.



- It builds upon the earlier **Saudi-Pakistan Strategic Mutual Defence Agreement** of 2025. With Türkiye joining the arrangement, the bilateral framework has expanded into a broader security grouping.
- The pact is being seen as a new form of **collective defence arrangement** in West Asia. However, it should not be equated with NATO because the full text and detailed operational obligations of the pact have not been made public.

Key Features of the Pact

1. Collective Defence Commitment

- The pact declares that an armed attack on one member will be treated as an attack on all three.

2. Defence Cooperation

- It aims to strengthen defence cooperation among the three countries.

3. Military Coordination

- The agreement can encourage joint military exercises, training and operational coordination.

4. Intelligence Sharing

- It may create formal channels for intelligence sharing, threat assessment and security coordination.

5. Strategic Deterrence

- The pact seeks to create deterrence in a region affected by missile attacks, drones, proxy conflicts and maritime insecurity.

Why Saudi Arabia, Türkiye and Pakistan Need the Pact?

1. Saudi Arabia: Security and Defence Capacity

- Saudi Arabia wants to reduce excessive dependence on the United States for security. Houthi attacks, Iranian missile and drone threats, Red Sea instability and risks around the **Strait of Hormuz** and **Bab-el-Mandeb** have exposed its security vulnerabilities.
- The pact gives Saudi Arabia access to **Pakistani military experience** and **Turkish defence technology**, while helping it build domestic defence capacity.

2. Türkiye: Regional Influence and Defence Markets

- Türkiye has a growing defence industry, especially in drones, aerospace and military technology. Through this pact, it can access Saudi capital, expand defence exports and strengthen its influence in West Asia.

3. Pakistan: Strategic Relevance and Leverage

- Pakistan gains greater strategic importance in West Asia. It also strengthens defence, economic and energy ties with Saudi Arabia. The agreement increases Pakistan's diplomatic weight in the Islamic world.

Strategic Capabilities and Benefits:

Country / Grouping	What It Brings to the Pact	What It Seeks to Gain
Saudi Arabia	Strong financial resources, energy influence, strategic Gulf location and high defence-spending capacity	Stronger security deterrence, access to Pakistani military support, Turkish defence technology and better protection for **Vision 2030** projects
Türkiye	Advanced defence industry, drone technology, aerospace capabilities and NATO-linked military experience	Saudi investment, larger defence export markets and greater geopolitical influence in West Asia
Pakistan	Nuclear capability, conventional military strength, large armed forces and long-standing defence links with Saudi Arabia	Greater importance in West Asian security, closer Saudi ties and stronger diplomatic leverage

Combined Strength	Saudi capital + Turkish defence technology + Pakistani military capability	Stronger collective defence, deeper military coordination and greater strategic autonomy

Why the Pact Should Not Be Equated with NATO

The pact resembles **NATO's Article 5** in language because it says an attack on one member will be treated as an attack on all. However, it should not be treated as a NATO-style alliance.

Reasons

- The full text of the agreement has not been publicly released.
- Detailed operational obligations are unclear.
- It is not known whether the pact requires automatic military action.
- Mutual defence pacts depend not only on legal language but also on political will.
- The earlier Saudi-Pakistan defence pact did not automatically result in direct military action during regional attacks.

Therefore, the agreement is more significant as a **strategic and defence-industrial partnership framework** than as an automatic war-triggering alliance.

Historical Background: Earlier Pan-Islamic and Pan-Arab Defence Pacts

- The Makkah agreement is not the first attempt to build security cooperation among Muslim-majority or Arab states. Earlier arrangements show that such pacts often face challenges due to political divisions, weak coordination and changing regional alignments.

Arrangement	Explanation
Treaty of Joint Defense and Economic Cooperation between Arab League States, 1950	This was a Pan-Arab collective security arrangement with a mutual-defence clause. However, its effectiveness remained limited because Arab states often differed politically and lacked strong military coordination.
Baghdad Pact, 1955 / CENTO	It was formed by Iraq, Türkiye, Pakistan, Iran and the United Kingdom mainly to contain Soviet influence in West Asia. After Iraq withdrew following the 1958 coup, it became the Central Treaty Organization. It ended in 1979 after the Iranian Revolution.
Peninsula Shield Force, 1984	Created by the Gulf Cooperation Council during the Iran-Iraq War, it aimed to protect the Arabian Peninsula through a joint military force. It was notably deployed in Bahrain in 2011.
Islamic Military Counter Terrorism Coalition, 2015	A Saudi-led coalition of more than 40 countries focused on terrorism through military, financial, ideological and media cooperation. Critics have viewed it as having an anti-Iran orientation.

Implications for India

1. Strengthening of Pakistan–Türkiye–Saudi Security Link

- Saudi Arabia's deeper defence partnership with Pakistan and Türkiye could strengthen a security network along India's western

flank. Since Pakistan and Türkiye have often taken positions against India on Kashmir at the UN and OIC, India must watch the diplomatic implications carefully.

2. Pakistan–Türkiye–China Axis

- Both Pakistan and Türkiye have close strategic ties with China. Saudi Arabia's closer security integration with them could indirectly strengthen a wider Pakistan–Türkiye–China alignment.

3. Impact on India–Saudi Relations

- India and Saudi Arabia have built strong energy, trade, investment and strategic ties through the **India–Saudi Strategic Partnership Council**. However, if Saudi security dependence on Pakistan increases, Islamabad may try to gain diplomatic leverage on issues such as Kashmir.

4. Pakistan's Military Modernisation

- Saudi finance, Turkish defence technology and Pakistani military expertise could help Pakistan acquire advanced drones, fighters, air-defence systems and other military platforms. This may affect India's conventional military calculations.

5. Western Indian Ocean Concerns

- If trilateral defence cooperation expands into maritime security, it may increase the presence of these countries in the **western Indian Ocean**, where India seeks to remain a net security provider.

6. Conflict Threshold Ambiguity

- The "attack on one is an attack on all" clause creates uncertainty over whether a future India–Pakistan crisis could draw political or military support from Saudi Arabia or Türkiye. Even if direct intervention is unlikely, it may give Pakistan a sense of strategic cover.

7. Counter-Terrorism Diplomacy

- Stronger Saudi-Pakistan security ties could make India's efforts to isolate Pakistan diplomatically on cross-border terrorism more difficult.

8. Nuclear Ambiguity

- Pakistan's nuclear capability gives the pact additional strategic weight. However, no formal Pakistani nuclear guarantee to Saudi Arabia has been publicly confirmed.

India's Way Forward

1. Deepen Minilateral Partnerships

- India should accelerate **IMEC** and **I2U2** to strengthen economic and strategic ties with Saudi Arabia, UAE and other Gulf partners.

2. Strengthen Chabahar and INSTC

- India should use **Chabahar Port** and the **International North-South Transport Corridor** to maintain access to Iran, Central Asia and Europe. This prevents India's regional options from becoming dependent on the Pakistan–Türkiye axis.

3. Diversify Gulf Partnerships

- India should expand defence, maritime, energy and technology cooperation with **UAE, Oman and Qatar**, ensuring that its West Asia policy does not depend only on one Gulf country.

4. Build Eastern Mediterranean Links

- Strategic engagement with **Greece, Cyprus, Armenia and Israel** can give India additional diplomatic and defence options in the Eastern Mediterranean.

5. Maintain Defence Autonomy in the Gulf

- India should deepen defence cooperation with Gulf countries without entering automatic mutual-defence commitments. This protects India's strategic autonomy.

6. Strengthen Indigenous Defence Capabilities

- Under **Atmanirbhar Bharat**, India must accelerate development of drones, counter-drone systems, AI-enabled warfare, electronic warfare, hypersonics and advanced air defence.

7. Strengthen Indian Ocean Security

- India should use platforms such as the **Indian Ocean Rim Association** to promote maritime transparency and prevent bloc-based security politics in the Indian Ocean.

8. Fast-Track Defence Forces Vision 2047

- India must build autonomy through capability by strengthening military, economic and technological power. West Asia should be treated as a strategic hub for energy security, trade, diaspora interests and maritime access.

Conclusion

The **Makkah Joint Defence Agreement** signals the emergence of a more multipolar and regionally driven security architecture in West Asia. It reflects Saudi Arabia's search for security diversification, Türkiye's ambition to expand regional influence and Pakistan's effort to gain strategic relevance. For India, the pact is not an immediate military threat, but it creates diplomatic, defence and maritime challenges. India's response should be based on strategic balancing: stronger Gulf partnerships, IMEC and I2U2, alternative connectivity through Chabahar and INSTC, enhanced Indian Ocean presence and faster defence indigenisation. The objective should be clear — protect India's interests in West Asia while preserving strategic autonomy.

India's Campaign for UNSC Seat 2028-29: Diplomacy, Representation and Global Power Politics

Source: Indian Express

Relevance: **UPSC GS Paper II:** International Relations, United Nations, Multilateral Institutions, India and Global Governance

Important Keywords

Prelims Keywords:

- UNSC | Non-Permanent Member | UN General Assembly | Two-Thirds Majority | P5

Mains Keywords:

- Multilateral diplomacy | Global governance reform | India's permanent seat claim | Global South politics | Strategic legitimacy

Why in News?

India has launched its campaign to serve as a **non-permanent member of the United Nations Security Council** for the **2028-29 term**.

The election will be held in **June 2027**. India's contest is for one seat from the **Asia group**, and the other contestant is **Tajikistan**. If elected, this will be India's **9th term** on the UNSC.

About the United Nations Security Council

The **United Nations Security Council** is one of the most powerful organs of the United Nations. It has primary responsibility for maintaining **international peace and security**.

Permanent Members: P5

The UNSC has five permanent members:

- **United States**
- **United Kingdom**
- **France**
- **Russia**
- **China**

These five countries also have **veto power**.

How Non-Permanent Members are Elected

The UNSC has **10 non-permanent members**. They are elected by the **UN General Assembly** for **two-year terms**.

Regional Distribution of Non-Permanent Seats

The UN divides member countries into regional groups.

Main UN Regional Groups

- Asia
- Africa
- Latin America
- Eastern Europe
- Western Europe and Others Group

The **Western Europe and Others Group** includes countries such as the **United States, Canada, Australia, New Zealand and Israel**.

Distribution of 10 Non-Permanent UNSC Seats

- **Africa:** 3 seats
- **Asia:** 2 seats
- **Latin America:** 2 seats
- **Western Europe and Others:** 2 seats
- **Eastern Europe:** 1 seat

Five elected members retire every year, ensuring rotation among non-permanent members.

How UNSC Elections Take Place

- Non-permanent members are elected by the **UN General Assembly**.
- Elections are conducted through **secret ballot**.
- A candidate needs a **two-thirds majority** of votes cast.
- Regional group endorsement is important but does not guarantee victory.
- Diplomatic outreach, bilateral relations, regional equations and issue-based positions influence voting.

India's Campaign for 2028-29

India has launched its campaign well before the election.

Key Details

- Term sought: **2028-29**
- Election year: **June 2027**
- Regional group: **Asia**
- Opponent: **Tajikistan**
- If elected: India's **9th term** on the UNSC

From a purely geopolitical perspective, India appears stronger because of:

- its large economy
- G20 membership
- major diplomatic presence
- long-standing UN participation
- claim for permanent membership
- Global South leadership

However, UN elections can produce unexpected outcomes.

Current Asian Context

- **Pakistan** is presently a UNSC member from Asia for **2025-26**.
- **Bahrain's** term expires in **2027**.
- **Kyrgyzstan** will replace Pakistan in **2027** and serve through **2028**.
- Since Kyrgyzstan represents Central Asia, India may argue that its candidature better serves wider Asian representation for **2028-29**.

However, India must still run a strong global campaign because voting is secret and political factors matter.

Why the Election is Not Automatic for India

Even though India has stronger global standing than Tajikistan, the result cannot be taken for granted.

Reasons

- UN elections are by **secret ballot**.
- Small countries often coordinate to support each other.
- Issue-based voting can affect outcomes.
- Global South sentiment may influence voting.
- Groups such as the **Organisation of Islamic Cooperation** can shape results.
- Chinese diplomatic influence may play a role in Asian contests.

Therefore, India needs sustained diplomatic engagement with all regions.

Recent Lessons from UN Elections

1. Germany's Defeat

In a recent three-way contest among Western countries for two seats, **Portugal and Austria defeated Germany**.

This was significant because Germany is:

- a major economy
- large UN financial contributor
- aspirant for permanent UNSC membership
- regular contender for non-permanent seats

The defeat showed that global standing alone is not enough.

2. Kyrgyzstan's Victory Over the Philippines

- In the Asian group, **Kyrgyzstan defeated the Philippines**, despite the Philippines being a long-standing UN member with ASEAN backing.
- Kyrgyzstan secured **142 votes out of 191 cast**, crossing the two-thirds requirement of **127 votes**.

Its victory was reportedly supported by:

- the **OIC group**
- strong Chinese backing
- solidarity among smaller countries

3. Bangladesh Candidate's Victory for UNGA Presidency

- The Foreign Minister of Bangladesh defeated the candidate from Cyprus for the UNGA Presidency.
- This too suggests the importance of Global South politics, coalition-building and support among smaller States.

India's Past Experience

- India faced a similar situation in **2010** when **Kazakhstan** was also in the fray.
- India used strong bilateral ties to persuade Kazakhstan to shift its candidature to **2017-18**.
- As a result, India's election became assured. Sustained diplomacy helped India secure **187 votes**, signalling strong global acceptance for India's role and its claim for permanent UNSC membership.

Why UNSC Membership Matters for India

1. Global Legitimacy

- The UN may face criticism, but global legitimacy for major international action still often requires UN approval.
- Even powerful countries need UN support to legitimise major peace and security initiatives.

2. Voice in Peace and Security Issues

UNSC membership gives India a direct voice in debates on:

- terrorism
- conflicts
- peacekeeping
- sanctions
- regional crises
- international security

3. Countering Pakistan's Narrative

- Pakistan is a UNSC member during **2025-26**.

Despite this, it has not been able to use the Council effectively to pressure India.

- The UNSC resolution condemning the **Pahalgam terrorist attack** was important for India.

4. Support for Permanent Seat Claim

- Every successful non-permanent term strengthens India's argument that it is a responsible and capable stakeholder in global security governance.

5. Diplomatic Outreach

- UNSC campaigns require outreach to almost all UN members, strengthening India's global diplomatic network.

Significance for India's Permanent Seat Claim

India has long demanded reform of the UNSC and a permanent seat.

India's claim is based on:

- large population
- major economy
- democratic credentials
- contribution to UN peacekeeping
- Global South leadership
- rising strategic influence
- need for representative global governance

A strong victory in the 2028-29 election would send a political message that India enjoys wide international support.

Challenges Before India

1. Secret Ballot Uncertainty

- Since voting is secret, public support may not always translate into actual votes.

2. Tajikistan's Candidature

- Tajikistan may benefit from Central Asian, OIC or other bloc support.

3. Smaller Country Solidarity

- Recent elections show that smaller countries may sometimes vote against global heavyweights.

4. China Factor

- China's influence in Asia and among smaller States may affect voting behaviour.

5. Global South Sensitivities

- India must carefully manage positions on conflicts and development issues that matter to the Global South.

6. Regional Balancing

- Kyrgyzstan's election already provides Central Asian representation, but this does not automatically secure India's path.

Way Forward

1. Early and Sustained Campaign

- India should maintain diplomatic engagement well before the June 2027 election.

2. Reach Beyond Traditional Partners

- India must seek support from Africa, Latin America, Pacific Island countries, Caribbean States, Europe and the Islamic world.

3. Use Development Diplomacy

- India's development partnerships, capacity-building programmes and humanitarian assistance should support its campaign.

4. Engage the Global South

- India should highlight issues such as debt, climate finance, food security, energy security and equitable global governance.

5. Strengthen Bilateral Ties with Central Asia

- India should maintain respectful engagement with Tajikistan and Central Asian States while advancing its candidature.

6. Project Responsible Security Role

- India should present itself as a credible voice on counter-terrorism, peacekeeping, maritime security and UN reform.

Conclusion

India's campaign for the **2028-29 UNSC non-permanent seat** is not merely a routine election. It is part of India's wider effort to shape global governance and strengthen its claim for a permanent seat. Although India appears stronger than Tajikistan in terms of global standing, recent UN elections show that outcomes can be unpredictable. A successful campaign will require sustained diplomacy, Global South engagement, coalition-building and careful management of international issues. A strong victory would reinforce India's image as a major power and a responsible stakeholder in international peace and security.

India–Uzbekistan Relations Elevated to a Comprehensive Strategic Partnership

Sources: PIB

Relevance: GS Paper II: India's bilateral relations and engagement with Central Asia

Important Keywords

Prelims:

- Uzbekistan | Comprehensive Strategic Partnership | UPI–UZQR | Exercise Dustlik | Uranium Supply | Fayaz Tepa | Kara Tepa | Aral Sea | SCO | ITEC

Mains:

- Connect Central Asia Policy | Critical-Mineral Security | Civil Nuclear Cooperation | Defence Co-development | Multimodal Connectivity | Digital Public Infrastructure | Counterterrorism | Global South

Why in News?

During the Indian Prime Minister's State visit to Uzbekistan on **August 29–30, 2026**, India and Uzbekistan elevated their relations to a **Comprehensive Strategic Partnership**.The two countries signed 11 agreements, set a target of **$5 billion in annual trade by 2030**, and agreed to establish a framework for the long-term supply of uranium from Uzbekistan to India.



Strategic Upgrade

India and Uzbekistan marked the 15th anniversary of their strategic partnership by expanding cooperation into a wider range of strategic and developmental areas.

The Comprehensive Strategic Partnership covers:

- trade, investment and industrial cooperation;
- energy, uranium and critical minerals;
- defence, counterterrorism and cybersecurity;
- transport and logistics connectivity;
- digital technology, artificial intelligence and space; and
- agriculture, health, education, culture and

tourism.

Uzbekistan's location, resources and regional influence place it at the centre of India's engagement with Central Asia.

Major Outcomes

Area	Outcome
Strategic relations	Comprehensive Strategic Partnership
Trade	$5-billion annual target by 2030
Uranium	Long-term supply framework
Critical minerals	Joint exploration, mining and processing
Defence	Co-development and co-production
Digital payments	Indian UPI applications to scan UZQR
Environment	$1-million grant for the Aral Sea region
Heritage	Restoration of Fayaz Tepa and Kara Tepa
Coordination	Foreign Ministers-led mechanism

Institutional Mechanisms

Foreign Ministers-led Coordination Mechanism

The two countries will establish a high-level mechanism led by their Foreign Ministers to:

- oversee the implementation of agreements;
- coordinate different areas of bilateral cooperation; and
- ensure timely completion of priority projects.

Joint Commission

- The existing joint commission will be elevated from the secretary level to the **ministerial level**, giving economic and technical cooperation stronger political supervision.
- The two sides also agreed to expand parliamentary contacts and review existing bilateral legal instruments to reflect current priorities.

Trade and Investment Cooperation

The current volume of bilateral trade exceeds **$1 billion**. India and Uzbekistan aim to raise it to $5 billion by 2030.

To achieve this objective, they will:

- diversify the range of traded goods;
- remove non-tariff and investment barriers;
- digitalise trade procedures;
- improve mutual market access; and
- encourage business-to-business partnerships.

A Joint Working Group will address non-tariff issues and investment barriers. Electrical goods, engineering products, automobiles, pharmaceuticals, jewellery and agriculture have been identified as priority sectors.

- A joint feasibility study on an **India–Uzbekistan Preferential Trade Agreement** has been completed. The concerned ministries will examine the next steps on a time-bound basis.
- Invest India and Uzbekistan's Investment Promotion Agency will promote investment through business forums, roadshows, seminars and stakeholder meetings. India also reaffirmed support for Uzbekistan's accession to the World Trade Organization.

Uranium and Civil Nuclear Cooperation

India and Uzbekistan agreed to establish a framework for the **long-term supply of uranium from Uzbekistan to India**.

The arrangement is significant because it can:

- diversify India's nuclear-fuel sources;
- improve the reliability of uranium supplies;
- support peaceful nuclear-energy cooperation; and

- contribute to India's wider energy requirements.

Both countries also expressed interest in expanding cooperation in the peaceful applications of nuclear energy.

Critical Minerals and Mining

Critical-mineral cooperation will cover the complete mineral value chain rather than being limited to the purchase of raw materials.

The two countries will explore joint projects in:

- geological exploration and mining;
- mineral processing and recycling;
- production of value-added goods; and
- development of integrated supply chains.

Indian companies may participate in developing mineral deposits in Uzbekistan, while Uzbek enterprises may collaborate on projects in India.

Renewable Energy

- The two sides agreed to explore cooperation in renewable energy, modernisation of energy infrastructure and prospective investment projects.
- This cooperation brings together Uzbekistan's resource potential and India's experience in energy transition and clean-energy development.

Defence Cooperation

India and Uzbekistan will strengthen direct engagement between their defence industries.

Areas of cooperation include:

- co-development and co-production of military hardware;
- institutional exchanges and capacity-building;
- exploration of defence-industrial projects; and
- continuation of joint military activities.

Exercise Dustlik

Dustlik is the joint military exercise between India and Uzbekistan. Its latest edition was held in Uzbekistan's Namangan Region in April 2026.

Security and Counterterrorism

The two countries reaffirmed zero tolerance towards terrorism, including cross-border terrorism.

They agreed to strengthen cooperation against:

- terrorism financing and safe havens;
- violent extremism and separatism;
- organised crime and illicit drug trafficking; and
- cyber threats.

Cooperation will continue through intelligence sharing, law-enforcement coordination and the Joint Working Group on Counterterrorism.

Transport and Logistics Connectivity

India and Uzbekistan agreed to strengthen multimodal transport routes and logistics corridors to facilitate the movement of goods and reduce freight costs.

Cooperation will also cover:

- restoration of freight transportation;
- modernisation of road infrastructure;
- exchange of road-construction technology; and
- development of energy-efficient public transport.

Improved connectivity is essential for expanding India's economic engagement with landlocked Central Asia.

UPI–UZQR Payment Linkage

- NPCI International Payments Limited and Uzbekistan's National Interbank Processing Centre concluded a commercial agreement on digital payments.
- Under the arrangement, Indian UPI applications will be able to scan Uzbekistan's national **UZQR** for merchant payments.

This can:

- simplify payments for Indian visitors;

- support tourism and business travel;
- encourage cross-border digital-payment interoperability; and
- expand the global reach of India's digital public infrastructure.

Information Technology and Artificial Intelligence

- The first IT Park in Tashkent was established in 2019 on the Indian model with support from the Software Technology Parks of India.

The two countries will now strengthen cooperation among:

- technology parks;
- companies and start-ups;
- research and educational institutions; and
- digital-innovation ecosystems.

They also agreed to exchange experience in developing safe, secure and trustworthy artificial intelligence systems. Cybersecurity cooperation will form part of the wider digital partnership.

Space Cooperation

India and Uzbekistan will expand cooperation in the peaceful uses of outer space through:

- space applications;
- exchange of scientific data;
- joint workshops and training; and
- capacity-building.

Agriculture and Food Security

Agricultural cooperation will focus on:

- value-chain development and agricultural exports;
- livestock and food security;
- resource-efficient technologies;
- agricultural science; and
- conservation of plant genetic resources.

Research institutions and enterprises from both countries will work together to improve productivity and promote trade in agricultural products.

Health and Pharmaceuticals

India and Uzbekistan will strengthen cooperation in biomedical research, medical innovation and public-health systems.

The **Tashkent Pharma Park** will provide a platform for:

- joint pharmaceutical projects;
- localised production;
- technology transfer;
- investment; and
- skilled workforce development.

The two sides also supported the establishment of medical centres, laboratories, research institutions and joint pharmaceutical enterprises in Uzbekistan. An MoU on traditional medicine was also concluded.

Education and Capacity-Building

- Educational cooperation will include joint research, academic exchanges, India studies in Uzbekistan and Uzbek studies in India.
- Cooperation will focus particularly on medicine, pharmaceuticals, chemistry, nanotechnology and biotechnology.

India's capacity-building contribution includes:

- over **2,700 Uzbek nationals** trained under the ITEC programme;
- more than **400 Uzbek students** selected for ICCR scholarships, including AYUSH scholarships; and
- announcement of the **Lal Bahadur Shastri Scholarship for Hindi Language** in Uzbekistan.

Indian students studying in Uzbekistan also contribute to people-to-people relations.

Cultural Exchange Programme

A Cultural Exchange Programme for **2026–2030** was signed. It covers:

- cultural festivals and exhibitions;
- artistic tours;
- institutional exchanges; and
- cooperation in archives.

Buddhist Heritage Cooperation

A Letter of Intent was concluded for conserving and restoring:

- **Fayaz Tepa**; and
- **Kara Tepa**.

These ancient Buddhist monasteries in southern Uzbekistan reflect the spread of Buddhism through the Silk Road and its historical presence in Central Asia.

- Heritage cooperation will also include digital documentation, three-dimensional modelling of archaeological artefacts and advanced conservation technologies.

Sports, Yoga and Tourism

- Sports cooperation will include athlete preparation and coach training in badminton, archery and chess.
- India's Ministry of AYUSH and Uzbekistan's Yoga Federation will cooperate in yoga-instructor training, international Yogasana competitions and the promotion of healthy lifestyles.
- Tourism can benefit from improved payments, cultural programmes, heritage conservation and stronger connectivity.

Environmental Cooperation

India announced a **$1-million grant** for afforestation and ecological rehabilitation in the Aral Sea region.

The initiative connects:

- Uzbekistan's **Yashil Makon** programme; and
- India's **Ek Ped Maa Ke Naam** campaign.

India will also provide technical support under its Grant-in-Aid framework.

Regional and International Cooperation

Central Asia–India Format

- Both sides reaffirmed their commitment to deeper engagement through the Central Asia–India mechanism at the level of Heads of State and other institutions.

United Nations Reform

- India and Uzbekistan called for reform of the United Nations, including the Security Council. Uzbekistan reaffirmed its support for India's candidature for permanent membership of the UN Security Council.

Multilateral Platforms

The two countries agreed to strengthen cooperation through:

- the Shanghai Cooperation Organisation;
- the United Nations;
- forums representing the Global South; and
- other international and regional bodies.

Uzbekistan congratulated India on its BRICS chairship in 2026. India supported Uzbekistan's NAM chairship for 2027–2030. Uzbekistan also expressed interest in joining the International Solar Alliance and the International Big Cat Alliance.

Significance for India

Strategic Presence in Central Asia

- A stronger partnership with Uzbekistan expands India's political and strategic engagement in Central Asia.

Energy and Mineral Security

- Long-term uranium supplies and critical-mineral projects can reduce India's dependence on concentrated external sources.

Regional Security

- Defence cooperation, Exercise Dustlik and intelligence sharing can help address terrorism, extremism and other regional threats.

Economic Opportunities

- The trade target and proposed preferential trade arrangement can expand markets for Indian pharmaceuticals, engineering products, automobiles and digital services.

Digital Diplomacy

- UPI–UZQR, artificial intelligence and IT-park cooperation demonstrate the growing role of Indian digital platforms in bilateral diplomacy.

Civilisational Linkages

- Restoration of Buddhist sites strengthens India's historical and cultural relationship with the Silk Road region.

Way Forward

- Prepare a time-bound roadmap for achieving the 2030 trade target.
- Advance the next steps towards a Preferential Trade Agreement.
- Operationalise the uranium-supply framework.
- Identify commercially viable critical-mineral projects.
- Improve multimodal freight and logistics connectivity.
- Implement UPI–UZQR interoperability.
- Promote direct defence-industry partnerships.
- Regularly review progress through the Foreign Ministers-led mechanism.

Conclusion

The Comprehensive Strategic Partnership brings trade, uranium, critical minerals, defence, connectivity, digital technology and cultural cooperation within a single framework.

Its success will depend on converting political commitments into functioning projects. Effective implementation can strengthen India's resource security, regional influence and long-term engagement with Central Asia.

UNCCD COP17: Shifting from Drought Relief to Proactive Resilience

Sources: The Hindu

Relevance: GS Paper II: International environmental conventions and global cooperation

Important Keywords

Prelims:

- UNCCD | COP17 | Rio Conventions | Land Degradation Neutrality | Drought Resilience Index | Drought Resilience Investment Facility | Open Natural Ecosystems | Bonn Challenge | Rangelands | SDG 15.3

Mains:

- Anticipatory Drought Management | Nature-Based Solutions | Ecosystem-Based Adaptation | Ridge-to-Valley Planning | Climate-Resilient Agriculture | Predictive Technologies | Community-Led Restoration | Drought Finance | Land–Water Nexus

Why in News?

At the **17th Conference of the Parties to the United Nations Convention to Combat Desertification**, held in Ulaanbaatar, Mongolia, India called for a fundamental shift from reactive drought relief to **proactive, technology-enabled resilience**.India advocated predictive technologies, localised early-warning systems, catchment restoration and anticipatory land-management policies to prevent dry spells from developing into humanitarian and economic crises.

Drought as a Developmental Challenge

Drought is no longer merely an occasional natural event. Rising temperatures, uncertain rainfall and

declining land quality have turned it into a persistent developmental challenge.

Drought creates interconnected effects on:

- water and food security;
- agricultural production;
- groundwater availability;
- biodiversity and ecosystems;
- rural livelihoods and migration; and
- wider economic stability.

A prolonged dry spell can therefore reverse gains in poverty reduction, health, nutrition and regional development.

From Reactive Relief to Proactive Resilience

Traditional drought management has largely focused on providing assistance after crops fail and water sources decline. The approach advocated at COP17 seeks to act before these impacts become severe.

A proactive system requires:

- prediction of drought conditions;
- continuous rainfall and soil-moisture monitoring;
- early release of preparedness funds;
- protection of catchments and groundwater;
- drought-resilient agriculture; and
- stronger community capacity to absorb shocks.

The objective is not only to respond to drought but also to reduce the vulnerability of people, land and water systems.

About UNCCD

The **United Nations Convention to Combat Desertification** was adopted in 1994 following the 1992 Rio Earth Summit.

It is one of the three Rio Conventions:

Convention	Main focus
UNCCD	Desertification, land degradation and drought
UNFCCC	Climate change
Convention on Biological Diversity	Biodiversity conservation

UNCCD is the only legally binding international framework specifically addressing desertification and the effects of drought while linking environmental protection with sustainable land management.

Membership and Decision-Making

- UNCCD has **197 Parties**, including India.
- Its Conference of the Parties is the principal decision-making body.
- The COP reviews implementation, monitors commitments and adopts policy guidance.
- India hosted UNCCD COP14 in New Delhi in 2019, where the New Delhi Declaration was adopted.

Land Degradation Neutrality

- The main operational framework of UNCCD is **Land** Degradation **Neutrality**, reflected in **SDG Target 15.3**.
- LDN refers to a situation where the quantity and quality of land resources required to support ecosystems and human well-being remain stable or improve.
- It does not mean that no land can ever be degraded. Rather, unavoidable degradation must be reduced and balanced through restoration and sustainable land management elsewhere.

About UNCCD COP17

COP17 was held in **Ulaanbaatar, Mongolia**, under the theme:

"Restoring Land. Restoring Hope"

- The conference brought together governments, scientists, civil society organisations, financial institutions and

pastoral communities.

It focused on:

- drought resilience;
- land restoration;
- rangelands and pastoralists;
- nature-based solutions;
- land degradation neutrality;
- early-warning systems;
- green finance; and
- cross-border data sharing.

Land degradation presently affects up to **40% of the world's land surface**, threatening water security, biodiversity, economic stability and the livelihoods of billions of people.

Rangelands and Pastoral Communities

- COP17 coincided with the **United Nations International Year of Rangelands and Pastoralists 2026**.
- Mongolia, the host country, highlighted the importance of rangelands and pastoral livelihoods. Nearly 77% of its land is degraded, and its **Billion Trees campaign** seeks to plant one billion trees by 2030.
- Globally, approximately 40–45% of rangelands are degraded. These ecosystems support pastoral livelihoods, food production, biodiversity and carbon storage.

Major Outcomes of COP17

Drought Resilience Index

The **Drought Resilience Index** was introduced as a comprehensive technical tool using:

- artificial intelligence;
- vulnerability mapping;
- risk assessment; and
- national preparedness indicators.

It assesses the ability of countries to anticipate, prepare for and adapt to drought. It can also guide investments towards highly vulnerable regions.

Drought Resilience Investment Facility

- The UNCCD and Luxembourg launched the **Drought Resilience Investment Facility** as a global catalytic financing platform.

It seeks to use public finance to reduce investment risks and mobilise private and institutional resources for:

- drought resilience;
- water security;
- climate-resilient agriculture; and
- land restoration.

New Financing

- COP17 announced approximately **$1.3 billion in new and pipeline financing** for land restoration and drought resilience in vulnerable countries.

Nature-Based Solutions

- The conference promoted nature-based solutions and ecosystem-based adaptation. These approaches use healthy forests, grasslands, wetlands, soil and water systems to reduce drought risks.

Drought as a Separate Agenda

- COP17 decided that drought would become a standalone agenda item from COP18 onwards. This will ensure its regular consideration instead of treating it only as an occasional negotiating issue.

No Legally Binding Drought Treaty

- Countries could not reach agreement on a legally binding global drought treaty. The issue was deferred to future negotiations despite an estimated annual drought-resilience finance gap of **$278 billion**.

A global drought framework could require countries to:

- prepare national drought plans;
- establish common monitoring standards;
- share rainfall and soil-moisture data;
- develop coordinated early-warning systems; and
- mobilise finance for resilience and

restoration.

Egypt is scheduled to host COP18 in Sharm El-Sheikh in 2028.

India's Position at COP17

India described drought as a defining developmental challenge and advocated an integrated approach combining science, institutions and local participation.

Predictive and Localised Monitoring

India called for the integration of:

- satellite-based drought assessment;
- rainfall monitoring;
- local soil-moisture information;
- predictive technologies; and
- early-warning systems.

Such monitoring should trigger preparedness at inter-ministerial and State levels before a dry spell becomes a crisis.

Land–Water Connection

India emphasised the principle:

"Restore the forest, before the flow"

- The statement highlights the need to protect catchments and riverscapes before attempting to restore downstream water availability.

Catchment and riverscape forestry can:

- reduce soil erosion;
- improve water retention;
- support groundwater recharge; and
- regulate river flows.

Community-Led Resilience

- India argued that vulnerable communities should be equipped to anticipate and absorb shocks. Local institutions, farmers and pastoralists must therefore participate in drought planning and land restoration.

Predictable International Finance

- India called for adequate, predictable and sustained international finance. It also highlighted domestic financial instruments such as Sovereign Green Bonds and the Green Credit Programme.

India's Land-Restoration Progress

- Under the **Bonn Challenge**, India has brought approximately **21.76 million hectares** of degraded and deforested land under restoration.
- India's target is to restore **26 million hectares by 2030**.

The progress contributes to:

- land degradation neutrality;
- biodiversity conservation;
- soil and water security;
- carbon sequestration; and
- livelihood protection.

Guide to Open Natural Ecosystems

India released its first **Guide to Grasslands and Other Open Natural Ecosystems**.

Open Natural Ecosystems include:

- grasslands and savannas;
- deserts;
- scrublands; and
- ravines.

Examples include the Thar landscape, Banni grasslands and Deccan savannas.

- These ecosystems have often been incorrectly classified as wastelands because of their low tree cover. Indiscriminate tree plantation can alter their ecology, affect groundwater and damage habitats adapted to open landscapes.
- The guide seeks to recognise them as distinct ecosystems requiring appropriate conservation rather than uniform afforestation.

Role of Pastoralists

India advocated recognising pastoral communities as custodians of rangelands.

Effective restoration should:

- protect grazing rights;
- conserve common property resources;
- combine traditional knowledge with modern science; and
- involve pastoralists in management decisions.

The **Orans of Rajasthan**, community-protected sacred landscapes, were highlighted as examples of local conservation of biodiversity, vegetation and water resources.

Major Challenges

Ecological Challenges

- Misguided afforestation can damage native grasslands, deserts and scrublands.
- Intensive cultivation and excessive fertiliser use reduce soil organic carbon.
- Poor irrigation management can cause salinisation.
- Invasive species and erosion weaken ecosystem resilience.

Agricultural Vulnerability

- Agricultural incentives may encourage water-intensive crops such as paddy and sugarcane in water-stressed areas. This increases groundwater depletion and drought vulnerability.
- Shrinking common property resources, including grazing lands and Orans, further increase pressure on rangelands.

Institutional Fragmentation

- Agriculture, forestry, water, environment and rural-development departments often work separately. This weakens landscape-level planning and causes duplication of expenditure.

Monitoring Gaps

- Remote sensing can identify vegetation stress, but inadequate ground-level soil-moisture monitoring and verification may delay drought assessment.

Land-Tenure Problems

- Insecure land rights can limit access to credit, insurance, subsidies and extension services, particularly for women managing farms.

Finance Gap

- Land restoration attracts less funding than many climate and biodiversity initiatives. Private investors face long project periods, uncertain returns, tenure disputes and weak systems for measuring ecological outcomes.

Climate Change

- Heavy rainfall followed by prolonged dry spells increases runoff, soil erosion and reservoir siltation while reducing groundwater recharge.

India's Initiatives

National Action Plan to Combat Desertification

- Launched in 2001 and revised in 2023, it provides an umbrella framework for coordinating programmes on desertification and land restoration.

PMKSY and Watershed Development

- These interventions promote rainwater harvesting, soil-moisture conservation and vegetation regeneration.

Green India Mission

- The mission supports forest restoration and carbon sequestration under the National Action Plan on Climate Change.

Soil Health Card Scheme

- It provides crop-specific nutrient recommendations to reduce excessive fertiliser use and improve soil health.

Space-Based Monitoring

- ISRO's Desertification and Land

Degradation Atlas uses remote sensing and GIS to map degraded land and support targeted restoration.

Mission Amrit Sarovar

- It creates and rejuvenates water bodies to improve water availability, groundwater recharge and drought resilience.

Aravalli Green Wall Initiative

- It seeks to restore degraded landscapes and combat desertification across the Aravalli region.

Way Forward

Shift to Anticipatory Financing

- Satellite, rainfall and soil-moisture indicators should automatically trigger preparedness funding before drought conditions worsen.

Adopt Agro-Ecological Zoning

- Crop incentives, electricity support and agricultural policies should encourage crops suited to local water availability and ecological conditions.

Follow Ridge-to-Valley Planning

- District-level plans should integrate forests, farms, soils, streams and groundwater while coordinating the work of different departments.

Protect Open Ecosystems

- Grasslands, savannas, deserts and scrublands must be recognised as distinct ecosystems. Restoration should prioritise native species and removal of invasive species over indiscriminate plantation.

Promote Sustainable Agriculture

- Regenerative agriculture, soil-carbon restoration, drought-resistant crops, precision irrigation and biochar can improve soil health and water retention.

Integrate Technology

- Satellite data, artificial intelligence and local soil sensors should be combined for hyperlocal drought forecasting, crop planning and irrigation management.

Mobilise Innovative Finance

- Blended finance and public de-risking can attract private investment into land restoration, sustainable agroforestry and drought-resilient agriculture.

Strengthen Community Rights

- Pastoralists, farmers, women and local institutions should participate in planning and monitoring. Secure land and grazing rights can improve long-term restoration outcomes.

Conclusion

UNCCD COP17 reinforced that drought is not merely a temporary shortage of rainfall but a threat to food, water, livelihoods and economic security. India's call for predictive technologies, catchment restoration and community-led resilience points towards a necessary policy shift. Sustainable land management must move from post-disaster compensation to anticipatory, science-based and locally grounded action.

Economy

Nature-Based Solutions and Climate-Resilient Agriculture: Securing India's Food Future

Source: Indian Express

Relevance: **UPSC GS Paper III: Agriculture, Climate Change, Food Security, Environment, Sustainable Development**

Important Keywords

Prelims Keywords:

- Climate-Resilient Agriculture | Nature-Based Solutions | NICRA | Biochar | National Mission for Sustainable Agriculture

Mains Keywords:

- Food security | Climate adaptation | Sustainable farming | Small farmers' resilience | Low-carbon agriculture

Why in News?

As climate change intensifies through **rising temperatures, erratic monsoons and frequent extreme weather events**, Indian agriculture is facing increasing stress. **Nature-based solutions** and **climate-resilient agriculture** have emerged as important approaches to strengthen farm resilience, protect soil health, reduce emissions and ensure food and nutritional security.

Why Indian Agriculture is Climate-Vulnerable

Agriculture remains central to India's economy and society. It supports the livelihoods of about **58% of India's population**, employs nearly **46.1% of the workforce**, and contributes around **18% of Gross Value Added**.

However, Indian agriculture is highly exposed to climate shocks due to structural factors.

Indicator	Status
Average landholding size	**1.08 hectares**
Small and marginal farmers	**89.4%**
Rainfed agriculture	**Around 60%**
Food output from rainfed farming	**Around 40%**

This makes India's farm sector highly dependent on monsoon behaviour and local weather conditions.

Climate change affects agriculture by:

- disrupting sowing and harvesting cycles
- reducing crop yields
- increasing pest and disease pressure
- reducing fertiliser use efficiency
- lowering soil fertility
- worsening soil moisture loss
- affecting photosynthesis and plant growth

At the same time, agriculture itself contributes to climate change through **greenhouse gas emissions, crop residue burning and deforestation**. Therefore, Indian agriculture needs both **adaptation** and **mitigation** strategies.

What is Climate-Resilient Agriculture?

Climate-Resilient Agriculture refers to farming practices that help agricultural systems adapt to

changing climatic conditions, reduce vulnerability to climate shocks and maintain productivity.

It includes both adaptation and mitigation measures.

Major Practices

- selection of climate-adapted crop varieties
- adjustment of sowing windows
- use of short-duration or stress-tolerant crops
- improved planting methods
- agroforestry
- biochar application
- efficient use of fertilisers
- efficient use of pesticides and insecticides
- better water management
- better soil health management
- reduced tillage and conservation agriculture

Climate-resilient agriculture also depends on social resilience. Farmers, households and communities need access to knowledge, credit, technology, government schemes and extension services.

What are Nature-Based Solutions?

Nature-Based Solutions are sustainable practices that use natural processes to address climate, environmental and livelihood challenges.

In agriculture, nature-based solutions aim to:

- improve adaptation and food production
- mitigate climate change
- restore ecosystems and biodiversity

Examples of Nature-Based Solutions in Agriculture

- **Regenerative agriculture**
- **Conservation agriculture**
- **Reduced tillage**
- **Zero tillage**
- **Agroforestry**
- **Biochar**
- **Improved soil and water management**

Nature-based solutions are now part of the emission reduction plans of at least **102 countries** under their Nationally Determined Contributions. Studies suggest that such solutions could deliver **37% of cost-effective climate mitigation** needed to keep global temperature rise below 2°C by 2030.

Climate Change and Food Security

- Climate change poses a serious risk to global food systems. As population rises, estimates suggest the world will need **60% additional food by 2050**.
- Developing countries are expected to face disproportionate impacts because their agriculture is more dependent on rainfall and natural resources.

For India, food security is closely linked with:

- monsoon stability
- soil health
- water availability
- small farmer resilience
- climate-resilient seeds
- sustainable farming systems

If farming systems fail to adapt, climate change can affect both **farm income** and **national food security**.

Biochar as a Nature-Based Solution

According to the **Indian Council of Agricultural Research**, **biochar** is charred biomass produced by slow pyrolysis, where organic material such as crop residue or wood waste is heated at **300–500°C** in the absence of oxygen.

- India generates nearly **350 million tonnes of agricultural waste annually**. If treated properly, this biomass can be converted into useful products such as organic fertiliser and bioenergy.

Benefits of Biochar

- improves soil fertility
- increases soil water retention
- improves nutrient use efficiency
- supports carbon sequestration

- reduces crop residue burning
- lowers particulate matter emissions
- helps mitigate climate change

Biochar provides a more sustainable alternative to open-field burning of crop residues. Research cited in the source notes that biochar could sequester an average of **376.11 megatonnes of CO_2-equivalent** in Indian soils and potentially reduce **41–63% of emissions** from agriculture and allied activities.

India's Policy Response

India has launched several policies and initiatives to promote climate-resilient and sustainable agriculture.

1. National Action Plan on Climate Change

- The **National Action Plan on Climate Change**, launched in **2008**, provides the broad framework for India's climate policy.

2. National Mission for Sustainable Agriculture

- The **National Mission for Sustainable Agriculture** was launched in **2014–15** under NAPCC.

It promotes:

- climate-resilient agriculture
- improved soil health
- efficient water use
- sustainable farming practices

3. Important Schemes Under Sustainable Agriculture

- **Per Drop More Crop**
- **Rainfed Area Development**
- **Soil Health and Fertility Scheme**
- **Mission for Integrated Development of Horticulture**
- **Agroforestry**
- **National Bamboo Mission**

4. National Agroforestry Policy

- India became the first country to adopt a **National Agroforestry Policy** in 2014.

5. National Mission on Natural Farming

- The **National Mission on Natural Farming** was launched in **2024** to promote sustainable and chemical-light farming systems.

6. National Innovations in Climate Resilient Agriculture

- The **National Innovations in Climate Resilient Agriculture** project was launched in **2011** by the Ministry of Agriculture and Farmers Welfare and is implemented by **ICAR**.

NICRA's vulnerability assessment of **651 agricultural districts** identified:

Category	Number of Districts
Vulnerable districts	**310**
Very highly vulnerable	**109**
Highly vulnerable	**201**

District Agriculture Contingency Plans have been prepared for all **651 agricultural districts**.

7. Climate-Resilient Crop Varieties

- Between **2014 and 2024**, ICAR released **2,900 crop varieties**, of which **2,661** are tolerant to one or more biotic or abiotic stresses.

These stresses include pests, diseases, water stress, temperature stress, humidity and soil-related stress.

Significance for India

1. Food and Nutritional Security

- Climate-resilient agriculture can protect yields from climate shocks and help secure food availability for India's large population.

2. Farmer Income Stability

- Small and marginal farmers are highly vulnerable to crop losses. Climate-resilient practices can reduce risk and improve income stability.

3. Soil and Water Conservation

- Practices like agroforestry, zero tillage, biochar and efficient irrigation improve soil health and water-use efficiency.

4. Climate Adaptation

- Stress-tolerant varieties, contingency plans and improved water management help farmers adapt to changing rainfall and temperature patterns.

5. Emission Reduction

- Biochar, reduced residue burning and sustainable farming practices can reduce greenhouse gas emissions from agriculture.

6. Biodiversity and Ecosystem Restoration

- Nature-based solutions help restore biodiversity, improve soil organisms and strengthen ecosystem services.

Challenges

1. Low Awareness

- Many farmers are unaware of climate risks and climate-resilient technologies.

2. High Upfront Cost

- New technologies such as biochar, water-smart systems and improved tools may require initial investment.

3. Limited Credit Access

- Small and marginal farmers often lack access to affordable credit.

4. Input Quality Issues

- Availability of quality seeds, biofertilisers, biopesticides and equipment remains uneven.

5. Extension Gaps

- Farmers need hand-holding and local demonstrations to build confidence in new practices.

6. Regional Variation

- Climate risks vary across districts, so one-size-fits-all solutions may not work.

Way Forward

1. Strengthen Farmer Awareness

- Climate literacy must be promoted through Krishi Vigyan Kendras, Farmer Producer Organisations and local extension networks.

2. Promote Localised Climate Planning

- District Agriculture Contingency Plans should be updated regularly and linked with real-time weather advisories.

3. Support Small and Marginal Farmers

- Financial support, subsidies and credit should target small farmers who face the greatest climate risk.

4. Scale Biochar and Residue Management

- Biochar can reduce residue burning and improve soil carbon. It should be promoted through local biomass-based enterprises.

5. Improve Access to Stress-Tolerant Varieties

- ICAR's climate-resilient crop varieties must reach farmers through reliable seed systems.

6. Strengthen Water-Smart Agriculture

- Micro-irrigation, rainwater harvesting, soil moisture conservation and watershed management must be expanded.

7. Promote Collaborative Governance

- Farmers, research institutions, government departments, civil society and private innovators must work together.

Conclusion

Climate change has made Indian agriculture more uncertain, especially for small, marginal and rainfed farmers. **Nature-based solutions** and **climate-resilient agriculture** provide a sustainable pathway to protect food security, farmer incomes, soil health and environmental balance. India has taken important steps through **NAPCC, NMSA,**

NICRA, agroforestry, natural farming and stress-tolerant crop varieties. However, the real challenge lies in adoption at the farm level. India must combine scientific innovation with farmer awareness, credit support, extension services and local climate planning. A climate-resilient farm sector is essential not only for agriculture but also for nutrition, rural livelihoods and sustainable development.

India as the World's Leading Ship Recycling Nation: Circular Economy, Maritime Industry and Green Compliance

Source: PIB

Relevance: UPSC GS Paper III: Maritime Economy, Circular Economy, Environment, Industrial Growth, Resource Security

Important Keywords

Prelims Keywords:

- Ship Recycling Act, 2019 | Hong Kong Convention | Alang-Sosiya Yard | Inventory of Hazardous Materials | Maritime India Vision 2030

Mains Keywords:

- Circular economy | Green ship recycling | Resource security | Worker safety | Sustainable maritime ecosystem

Why in News?

India became the **world's leading ship recycling nation in 2025**, with its global market share rising from **30.1% in 2024 to 35.4% in 2025**. Its ship recycling volume also increased from **1.86 million gross tons to 2.99 million gross tons**, marking nearly **60% growth**.

- This achievement has been supported by **regulatory reforms, Hong Kong Convention compliance, yard modernisation, worker training and stronger safety and environmental standards**.

How India Became a Global Leader in Ship Recycling

- According to **UNCTAD**, India ranked first globally in ship recycling in **2025**. The growth shows India's rising competitiveness in handling end-of-life ships in a regulated and commercially viable manner.



- The achievement is also significant because India has met the **Maritime India Vision 2030** target of becoming the world's leading ship recycling nation **five years ahead of schedule**.
- India is now planning to nearly double its ship recycling capacity to around **9 million light displacement tons** through the planned expansion of the **Alang Ship Recycling Yard**. This expansion is supported by a comprehensive master plan

focused on infrastructure improvement and global competitiveness.

Alang-Sosiya Cluster: Backbone of India's Ship Recycling Sector

The **Alang-Sosiya ship recycling cluster in Gujarat** is the centre of India's ship recycling industry. It accounts for about **98% of India's ship recycling activity** and has an annual recycling capacity of around **6 million gross tons**.

- Alang produces nearly **3.50 million metric tonnes of steel annually** through recycling. This reduces dependence on fresh extraction of natural resources and supports India's **circular economy**.

The cluster is supported by:

- authorised ship recycling yards
- downstream steel re-rolling mills
- waste-management facilities
- allied industrial infrastructure
- safety and training institutions

The **Safety Training and Labour Welfare Institute** at Alang-Sosiya has cumulatively trained over **1.5 lakh workers** in occupational safety, hazardous-material handling and emergency response.

- Apart from Alang-Sosiya, India also has ship recycling facilities at **Amar Iron Udyog in Kolkata** and **Steel Industrials Kerala Limited in Kerala**.

Modernisation of Indian Ship Recycling Yards

Indian yards have been upgraded to meet higher safety and environmental standards.

Major improvements include:

- engineered and demarcated recycling plots
- impermeable working surfaces
- drainage systems
- mechanised material handling equipment
- segregated hazardous-waste storage
- authorised downstream waste treatment linkages
- structured safety, health and emergency response systems

These changes have helped India move from conventional dismantling practices towards a **modern, internationally aligned ship recycling industry**.

Regulatory and Compliance Framework

India has created a detailed legal and institutional framework for safe and environmentally sound ship recycling.

1. **Ship Recycling Act, 2019:** The **Ship Recycling Act, 2019** is the principal law governing ship recycling in India. It designates the **Directorate General of Shipping** as the **National Authority** and provides for authorisation, certification, inspection and enforcement.
2. **Ship Recycling Rules, 2021:** The Rules operationalise the Act by laying down requirements for facility authorisation, ship recycling plans, hazardous-material management, worker safety, training and reporting.
3. **Ship Recycling Regulations, 2026:** The Regulations strengthen implementation through detailed operational, environmental and safety standards. They promote uniform compliance across recycling facilities.
    - Together, the Act, Rules and Regulations regulate the full lifecycle of ship recycling, from ship preparation and certification to yard authorisation and compliance monitoring.

Hong Kong Convention and India's Alignment

- The **Hong Kong International Convention for the Safe and Environmentally Sound**

Recycling of Ships is the principal global framework for ship recycling. It became legally binding on **26 June 2025**.

- India has aligned its domestic framework with the Convention through the **Ship Recycling Act, Rules and Regulations**. This makes international safety and environmental standards part of India's national regulatory system.
- The government has provided **₹53.5 crore** for yard modernisation, helping **115 ship recycling facilities** achieve compliance with Hong Kong Convention requirements.
- Further, **35 Alang ship recycling yards** have applied for inclusion in the **EU list of approved ship recycling facilities**. **Shree Ram Vessel Scrap** and **Y. S. Investments** have been included in the draft **16th European List of Ship Recycling Facilities**.

Inventory of Hazardous Materials

The **Inventory of Hazardous Materials** identifies hazardous substances present aboard ships. It supports safe handling throughout the ship lifecycle and before recycling.

IHM improves:

- traceability
- transparency
- hazardous-material risk management
- safety of workers
- environmental compliance

It is an important tool for preventing unsafe dismantling and reducing pollution risks.

Ship-breaking Credit Note Scheme

The **Ship-breaking Credit Note Scheme** has been introduced under the **Ship Building Financial Assistance Scheme 2.0**.

It encourages shipowners to recycle vessels at compliant Indian yards while also promoting shipbuilding in India.

Under the scheme:

- scrapping a ship generates a **Credit Note equal to 40% of the recycled vessel's scrap value**;
- this Credit Note can be used for purchasing a new vessel built in India;
- it can cover up to **5% of the value of the new Indian-built vessel**.

This links **sustainable ship recycling** with **domestic shipbuilding**, supporting both environmental responsibility and industrial growth.

Ex-INS Viraat: Case Study in Responsible Recycling

Ex-INS Viraat is an important example of India's ship recycling capability.

- It served the **Royal Navy for 27 years** and the **Indian Navy for 30 years** before being decommissioned in **March 2017**. The aircraft carrier reached **Alang, Gujarat, in September 2020** for dismantling and recycling.
- During its service, Ex-INS Viraat recorded more than **22,622 flying hours**, spent **2,252 days at sea**, and sailed over **5.88 lakh nautical miles**.
- Its recycling showed India's ability to handle large and complex vessels, recover valuable materials safely, support employment and follow improved environmental and occupational-safety standards.

Significance of Ship Recycling for India

1. Resource Security

- Ship recycling provides ferrous scrap for the domestic steel industry and reduces dependence on imported raw materials.

2. Circular Economy

- Steel and reusable materials recovered from ships reduce waste and support efficient resource use.

3. Environmental Benefits

- Regulated recycling prevents unsafe disposal of end-of-life ships and reduces marine and coastal pollution.

4. Lower Energy Use

- Recycled steel requires less energy than primary steel production and supports India's decarbonisation goals.

5. Employment Generation

- The sector supports workers engaged in dismantling, processing, material recovery, transport, re-rolling mills and waste management.

6. Industrial Ecosystem

- Recovered steel and reusable components support **Make in India** and **Atmanirbhar Bharat** by strengthening domestic manufacturing.

Challenges

- Despite India's progress, some issues require continuous attention.
- Indian yards must maintain global standards consistently as international scrutiny rises. Hazardous-material handling needs strict enforcement because ships may contain asbestos, heavy metals, oils and other risky materials. Worker safety must remain central, especially in physically demanding dismantling operations.
- The sector also needs better technology, stronger waste-management linkages, stable demand for recycled materials and transparent certification systems. India must also ensure that expansion of capacity does not weaken environmental safeguards.

Way Forward

1. Strengthen Green Compliance

- All recycling yards should fully comply with the Hong Kong Convention and national safety standards.

2. Improve Worker Welfare

- Training, protective equipment, health insurance, emergency response systems and labour welfare measures should be expanded.

3. Upgrade Technology

- Mechanised dismantling, digital tracking, hazardous-material mapping and better waste-treatment systems should be promoted.

4. Expand Responsible Capacity

- Alang's expansion should be aligned with environmental safeguards and coastal-zone management.

5. Promote Global Recognition

- India should support more yards in securing EU and international approvals.

6. Link Recycling with Shipbuilding

- The Ship-breaking Credit Note Scheme should be used to connect recycling, steel recovery and domestic vessel construction.

7. Strengthen Circular Economy Markets

- Recycled steel should be integrated into domestic manufacturing, infrastructure and industrial supply chains.

Conclusion

India's rise as the **world's leading ship recycling nation in 2025** reflects the success of regulatory reform, yard modernisation and international compliance. The sector supports **resource security, employment, circular economy and environmental sustainability**. The Alang-Sosiya cluster remains the backbone of this progress, while the Hong Kong Convention-aligned framework has

improved safety and credibility. Going forward, India must combine capacity expansion with green technologies, worker welfare and strict compliance. Sustainable ship recycling can become a major pillar of India's maritime economy.

Natural Farming: India's Path to Resilient, Low-Input and Climate-Smart Agriculture

Source: The Hindu

Relevance: **UPSC GS Paper III: Agriculture, Food Security, Climate Change, Sustainable Development, Environmental Degradation**

Important Keywords

Prelims Keywords:

- Natural Farming | National Mission on Natural Farming | PM-PRANAM | Jeevamrutha | Waaphasa

Mains Keywords:

- Climate-resilient agriculture | Input sovereignty | Soil health | Agroecology | Farmer income security

Why in News?

Natural farming has gained renewed attention after concerns over **global energy and fertiliser market vulnerability**, climatic stress linked to **El Niño**, and the need to reduce dependence on costly external farm inputs.

- The Prime Minister's recent appeal for greater **resource consciousness** and a shift towards **natural farming** reflects the need to make Indian agriculture more resilient against external shocks such as fertiliser price rise, fossil fuel dependence, groundwater stress and climate variability.

What is Natural Farming?

- **Natural farming**, also called **Prakritik Kheti**, is a chemical-free and ecologically regenerative farming system. It relies on **local biodiversity, on-farm biomass, natural biological processes and indigenous knowledge**, instead of synthetic fertilisers, chemical pesticides and heavy external inputs.
- It treats the farm as a **living ecosystem** where soil organisms, crops, livestock, trees, water and biomass interact with each other. The core philosophy is to work **with nature**, rather than controlling agriculture only through market-bought inputs.

Key Practices in Natural Farming

1. Zero Synthetic Inputs

- Natural farming avoids synthetic fertilisers such as urea and DAP, chemical pesticides, herbicides and growth regulators. Soil fertility is improved through organic residues, mulching and microbial activity.

2. Minimum Soil Disturbance

- Deep tillage is reduced so that earthworms, soil microbes and natural soil structure are protected.

3. Multicropping and Biodiversity

- Instead of monocropping, farmers are encouraged to grow cereals, pulses, oilseeds, vegetables, trees and livestock-based systems together. This reduces pest risk and improves income diversity.

4. Mulching and Soil Cover

- Crop residues, dried leaves and live cover crops are used to protect the soil, retain moisture and reduce erosion.

5. Indigenous Livestock Integration

- Cow dung and cow urine are used as base materials for microbial formulations. However, individual ownership of cattle is not compulsory if community-level bio-input systems are available.

Core Indian Natural Farming Inputs

Jeevamrutha

- A fermented microbial solution prepared from cow dung, cow urine, jaggery, pulse flour, local soil and water. It helps revive beneficial microbes in the soil.

Bijamrutha

- A seed-treatment mixture prepared from cow dung, cow urine, lime and local soil. It protects seeds from fungal and soil-borne diseases.

Acchadana

- Mulching with crop residues, straw, leaves or live intercrops to reduce water loss and maintain soil temperature.

Waaphasa

- Maintaining a balance of air and moisture in the root zone, reducing the need for frequent irrigation.

Why Natural Farming is Becoming Important

1. Reduces External Vulnerability

- India's agriculture depends heavily on imported fertilisers, fossil fuels and external inputs. Natural farming reduces dependence on these inputs and improves **input sovereignty** at the village level.

2. Improves Soil Health

- Natural farming promotes soil organic carbon, microbial activity, earthworms and nutrient recycling. This is important because soil degradation is a major threat to long-term farm productivity.

3. Lowers Cost of Cultivation

- Small and marginal farmers often face debt due to expensive chemical inputs. Natural farming can reduce purchased-input expenditure by using local biomass and bio-inputs.

4. Builds Climate Resilience

- Mulching, crop diversity, soil cover and water conservation help farms withstand drought, heat stress and rainfall variability.

5. Supports Public Health

- Chemical-free food systems can reduce exposure of farmers, consumers, livestock, soil organisms and water bodies to hazardous agrochemicals.

6. Empowers Rural Women

- Natural farming is knowledge-intensive. Women's Self-Help Groups, Krishi Sakhis, Community Resource Persons and Farmer Master Trainers can play an important role in training, bio-input preparation and local extension.

7. Promotes Circular Agriculture

- Farm waste, dung, crop residue and biomass are recycled within the farming system, reducing stubble burning and improving resource efficiency.

Policy Push in India

- The Centre has launched the **National Mission on Natural Farming** to promote natural farming practices. **PM-PRANAM** was also conceived to encourage States to reduce dependence on chemical fertilisers.

- Several States, including **Andhra Pradesh, Himachal Pradesh, Gujarat, Kerala and parts of the North-East**, have announced policies related to natural farming, agroecology or organic transition.
- However, policy announcements alone are not enough. Natural farming needs **institutional preparation, scientific support, field-level extension, bio-input systems, market linkages and transition finance**.

Lessons from Andhra Pradesh Model

- Andhra Pradesh's natural farming programme has shown both the possibilities and complexities of large-scale transition. Its recognition through the **Food Planet Prize 2026** brought international attention to the State's efforts.
- The main lesson is that natural farming cannot be scaled only through slogans or acreage targets. It requires long-term support, handholding, local institutions, trained facilitators and farmer networks.
- The success of the **Green Revolution** was not due to seeds alone. It was supported by a complete ecosystem of irrigation, fertilisers, extension services, agricultural universities, procurement, MSP, rural credit and markets. Natural farming also needs a comparable support architecture.

Institutional Ecosystem Needed

Natural farming should be promoted through **cluster-based and landscape-level planning**. Each State can identify a few contiguous clusters, such as a block or 20–30 villages, and saturate them with support.

Such clusters should include:

- trained field facilitators
- Bio-input Resource Centres
- Farmer Producer Organisations
- demonstration plots
- soil-health monitoring
- transition finance
- Krishi Vigyan Kendra support
- market linkages
- certification and traceability systems

These "living landscapes" can generate evidence across different agro-climatic zones and cropping systems.

Challenges

1. Yield Uncertainty

- Natural farming outcomes may vary across crops, soils and regions. Some crops may perform well, while others may show yield decline during transition.

2. Transition Risk

- Soil biology takes time to recover. During this period, farmers may face yield fluctuations, weed pressure, labour demand and market uncertainty.

3. Nutrient Management Issues

- A paddy field, cotton crop, orchard and pulse crop do not have identical nutrient needs. Natural farming must be supported by scientific nutrient budgeting and location-specific protocols.

4. Labour and Gender Burden

- Bio-input preparation, mulching, manual weeding and livestock care may increase labour demand. Since women already perform large amounts of unpaid farm work, natural farming may increase their time burden if not supported properly.

5. Certification and Market Gaps

- Farmers may not automatically get premium prices for chemical-free produce. Weak certification, consumer confusion and fraudulent labelling can reduce farmer

benefits.

6. Food Security Concerns

- India must avoid abrupt, large-scale shifts without preparation. The lesson from Sri Lanka's sudden fertiliser ban is that ecological transition must be phased, evidence-based and institutionally supported.

7. Unequal Access to Resources

- Tenant farmers, landless cultivators and livestock-deficient regions may find it difficult to access cattle-based inputs unless community-level bio-input systems are developed.

Way Forward

1. Prepare a Natural Farming Suitability Atlas

- India should map crops, soils, rainfall patterns, biomass availability, livestock resources and transition risks across agro-climatic regions.

2. Adopt a Phased Transition

- Farmers should initially convert part of their land and gradually reduce chemical inputs instead of shifting suddenly.

3. Provide Transition Finance

- A three-to-five-year support package should include working capital, crop insurance, income support and risk protection.

4. Build Farmer-Led Extension

- Practising natural farmers, Krishi Sakhis, Community Resource Persons, KVKs, State Agricultural Universities and ICAR institutions should provide continuous support.

5. Strengthen Bio-input Resource Centres

- BRCs should be run through FPOs, cooperatives, women's SHGs and rural youth enterprises with quality testing and transparent pricing.

6. Promote Diversified Farming Systems

- Natural farming should include crop rotation, intercropping, pulses, agroforestry, livestock integration, residue recycling and water harvesting.

7. Ensure Market Linkages

- Natural, organic, chemical-free and residue-free produce should be clearly distinguished. QR-based traceability, participatory certification and residue testing can improve consumer trust.

8. Create Strong Research Evidence

- ICAR, State Agricultural Universities and KVKs must conduct long-term trials comparing natural, organic, integrated and conventional systems on yield, income, soil health, water use, labour and nutrition.

Conclusion

Natural farming is not merely an ideological alternative to chemical farming; it is becoming a **resilience imperative** for India. It can reduce input dependence, improve soil health, conserve water, empower rural institutions and protect farmers from external shocks. But it cannot succeed through abrupt transition or policy declarations alone. India must build a Green Revolution-like ecosystem for natural farming — with research, extension, finance, markets, certification and community institutions. A phased, science-backed and farmer-centred approach can make natural farming a pathway to sustainable agriculture and rural resilience.

India's Coconut Sector: From "Kalpavriksha" to Global Prominence

Source: PIB

Relevance: **GS Paper III: Agriculture, food processing, exports and farmers' income**

Important Keywords

Prelims:

- Coconut Development Board, milling copra, ball copra, NAFED, NCCF, PICCS, Neera, TMOC

Mains:

- Multi-tier farming, plantation rejuvenation, value addition, farmer collectivisation, export diversification

Why in News?

India ranks first globally in coconut production. In 2025–26:

- Coconut-product exports reached **₹7,038.35 crore**, registering a **62% annual increase**.
- Around **2,175 hectares** were added under cultivation.
- Nearly **1,672 hectares** were covered under rejuvenation.

The Union Budget 2026–27 also announced the **Coconut Promotion Scheme** to address diseases, aging plantations, low productivity and limited processing.

Importance of Coconut

- Coconut is known as **Kalpavriksha**, the **"Tree of Life"** or the **"Tree of a Thousand Uses."** It provides food, oil, beverages, medicine, fibre, coir, timber, fuel, handicraft material and industrial raw materials.
- Coconut cultivation in India has a history of nearly **3,000 years**. The sector supports around **30 million people**, including approximately **10 million farmers**, most of whom are small and marginal cultivators.

India in the Global Coconut Economy

Indicator	India's Position
Global rank in production	1st
Global rank in cultivation area	3rd
Share in global production	31.24%
Share in global area	17.90%
Production in 2024–25	20,301.22 million nuts
Cultivated area	2.19 million hectares
Average productivity	9,249 nuts per hectare

Leading States

- **Kerala:** Largest cultivated area—about **7.54 lakh hectares**
- **Tamil Nadu:** Highest production
- **Andhra Pradesh:** Highest productivity
- West Bengal and Tamil Nadu follow Andhra Pradesh in productivity.

Kerala produces approximately **5,149.87 million nuts**. Cultivation is also expanding into Odisha, Gujarat, Assam, Arunachal Pradesh and Chhattisgarh.

Coconut-Based Multi-Tier Farming

Multi-tier farming involves growing compatible fruits, vegetables, spices and plantation crops between coconut palms.

Benefits

- Provides income before palms begin yielding
- Improves land, water and sunlight utilisation
- Creates year-round employment

- Diversifies farmers' income
- Reduces dependence on a single crop

Bastar Example

- A farmer in Chhattisgarh planted around **2,500 coconut palms** and integrated them with pineapple, dragon fruit, mango, citrus, banana, coffee and vegetables. The farm generated about **₹5–6 lakh annually from coconut** and nearly **₹10 lakh from intercrops**, showing the potential of coconut-based diversified farming.

Growth of Coconut Exports

- India's coconut exports increased from only **₹25.3 crore in 2001–02** to **₹7,038.35 crore in 2025–26**.
- During 2021–22 to 2025–26, export turnover rose from **₹3,236.83 crore to ₹7,038.35 crore**.

Major Export Products

- Activated carbon
- Coconut oil and virgin coconut oil
- Coconut milk and water
- Fresh, frozen and grated coconut
- Copra
- Desiccated coconut

- **Activated carbon** accounts for the largest export volume.
- The market has expanded from the Middle East to Europe, the Americas and Australia. Major partners include the USA, UAE, Sri Lanka, Germany, Russia, Turkey, Belgium, the UK and the Netherlands.

Coconut Development Board

- The **Coconut Development Board (CDB)** was established on **12 January 1981**. It functions under the **Ministry of Agriculture and Farmers Welfare** and is headquartered in **Kochi**.
- It works across **22 States and Union Territories** and received **₹147.21 crore in 2025–26**.

Major Functions

- Production of quality seedlings
- Expansion of coconut cultivation
- Productivity improvement
- Pest and disease management
- Replanting and rejuvenation
- Processing and product diversification
- Skill and enterprise development
- Market and export promotion
- Recommendations on MSP and trade policies

The CDB is the **Export Promotion Council for coconut products other than husk and fibre products**.

Minimum Support Price for Copra

Copra is the dried kernel of a mature coconut.

Milling Copra	Ball Copra
Kernel is removed and dried	Whole coconut is dried with kernel inside the shell
Mainly used for oil extraction	Used as edible dry fruit and for religious purposes

NAFED and **NCCF** are the Central Nodal Agencies for copra procurement under the **Price Support Scheme**.

MSP for the 2026 Season

Type	MSP	Increase over 2025
Milling copra	**₹12,027 per quintal**	₹445
Ball copra	**₹12,500 per quintal**	₹400

Coconut

- **Coconut is a major tropical plantation crop grown mainly in coastal and humid regions.**

About Coconut

- **Scientific name:** *Cocos nucifera*
- **Family:** Arecaceae
- It is a large palm mainly found in **subtropical coastal regions**.
- Probable origin: **Southeast Asia**.
- It spread across the Pacific through migrating **Indonesians and Polynesians**.

Global Distribution

Coconut is widely grown in:

- India, Philippines, Sri Lanka, Thailand, Indonesia, Oceania region

Distribution in India

Major coconut-growing States include:

- **Kerala ,Tamil Nadu ,Karnataka ,Andhra Pradesh ,Odisha ,Goa ,West Bengal**

Uses

Coconut is used as:

- Whole fruit, Coconut milk, Kernel / flesh, Husk, Mesocarp fibre, Coir-based products

Climatic Conditions

Factor	Requirement
Rainfall	1000–3000 mm annually
Temperature	Around 27°C
Light	Requires maximum sunlight
Humidity	Warm and humid climate
Altitude	Usually up to 600 m; can grow up to 800 m if temperature is favourable
Soil	Coastal sandy, sandy loam and laterite soils

Major Government Initiatives

1. Quality Planting Material

The programme supports seed farms, seed gardens, nurseries, accreditation and certification.

Demonstration-cum-Seed Production Farms

- ₹30 lakh for establishing a farm during the first two years
- Up to ₹1 lakh per hectare annually from the third year until yield stabilisation
- **2.41 lakh seedlings** produced through 11 farms in 2025–26

Other achievements included:

- Twelve new nurseries with a capacity of **1.06 lakh seedlings**
- Maintenance support to six nurseries
- **₹239.35 lakh** for public-sector nurseries
- Production of **11.97 lakh planting materials**, sufficient for about **6,850–7,500 hectares**

2. Expansion of Cultivated Area

Assistance of **₹56,000 per hectare** is released in two annual instalments.

- Maximum: Two hectares per beneficiary
- Minimum: 0.08 hectare or 20 cents

In 2024–25, **2,979 hectares** were added, benefiting **13,068 farmers**. In 2025–26, ₹632.77 lakh supported new plantations in Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Odisha, West Bengal, Gujarat, Assam and Arunachal Pradesh.

3. Productivity Improvement Through Coconut-Based Cropping System

PICCS is implemented through State departments and the CDB on a cluster basis.

Assistance

- 100% of eligible cost
- ₹42,000 per hectare
- Maximum two hectares per beneficiary
- Released in two annual instalments

Performance in 2025–26

- **18,800 hectares** covered
- **48,696 farmers** benefited
- **266 clusters** formed
- ₹3,943 lakh provided
- State convergence covered another 5,935 hectares

The broader programme also supports farm ponds,

community tanks, organic farming, mechanisation and post-harvest equipment.

4. Replanting and Rejuvenation

The programme replaces disease-affected, old and unproductive palms and improves the remaining gardens.

- Assistance: Up to **₹54,000 per hectare over two years**
- Coverage during the previous five years: **25,517 hectares**
- Expenditure: **₹130.46 crore**

Technology, Processing and Marketing

Technology Mission on Coconut

The **Technology Mission on Coconut** supports:

- Pest and disease-management technologies
- Processing technologies
- Product diversification
- Commercial adoption of innovations

The CDB also provides quality testing, incubation, training and consultancy services.

Market Development

Up to 2025–26, the Board registered **8,299 exporters**, increasing to around **8,700 by 31 July 2026**.

During the previous five years, it facilitated:

- 72 entrepreneurs in 20 domestic trade fairs
- 224 exporters in international trade fairs
- 392 domestic buyer-seller meetings for 215 entrepreneurs
- Brand promotion for nine units
- Establishment of 15 retail kiosks

Procurement and primary processing centres help FPOs and cooperatives aggregate produce, reduce intermediaries and process milling copra, ball copra and tender coconuts.

Skill Development and Enterprise Creation

Friends of Coconut Tree

- The programme trains unemployed youth in mechanical palm climbing, plant protection and entrepreneurship. It trained **378 climbers in 2024–25**.

Cocomitra

- It organises trained climbers into registered units of **6–10 members** and provides climbing devices, tools and mobility support.

Kera Kaushal Kendra

- It creates registered **15-member handicraft groups** producing items from coconut shell, wood and fibre. Each approved centre is eligible for **₹2.67 lakh from 2026–27**.

Neera Technician Training

- **Neera** is the fresh, unfermented and zero-alcohol sap collected from coconut inflorescences. seven-day programme trains workers in scientific tapping and processing through licensed FPOs.

Kera Suraksha Insurance Scheme

- It provides accident insurance to coconut climbers, Neera technicians, hybridisation workers and coconut labourers.

Coconut Promotion Scheme

Announced in the Union Budget 2026–27, the scheme addresses **root wilt disease, pest outbreaks and aging plantations**.

Key Components

- Large-scale production of quality seedlings
- Expansion into suitable areas
- Phased replanting and rejuvenation
- Holistic crop-health management
- Integrated processing units
- Value addition and export promotion

The scheme is part of a broader **₹350 crore allocation for high-value agriculture**, including coconut, cashew and cocoa. It aims to improve farmers' incomes and position India as a global leader in coconut and coir exports by the 2030s.

Significance

- Secures the livelihoods of small and marginal farmers.
- Generates employment in harvesting, processing and handicrafts.
- Promotes crop and income diversification.
- Expands exports of high-value products.
- Encourages rural enterprises and FPOs.
- Enables complete use of shells, husks, wood and fibre.

Challenges

- Aging and unproductive plantations
- Root wilt and pest outbreaks
- Droughts, cyclones and water stress
- Small and fragmented holdings
- Shortage of trained climbers
- Limited farm-level processing
- Price fluctuations
- Weak market access
- Strict export quality requirements

Way Forward

- Replace senile palms with high-yielding, climate-resilient varieties.
- Strengthen pest surveillance and crop-health services.
- Expand multi-tier farming and micro-irrigation.
- Develop processing clusters near production centres.
- Increase mechanical harvesting services.
- Strengthen FPO-led aggregation and marketing.
- Improve testing, traceability, packaging and certification.
- Promote complete utilisation of coconut by-products.

Conclusion

India's coconut sector is moving from traditional cultivation to a diversified and export-oriented value chain. Higher productivity, plantation rejuvenation, value addition and organised marketing will be essential to make coconut farming more resilient, remunerative and globally competitive.

Solar Irrigation and Groundwater: Designing PM-KUSUM 2.0 for Sustainable Agriculture

Source: The Hindu

Relevance: **GS Paper III: Agriculture, groundwater, renewable energy, farm subsidies and climate change**

Important Keywords

Prelims:

- PM-KUSUM, solar irrigation, grid-connected pumps, solarised agricultural feeders, feed-in tariff

Mains:

- Water–energy–food nexus, differentiated regional approach, groundwater monitoring, micro-irrigation, climate-resilient agriculture

Why in News?

Over the past five years, **PM-KUSUM has installed more than 2.5 million solar pumps**. As the government prepares PM-KUSUM 2.0, the key challenge is to expand clean and affordable



irrigation without worsening groundwater over-exploitation.

Solar Irrigation and Groundwater

Heavily subsidised or free agricultural electricity has contributed to:

- Excessive groundwater extraction
- Falling water tables
- Depletion of aquifers
- Increasing subsidy burdens on electricity utilities

Solar pumps provide electricity at almost zero operating cost after installation. A standalone pump without any conservation incentive may therefore encourage farmers to pump more water.

However, solar irrigation does not automatically cause groundwater depletion. Its impact depends on:

- Design of the irrigation model
- Ownership structure
- Pricing incentives
- Local hydrogeology
- Cropping pattern
- Soil type
- Economic returns from additional irrigation

The correct policy question is therefore not whether solar irrigation is inherently harmful, but **which model should be deployed in a particular region and with what incentives**.

Why Outcomes Depend on the Model

1. Grid-Connected Individual Solar Pumps

- Farmers use solar electricity for irrigation and sell unused power to the grid. The ability to earn from surplus electricity gives them a reason to limit unnecessary pumping.

Gujarat's Suryashakti Kisan Yojana

- Under the **Suryashakti Kisan Yojana**, around 100 agricultural feeders were shifted to solar energy.

The programme offered a feed-in tariff of approximately **₹7 per unit**. Participating farmers:

- Recorded slower growth in energy use and irrigation than non-solar farmers
- Earned an average of about **₹21,900**

annually

- Shifted from being only energy consumers to energy producers

The model demonstrates how pricing incentives can link energy sales with groundwater conservation.

2. Fee-for-Service Centralised Model

- Under Bangladesh's common centralised model, a pump owner supplies irrigation water to several farmers within a fixed command area and earns revenue from the service.
- Solar irrigation was **20–30% cheaper than diesel irrigation**, but users did not apply more water than diesel-pump users.
- Excessive use by one farmer would reduce the operator's ability to serve others. Financial sustainability therefore encouraged efficient and equitable distribution.

3. Standalone Off-Grid Pumps

A farmer owns or operates a pump that is not connected to the electricity grid. The electricity cannot be sold, reducing the financial incentive to conserve energy.

Its groundwater impact varies with:

- Installed pump capacity
- Depth of the water table
- Whether it replaces diesel or grid electricity
- Years of operating experience
- Extent of irrigation already available

Comparison of Solar Irrigation Models

Model	Main Feature	Groundwater Incentive
Grid-connected individual pump	Surplus electricity sold to grid	Farmer earns by reducing unnecessary pumping
Solarised agricultural feeder	Entire feeder shifts to solar power	Benefits DISCOMs but requires separate water-saving incentives
Fee-for-service system	Operator sells water to several farmers	Efficient distribution expands the customer base
Standalone off-grid pump	Independent irrigation without grid access	Suitable where irrigation access and groundwater risk are low

Importance of Regional Conditions

Hard-Rock and Rainfed Regions

- Hard-rock aquifers have limited storage capacity. In rainfed areas, each additional unit of irrigation can generate high agricultural returns.
- Evidence indicates little difference in water use between solar and non-solar farmers in such regions because irrigation remains constrained by water availability and crop needs.

Punjab and Haryana

Irrigation is already widespread and dominated by water-intensive crops such as rice and wheat. There is limited scope for further expansion of irrigated area.

The priority is to make the existing water–energy–food system more sustainable by:

- Replacing subsidised fossil-fuel electricity
- Rewarding reduced pumping
- Improving irrigation efficiency
- Lowering the financial burden on power utilities

Eastern India

Large areas remain rainfed because of expensive diesel and unreliable electricity rather than severe water scarcity.

Here, solar pumps can:

- Expand reliable irrigation
- Raise agricultural productivity
- Reduce diesel dependence
- Improve climate resilience

The immediate objective in such regions should be **irrigation access**, not restricting water use.

Water–Energy–Food Nexus

Solar irrigation cannot be assessed only as an energy or groundwater intervention. It affects three connected systems.

Water

- Pump design and pricing influence the quantity of groundwater extracted.

Energy

- Solar power can replace subsidised fossil-fuel electricity and expensive diesel.

Food

- Reliable irrigation affects crop choice, productivity and farmers' capacity to respond to rainfall uncertainty.
- Policy must therefore examine combined outcomes across all three systems rather than maximise benefits in one area at the cost of another.

Environmental and Fiscal Benefits

Groundwater irrigation in India is estimated to generate **45–62 million tonnes of carbon dioxide annually**.

State agricultural electricity subsidies collectively exceed **₹1 lakh crore per year**.

Evidence from Gujarat indicates that each grid-connected solar farmer:

- Offsets approximately **12.3 tonnes of CO_2 annually**
- Uses solar power on the farm
- Exports surplus electricity
- Helps recover public investment through reduced subsidy requirements

Subsidy savings covered nearly one-fourth of government investment within the first two years. With India having more than **25 million agricultural pumps**, the potential fiscal and emission benefits are substantial.

Challenges Before PM-KUSUM 2.0

Limited Uptake of Individual Grid Connection

- The model of paying farmers for surplus electricity has not expanded sufficiently because of complex connection procedures and unattractive buyback conditions.

Weak Water Incentives in Feeder Solarisation

- Solarising an entire feeder supports clean-energy transition but does not automatically change farmers' pumping behaviour.

Uniform Policy Design

- Applying the same model across water-stressed, hard-rock and irrigation-deprived regions can produce unsuitable outcomes.

Inadequate Groundwater Monitoring

- Without timely information on aquifer conditions, emerging stress may not be identified early.

Ownership-Centred Approach

- Excessive focus on individual pump ownership can limit access for small farmers and reduce the scope for shared, efficient irrigation services.

Appropriate Model for Different Regions

Regional Condition	Preferred Approach
Water-stressed with grid access	Grid-connected pumps with surplus-power buyback
Solarised agricultural feeders	Add incentives for reduced water and energy use

Limited irrigation and poor grid access	Standalone off-grid solar pumps
Smallholder-dominated regions	Shared pumps through cooperatives or associations
Low groundwater risk	Expand affordable irrigation access
Emerging groundwater stress	Monitoring and adaptive management

Way Forward

Improve Grid-Connected Pump Model

- Simplify grid-connection procedures.
- Offer attractive buyback prices.
- Reflect the local value of water and crops in incentives.
- Motivate DISCOMs to support farmer participation.

Link Feeder Solarisation with Water Saving

Feeder-level solarisation should be combined with:

- Micro-irrigation support
- Direct payments for reduced pumping
- Incentives similar to Punjab's **Pani Bachao, Paisa Kamao**
- Crop-related measures such as Haryana's **Mera Pani Meri Virasat**

Expand Shared Irrigation Services

Standalone pumps in irrigation-deprived areas should be scaled through:

- Water-user associations
- Water-selling entrepreneurs
- Farmer cooperatives

This can widen access without requiring every small farmer to purchase a separate pump.

Adopt Adaptive Regional Planning

Deployment should be based on groundwater risk, aquifer type, crop pattern, energy access and the existing level of irrigation. Continuous monitoring should allow policies to be modified when stress begins to emerge.

Conclusion

Solar irrigation is not inherently responsible for groundwater over-extraction. Unsustainable outcomes arise when pump design, pricing and local water conditions are ignored. PM-KUSUM 2.0 should therefore move from uniform pump deployment to region-specific models that align farmers' incentives with groundwater sustainability, clean energy and reliable irrigation.

Regenerative Agriculture: Rebuilding Farming Systems for a Resilient India

Source: PIB

Relevance: UPSC: GS Paper III—Agriculture, environmental conservation, climate change and sustainable development

Important Keywords

Prelims:

- Regenerative agriculture, natural farming, green manuring, cover cropping, mulching, agroforestry, PDMC, NMNF, PKVY, RAD

Mains:

- Soil restoration, carbon sequestration, biodiversity, climate resilience, input-cost reduction and integrated farming

Why in News?

India is promoting regenerative farming through natural farming clusters, micro-irrigation,

agroforestry, Integrated Farming Systems and scientific soil management.

As of March 2026:

- natural farming clusters covered **8.80 lakh hectares** and enrolled **18.19 lakh farmers**;
- approximately **109 lakh hectares** were covered under Per Drop More Crop by May 2026; and
- **25.89 crore Soil Health Cards** had been generated since the scheme's inception.

Need for Regenerative Agriculture

India's agriculture and allied sectors recorded decadal growth of **4.45% during FY2016–FY2025**. Sustaining this progress requires restoration of the natural resources on which farming depends.

Major Concerns

- Intensive cultivation has reduced soil vitality.
- Excessive chemical use has increased dependence on external inputs.
- Declining soil health requires farmers to use more inputs for the same output.
- Erratic rainfall, heatwaves, droughts and excess rain increase crop losses.
- Small and marginal farmers face rising costs and uncertain harvests.
- Degraded land and declining water availability threaten long-term productivity.

Regenerative agriculture addresses these concerns by rebuilding soil fertility and strengthening farm resilience.

What Is Regenerative Agriculture?

Regenerative agriculture is a **holistic farming approach** that seeks to restore soil health, enhance biodiversity and improve the long-term productivity and resilience of farming systems.

Healthy soils:

- support food and nutritional production;
- store carbon;
- retain water;
- promote microorganisms; and
- sustain biodiversity.

Sustainable and Regenerative Agriculture

Sustainable agriculture	Regenerative agriculture
Seeks to maintain existing natural resources	Seeks to restore degraded natural resources
Focuses on reducing further environmental harm	Focuses on actively improving ecosystem health
Preserves current soil conditions	Rebuilds soil organic matter and fertility
Emphasises long-term continuity	Emphasises ecological renewal and resilience

Core Principles

Regenerative agriculture is based on:

- minimising soil disturbance;
- protecting living roots of perennial crops;
- maintaining continuous soil cover;
- integrating livestock;
- limiting chemical inputs; and
- enhancing biodiversity.

Major Regenerative Practices

1. Water and Resource Efficiency

Micro-irrigation

Drip, sprinkler and fogger systems deliver water more precisely to crops.

They help to:

- reduce water wastage;
- improve water-use efficiency;
- increase crop productivity; and
- strengthen resilience to drought and water stress.

Farm Mechanisation

Mechanisation enables timely and precise agricultural operations. It optimises the use of:

- water;
- fuel;
- fertilisers; and
- other farm inputs.

This reduces wastage, lowers the carbon footprint and improves resource management.

2. Soil and Nutrient Management

Nitrogen Fertiliser Management

Scientific nitrogen management involves:

- selecting the appropriate fertiliser;
- applying it at the correct time and dose;
- deep placement of supergranular urea;
- using leaf-colour charts to assess nitrogen requirements;
- using cyanobacteria as a biological input; and
- practising legume intercropping.

These measures improve nitrogen-use efficiency and reduce nitrous oxide emissions and nutrient losses.

Natural Farming

- Natural farming is a chemical-free approach based on traditional knowledge and locally prepared biological inputs.

Important inputs include:

- Beejamrut;
- Jeevamrut;
- GhanJeevamrut;
- Neemastra; and
- Dashparni.

It also promotes:

- native livestock-based inputs;
- traditional seed varieties;
- botanical pest-control formulations;
- continuous cover cropping;
- multi-cropping;
- mulching;
- minimum soil disturbance;
- trees along farm boundaries; and
- integration of crops and livestock.

These practices reduce input costs, maintain soil fertility and restore ecological balance.

Green Manuring

Green-manure crops are grown and incorporated into the soil to:

- add organic matter;
- supply nutrients;
- improve soil structure; and
- increase carbon sequestration.

Cover Cropping

Cover crops are grown mainly to protect the soil rather than for harvesting. They:

- prevent soil erosion;
- maintain organic carbon;
- retain living roots; and
- support nutrient cycling.

Mulching

Mulching covers the soil with organic residues such as leaves and straw. It:

- conserves moisture;
- regulates soil temperature;
- suppresses weeds;
- supports beneficial microorganisms; and
- improves crop productivity.

3. Integrated and Climate-Resilient Farming

Integrated Farming Systems

Integrated Farming Systems combine several farm enterprises within a single system, including:

- crops;
- livestock;
- fisheries;
- horticulture;
- agroforestry; and
- apiculture.

They promote intercropping, crop rotation, multi-cropping and mixed farming.

This approach:

- uses farm resources more efficiently;
- converts the waste of one activity into inputs for another;
- diversifies farmers' incomes;
- reduces the risk of complete crop failure;

and

- improves resilience to floods and droughts.

Agroforestry

Agroforestry integrates trees with agricultural and plantation crops.

It helps to:

- generate additional farm income;
- restore degraded land;
- improve soil moisture;
- regulate local temperatures;
- store carbon;
- reduce greenhouse-gas emissions; and
- strengthen rainfed agriculture.

Climate-Resilient Agriculture

Climate-resilient agriculture includes:

- balanced nutrient and fertiliser use;
- effective pest management;
- judicious water use;
- field-level moisture conservation; and
- soil-protective land preparation.

Its community-level innovations include:

- water-sharing groups;
- seed and fodder systems;
- community nurseries;
- collective marketing arrangements; and
- locally suitable farming technologies.

Benefits of Regenerative Agriculture

Environmental Benefits

Soil Restoration

- It improves soil organic matter, structure and long-term fertility.

Biodiversity Enhancement

- It supports pollinators, beneficial insects, soil microorganisms and other species.

Climate-change Mitigation

- Improved soils and tree-based systems absorb and store carbon, helping reduce agricultural emissions.

Water Conservation

- Healthy soils retain more water, reduce runoff and limit the movement of sediment and pollutants into rivers and lakes.

Economic and Social Benefits

Lower Input Costs

- Reduced dependence on synthetic fertilisers, pesticides and excessive irrigation lowers cultivation costs.

Improved Profitability

- Healthier soils and efficient resource use help stabilise yields and improve net farm income.

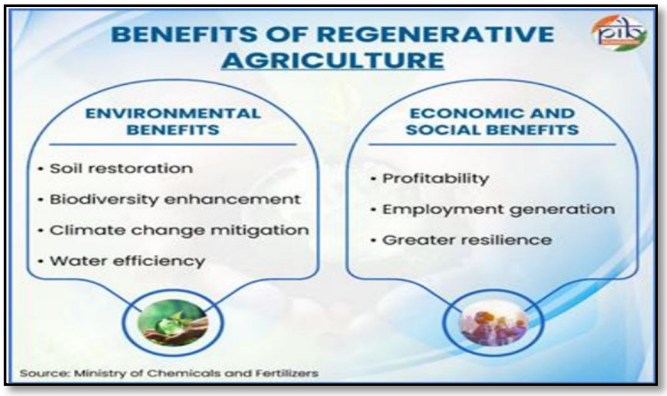
Greater Resilience

- Diversified farms can better withstand climatic variability, crop failure and market fluctuations.

Employment Generation

New opportunities can emerge in:

- farming;
- advisory services;
- bio-input production;
- technology; and
- ecological management.



Link with Sustainable Development Goals

- Regenerative agriculture supports **SDG 13—Climate Action**, particularly Target 13.1, which seeks to strengthen resilience and adaptive capacity to climate-related hazards and natural disasters.



It contributes by:

- improving farm-level adaptation;
- increasing carbon storage;
- reducing emissions;
- protecting water resources; and
- strengthening resilience to climatic shocks.

Government Initiatives

1. National Mission on Natural Farming

The **National Mission on Natural Farming (NMNF)** was launched in 2024 to help farmers progressively shift towards natural farming.

Key Features

- Output-based incentive of **₹4,000 per acre per year for two years**
- Assistance limited to one acre per farmer
- Provision for **10,000 need-based Bio-input Resource Centres**
- Formation of natural farming clusters
- Two Community Resource Persons for each cluster

The CRPs were trained through Krishi Vigyan Kendras, agricultural universities and local natural-farming institutions.

2. Paramparagat Krishi Vikas Yojana

The **Paramparagat Krishi Vikas Yojana (PKVY)** was launched in 2015 to support organic farming.

It assists farmers in:

- adopting eco-friendly practices;
- obtaining organic certification; and
- accessing markets for organic produce.

3. Per Drop More Crop

Per Drop More Crop (PDMC) has been implemented since 2015–16 to promote drip and sprinkler irrigation.

Financial Assistance

- Small and marginal farmers: **55%**

- Other farmers: **45%**
- States may provide additional subsidies from their budgets.

4. Rainfed Area Development Programme

The **Rainfed Area Development Programme (RAD)** has operated since 2014–15. It promotes Integrated Farming Systems through an area-based cluster approach.

Key Features

- Clusters of approximately 20 hectares
- Multi-cropping, crop rotation, intercropping and mixed cropping
- Integration of horticulture, livestock, fisheries and apiculture
- Assistance of **₹30,000 per family**
- Additional **₹10,000 per cluster** for training and capacity building

During 2024–25, KVKs conducted **4,416 demonstrations** and trained **96,013 farmers** in location-specific IFS models. An allocation of ₹343.86 crore was made to States and Union Territories for RAD in 2025–26.

5. Agroforestry Component under PM-RKVY

The former Sub-Mission on Agroforestry was restructured as the **Agroforestry Component under PM-RKVY from 2023–24**.

Activities Supported

- establishment of new nurseries;
- sapling production in existing nurseries;
- tissue-culture units;
- skill development;
- awareness programmes;
- research and development;
- monitoring and evaluation;
- voluntary agricultural carbon-market projects; and
- local agroforestry initiatives.

Assistance Pattern

- Government agencies: **100% assistance**
- Private beneficiaries: **50% back-ended credit-linked assistance**

Progress during 2025–26

- Sanctions: **₹78.31 crore**
- States and Union Territories covered: **27**
- New nurseries established: **135**
- Existing nurseries producing saplings: **614**
- Saplings raised: **176.59 lakh**
- Farmers benefited: approximately **25,693**

6. Soil Health Card Scheme

The **Soil Health Card Scheme**, launched in 2015, provides plot-wise soil-test reports for each landholding.

Key Features

- Assesses soil health across **12 parameters**
- Covers macronutrients, micronutrients and soil properties
- Cards are issued every two years
- Provides crop-specific recommendations on:
  - chemical fertilisers;
  - bio-fertilisers;
  - organic inputs; and
  - soil treatments.

Major Implementation Challenges

- Convincing farmers to shift from familiar input-intensive practices
- Managing initial transition risks and possible short-term uncertainty
- Ensuring access to quality biological inputs and planting material
- Providing location-specific technical guidance
- Expanding micro-irrigation in water-stressed areas
- Creating reliable certification and market access for organic produce
- Coordinating multiple schemes and implementing institutions
- Measuring soil improvement and carbon storage scientifically
- Making regenerative practices economically viable for small farmers

Way Forward

- Strengthen cluster-based implementation and farmer-to-farmer learning.
- Expand Bio-input Resource Centres near natural-farming clusters.
- Provide location-specific advice through KVKs and trained Krishi Sakhis.
- Integrate Soil Health Card recommendations with farm-level planning.
- Promote water-efficient systems according to local water availability.
- Develop assured markets and credible certification for regenerative produce.
- Encourage crop-livestock-tree integration in rainfed regions.
- Monitor soil carbon, biodiversity, water use and farmers' income.
- Support farmers during the initial transition period.
- Converge natural farming, micro-irrigation, agroforestry and IFS programmes.

Conclusion

Regenerative agriculture seeks to move Indian farming from resource depletion towards ecological restoration. By rebuilding soil health, conserving water, increasing biodiversity and diversifying farm income, it can strengthen both agricultural productivity and climate resilience. Government schemes provide an expanding support system, but successful transformation will depend on local adaptation, scientific monitoring, farmer training and remunerative markets.

UPI: Transforming India's Digital Payment Landscape

Source: The Hindu

Relevance: **UPSC: GS Paper III—Digital economy, financial inclusion and infrastructure**

Important Keywords

Prelims:

- Unified Payments Interface, NPCI, interoperability, real-time payment, two-factor authentication

Mains:

- Digital Public Infrastructure, financial inclusion, formalisation, payment sovereignty, cross-border connectivity

Why in News?

The **Unified Payments Interface (UPI)** completed ten years on August 25, 2026. Its annual transactions increased from 1.78 crore in 2016–17 to over 24,162 crore in 2025–26, while transaction value rose from ₹0.07 lakh crore to nearly ₹314 lakh crore.



What Is UPI?

UPI is an interoperable, real-time payment system developed by the **National Payments Corporation of India (NPCI)**.

It allows users to:

- access multiple bank accounts through one mobile application;
- transfer money directly between bank accounts;
- make peer-to-peer and merchant payments;
- use different participating banks and payment applications; and
- complete transactions throughout the day.

UPI brings fund transfers, merchant payments and several banking services onto a common platform.

How UPI Works

A user links a bank account to a UPI-enabled application. Transactions can then be initiated through:

- a UPI identification number;
- mobile number;
- QR code;
- bank-account details; or
- other supported payment instructions.

UPI uses **two-factor authentication** and end-to-end encryption to strengthen transaction security.

Why Is UPI Interoperable?

- Interoperability allows a customer of one bank or application to transact with a user or merchant connected to another participating bank or application.
- Thus, users are not restricted to making payments only within the same bank or payment platform.

Evolution of UPI

2016: Launch and Public Rollout

- UPI was launched on a pilot basis in April 2016 with 21 member banks.
- It was rolled out publicly in August 2016 through UPI-enabled banking applications.
- The **BHIM application** was launched in December 2016 to facilitate direct bank-to-bank payments through mobile devices.

2017: Dynamic QR

Dynamic QR codes were introduced for retail merchants.

Unlike a basic QR code, a dynamic QR can include:

- merchant details;
- transaction amount; and
- payment-specific information.

This reduces manual entry and payment errors.

2018: UPI 2.0

UPI 2.0 introduced several features:

- **Invoice in the Inbox:** Allows users to check an invoice before payment.
- **Signed Intent and QR:** Improves payment authorisation and security.
- **UPI Mandates:** Enables pre-authorised recurring payments.
- **Overdraft Linking:** Permits transactions through linked overdraft accounts.

2019: IPO Payments and Mass Adoption

- The Securities and Exchange Board of India allowed retail investors to use UPI while applying for initial public offerings through designated intermediaries.
- In October 2019, UPI crossed **one billion monthly transactions** for the first time.

2020–2022: Expansion of Access and Use Cases

UPI AutoPay

UPI AutoPay introduced recurring electronic mandates for:

- subscriptions;
- utility bills;
- insurance premiums;
- systematic investment plans; and
- loan instalments.

UPI 123PAY

UPI 123PAY brought feature-phone users into the digital-payment system through:

- interactive voice response;
- application-based payments;
- missed-call-based transactions; and
- proximity sound-based payments.

UPI Lite

UPI Lite enabled faster, low-value and PIN-less transactions.

Linking eligible credit cards with UPI expanded Credit-card Integration

the available sources of payment.

Growth Milestones

During 2021–22, UPI:

- processed transactions worth more than $1 trillion; and
- crossed five billion monthly transactions in March 2022.

Bhutan became UPI's first international deployment.

2023: Credit and Market Dominance

- **Credit Line on UPI** enabled users to link pre-sanctioned bank credit lines as a funding source.
- UPI accounted for approximately **70% of India's digital-payment transactions in 2023–24**.

Recent Innovations

UPI Circle

UPI Circle allows a primary user to authorise a secondary user to transact from the primary user's bank account within predefined limits.

Revised Transaction Limits

- The limit for tax payments was raised from ₹1 lakh to ₹5 lakh per transaction.
- Higher limits apply to selected areas such as capital markets, IPO subscriptions, loan collections, insurance, healthcare and education.
- The limit for UPI 123PAY was increased to ₹10,000 per transaction.
- The UPI Lite wallet limit was raised to ₹5,000, with a ₹1,000 per-transaction limit.

On-device Authentication

- Users can authenticate UPI transactions through smartphone fingerprints or facial recognition.

Aadhaar-based Face Authentication

Aadhaar-based face authentication simplifies UPI PIN onboarding, particularly for:

- first-time users;
- senior citizens; and
- users without easy access to payment cards.

Growth of UPI

Annual Growth

Indicator	2016–17	2025–26
Transaction volume	1.78 crore	More than 24,162 crore
Transaction value	₹0.07 lakh crore	Approximately ₹314 lakh crore

Over the decade:

- transaction volume increased almost **13,000-fold**; and
- transaction value increased more than **4,000-fold**.

UPI in July 2026

The ecosystem comprised:

- **741 live banks**;
- **2,365.8 crore transactions** during the month; and
- transaction value of **₹29.87 lakh crore**.

The growth reflects widespread adoption by individuals, merchants, banks and financial institutions.

UPI as Digital Public Infrastructure

- UPI is a major component of India's **Digital Public Infrastructure** because it provides common digital payment rails on which banks, payment applications and businesses

can offer services.

Its principal features are:

- open and interoperable architecture;
- real-time settlement;
- round-the-clock availability;
- low-cost acceptance infrastructure;
- ability to operate at a large scale; and
- support for continuous private-sector innovation.

The IMF has recognised UPI as the world's largest real-time payment system by transaction volume.

UPI's Global Footprint

- In 2024, UPI accounted for approximately **49% of global real-time payment transaction volume**.
- As of August 2026, UPI was live in **11 foreign countries** for merchant acceptance, cross-border remittances or both.

These include:

- Bhutan;
- Nepal;
- Singapore;
- United Arab Emirates;
- France;
- Sri Lanka;
- Mauritius;
- Qatar;
- Cambodia;
- Greece; and
- Maldives.

Recent International Developments

Cambodia

- In June 2026, NPCI International Payments Limited partnered with ACLEDA Bank to introduce UPI acceptance in Cambodia.

Greece

- UPI-based cross-border remittances between Greece and India became operational in June 2026 through Eurobank.

Maldives

- On July 30, 2026, cross-border remittances between the Maldives' **Favara** instant-payment system and India's UPI became operational.
- International expansion strengthens India's cross-border payment connectivity and demonstrates the exportability of its digital public infrastructure.



Significance of UPI

1. Financial Inclusion

- UPI has expanded access to digital financial services, including among rural and underserved communities. Products such as UPI 123PAY reduce dependence on smartphones.

2. Convenience for Users

- It provides instant bank-to-bank transactions without requiring users to enter lengthy banking details for every payment.

3. Support for Small Businesses

- Street vendors and small merchants can accept digital payments through QR codes without purchasing expensive card-processing equipment.

4. Ease of Doing Business

- Real-time settlement simplifies payments among customers, merchants and enterprises.

5. Formalisation of Transactions

- Digital payment records improve transaction traceability and support wider participation in the formal economy.

6. Fintech Innovation

- UPI's common infrastructure allows banks and payment companies to build diverse applications and services, increasing competition.

7. Government Payments

- The platform can support transparent and efficient payments involving government institutions and citizens.

8. Global Digital Leadership

- UPI demonstrates India's ability to build population-scale, interoperable and inclusive digital infrastructure.

Major Challenges

Cybersecurity and Fraud

Growing transaction volumes attract:

- phishing;
- impersonation;
- fraudulent payment requests;
- social engineering; and
- account-related attacks.

Technical security alone cannot prevent fraud when users are deceived into authorising transactions.

Scalability and Reliability

- The payment infrastructure must handle rapidly growing volumes without delays, outages or failed transactions.

Connectivity Divide

- Core UPI services generally require stable telecommunications and Internet access. Connectivity limitations can restrict use in rural and remote regions.

Digital Literacy

- Users unfamiliar with digital payments may struggle to identify fraudulent links, misleading QR codes or unauthorised requests.

Grievance Redressal

- Failed or disputed transactions require timely, simple and coordinated resolution among banks, payment applications and NPCI.

International Merchant Acceptance

- Operational availability in a country does not automatically produce widespread merchant adoption. Local payment systems, regulations and consumer habits may limit expansion.

Sustainability of the Ecosystem

- Banks, payment companies and service providers need a sustainable operating model while maintaining affordability and broad access.

Data Protection

- The scale of payment data requires strong safeguards against unauthorised access, profiling and misuse.

Way Forward

- Strengthen real-time fraud detection and inter-bank threat intelligence.
- Conduct continuous user-awareness campaigns in regional languages.
- Expand UPI 123PAY and low-connectivity payment options.
- Build redundancy to prevent outages at high transaction volumes.
- Improve time-bound grievance redressal and customer compensation.
- Use device-based and Aadhaar-enabled authentication responsibly.
- Strengthen data protection, privacy and cybersecurity audits.

- Ensure accessibility for senior citizens and persons with disabilities.
- Promote cross-border interoperability through bilateral partnerships.
- Encourage international merchant adoption and transparent currency conversion.
- Maintain competition and prevent excessive platform concentration.
- Balance consumer affordability with the financial sustainability of service providers.

Conclusion

In ten years, UPI has evolved from a pilot involving 21 banks into the backbone of India's digital-payment ecosystem. Its interoperability, real-time operation and continuous innovation have promoted financial inclusion, merchant digitisation and fintech development. The next phase must prioritise cybersecurity, reliability, accessibility, consumer protection and sustainable global expansion.

MMDR Amendment Act, 2026: Towards a Uniform Mineral Taxation Framework

Source: PIB

Relevance: GS Paper III: Mineral resources, critical minerals, energy security, infrastructure and industrial development

Important Keywords

Prelims:

- MMDR Act, 1957 | MMDR Amendment Act, 2026 | Section 9D | Section 13 | Mineral Rights | Mineral-Bearing Land | Royalty | Auction Premium | Dead Rent | District Mineral Foundation (DMF) | PMKKKY | National Critical Mineral Mission | NMEDT | KABIL | Unified Mining Portal | Minor Minerals

Mains:

- Uniform Mineral Taxation | Fiscal Predictability | Fiscal Federalism | Cooperative Federalism | Integrated National Mineral Market | Critical-Mineral Security | Resource Federalism | Sustainable Mining | Domestic Value Addition | Mining-Affected Communities | Environmental Externalities | Mineral Self-Reliance

Why in News?

The **Mines and Minerals (Development and Regulation) Amendment Act, 2026** has amended the MMDR Act, 1957 to establish a more uniform and predictable fiscal framework for mining.Under the amendment, State governments cannot impose fresh taxes, cesses or other levies on mineral rights and mineral-bearing land except according to the conditions or restrictions prescribed by the Central Government.

Regulation of Mining in India

Mining in India is primarily regulated by the **Mines and Minerals (Development and Regulation) Act, 1957**.

The Act provides the legal framework for:

- granting mineral concessions;
- regulating mining leases;
- collection of royalty;
- mineral exploration;
- auction of mineral blocks; and
- conservation and development of minerals.

The 2026 amendment mainly addresses the growing differences in taxes and charges imposed by States on mineral extraction and mineral-bearing

land.

Why Are Minerals Strategically Important?

Minerals form the basic inputs for:

- steel and cement;
- electricity generation;
- transport and construction;
- electronics and telecommunications;
- defence manufacturing;
- renewable-energy systems; and
- housing and public infrastructure.

Therefore, the availability and cost of minerals influence industrial competitiveness, national security, employment and household expenditure.

Why Was the Amendment Needed?

1. Multiplicity of Levies

Mining operations are subject to several taxes, charges and statutory payments, including:

  - royalty;
  - auction premium;
  - dead rent;
  - District Mineral Foundation contributions;
  - Goods and Services Tax;
  - transit fees; and
  - State-level taxes on mineral-bearing land.
- Around 14 different taxes, charges and fees may apply to mining activities. In some cases, additional State levies on mineral-bearing land have reportedly reached 20%.
- The cumulative burden can make domestic mining commercially unviable.

2. Variation across States

- Minerals are concentrated in a limited number of States, but their output supports industries throughout the country.
- Different State-level taxes result in different prices for the same mineral. This disrupts supply chains, increases logistics costs and fragments the national mineral market.

3. Critical and Strategic Mineral Security

High levies can make the extraction of critical and atomic minerals, including graphite and uranium, uneconomical.

These minerals are important for:

- clean-energy technologies;
- electronics;
- strategic industries;
- nuclear energy; and
- defence production.

A stable tax framework is therefore connected with economic and national security.

4. Import Dependence

- India imported minerals worth approximately **₹10.12 lakh crore in 2025–26**. If domestically produced minerals become more expensive than imports, industries such as steel may prefer foreign raw materials.
- At the same time, high domestic costs can reduce export competitiveness. For example, iron ore exports earned approximately **₹15,136 crore in 2025–26**.

5. Impact on Consumers

Mining-stage taxes become part of the final price of minerals. These costs are transmitted through:

- steel;
- cement;
- electricity;
- transport;
- construction; and
- housing.

Thus, excessive mineral taxation may ultimately increase expenditure for ordinary households.

6. Employment Concerns

Mining supports a large workforce, especially in

mineral-rich and tribal regions.

- Coal mining supports more than **5 lakh direct and indirect jobs**.
- The non-coal mineral sector supports more than **one crore workers**.

Small and medium miners are particularly vulnerable because they operate with limited financial margins.

7. Need for Long-Term Investment

- Mining projects require large investments in exploration, machinery, processing, transport and environmental management. Sudden or unpredictable levies can discourage such investments and delay the opening of new mines.

Major Provisions of the MMDR Amendment Act, 2026

New Section 9D: Restrictions on State Levies

The amendment inserts **Section 9D** into the MMDR Act.

It provides that a State government cannot impose any tax, cess or other levy on:

- mineral rights; or
- mineral-bearing land.

The restriction applies regardless of whether the levy is calculated according to:

- mineral quantity;
- mineral value;
- royalty; or
- any other basis.

States may impose such levies only according to the conditions or restrictions prescribed by the Central Government.

Treatment of Earlier Levies

The amendment makes a distinction between unpaid demands and amounts already collected.

- A levy that had not been paid or collected before the commencement of the amendment will be treated as invalid.
- Money already deposited or recovered before commencement will not be refunded.

This limits pending retrospective liabilities while protecting completed collections.

Amendment to Section 13

- Section 13 has been amended to empower the Central Government to frame rules prescribing the conditions under which States may impose levies on mineral rights or mineral-bearing land.

Fiscal Framework: Before and After the Amendment

Earlier position	Position after the amendment
State-level mineral taxation could vary widely	A Centre-directed framework will operate under Section 9D
Fresh levies could arise after mining operations began	New levies require compliance with centrally prescribed conditions
Unpaid retrospective demands could remain pending	Unpaid or uncollected past levies become invalid
Miners faced different fiscal burdens across States	The amendment seeks greater uniformity and predictability
Small miners were more vulnerable to additional levies	A common framework may reduce unequal fiscal pressure

Will the Amendment Reduce State Revenue?

- The amendment restricts fresh State levies on mineral rights and mineral-bearing land. However, it does not remove the established revenue streams available to mineral-producing States.

Major Revenue Sources Continue

States will continue to receive revenue through:

- royalty;
- auction premium;
- dead rent;
- District Mineral Foundation contributions;
- other permissible mining payments; and
- revenue from minor minerals.

Nearly **90% of mining-sector revenue** presently accrues to State governments.

Growth in State Revenue

- Since 2014, revenue accruing to States from mineral production has reportedly increased by **354%**. States have received more than **₹7 lakh crore**, including revenue from coal.
- Their mineral revenue reached approximately **₹1.14 lakh crore in 2025–26**.

Over the same period, the States' share in coal revenue increased substantially, while the Centre's share declined.

Auction Premium

The auction system introduced in 2015 created an additional revenue stream for States.

Since its introduction:

- approximately **₹2.32 lakh crore** has been collected as royalty from 1,200 operating mines; and
- about **₹96,000 crore** has been collected as auction premium from 100 auctioned mines.

Odisha alone earned around **₹87,000 crore** as auction premium from operationalised blocks between 2020–21 and 2025–26.

Minor Minerals Remain under State Control

The amendment does not alter State control over nearly 50 minor minerals, including:

- sand, gravel, clay, silica, granite; , marble, gypsum; and laterite.

State governments will continue to regulate and earn revenue from this category.

Mineral-Sector Reforms since 2014

1. Competitive E-Auction

- The 2015 amendment ended the discretionary allocation of major mineral concessions and introduced competitive auctions.

Since then:

- 723 major mineral blocks have been auctioned across 17 States;
- Rajasthan has auctioned 140 blocks;
- Madhya Pradesh has auctioned 127 blocks; and
- Odisha has auctioned 76 blocks.

In 2025–26, a record **212 blocks were auctioned** and **36 became operational**. In the coal sector, 141 mines have been auctioned and 23 operationalised.

2. Growth in Mineral Production

In 2025–26:

- the value of major mineral production rose by 26.8%;
- iron ore output reached 313 million tonnes;
- limestone production reached 484 million tonnes; and
- coal production remained above one billion tonnes.

Non-coal mineral production has nearly tripled since 2014.

India's global position includes:

- second in limestone;
- third in zinc;
- fourth in iron ore; and
- fifth in bauxite.

3. National Critical Mineral Mission

- The **National Critical Mineral Mission** was approved in January 2025 with an outlay of **₹16,300 crore** up to 2030–31, including ₹2,600 crore of budgetary support.

- The Geological Survey of India and the National Mineral Exploration and Development Trust are working towards 1,200 critical-mineral exploration projects.
- Of the 777 projects sanctioned by the NMEDT, 255 relate to critical minerals.

4. Overseas Mineral Sourcing

- The exploration framework now allows NMEDT support for overseas projects.
- **Khanij Bidesh India Limited** has secured exclusive rights for lithium exploration in Argentina. Such overseas partnerships seek to diversify India's mineral supply sources.

5. Recycling and Processing

- A **₹1,500-crore critical-mineral recycling incentive scheme** was launched in October 2025.

Critical Mineral Processing Parks are being supported in:

- Andhra Pradesh;
- Gujarat;
- Odisha; and
- Maharashtra.

Customs duties have also been removed on specified critical minerals, lithium-ion battery scrap and processing machinery.

6. Research and Innovation

- Nine institutions have been designated as **Centres of Excellence** with ₹210 crore under the MAHA mission to strengthen critical-mineral research and technological capabilities.

7. Wider Exploration Ecosystem

- Exploration activity has expanded significantly, with 51 private agencies notified for such work.
- The NMEDT contribution has been raised to 3%. The framework also provides partial reimbursement of direct exploration costs, subject to prescribed limits.
- During Field Season 2025–26, the Geological Survey of India completed 457 projects, including 230 relating to critical and strategic minerals.

8. Operational Reforms

Recent reforms allow:

- a one-time extension of a mining lease area by up to 10%;
- extension of composite licence areas by up to 30%;
- wider sale of minerals from captive mines; and
- addition of critical, strategic or deep-seated minerals to existing leases without extra payment.

9. Digital Monitoring

- The **Unified Mining Portal**, developed with State governments, tracks mineral blocks from auction to operationalisation.
- Proposed coal and mineral exchanges can support transparent transactions and market-based price discovery.

Welfare of Mining-Affected Communities

District Mineral Foundations

- A total of **656 District Mineral Foundations**, including 106 in aspirational districts, have been established for communities affected by mining.
- The entire DMF collection is used for local projects, with district administrations deciding the priorities.

PMKKKY

The **Pradhan Mantri Khanij Kshetra Kalyan Yojana** guides the use of DMF funds for:

- roads;
- hospitals;
- schools;
- drinking water;
- sanitation; and

- improvement of living conditions.

The 2026 amendment does not alter DMF collections or the operation of PMKKKY.

Significance of the Amendment

1. Predictable Fiscal Environment

- A uniform framework can reduce unexpected liabilities and help companies make long-term investment decisions.

2. Integrated National Mineral Market

- Reduced variation in State levies can improve interstate movement, supply-chain efficiency and price comparability.

3. Energy and Mineral Security

- Commercially viable domestic mining can reduce excessive dependence on imported coal, critical minerals and industrial raw materials.

4. Industrial Competitiveness

- Lower input uncertainty can support steel, cement, aluminium, power, transport, defence and renewable-energy industries.

5. Support for Small Miners

- Small and medium operators may benefit from a stable framework because they are less capable of absorbing multiple or sudden taxes.

6. Employment and Regional Development

- Sustained mining operations can protect employment in mineral-rich and tribal regions, provided environmental and community safeguards are effectively implemented.

Way Forward

Cooperative Federalism

- Rules under Sections 9D and 13 should be framed after meaningful consultation with mineral-producing States.

Transparent Fiscal Formula

- Permissible levies should be based on clear principles such as mineral value, environmental cost and regional infrastructure needs.

Strengthen DMF Governance

- DMF planning should include local communities, particularly Gram Sabhas in tribal areas. Expenditure and project outcomes should be publicly disclosed.

Link Mining with Local Development

- Mineral-rich districts should receive better infrastructure, healthcare, education, skill development and livelihood diversification.

Build Complete Mineral Value Chains

- Exploration should be connected with domestic processing, recycling, research and manufacturing, particularly for critical minerals.

Periodic Review

- The effect of the amendment on State revenue, mineral prices, investment, employment and imports should be independently reviewed.

Conclusion

The MMDR Amendment Act, 2026 seeks to replace fragmented mineral taxation with a stable and uniform framework. It can improve investment, domestic production and critical-mineral security while protecting existing State revenue streams.Its long-term success will depend on balancing national market integration with fiscal federalism, environmental protection and the rights of mining-affected communities.

Environment & Ecology, DM

India's Solar Growth Enters a New Era: Policy Push for Clean Energy Transition

Source: PIB

Relevance: **UPSC GS Paper III: Renewable Energy, Energy Security, Climate Change, Infrastructure, Manufacturing**

Important Keywords

Prelims Keywords:

- PM Surya Ghar | PM-KUSUM | PM Surya Sarovar Yojana | Green Energy Corridor | International Solar Alliance

Mains Keywords:

- Clean energy transition | Energy security | Net-zero by 2070 | Domestic solar manufacturing | Grid integration and storage

Why in News?

India's solar sector has entered a new phase with the approval of the **Pradhan Mantri Surya Sarovar Yojana** on **31 July 2026**. The scheme aims to develop **5,000 MW of floating solar photovoltaic projects** with co-located energy storage systems, strengthening India's clean energy transition.

India's Solar Rise: Capacity Expansion

- India's solar capacity has expanded from around **3 GW in 2014** to **162.15 GW by 30 June 2026**. This rapid rise has made solar energy one of the strongest pillars of India's renewable energy sector.
- Solar expansion has been driven by **policy support, infrastructure creation, competitive bidding, rooftop solar adoption, agricultural solarisation and domestic manufacturing**.

Solar Capacity Composition

Segment	Installed Capacity
Large solar projects	**118.79 GW**
Grid-connected rooftop solar	**27.88 GW**
Hybrid and off-grid solar	Remaining capacity

Major solar States include **Rajasthan, Gujarat, Karnataka, Tamil Nadu, Andhra Pradesh and Maharashtra**.

India's Solar Journey: Chronology

Year	Key Development
2010	**National Solar Mission launched**
2014	Solar capacity around **3 GW**; Solar Parks Scheme launched
2015	Solar target revised to **100 GW**
2017	Solar tariff fell to **₹2.44/unit** at Bhadla
2021	**Panchamrit goals** announced at COP26
2024	**PM Surya Ghar** launched
2025	India became the **second-largest solar growth market**
2026	Solar capacity reached **162.15 GW**

Pradhan Mantri Surya Sarovar Yojana

The **Pradhan Mantri Surya Sarovar Yojana** is the latest major step in India's solar journey.

Key Features

- Approved on **31 July 2026**
- Supports **5,000 MW** of **Floating Solar Photovoltaic projects**
- Includes co-located **Energy Storage Systems**
- Minimum storage capacity: **2 hours / 10,000 MWh**
- Outlay: **₹5,070 crore**
- Implementation period: **FY 2026–27 to FY 2030–31**
- Uses **reservoirs and industrial ponds**
- All States and Union Territories are eligible

Significance

The scheme reduces pressure on scarce land, improves grid reliability and helps States manage peak power demand. It is based on the **National Institute of Solar Energy** assessment, which estimates India's floating solar potential at about **102.18 GWp**.

- It is expected to reduce nearly **10 million tonnes of CO_2 emissions annually**, generate **16,000–17,000 full-time equivalent jobs**, and promote domestic manufacturing of **floatation systems, PV cells, modules and energy storage systems**.

Major Solar Schemes and Policy Architecture

India's solar expansion is supported by five major policy pillars.

1. Vision: Panchamrit and Mission LiFE

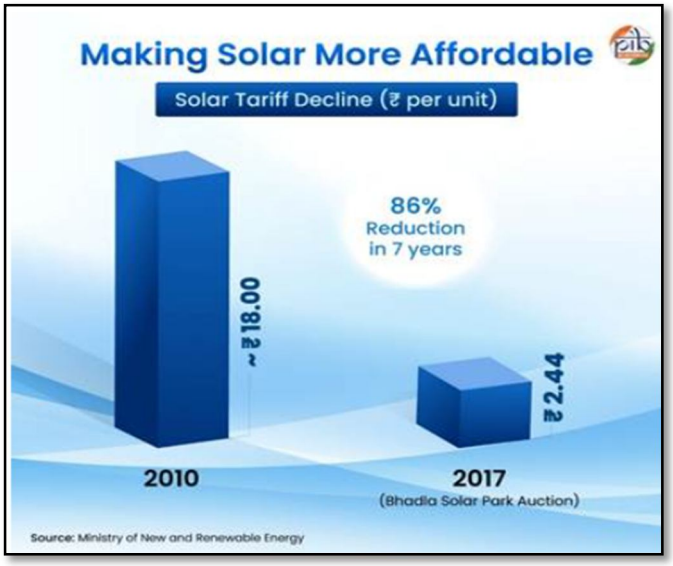
- At COP26, India announced the **Panchamrit goals**, including **500 GW non-fossil fuel capacity by 2030** and **net-zero emissions by 2070**. **Mission LiFE** promotes sustainable consumption and citizen participation in climate action.

2. Demand Creation: National Solar Mission and RPOs

- The **National Solar Mission** created long-term policy direction for solar deployment. **Renewable Purchase Obligations** require obligated entities to procure a fixed share of electricity from renewable sources. The RPO target for **2026–27 is 35.95%**.

3. Cost Reduction: Competitive Bidding

- Transparent competitive bidding and e-reverse auctions reduced solar tariffs from around **₹18/unit in 2010** to **₹2.44/unit** at Bhadla in 2017, making India one of the world's lowest-cost solar markets.



4. Infrastructure Support

- Solar parks and the **Green Energy Corridor** provide land, transmission and evacuation infrastructure for large-scale solar deployment.

5. Manufacturing Support

- The **PLI Scheme for High-Efficiency Solar PV Modules** and **ALMM** strengthen domestic manufacturing and quality assurance.

Solar Parks, Green Energy Corridor and Infrastructure Support

- The **Solar Parks Scheme** was launched in **December 2014** with an initial target of **20 GW**, later enhanced to **40 GW**.
- As of February 2026, **54 solar parks** with sanctioned capacity of **39,188 MW** have been approved.

Examples

- **Bhadla Solar Park, Rajasthan — 2,245 MW**, one of the world's largest solar complexes
- **Pavagada Solar Park, Karnataka**
- **Rewa Ultra Mega Solar Park, Madhya Pradesh**

Andhra Pradesh

- Andhra Pradesh has **5 solar parks** with sanctioned capacity of **4,200 MW**, making it an important solar State.

Green Energy Corridor

- The **Green Energy Corridor Programme** supports transmission of renewable energy from generation centres to demand centres. It has enabled evacuation of **24,567.8 MW** of renewable energy and is planned to support evacuation of around **44 GW** across ten States.

PLI, ALMM and Domestic Solar Manufacturing

Production Linked Incentive Scheme for Solar PV

The **PLI Scheme for High-Efficiency Solar PV Modules** aims to promote domestic manufacturing and reduce import dependence.

Key Facts

- Total outlay: **₹24,000 crore**
- Tranche I: **₹4,500 crore**, approved in 2021
- Tranche II: **₹19,500 crore**, approved in 2022
- Letters of Award issued for **48,337 MW** manufacturing capacity
- Incentives linked to **sales, efficiency and local content**

As of September 2025, the scheme had attracted around **₹52,900 crore investment** and generated about **44,400 jobs**.

Approved List of Models and Manufacturers

- **ALMM**, introduced in **2019**, is a quality assurance framework for solar PV modules and cells. It ensures that only approved models and manufacturers are used in eligible solar projects.
- Together, **PLI and ALMM** strengthen India's domestic solar ecosystem, reduce import dependence and improve quality confidence for developers and consumers.

Solar for Households and Farmers

PM Surya Ghar: Muft Bijli Yojana

Launched on **13 February 2024**, **PM Surya Ghar** is the world's largest domestic rooftop solar programme.

Key Features

- Outlay: **₹75,021 crore**
- Target: **one crore households**
- Up to **300 units of free electricity per month**
- Subsidy support for rooftop solar
- Collateral-free loans
- Dedicated national portal for registration, installation and subsidy disbursement

PM-KUSUM Scheme

The **Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan**, launched in **2019**, promotes solar energy use in agriculture.

Components

- **Component A:** Decentralised solar power plants on barren or fallow land
- **Component B:** Standalone solar agriculture pumps

- **Component C:** Solarisation of grid-connected agricultural pumps

Key Achievements

- Nearly **11.49 lakh off-grid solar pumps** installed
- More than **15.89 lakh agricultural pumps** covered through feeder-level solarisation
- Around **1,726 MW** decentralised solar capacity commissioned on farmers' land
- Over **21.77 lakh farmers** benefited

PM-KUSUM provides reliable daytime power, reduces diesel dependence and allows farmers to earn by selling surplus power where eligible.

Distributed Solar Growth

- India's solar transition is not limited to large solar parks. Rooftop solar and agricultural solarisation are becoming important.
- In **FY 2025–26**, distributed solar solutions contributed **16.3 GW**, or **36%** of the **44.61 GW** solar capacity added during the year.

Of this:

- **7.6 GW** came from **PM-KUSUM**
- **8.7 GW** came from **rooftop solar**

This shows that households and farmers are becoming active energy producers.

India's Global Solar Leadership

International Solar Alliance

- The **International Solar Alliance** was co-founded by **India and France at COP21 in Paris in 2015**. It promotes solar deployment, finance, technology sharing and capacity-building among member countries.

8th ISA Assembly

- The **8th Assembly of ISA** was held in **New Delhi in October 2025**. It brought together ministers and delegates from more than **125 countries** and focused on solar finance, resilient supply chains, inclusive access and technology cooperation.

One Sun One World One Grid

- The **One Sun One World One Grid** initiative was proposed by India in **2018**. It aims to create an interconnected global renewable energy grid. At COP26, India and the United Kingdom launched the **Green Grids Initiative–OSOWOG** to promote cross-border renewable energy trade.
- India also helped build consensus during its **G20 Presidency** on tripling global renewable energy capacity by 2030.

Significance of India's Solar Push

1. Energy Security

- Solar power reduces dependence on imported fossil fuels and strengthens domestic energy availability.

2. Climate Action

- Solar expansion supports India's **NDCs, Panchamrit commitments and net-zero target**.

3. Manufacturing and Jobs

- PLI, ALMM and PM Surya Sarovar promote domestic manufacturing, value addition and clean energy employment.

4. Rural Transformation

- PM-KUSUM supports farmers through reliable power, reduced diesel use and additional income opportunities.

5. Household Savings

- PM Surya Ghar reduces electricity bills and encourages rooftop solar adoption.

6. Global Leadership

- ISA and OSOWOG strengthen India's role in global clean energy diplomacy.

Challenges

1. Grid Integration

- Large solar capacity requires stronger transmission, storage and balancing systems.

2. Storage Cost
- Solar is intermittent, so affordable batteries and energy storage systems are essential.

3. Land Pressure
- Ground-mounted solar projects need large land parcels. Floating solar can help reduce this pressure.

4. Import Dependence
- India must strengthen domestic production of wafers, cells, modules and storage technologies.

5. DISCOM Readiness
- Rooftop solar and RPO implementation require strong cooperation from distribution companies.

Way Forward

1. Scale Floating Solar with Storage
- PM Surya Sarovar should be implemented effectively to reduce land pressure and improve grid reliability.

2. Strengthen Green Energy Corridors
- Transmission networks must grow in line with renewable energy capacity.

3. Deepen Domestic Manufacturing
- PLI and ALMM should be used to build a complete solar value chain.

4. Expand Rooftop Solar Access
- Subsidies, loans and digital portals must remain simple and citizen-friendly.

5. Solarise Agriculture Sustainably
- PM-KUSUM should be linked with efficient irrigation, feeder management and farmer income.

6. Promote Global Solar Cooperation
- India should use ISA and OSOWOG to expand solar finance, technology transfer and Global South cooperation.

Conclusion

India's solar growth shows how coordinated policy can transform an emerging technology into a mainstream energy source. From **solar parks and rooftop systems** to **floating solar, agricultural pumps, domestic manufacturing and global alliances**, India is building a complete solar ecosystem. The next phase must focus on **storage, grid reliability, local manufacturing and inclusive access**, making solar power central to India's clean energy transition.

Environmental Performance Index 2026: India's Low Rank and the Debate on Environmental Governance

Source: Indian Express

Relevance: **UPSC GS Paper III: Environment, Climate Change, Sustainable Development, Conservation**
Prelims: Environmental Indices, EPI, CCPI, CRI, SDGs, Paris Agreement

Important Keywords

Prelims Keywords:
- Environmental Performance Index | Yale University | CIESIN | Climate Change Performance Index | Climate Risk Index

Mains Keywords:
- Environmental governance | Sustainable development | Climate vulnerability | Decarbonisation | Ecological accountability

Why in News?

The **Environmental Performance Index 2026** was recently released. India ranked **176th out of 177 countries**, while **Estonia** topped the index. The report has again brought attention to India's

environmental performance, climate governance, sustainability indicators and the debate over global environmental rankings.

What is the Environmental Performance Index?

The **Environmental Performance Index** is a **biennial global index** that ranks countries based on their environmental performance.

It acts as a **data-driven scorecard** to assess how well countries are performing in areas such as:

- air quality
- water quality
- biodiversity
- sustainable forestry
- greenhouse gas reduction
- climate change action
- ecosystem vitality
- environmental public health

The index helps policymakers track sustainability progress, identify ecological vulnerabilities and improve environmental policy.

Institutions Behind EPI

The EPI is developed by:

- **Yale Center for Environmental Law & Policy**
- **Columbia University's Center for International Earth Science Information Network**
- **Yale Center for Geospatial Solutions**
- Supported by the **McCall MacBain Foundation**

Methodology of EPI 2026

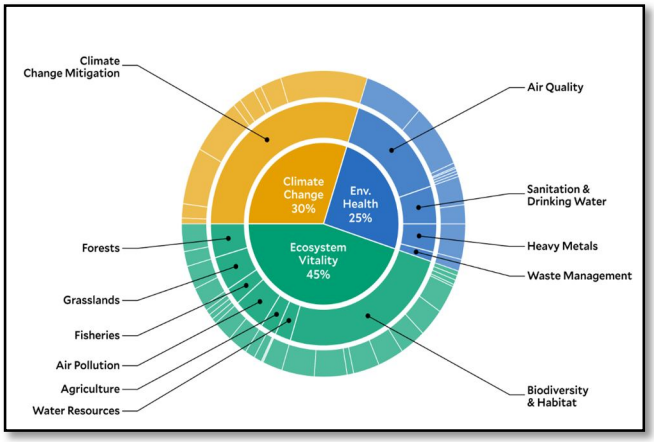
The **EPI 2026** assessed:

- **177 countries**
- **47 specific metrics**
- **12 issue categories**
- **3 broad policy objectives**

Three Policy Objectives

Policy Objective	Focus Area
Environmental Health	Air quality, water, sanitation and public health
Ecosystem Vitality	Biodiversity, forests, fisheries and natural resources
Climate Change	Greenhouse gas reduction and decarbonisation

The index is also linked to broader global goals such as the **UN Sustainable Development Goals** and the **Paris Climate Agreement**.



Global Rankings in EPI 2026

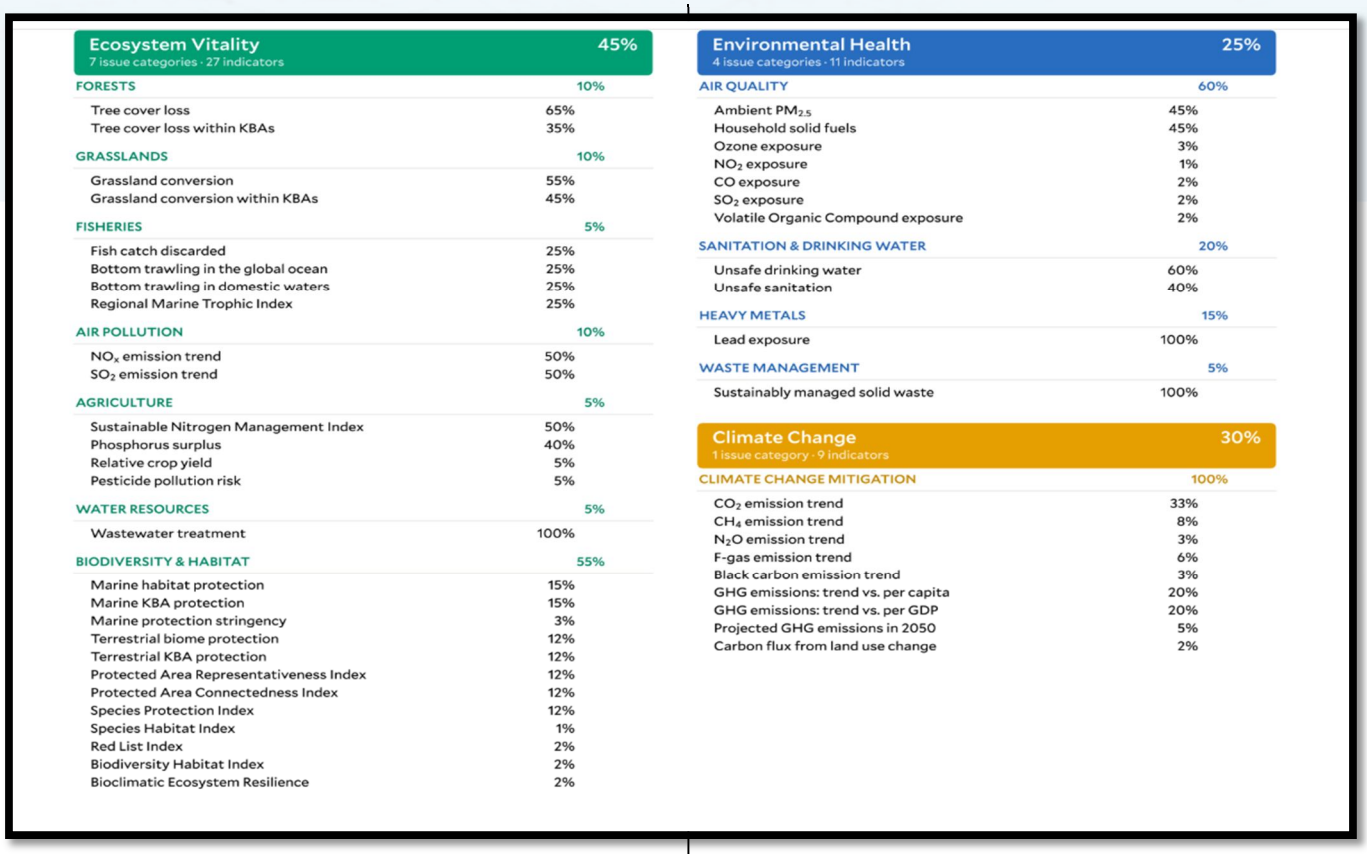
European countries dominated the top ranks.

Top 10 Countries in EPI 2026

Rank	Country
1	Estonia
2	Luxembourg
3	United Kingdom
4	Finland
5	Netherlands
6	Germany
7	France
8	Norway
9	Sweden
10	Austria

Key Global Facts

- **Estonia** ranked **1st** with a score of **74.79**.
- **Laos** ranked lowest with a score of **21.78**.



Ecosystem Vitality — 7 issue categories · 27 indicators	45%
FORESTS	**10%**
Tree cover loss	65%
Tree cover loss within KBAs	35%
GRASSLANDS	**10%**
Grassland conversion	55%
Grassland conversion within KBAs	45%
FISHERIES	**5%**
Fish catch discarded	25%
Bottom trawling in the global ocean	25%
Bottom trawling in domestic waters	25%
Regional Marine Trophic Index	25%
AIR POLLUTION	**10%**
NO_x emission trend	50%
SO_2 emission trend	50%
AGRICULTURE	**5%**
Sustainable Nitrogen Management Index	50%
Phosphorus surplus	40%
Relative crop yield	5%
Pesticide pollution risk	5%
WATER RESOURCES	**5%**
Wastewater treatment	100%
BIODIVERSITY & HABITAT	**55%**
Marine habitat protection	15%
Marine KBA protection	15%
Marine protection stringency	3%
Terrestrial biome protection	12%
Terrestrial KBA protection	12%
Protected Area Representativeness Index	12%
Protected Area Connectedness Index	12%
Species Protection Index	12%
Species Habitat Index	1%
Red List Index	2%
Biodiversity Habitat Index	2%
Bioclimatic Ecosystem Resilience	2%

Environmental Health — 4 issue categories · 11 indicators	25%
AIR QUALITY	**60%**
Ambient $PM_{2.5}$	45%
Household solid fuels	45%
Ozone exposure	3%
NO_2 exposure	1%
CO exposure	2%
SO_2 exposure	2%
Volatile Organic Compound exposure	2%
SANITATION & DRINKING WATER	**20%**
Unsafe drinking water	60%
Unsafe sanitation	40%
HEAVY METALS	**15%**
Lead exposure	100%
WASTE MANAGEMENT	**5%**
Sustainably managed solid waste	100%

Climate Change — 1 issue category · 9 indicators	30%
CLIMATE CHANGE MITIGATION	**100%**
CO_2 emission trend	33%
CH_4 emission trend	8%
N_2O emission trend	3%
F-gas emission trend	6%
Black carbon emission trend	3%
GHG emissions: trend vs. per capita	20%
GHG emissions: trend vs. per GDP	20%
Projected GHG emissions in 2050	5%
Carbon flux from land use change	2%

- Five European countries occupied the top five positions.
- EPI 2026 scores showed a strong correlation with national wealth, with a correlation value of **r = 0.69**.

This means richer countries generally perform better, though some countries outperform or underperform within their income group.

India's Performance in EPI 2026

India ranked **176th out of 177 countries**, second from the bottom.

India's Key Scores

Indicator	India's Performance
Rank	**176th / 177**
Overall EPI Score	**22.46**
Regional Average	**31.81**
Tree Cover Loss in Key Biodiversity Areas	**-3.92**

India's low rank reflects concerns related to air pollution, biodiversity pressure, climate vulnerability and sustainability challenges.

India's Objection to EPI Methodology

- India has previously questioned the methodology of the EPI.
- In **2022**, when India ranked **180th out of 180 countries**, the **Ministry of Environment, Forest and Climate Change** rejected the ranking. It argued that the index used indicators based on **unfounded assumptions**, extrapolations and unscientific methods.

Other Important Climate-Related Indices

EPI should be studied along with other climate-related indices such as:

- **Climate Change Performance Index**
- **Climate Risk Index**

These indices measure different aspects of climate and environmental performance.

Climate Change Performance Index 2026

The **Climate Change Performance Index** is an independent monitoring tool that tracks the climate mitigation performance of **63 countries and the European Union**.

It is published by:

- **Germanwatch**
- **New Climate Institute**
- **Climate Action Network International**

CCPI Assessment Categories

Category	Weightage
GHG Emissions	**40%**
Renewable Energy	**20%**
Energy Use	**20%**
Climate Policy	**20%**

CCPI 2026 Top Rankings

The top three positions remained vacant because no country achieved a "very high" rating.

Rank	Country	Score
1	Vacant	—
2	Vacant	—
3	Vacant	—
4	Denmark	80.52
5	United Kingdom	70.80
6	Morocco	70.75
7	Chile	70.63
8	Luxembourg	70.45
9	Lithuania	70.30
10	Netherlands	67.27

India in CCPI 2026

- India ranked **23rd**.
- India's score was **61.31**.
- India fell **13 places** from its earlier rank of 10th.
- **Saudi Arabia** ranked last at **67th position** with a score of **11.9**.

Climate Risk Index 2026

The **Climate Risk Index** is released by **Germanwatch**.

It measures the impact of climate-related extreme weather events on countries.

What Does CRI Measure?

The index ranks countries based on:

- fatalities
- people affected
- economic losses
- long-term exposure to climate disasters

The country most affected by climate-related disasters is ranked highest.

India in Climate Risk Index 2026

India ranked **9th** among countries most affected by climate-related disasters over the last 30 years.

India's Climate Vulnerability: 1995–2024

Indicator	India's Status
Rank	**9th most affected globally**
Extreme weather events	**430**
Economic losses	**$170 billion**
Fatalities	**80,000**
Share of global deaths	**9.6%**

Top 10 Most Affected Countries

Rank	Country
1	Dominica
2	Myanmar
3	Honduras
4	Libya
5	Haiti
6	Grenada
7	Philippines
8	Nicaragua
9	India
10	The Bahamas

Significance for India

1. Environmental Governance Alert
- India's low EPI rank highlights the need to strengthen environmental regulation, pollution control and ecological conservation.

2. Climate Vulnerability Concern
- India's CRI ranking shows that the country remains highly vulnerable to floods, cyclones, heatwaves and extreme rainfall events.

3. Development-Environment Balance
- India must pursue growth while reducing pollution, protecting forests and improving resource efficiency.

4. Global Climate Negotiations
- These indices influence global perceptions of India's environmental performance and climate commitments.

5. Policy Course Correction
- They help identify areas needing improvement, such as air quality, biodiversity protection, waste management and emissions reduction.

Concerns and Limitations

1. Methodological Disputes
- India has questioned EPI methodology, especially the use of assumptions and extrapolated indicators.

2. Wealth Bias
- EPI scores are strongly correlated with country wealth, which may disadvantage developing countries with large populations and developmental needs.

3. Different Indices, Different Outcomes
- India ranks poorly in EPI but performs relatively better in CCPI. This shows that indices measure different aspects of sustainability.

4. Data Quality Issues
- Environmental data collection and reporting vary across countries, affecting comparability.

5. Limited Reflection of Equity
- Indices may not fully capture principles such as **Common but Differentiated Responsibilities** and historical emissions.

Way Forward

1. Improve Air and Water Quality
- India must strengthen pollution control, urban planning, clean fuel transition and river conservation.

2. Protect Biodiversity and Forests
- Tree cover loss in key biodiversity areas must be reduced through stronger conservation and monitoring.

3. Accelerate Clean Energy Transition
- Renewable energy, green hydrogen, electric mobility and energy efficiency should be scaled up.

4. Improve Climate Adaptation
- India needs better disaster preparedness, climate-resilient infrastructure and early warning systems.

5. Strengthen Environmental Data Systems
- Transparent, scientific and real-time environmental data can improve both policy and global reporting.

6. Engage with Global Index Makers
- India should constructively engage with global ranking institutions to ensure fair methodology and accurate data.

7. Promote Sustainable Development
- Environmental policy must integrate livelihood security, energy access and ecological protection.

Conclusion

The **Environmental Performance Index 2026** places

India near the bottom, raising concerns about environmental quality and sustainability. However, India's performance must be understood with methodological debates, development challenges and climate equity concerns. The larger lesson is clear: India needs stronger environmental governance, credible data systems, faster clean energy transition and climate-resilient development. Global rankings should not be treated as final judgments, but as tools for policy reflection and improvement.

Roads Reimagined: India's Electric Vehicle Ecosystem and the Clean Mobility Transition

Source: PIB

Relevance: UPSC GS Paper III: Environment, Energy Security, Infrastructure, Industrial Policy, Science and Technology

Important Keywords

Prelims Keywords:

- Electric Vehicles | FAME India | PM E-DRIVE | PLI-ACC Battery | CAFE Norms

Mains Keywords:

- Clean mobility | Energy security | Low-carbon transport | Domestic manufacturing | Green industrial transition

Why in News?

India's **electric vehicle ecosystem** is expanding rapidly, with EV sales rising nearly **46 times since 2016**. According to the PIB report, EV sales increased from around **50,000 units in 2016** to about **23 lakh units in 2025**, while EV exports rose from **USD 1.2 million in 2020** to **USD 84 million in 2024**. This reflects India's growing shift towards **clean mobility, energy security and domestic EV manufacturing**.

What is an Electric Vehicle?

An **Electric Vehicle** is a vehicle powered by an **electric motor** using energy stored in a **battery**. The battery can be recharged through an external power source.

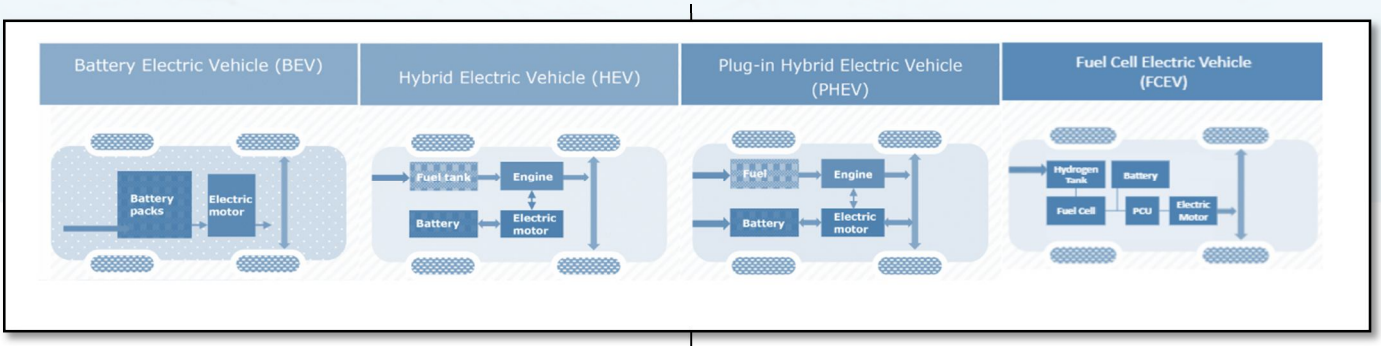
- EVs are important because they reduce dependence on fossil fuels, lower vehicular emissions and support India's transition towards a cleaner transport system.

Types of Electric Vehicles

Type of EV	Meaning
Battery Electric Vehicle	Fully electric vehicle powered only by battery
Hybrid Electric Vehicle	Uses both internal combustion engine and electric motor
Plug-in Hybrid Electric Vehicle	Hybrid vehicle with externally rechargeable battery
Fuel Cell Electric Vehicle	Produces electricity from chemical energy, usually hydrogen

India's EV Growth in the Last Decade

India's EV transition began gaining momentum after the launch of the **National Electric Mobility Mission Plan** and **FAME India Scheme** in 2015.



Key Growth Indicators

Indicator	Status
EV sales in 2016	Around **50,000 units**
EV sales in 2025	Around **23 lakh units**
Growth since 2016	Nearly **46 times**
EV adoption FY 2015–16	**0.08%**
EV adoption FY 2025–26	**8.26%**
EV exports in 2020	**USD 1.2 million**
EV exports in 2024	**USD 84 million**

This growth has been driven by policy incentives, improved vehicle availability, rising environmental awareness and increasing consumer confidence.

Why EVs are the Smart Choice

1. Lower Running Cost

- EVs reduce fuel expenses and have fewer moving parts, resulting in lower maintenance costs.

2. Eco-Friendly Mobility

- EVs have zero tailpipe emissions and a smaller carbon footprint compared to conventional vehicles.

3. Silent Ride

- EVs reduce engine noise and help lower urban noise pollution.

4. Convenient Charging

- Charging options are expanding through home charging and public charging stations.

5. Tax and Policy Benefits

- Lower registration fees, tax incentives and government schemes make EVs financially attractive.

6. Easy Driving Experience

- EVs do not require gear or clutch operation, making driving smoother and easier.



Policy Engine Behind India's EV Growth

India's EV growth has been supported by a combination of demand incentives, manufacturing incentives, battery localisation and charging infrastructure expansion.

Major Policy Interventions

- **National Mission on Manufacturing, 2025**
- **PM E-DRIVE Scheme, 2024**

- **PM e-Bus Sewa Payment Security Mechanism Scheme, 2024**
- **Scheme for Promotion of Manufacturing of Electric Passenger Cars in India, 2024**
- **PLI Scheme for Automobile and Auto Components Industry, 2021**
- **PLI Scheme for Advanced Chemistry Cell Battery Storage, 2021**

Major Government Schemes

1. National Electric Mobility Mission Plan

- The **NEMMP 2020** provided a roadmap for faster adoption and domestic manufacturing of EVs. It aimed to improve energy security and promote clean mobility.

2. FAME India Scheme

- The **FAME India Scheme** was launched in 2015 under the NEMMP framework. It supported EV adoption through buyer incentives, charging infrastructure and manufacturing support.

3. PM E-DRIVE Scheme

- The **PM Electric Drive Revolution in Innovative Vehicle Enhancement Scheme** was notified in 2024 by the Ministry of Heavy Industries.

Key Features

- Outlay of **₹10,900 crore**
- Covers e-two-wheelers, e-three-wheelers, e-trucks, e-buses and e-ambulances
- Supports domestic manufacturing through the Phased Manufacturing Programme
- Provides incentives to reduce purchase cost
- Allocates **₹4,391 crore** for e-buses
- Provides **₹2,000 crore** for public charging stations
- Allocates **₹780 crore** for modernisation of vehicle testing agencies

4. PM e-Bus Sewa Payment Security Mechanism Scheme

- This scheme supports deployment of **10,000 electric buses** through the Public Private Partnership model. It provides payment security coverage for buses for up to **12 years**.
- It aims to strengthen urban bus transport, reduce vehicular pollution and improve clean public mobility.

5. PLI Scheme for Automobile and Auto Components

- The **PLI-Auto Scheme, 2021** promotes domestic manufacturing of advanced automotive technology, including EVs.
- It requires a minimum **50% domestic value addition** and encourages investment across the automotive value chain.

6. PLI Scheme for Advanced Chemistry Cell Battery Storage

- The **PLI-ACC Battery Scheme, 2021** has an outlay of **₹18,100 crore** and aims to establish **50 GWh** of advanced battery manufacturing capacity.
- Batteries account for nearly **35–40%** of an EV's total cost. Therefore, domestic battery manufacturing is critical for reducing EV prices and improving energy security.

7. Low GST on EVs

- EVs attract a concessional **5% GST**, making them more tax-friendly compared to conventional vehicles.

Manufacturing, Startups and Exports

- India is moving from an assembly-led EV market to a broader manufacturing ecosystem.

Domestic production now covers:

- battery packs
- motors
- drivetrains
- power electronics
- wiring systems

  - charging equipment
- Major Indian manufacturers such as **Tata Motors, Mahindra, TVS and Bajaj Auto** are expanding EV capacity. Global players are also exploring manufacturing opportunities in India.
- India has around **400 EV startups**, working in areas such as charging infrastructure, battery innovation, low-cost manufacturing and data-driven mobility solutions.
- EV exports have grown from **USD 1.2 million in 2020** to **USD 84 million in 2024**, with destinations including **Nepal, Indonesia and Japan**.

EV Infrastructure and Charging Network

- Charging infrastructure is essential for wider EV adoption.As of **July 2026**, India had **52,718 public charging stations**, of which **16,561** were equipped with fast charging facilities.
- Tools such as **e-Amrit** help users locate charging stations. Industry players are also expanding fast-charging networks across cities and highways.

India Electric Mobility Index

The **India Electric Mobility Index** was launched by **NITI Aayog** in August 2025.
It tracks the progress of States and Union Territories in electric mobility across three pillars:

- transport electrification
- charging infrastructure readiness
- EV research and innovation

Regions are classified as:

- **Frontrunners**
- **Performers**
- **Aspirants**

Delhi, Maharashtra and Chandigarh emerged as frontrunners due to their stronger EV ecosystems.

India's EV and Climate Vision

India's EV policy is linked with its wider climate commitments.

Key Climate Goals

Goal	Target
EV penetration	**30% by 2030**
Emission reduction	Cut **1 billion tonnes** of projected carbon emissions by 2030
Carbon intensity	Reduce by **45% by 2030**
Net-zero target	Achieve net-zero by **2070**

Transport accounts for around **9% of India's total emissions**. Therefore, EVs are important for reducing oil dependence, improving air quality and supporting a low-carbon economy.

Challenges in India's EV Transition

1. Charging Infrastructure Gap

- Although charging stations are increasing, range anxiety remains a concern in many regions.

2. Battery Dependence

- India still depends on imports for key battery minerals and components, especially lithium, cobalt and nickel.

3. High Upfront Cost

- EVs have lower running costs, but initial purchase cost remains a barrier for many consumers.

4. Grid Readiness

- Large-scale EV charging requires reliable electricity supply and smart grid management.

5. Recycling and Battery Waste

- Battery recycling systems must be strengthened to manage end-of-life batteries

sustainably.

6. Uneven State-Level Progress

- Some States have mature EV ecosystems, while others need stronger policy support and infrastructure.

Way Forward

1. Expand Charging Infrastructure

- India must build reliable public charging networks across cities, highways and rural growth centres.

2. Localise Battery Manufacturing

- Domestic production of battery cells, components and critical minerals must be strengthened.

3. Strengthen Public Transport Electrification

- E-buses, e-rickshaws and last-mile EVs can reduce pollution and improve urban mobility.

4. Improve Affordability

- Financial incentives, low-interest loans and battery leasing models can make EVs more accessible.

5. Promote Battery Recycling

- India should scale up recycling of lithium-ion batteries and adopt circular economy principles.

6. Support EV Startups

- Startups working in charging, battery technology, software and mobility solutions should receive regulatory and financial support.

7. Improve State-Level Coordination

- States should align EV policies with land, power, transport, urban planning and industrial policy.

Conclusion

India's EV transition is no longer limited to environmental policy; it has become a major pillar of **energy security, industrial transformation and climate action**. Rising EV sales, expanding charging infrastructure, domestic manufacturing, startup innovation and policy support show that India is entering a decisive phase of clean mobility. However, the next stage will depend on battery localisation, mineral security, grid readiness, affordable financing and recycling systems. If implemented effectively, India can become not only a large EV market but also a global hub for **electric mobility manufacturing, exports and green industrial growth**.

India's Energy Journey: Expanding Capacity, Strengthening Energy Security and Building a Cleaner Future

Source: PIB

Relevance: **UPSC GS Paper III: Energy Security, Infrastructure, Renewable Energy, Environment, Climate Change, Industrial Growth**

Important Keywords

Prelims Keywords:

- Non-Fossil Capacity | PM Surya Ghar | Green Hydrogen Mission | GOBARdhan | SHANTI Act

Mains Keywords:

- Energy security | Clean energy transition | Domestic resource mobilisation | Energy access | Self-reliant energy system

Why in News?

India's energy sector is undergoing a major transformation, with total installed power capacity reaching around **552 GW in July 2026**, compared to **249 GW in 2014**. The country's **non-fossil capacity** has reached **300.50 GW**, forming more than **54% of total installed capacity**.

India now ranks **third globally in renewable energy installed capacity**, reflecting the country's focus on energy security, clean energy expansion and self-reliance.

India's Energy Landscape

India's energy strategy is based on a mixed approach: expanding renewables, strengthening domestic fossil resources, improving energy access and investing in future technologies.

Key highlights include:

- **Total installed power capacity:** around **552 GW**
- **Non-fossil capacity: 300.50 GW**
- **Solar capacity: 164.59 GW**
- **Wind capacity: 58.14 GW**
- **Hydropower capacity: 57.24 GW**
- **Bio-power capacity: 11.75 GW**
- **Nuclear capacity: 8.78 GW**
- **Coal production:** over **1,040 MT in FY2025-26**
- **LPG coverage:** increased from **55.9% in 2014** to **107.2% in 2026**

These figures show that India is not depending on one source alone. It is building a diversified energy system.

Coal and Conventional Energy Security

- Coal continues to remain important for India's energy security. It meets nearly **55% of India's primary energy needs** and supports more than **70% of electricity generation**.
- India has around **4,00,715 million tonnes of coal reserves** and is the world's **second-largest coal producer and consumer**. Coal production increased from **609.18 MT in FY2014-15** to over **1,040 MT in FY2025-26**.
- Coal imports by thermal power plants declined by about **27.4%**, from **62.5 MT in FY2024-25** to **45.4 MT in FY2025-26**. This indicates an effort to reduce import dependence.
- The government also approved a **₹37,500 crore scheme** in May 2026 to promote **surface coal/lignite gasification**. It is expected to support the national target of **100 MT coal/lignite gasification by 2030**, mobilise investments and generate employment.



Renewable Energy Expansion

1. Solar Energy

- Solar power has become the largest component of India's renewable energy capacity. Installed solar capacity reached **164.59 GW** as of **31 July 2026**, compared to **2.8 GW in 2014**.

- India also became the world's **second-largest solar growth market in 2025**, adding more than **37 GW** of solar capacity.

2. PM Surya Ghar: Muft Bijli Yojana

The scheme was launched in February 2024 with an outlay of **₹75,021 crore** for **1 crore households**.

Major outcomes include:

- **51.58 lakh households** benefiting from rooftop solar
- around **₹28,024 crore subsidy** transferred
- nearly **19 lakh households** receiving zero electricity bills
- **14.8 GW rooftop solar capacity** commissioned

The scheme links clean energy with household savings and decentralised power generation.

3. Pradhan Mantri Surya Sarovar Yojana

- The government approved **PM Surya Sarovar Yojana** on **31 July 2026** with an outlay of **₹5,070 crore**.
- It targets **5,000 MW floating solar PV projects** with energy storage systems. This adds a new dimension to solar growth by using water bodies and supporting storage-based renewable power.

4. Wind Energy

- India ranks **fourth globally** in installed wind power capacity. Wind capacity reached **58.14 GW** as of **31 July 2026**.
- India added **6.05 GW** in FY2025-26, its highest-ever annual wind capacity addition. Around **28 GW** of additional wind capacity is under implementation.
- The wind sector has also achieved **70–80% indigenisation** across key components, supporting domestic manufacturing.

About Global Wind Day

- Observed annually on 15 June.
- Promotes awareness about wind energy and its role in addressing climate change.
- India hosted the Global Wind Day 2026 Conference in Goa.
- Theme: *"Wind Energy: From Ambition to Acceleration."*
- An industry report titled "Elevating India's Wind Turbine Exports for Global Markets" was released
- **India ranks fourth globally in installed wind power capacity.**

International Cooperation

- **India–UK:** Offshore Wind Taskforce launched in February 2026 under Vision 2035.
- **India–Belgium:** Cooperation in offshore wind, research, technology and green taxonomy.
- **India–Denmark:** Cooperation agreement signed in 2019 and renewed in May 2025; focuses on offshore wind, power-system modelling and renewable-energy integration.

5. Hydropower

- Hydropower capacity, including large and small hydro, reached **57.24 GW**. It provides reliable and flexible power and supports grid stability as solar and wind expand.
- The **Small Hydro Power Development Scheme** was approved in March 2026 for FY2026-27 to FY2030-31 with an outlay of **₹2,584.60 crore**. It aims to add around **1,500 MW** of small hydro capacity, especially in hilly and North-Eastern regions.

Bioenergy, GOBARdhan and Waste-to-Energy

- Bioenergy is becoming an important part of India's circular energy economy. Bio-power capacity stood at **11.75 GW** as of **31 July**

2026.

- The **CBG/Bio-CNG ecosystem** has also expanded, with **1,929 plants registered**, **217 commissioned**, and **357 under construction** as of August 2026.
- Waste-to-energy capacity includes both grid-connected and off-grid plants. The **National Bioenergy Programme** supports waste-to-energy, biomass and biogas projects through financial assistance.

GOBARdhan Scheme

- The **Galvanizing Organic Bio-Agro Resources Dhan — National Circular Bioenergy Scheme** was approved on **6 August 2026** with an outlay of **₹23,731 crore** for FY2026-27 to FY2035-36.
- It aims to nearly **increase domestic Compressed Biogas production ten-fold** and create a circular bioeconomy by converting organic waste, cattle dung, agricultural residue and biomass into clean energy and manure.

Green Hydrogen, Nuclear and Geothermal Energy

1. National Green Hydrogen Mission

- The **National Green Hydrogen Mission** was approved in January 2023 with an outlay of **₹19,744 crore**. It targets **5 MMT of green hydrogen production by 2030**.
- By February 2026, around **8,000 tonnes per annum** of green hydrogen production capacity had been commissioned.
- In July 2026, the government launched **12 pilot projects** for **70 hydrogen-powered vehicles across 21 routes**. India's first indigenous hydrogen fuel cell-powered train began operations on the **Jind–Sonipat section** in July 2026.

2. Nuclear Energy

- India's installed nuclear capacity reached **8.78 GW** as of **31 July 2026**.
- The **Nuclear Energy Mission** aims to increase nuclear power capacity to **100 GW by 2047**. Capacity is projected to rise to **22.38 GW by 2031-32**.
- The Mission also provides **₹20,000 crore** for **Small Modular Reactors**, with a target of at least **five indigenous SMRs by 2033**.
- The **500 MWe Prototype Fast Breeder Reactor at Kalpakkam** achieved first criticality on **6 April 2026**, marking an important milestone in India's three-stage nuclear programme.

What is Nuclear Energy?

- Nuclear energy is the use of controlled atomic reactions to produce power. At its core, it relies on splitting atoms in a process called fission, which releases large amounts of heat. This heat is then used to generate electricity without producing greenhouse gases. Globally, nuclear energy is valued as a clean, dependable source that complements renewable options like solar and wind.

Evolution of India's Nuclear Laws

- India's nuclear power journey has been guided by a series of landmark legislations that ensured the peaceful use of atomic energy while safeguarding national interests. Each step reflected the country's growing confidence and maturity in managing nuclear technology responsibly.

- **The Atomic Energy Act, 1962,** replaced the earlier 1948 law and laid down the foundation for India's nuclear programme. It empowered the government to regulate atomic energy for

peaceful purposes, ensuring strict control over research, development, and use of nuclear materials.

- **Amendments in 1986, 1987, and 2015 in the Atomic Energy Act of 1962** gradually opened the sector beyond the Central Government, allowing government companies and joint ventures to participate in nuclear power generation. The amendments reflected India's intent to expand capacity while keeping strategic oversight intact.
- **The Civil Liability for Nuclear Damage Act, 2010,** introduced a no-fault liability regime, ensuring compensation in case of nuclear incidents. This law provided clarity on responsibility and built public trust by prioritizing safety and accountability in nuclear operations.

3. SHANTI Act, 2025

- The **Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India Act, 2025** enables private-sector participation in nuclear energy under licence.
- It gives statutory status to the **Atomic Energy Regulatory Board**, strengthening nuclear regulatory and safety functions.

4. Geothermal Energy

- The **National Policy on Geothermal Energy** was notified on **15 September 2025**.
- The Geological Survey of India has estimated India's geothermal potential at around **10,600 MW**, based on exploration across **381 hot springs**. The policy promotes partnerships, R&D and pilot projects to test techno-economic viability.

Fuel Access and Offshore Exploration

- India's fuel landscape has also evolved. LPG coverage increased from **55.9% in 2014** to **107.2% in 2026**, while LPG consumers rose from **14.51 crore** to **33.18 crore**.
- Under **Pradhan Mantri Ujjwala Yojana**, refill delivery reached around **49.21 crore cylinders** in FY2025-26. This shows that clean cooking has shifted from being only an access issue to a household energy-use transformation.
- India is also the world's **fourth-largest crude refiner**, with an installed refining capacity of **258.1 million tonnes per annum** across **22 operational refineries**.
- The **Samudra Manthan National Offshore Exploration Scheme** was approved on **31 July 2026** with an outlay of **₹84,084 crore** to boost offshore oil and gas exploration.



Nuclear Energy Mission

Significance of India's Energy Transition

1. Energy Security
- India is reducing import dependence by strengthening domestic coal, gas, bioenergy, renewable power and offshore exploration.

2. Clean Energy Expansion
- Solar, wind, hydro, nuclear, green hydrogen and geothermal energy support India's long-term decarbonisation pathway.

3. Household Energy Access
- Schemes such as **PM Surya Ghar** and **PMUY** connect energy policy with household welfare.

4. Domestic Manufacturing
- Wind turbine manufacturing, solar capacity growth, nuclear technology and hydrogen pilots support industrial self-reliance.

5. Grid Stability
- Hydropower, storage-based floating solar and nuclear power can support reliable electricity as variable renewable energy expands.

6. Circular Economy
- Bioenergy and GOBARdhan convert waste into energy, manure and economic value.

Challenges

India's energy transition faces multiple challenges. Coal continues to dominate electricity generation, creating pressure to balance energy security with climate goals. Renewable energy expansion needs grid modernisation, storage, land availability and transmission capacity.

- Green hydrogen and geothermal energy are still emerging and require cost reduction, technology maturity and market creation. Nuclear expansion needs safety, financing and public trust. Bioenergy depends on reliable feedstock supply and local-level implementation.
- Energy affordability also remains important because rapid transition must not create excessive cost burdens on households and industries.

Way Forward

1. Diversified Energy Strategy
- India should continue balancing coal, renewables, nuclear, bioenergy and emerging fuels to ensure reliable supply.

2. Grid and Storage Expansion
- Battery storage, pumped hydro, floating solar with storage and smart grids are essential for renewable integration.

3. Domestic Manufacturing
- Solar modules, wind turbines, electrolysers, nuclear components and energy storage systems should be produced domestically.

4. Stronger Bioenergy Ecosystem
- GOBARdhan and CBG plants need better feedstock aggregation, city gas offtake and credit support.

5. Responsible Coal Transition
- Coal use should be made cleaner through efficiency, gasification, mine reclamation and gradual diversification.

6. Innovation in Emerging Technologies
- Green hydrogen, SMRs, geothermal energy and offshore exploration require research, pilots and public-private partnership.

7. Affordable Energy Access
- Energy transition must remain people-centric by ensuring reliable, affordable and clean energy for households, farmers and industries.

Conclusion

India's energy journey reflects a careful balance between **security, sustainability and innovation**. The country is expanding renewables rapidly while strengthening domestic resources, energy access

and future technologies. Solar, wind, bioenergy, nuclear, green hydrogen, geothermal energy and offshore exploration together indicate a diversified energy strategy. The next phase must focus on grid stability, storage, affordability, domestic manufacturing and responsible transition. A resilient and self-reliant energy system will be central to India's economic growth and climate commitments.

Forest Fires in India: Himalayan Vulnerability, Monitoring Gaps and Disaster Preparedness

Source: Indian Express

Relevance: **UPSC GS Paper III: Disaster Management, Environment, Climate Change, Forest Conservation**

Important Keywords

Prelims Keywords:

- Forest Fire | Crown Fire | Forest Survey of India | MODIS | National Action Plan on Forest Fire

Mains Keywords:

- Climate resilience | Forest governance | Himalayan vulnerability | Community participation | Disaster preparedness

Why in News?

A Parliamentary Standing Committee on **Science and Technology, Environment, Forest and Climate Change** has flagged major gaps in forest fire monitoring and management in the Himalayan region.

- The committee recommended the launch of a **geostationary satellite** for round-the-clock forest fire monitoring, regional climate-fire studies, dedicated **NDRF response centres** for Himalayan forest fires, and a **National Pine-Needle Utilisation Policy**.

What are Forest Fires?

- The **National Institute of Disaster Management** defines a forest fire as an **unclosed and freely spreading fire** that consumes natural fuels such as vegetation, litter and organic matter.
- When such fires burn completely out of control, they are called **wildfires**.
- Forest fires may be natural or human-induced. While low-intensity fires may help nutrient cycling in some ecosystems, uncontrolled and high-intensity fires can cause serious ecological, economic and health damage.



Types of Forest Fires

1. Ground Fires

- These fires burn organic matter present in the soil. They usually spread slowly beneath the vegetation layer.

2. Surface Fires

- These are caused by the burning of dry leaves, branches and ground-level vegetation. They spread quickly and are commonly seen in India.

3. Crown Fires

- These fires spread from one tree top to another. They generate intense heat and large flames. Crown fires are comparatively rare in India.

National Disaster Management Authority (NDMA)

- **NDMA is the apex body for disaster management in India, headed by the Prime Minister.**

Evolution

- In **August 1999**, Government of India set up a **High-Powered Committee** on disaster management.
- After the **Gujarat earthquake**, a **National Committee** was also set up.
- The **Tenth Five-Year Plan** included a detailed chapter on Disaster Management for the first time.
- The **Twelfth Finance Commission** reviewed financial arrangements for disaster management.
- On **23 December 2005**, the **Disaster Management Act, 2005** was enacted.

About NDMA

- **Full Form:** National Disaster Management Authority.
- **Established under:** Disaster Management Act, 2005.
- **Headed by:** Prime Minister of India.
- It is the **apex body** for disaster management in India.
- It promotes a **holistic and integrated approach** to disaster management.

State and District Level Bodies

- **SDMA:** State Disaster Management Authority.
  - Headed by the **Chief Minister** of the State.
- Institutional mechanisms are also created at the **District level**.

Vision

To build a **safer and disaster-resilient India** through a holistic, pro-active, technology-driven and sustainable strategy involving all stakeholders.

Core Approach

- Prevention
- Mitigation
- Preparedness
- Capacity building
- Technology-driven disaster management
- Multi-hazard and multi-sectoral strategy
- Participation of government agencies, NGOs and people

Major Functions

- Lay down policies on **disaster management**.

- Approve the **National Plan**.
- Approve disaster management plans of Union Ministries and Departments.
- Issue guidelines for **State Disaster Management Plans**.
- Integrate disaster prevention and mitigation into development plans.
- Coordinate implementation of disaster management policies and plans.
- Recommend funds for **mitigation**.
- Support other countries affected by major disasters, as decided by the Central Government.
- Promote preparedness and capacity building.
- Frame broad policies for the **National Institute of Disaster Management**.

Significance

- Strengthens India's disaster preparedness and response system.
- Promotes a shift from **relief-centric** to **prevention and mitigation-based** disaster management.
- Encourages coordination among Centre, States, districts, NGOs and communities.
- Supports building a **disaster-resilient India**.

Forest Fire Vulnerability in India

India's total **forest and tree cover** is around **8.27 lakh sq km**, nearly **24%** of the country's geographical area.

According to the Forest Survey of India:

- about **54.40%** of forest area is vulnerable to occasional fires
- **7.49%** faces moderately frequent fires
- **2.40%** experiences high fire incidence
- around **35.71%** is largely unaffected

The forest fire season in India generally lasts from **November to June**, with higher incidents in **March, April and May** due to dry biomass, rising temperatures and summer conditions.

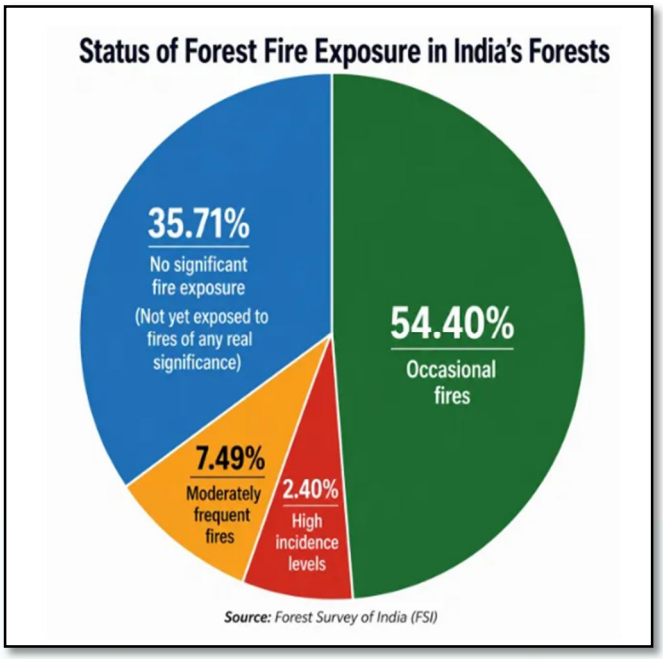
Causes of Forest Fires

Most forest fires in India are believed to be **human-induced**.

Major causes include:

- burning forests for fresh grass growth
- covering up illegal tree cutting
- poaching-related fires
- shifting cultivation practices
- Mohua leaf and tendu patta collection
- accumulation of dry pine needles
- sparks from electricity cables
- lightning
- rising temperatures and prolonged dry spells

Setting a forest on fire is a punishable offence under the **Bharatiya Nyaya Sanhita, 2023**.



Why Himalayan Forest Fires Need Special Attention

The Himalayan region is highly vulnerable because of steep slopes, dry biomass, fragile ecosystems and climate variability.

- The parliamentary committee noted that the **Western and Eastern Himalayas** together make up around **17% of India's landmass**, but account for nearly **57% of India's forest fire incidents**.

In the **Western Himalayas**, fires are driven mainly by:

- extreme pre-monsoon heat
- pine-needle fuel load
- human ignition near settlements

In the **Eastern Himalayas**, fires are linked to atmospheric dryness and cultivation-related burning practices.

Why Pine Trees are Fire-Prone

- Chir pine trees shed dry needles locally known as **Pirul**. These needles contain resin and become highly inflammable during summer. Once accumulated on the forest floor, even a small spark can trigger a large fire.

Monitoring and Management in India

Forest Survey of India

- The **Forest Survey of India** monitors forest fires and sends satellite-based alerts to State Forest Departments and registered users.
- At present, India relies on foreign polar-orbiting satellites such as **AQUA** and **Suomi-NPP**. These satellites observe India only a limited number of times in a day, creating monitoring gaps.

Role of States and Centre

- Forest fire prevention and management is primarily the responsibility of **State Forest Departments**, as forests are managed by States.
- The **Ministry of Environment, Forest and Climate Change** is the nodal ministry for disaster management related to forest fire, water pollution and hazardous substances.

Financial and institutional support is provided through:

- **Forest Fire Prevention and Management Scheme**
- **Development of Wildlife Habitats**
- **Compensatory Afforestation Fund Management and Planning Authority**

Methods Used to Prevent and Control Forest Fires

Important methods include:

- construction of watch towers
- early detection systems
- fire watchers
- water conservation structures
- local community involvement
- fire lines
- satellite-based monitoring
- GIS and remote sensing tools

Fire Lines

- **Kachha fire lines** reduce fuel load by removing undergrowth and shrubs while retaining trees.
- **Pucca fire lines** are clear-felled strips that separate forest blocks and help stop fire spread.

Parliamentary Committee Recommendations

The committee made several important recommendations for better fire management.

1. Geostationary Satellite

- India should prioritise a satellite that can provide continuous forest fire monitoring, especially in vulnerable regions.

2. Climate-Fire Study

- A region-specific study should examine the empirical link between climate change and fire frequency by analysing temperature, rainfall and dry spells.

3. NDRF Response Centres

- At least two regional **NDRF response centres** should be set up for forest fires in the Himalayan region.

4. Pine-Needle Utilisation Policy

- A **National Pine-Needle Utilisation Policy** should identify collection zones and provide fiscal and market incentives for pine needle use.

5. Better Preparedness

- The committee emphasised stronger regulation, monitoring and mitigation systems for Himalayan forest fires.

Impact of Forest Fires

1. Climate Impact

- Intense fires release carbon dioxide, carbon monoxide, methane, nitrous oxide and other gases, contributing to global warming.

2. Carbon Flipping

- Forests can shift from being carbon sinks to carbon sources when stored carbon is released through repeated fires.

3. Biodiversity Loss

- High-intensity fires destroy vegetation, wildlife habitats, flora and fauna.

4. Soil Degradation

- Burning of vegetation and organic matter reduces soil quality and increases erosion, especially on Himalayan slopes.

5. Human Health Effects

- Smoke and particulate matter cause respiratory problems, eye irritation and poor air quality.

6. Economic Losses

- Forest fires affect agriculture, tourism, infrastructure, local livelihoods and forest-based communities.

National Action Plan on Forest Fire

The **National Action Plan on Forest Fire** was prepared by the Ministry of Environment, Forest and Climate Change.

Its objectives are to:

- reduce forest fires by informing, enabling and empowering forest-fringe communities
- incentivise communities to work with State Forest Departments
- reduce vulnerability of forests to fire hazards
- improve the capacity of forest personnel and institutions
- speed up recovery after fire events

A **Central Monitoring Committee** has also been constituted to oversee the implementation of the plan.

Challenges

India faces several challenges in forest fire management. Monitoring still depends on satellites that do not provide continuous coverage. Fire response capacity is uneven across States. Many fires occur in remote and difficult terrain, especially in the Himalayas.

- Human-induced fires are hard to regulate because many offenders remain unidentified. Local communities may not always have incentives to prevent fires. Climate change is increasing dry spells and heat stress, while pine needle accumulation remains a serious fuel-load problem in Himalayan forests.

Way Forward

1. Launch Dedicated Fire-Monitoring Satellite

- A geostationary satellite can improve real-time detection and response.

2. Strengthen Himalayan Fire Response

- Dedicated NDRF centres, trained forest teams and rapid-response units should be created.

3. Use Pine Needles Productively

- Pine needles can be used for biomass, briquettes, composting and livelihood-linked enterprises.

4. Improve Community Participation

- Forest-fringe communities should be incentivised for prevention, reporting and early response.

5. Link Climate Science with Fire Planning

- Temperature, rainfall, dry spells and vegetation data should be used for fire-risk prediction.

6. Promote Controlled Fuel Management

- Removal of dry biomass, maintenance of fire lines and controlled clearing can reduce fire intensity.

7. Strengthen Legal and Institutional Accountability

- Illegal burning should be tracked and penalised, while State Forest Departments must improve preparedness.

Conclusion

Forest fires are no longer only a seasonal forest-management issue; they are a climate, disaster-management and livelihood challenge. The Himalayan region requires special attention because of high fire incidence, fragile slopes, pine-needle fuel load and growing climate stress. India needs better satellite monitoring, stronger State capacity, community participation, scientific fuel management and region-specific fire response systems. A modern forest fire strategy must combine technology, ecology and local livelihoods.

Small River Rejuvenation Framework: Restoring India's Local River Systems

Source: The Indian Express

Relevance: GS Paper II: Environmental governance and government programmes

Important Keywords

Prelims:

- Small Rivers | National Mission for Clean Ganga (NMCG) | Small River Rejuvenation Framework | Nature-Based Solutions | Geomorphological Correction | River Connectivity | Ecosystem Services | Groundwater Recharge | Environmental Flow | National Waterways Act, 2016 | Inland Waterways Authority of India | Inland Vessels Act, 2021

Mains:

- River-Basin Approach | Tributary–Main River Interdependence | Urban River Degradation | Pollution Prevention at Source | Climate-Resilient Restoration | Ecological Rejuvenation | Wetland and Floodplain Connectivity | Community-Led Governance | Scheme Convergence | Integrated Water-Resource Management



Why in News?

A draft **Small River Rejuvenation (SRR) Framework** has been unveiled under the **National Mission for Clean Ganga**. It seeks to revive small rivers through cost-effective, nature-based ecological solutions suited to local biodiversity and available natural resources.

- The framework recognises that smaller rivers face different ecological and administrative challenges from large rivers and therefore require a distinct restoration strategy.

What Are Small Rivers?

Small rivers are natural watercourses that:

- generally extend between **50 and 150 km**;
- usually flow within one or two districts; and
- may be seasonal or perennial.

Their limited geographical spread distinguishes them from large interstate river systems. However, their ecological and social importance can be substantial because they directly support local communities and often function as tributaries of larger rivers.

Why Do Small Rivers Require a Separate Strategy?

For several decades, India's river-cleaning programmes concentrated mainly on large and medium rivers. Since 2019, the policy focus has gradually expanded to include smaller rivers.

Small rivers require distinct treatment because:

- their catchments are relatively localised;
- encroachment can quickly narrow their channels;
- untreated urban sewage can dominate their flow;
- reduced natural flow affects them more severely;
- restoration requires coordination among fewer districts but several local agencies;
- their ecological conditions differ from one region to another; and
- sustaining their flow is often more difficult than their initial restoration.

A single engineering-based model cannot adequately address these local variations.

Present Condition of Small Rivers

Increasing population, rapid urbanisation, pollution and changes in land use have disrupted the natural flow of many small rivers.

Major Forms of Degradation

- Encroachment of river channels and floodplains;
- narrowing of river width;
- discharge of untreated sewage;
- dumping of garbage and sludge;
- reduced seasonal and perennial flow;
- disconnection from wetlands and local

water bodies;
- physical alteration of riverbanks; and
- conversion of rivers into urban drains.

Small rivers passing through cities are especially vulnerable because municipal and industrial waste often exceeds their natural capacity to dilute pollutants.

Examples of Degraded Small Rivers

Sahibi River
- It is a tributary of the Yamuna.
- It has suffered severe ecological degradation.
- In Delhi, it is now commonly associated with the Najafgarh drain.

Mithi River
- It begins at Vihar Lake and flows through Mumbai.
- Garbage and sludge have severely degraded it.

Musi River
- It flows through Hyderabad.
- It is a tributary of the Krishna River.
- It is also known as Muchukunda or Musunuru.
- The river has become highly polluted.

Cooum River
- It flows through Chennai.
- It was once described as the "Thames of South India".
- It has become highly polluted and toxic.

Other degraded rivers include:
- Vrishabhavathi in Bengaluru;
- Bharalu and Bahini in Guwahati;
- Varuna and Assi in Varanasi; and
- Mula and Mutha in Pune.

Significance of Small Rivers

Small rivers provide ecosystem services that can be grouped into four broad categories.

Provisioning Services

They provide:
- water for drinking;
- irrigation;
- water for livestock; and
- support for wildlife.

Regulating Services

Small rivers help regulate:
- groundwater recharge;
- the hydrological cycle;
- floodplains;
- wetlands; and
- aquatic vegetation.

Supporting Services

They contribute to:
- nutrient cycling;
- soil and sediment transportation;
- habitat formation; and
- survival of aquatic species such as fish, prawns, turtles and gharials.

Cultural Services

Rivers are closely connected with:
- religious practices;
- local traditions;
- community identity; and
- cultural landscapes.

What Is River Rejuvenation?

River rejuvenation is the process of restoring the ecological health and natural functioning of a degraded river.

It is wider than river cleaning. Removing waste or treating sewage addresses pollution, but rejuvenation also requires:
- adequate and sustained flow;
- restoration of river channels;
- protection of floodplains;
- reconnection with wetlands and water bodies;
- revival of aquatic habitats; and

- prevention of future degradation.

About the Small River Rejuvenation Framework

The draft framework has been introduced under the National Mission for Clean Ganga.

Its main objective is to restore small rivers through **nature-based and locally suitable interventions**, instead of depending only on expensive engineering and technological solutions.

Core Principles

The framework emphasises:

- ecological restoration;
- cost-effective interventions;
- use of local natural resources;
- protection of local biodiversity;
- climate resilience;
- connectivity with water bodies;
- separate approaches for urban and rural rivers; and
- maintenance of river health after restoration.

Major Areas of Intervention

1. Pollution and Climate-Related Interventions

The framework seeks to:

- reduce contamination;
- address sewage and waste inflows;
- improve water quality; and
- build resilience against climate-related changes in river flow.

2. Connectivity Restoration

A healthy river must remain connected with its wider hydrological system. The framework proposes to reconnect rivers with:

- wetlands;
- ponds;
- lakes;
- floodplains;
- tributaries; and
- other local water bodies.

Such connectivity supports natural water storage, groundwater recharge and biodiversity.

3. Geomorphological Correction

River geomorphology refers to the physical form and processes of a river, including its channel, banks, sediment and flow pattern.

Geomorphological correction may address:

- narrowed or altered channels;
- damaged riverbanks;
- disturbed sediment movement;
- physical obstructions; and
- changes caused by encroachment or construction.

The objective is to restore the river's natural physical functioning rather than merely improve its outward appearance.

Urban and Rural Rivers Require Different Approaches

The framework recognises that urban and rural small rivers face different problems.

Urban Rivers

They are more likely to experience:

- sewage discharge;
- solid-waste dumping;
- channel encroachment;
- concretisation;
- industrial pollution; and
- reduced floodplain space.

Rural Rivers

Their major concerns may include:

- reduced seasonal flow;
- catchment degradation;
- agricultural runoff;
- soil erosion;
- disconnection from ponds and wetlands; and
- excessive extraction of water.

Therefore, restoration measures must reflect the

local land use, pollution sources and ecological conditions.

How Will Rivers Be Prioritised?

Small rivers will be selected for rejuvenation according to factors such as:

- extent of reduction in water flow;
- level of pollution;
- ecological importance;
- administrative feasibility; and
- local environmental conditions.

This approach allows limited resources to be directed towards rivers where intervention is both urgent and practically achievable.

Funding and Implementation

The framework proposes to use resources available under existing government programmes, including:

- VB-G RAM G Scheme;
- Swachh Bharat Mission; and
- Namami Gange.

Convergence of programmes can provide labour, sanitation infrastructure and river-cleaning resources without creating an entirely separate implementation system.

State-Led Initiatives

Uttar Pradesh

The **One District–One River programme** seeks to revive dying and polluted rivers.

Rivers covered by rejuvenation measures include:

- Noon;
- Sakarni;
- Ghurari;
- Manorama; and
- Tamsa.

Kerala

State initiatives have focused on the ecological restoration of:

- Chithari River; and
- Kammalamkudi River.

These programmes demonstrate that small-river restoration can be planned at the State and district levels.

Community-Led Initiatives

Local communities have participated in restoring rivers and streams such as:

- Sukhnag and Sandran, tributaries of the Jhelum in Jammu and Kashmir;
- Manganga and Kayadhu in Maharashtra;
- Lilagar in Chhattisgarh; and
- Rushikulya and Daya in Odisha.

Community participation is important because local residents possess knowledge about:

- historical river channels;
- seasonal flow;
- traditional water bodies;
- sources of pollution; and
- changes in land use.

How Do Small Rivers Affect Larger Rivers?

Small rivers, tributaries and streams are integral parts of larger river basins.

When a healthy tributary joins a major river, it contributes:

- freshwater;
- nutrients;
- sediments;
- aquatic organisms; and
- ecological connectivity.

A degraded tributary may instead carry:

- untreated sewage;
- industrial pollutants;
- garbage;
- sludge; and
- excessive sediment.

Therefore, cleaning only the main river cannot ensure basin-wide improvement if its tributaries

continue to bring pollutants. Restoring small rivers complements programmes for larger rivers by addressing pollution and ecological degradation closer to their sources.

Small Rivers and Inland Water Transport

- Rivers and canals can provide an energy-efficient mode of transport. However, navigation depends on the long-term ecological health of river systems.

Comparative Energy and Cost Advantages

According to the International Labour Organization, inland water transport:

- consumes three to six times less energy than road transport; and
- consumes up to two times less energy than rail transport.

The approximate freight costs are:

Mode of transport	Cost per tonne-kilometre
Inland waterways	₹1.06
Railways	₹1.36
Roads	₹2.50

Current Position

- Inland waterways carry approximately 2% of India's freight.
- Railways carry around 18%.
- Roads carry about 71%.
- India has **111 National Waterways** across 23 States and four Union Territories.
- Only 32 National Waterways are presently operational.
- The Union Budget 2026–27 proposes to operationalise 20 additional waterways over five years.

Small-river rejuvenation is primarily ecological, but restoring the wider river network supports the sustainable development of river-based activities.

Policy Framework for Inland Waterways

Inland Waterways Authority of India

- The IWAI was constituted under Section 3 of the **Inland Waterways Authority of India Act, 1986**.
- It develops and maintains infrastructure for inland water transport.

National Waterways Act, 2016

- It declared 111 waterways as National Waterways, consisting of five existing and 106 newly declared waterways.

Inland Vessels Act, 2021

- It seeks to provide harmonised regulation of inland vessels and enable their safe and seamless movement across States.

Coastal Shipping Act, 2025

- It identifies suitable coastal shipping routes and seeks better coordination between coastal shipping and inland water transport.

National Waterways Regulations, 2025

The regulations concerning the construction of jetties and terminals seek to:

- expand cargo and passenger networks; and
- encourage private investment.

River Cruise Tourism Roadmap 2047

- Launched in 2024, it provides a framework for developing river cruise tourism. Such activities require ecologically healthy rivers for long-term sustainability.

Implementation Challenges

Maintaining River Flow

- Restoring a river once is easier than maintaining adequate water flow over time. Continued extraction, altered land use and catchment degradation can reverse improvements.

Multiple Agencies

River restoration may involve:

- municipal bodies;
- rural local bodies;

- pollution-control authorities;
- irrigation departments;
- district administrations; and
- local communities.

Weak coordination can delay implementation.

Encroachment

- Removing long-standing encroachments from channels and floodplains can be legally and socially difficult.

Sewage Management

- A river cannot remain clean unless towns and cities prevent untreated wastewater from entering it.

Uniform Solutions

- The ecological conditions of rivers vary. A single technical model may be unsuitable for all river systems.

Monitoring Difficulties

- Long-term assessment must measure river flow, water quality, biodiversity, channel condition and connectivity—not merely the quantity of waste removed.

Way Forward

Adopt a River-Basin Approach

- Small rivers should be managed as parts of larger river basins rather than as isolated water channels.

Ensure Ecological Flow

- Restoration plans must protect sufficient natural flow to sustain aquatic ecosystems and dilute pollution.

Restore Local Connectivity

- Rivers should be reconnected with ponds, wetlands, floodplains and groundwater systems.

Prevent Pollution at Source

- Urban local bodies must control sewage, industrial discharge, garbage and sludge before they enter rivers.

Reduce Surface Runoff

- Catchment treatment and nature-based measures should slow runoff, improve water infiltration and enhance groundwater recharge.

Develop Local Restoration Plans

Each river needs a plan based on:

- its biodiversity;
- flow conditions;
- land use;
- pollution sources;
- natural resources; and
- urban or rural setting.

Strengthen Community Participation

Local communities should participate in planning, implementation and monitoring to ensure that restored rivers are protected over time.

Measure Ecological Outcomes

Success should be assessed through:

- cleaner water;
- sustained flow;
- restored biodiversity;
- improved groundwater recharge;
- stable riverbanks; and
- renewed connection with local water bodies.

Conclusion

Small rivers are the connecting links of India's larger river systems. Their degradation affects local water security, groundwater, biodiversity and the ecological condition of major rivers.

The draft SRR Framework marks a shift from isolated, engineering-heavy interventions towards local, nature-based restoration. Its success will depend on sustained flow, pollution prevention, institutional coordination and active community participation.

S & T, Internal Security

Naxal-Free India: Integrated Strategy Against Left-Wing Extremism

Source: PIB

Relevance: **UPSC GS Paper III: Internal Security, Left-Wing Extremism, Security Challenges, Development and Extremism**

Important Keywords

Prelims Keywords:

- Left-Wing Extremism | National Policy and Action Plan 2015 | CoBRA | Special Central Assistance | Eklavya Model Residential Schools

Mains Keywords:

- Internal security strategy | Security-development approach | Tribal welfare | Rehabilitation of surrendered cadres | Governance in remote areas

Why in News?

India has achieved the milestone of becoming effectively free from **Left-Wing Extremism**, with no district remaining officially LWE-affected. According to the government, this was achieved through an integrated strategy combining **security operations, infrastructure expansion, rehabilitation of surrendered cadres, tribal welfare and improved governance**.

What is Left-Wing Extremism?

- **Left-Wing Extremism (LWE)** refers to armed extremist movements inspired by Maoist ideology. In India, it traces its origin to the **Naxalbari uprising of 1967** in West Bengal.
- The movement followed the idea of armed revolution and challenged the authority of the democratic state. Over time, several extremist groups merged into the **CPI (Maoist)** in 2004, making LWE one of India's major internal security challenges.
- LWE was not only a law-and-order problem. It also reflected gaps in **governance, tribal welfare, land rights, connectivity, education, livelihoods and state presence** in remote areas.

Peak of LWE Violence Before 2014

The decade from **2004 to 2014** was among the most violent phases of LWE.

Key facts include:

- Violence peaked in **2010** with **1,936 incidents**.
- The decade recorded **17,542 violent incidents**.
- **1,913 security personnel** and **5,019 civilians** lost their lives.
- Naxalism was officially described as India's biggest internal security challenge.

This period showed that scattered and state-wise responses were not enough. A national and coordinated policy became necessary.



Policy Shift: From Fragmented Response to Integrated Strategy

A major shift came with the **National Policy and Action Plan to address LWE, 2015**.

It replaced an ad hoc approach with a **whole-of-government strategy**. The policy combined:

- security operations
- development programmes
- infrastructure expansion
- rehabilitation
- tribal welfare
- better Centre-State coordination

The government adopted a three-pronged approach based on **Dialogue, Security and Coordination**.

Three Pillars of India's Anti-LWE Strategy

1. Restoring Trust in the State

- The first aim was to rebuild the faith of remote communities in the state. This was done through stronger security presence, better coordination, surrender policies and community outreach.

2. Expanding Infrastructure and Connectivity

- Roads, mobile towers, banks, schools and healthcare facilities were expanded in earlier LWE-affected regions. This helped connect isolated tribal villages with mainstream governance.

3. Delivering Welfare with Dignity

The strategy focused on tribal welfare, education, skill development, livelihood support and rehabilitation of surrendered cadres.

- The approach followed a simple chain: **security created space for development, development-built trust, and trust enabled welfare delivery**.

Security Measures and Technology Use

The government strengthened the security grid in LWE-affected areas.

Key Measures

- **663 fortified police stations** were constructed.
- **408 new CAPF security camps** were established in the past seven years.

- **68 night-landing helipads** were built for rapid deployment and evacuation.
- Security forces received **400 bullet-proof and blast-proof vehicles**.
- Special forces such as **CoBRA, CRPF, District Reserve Guard, Jharkhand Jaguar and Greyhounds** were integrated.

Technology as a Game Changer

Modern technology was used for surveillance and intelligence. This included:

- drones and UAVs
- satellite imagery
- AI-based data analysis
- location tracking
- call-log analysis
- mobile data analytics
- social media monitoring

This helped security forces improve precision and reduce the operational space of extremist groups.



Landmark Operations

The government followed a **"Trace, Target, Neutralise"** approach. Major operations included:

- **Operation Black Forest**
- **Operation Octopus**
- **Operation Double Bull**
- **Operation Thunderstorm**
- **Operation Bhimbarg**
- **Operation Chakrabandha**

These operations weakened Maoist networks, restored state presence and enabled development programmes in long-affected regions.

Choking the Support System

The strategy targeted not only armed cadres but also the financial and logistical ecosystem of LWE.

A dedicated vertical was created in the **National Investigation Agency** to disrupt Naxal financing networks.

Key actions included:

- seizure of assets by NIA
- attachment of assets by the Enforcement Directorate
- investigation and filing of charge sheets in LWE-related cases
- action against support networks and financing channels

This reduced the ability of extremist groups to sustain violence.

Surrender, Rehabilitation and Mainstreaming

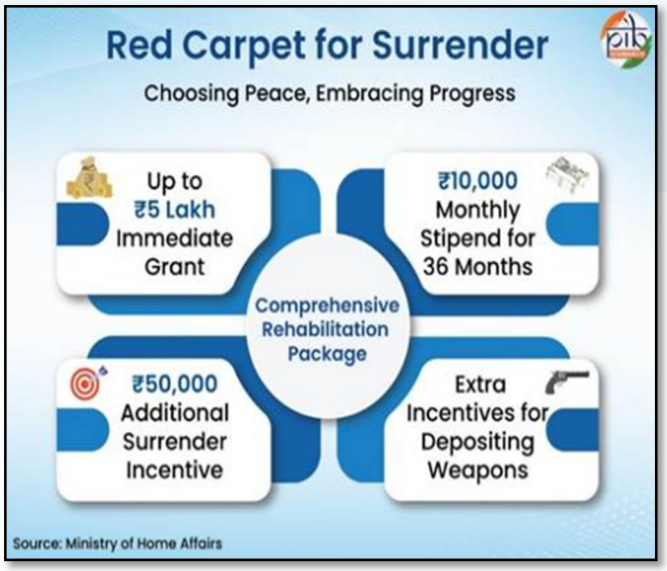
The government combined security action with rehabilitation.

Surrendering cadres receive:

- **₹5 lakh** immediate grant for higher-ranked cadres
- **₹2.5 lakh** for other cadres
- **₹10,000 monthly stipend** for 36 months
- additional incentives for surrender and depositing weapons

In **2025**, **2,337 Naxalites** surrendered. Between **2024 and March 2026**, **3,927 cadres** surrendered.

This "red carpet for surrender" approach helped bring cadres back into mainstream society and wakened extremist recruitment.



Infrastructure and Welfare Push in LWE-Affected Areas

The anti-LWE strategy was not limited to policing. It also focused on development.

Road Connectivity

- A total of **15,189 km of roads** were constructed under LWE-specific road schemes such as the **Road Requirement Plan** and the **Road Connectivity Project for LWE Affected Areas**.

Digital Connectivity

- **9,497 mobile towers** were commissioned. Around **96% of villages** in the most affected areas now have mobile connectivity.

Financial Inclusion

Between 2015 and 2026:

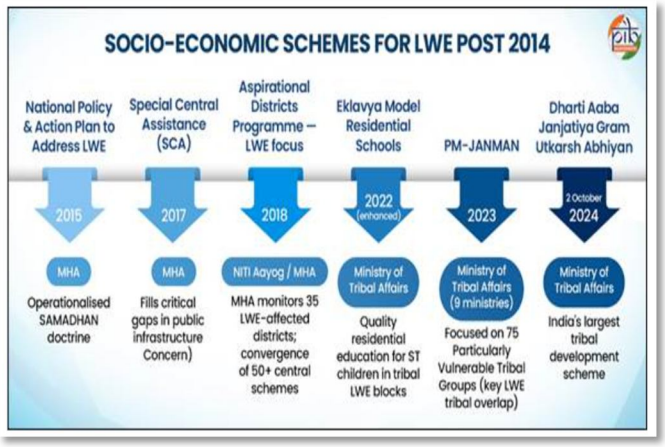
- **1,804 bank branches** were opened
- **1,321 ATMs** were installed
- **74,720 banking correspondents** were appointed
- **6,025 post offices** were established

Education and Skill Development

- The government sanctioned **259 Eklavya Model Residential Schools**, of which **179** became functional. It also developed **47 ITIs** and **49 Skill Development Centres**. Skill training was provided to more than **90,000 youth and women**.

Tribal Youth Exchange Programme

- Since 2014, **37,655 tribal youth** participated in exposure visits under the **Tribal Youth Exchange Programme**, promoting national integration and awareness.



Chhattisgarh and Bastar Region

- Bastar in Chhattisgarh was one of India's most Naxal-affected regions. Difficult terrain, weak connectivity and limited state presence allowed extremist groups to grow.
- A major turning point was the formation of the **Bastariya Battalion** in 2017. It recruited local youth, including many from Bijapur, Sukma and Dantewada. Local participation improved intelligence, trust and coordination.

Development also expanded:

- more than **3,240 km of roads** were built in the Bastar region
- **889 mobile towers** were installed
- surrendered cadres were linked with education, skills and livelihood support
- CAPF camps were converted into service

centres under the **Shaheed Veer Gunda Dhur Seva Dera** initiative

Cultural programmes such as **Bastar Pandum** and **Bastar Olympics** strengthened tribal identity and community participation.



Challenges Ahead

Even after major success, some challenges remain.

1. Consolidation of Gains

- Former LWE areas need continuous governance presence to prevent relapse.

2. Legacy Districts

- Some districts remain under legacy and thrust categories for continued monitoring and support.

3. Tribal Livelihoods

- Peace will last only if tribal communities get secure livelihoods, education and land-linked development.

4. Preventing Alienation

- Development must be participatory and respectful of local culture, forests and community rights.

5. Rehabilitation Follow-up

- Surrendered cadres need long-term skill, livelihood and social support.

Way Forward

1. Continue Security Vigilance

- Even if LWE violence has reduced, intelligence and area domination must continue in sensitive zones.

2. Deepen Governance Outreach

- Schools, health centres, banks, roads and digital services should reach all remote habitations.

3. Strengthen Tribal Welfare

- Schemes such as **EMRS, PM-JANMAN and Dharti Aaba Janjatiya Gram Utkarsh Abhiyan** must be effectively implemented.

4. Focus on Livelihoods

- Skill training, forest-based livelihoods, agriculture support and local enterprises should be expanded.

5. Ensure Community Participation

- Tribal communities should be partners in development, not passive beneficiaries.

6. Monitor Rehabilitation Outcomes

- The success of surrender policies must be measured through employment, education and social reintegration.

Conclusion

India's progress against Left-Wing Extremism shows that internal security challenges cannot be solved by force alone. The success came from a combined approach of **security, development, rehabilitation, connectivity and tribal welfare**. The major lesson is that peace becomes durable when the state is visible not only through police stations and security camps, but also through **schools, roads, banks, healthcare, livelihoods and dignity**. The next challenge is to consolidate these gains and ensure that former conflict zones become centres of inclusive development.

Critical Minerals: Foundation of India's Strategic Power and Industrial Security

Source: The Hindu

Relevance: **UPSC GS Paper III: Mobilisation of Resources, Energy Security, Sustainable Development, Industrial Policy, Strategic Technologies**

Important Keywords

Prelims Keywords:

- Critical Minerals | Rare Earth Elements | National Critical Mineral Mission | KABIL | Lithium

Mains Keywords:

- Mineral security | Clean energy transition | Strategic autonomy | Supply chain resilience | Resource geopolitics

Why in News?

Critical minerals have moved from being a resource policy issue to becoming a major question of **industrial strategy, energy security and national security**. Minerals such as **lithium, cobalt, nickel, graphite, copper and rare earth elements** are essential for electric vehicles, battery storage, renewable energy, semiconductors, defence systems and advanced manufacturing.As decarbonisation and digitalisation expand, mineral security is becoming as important as oil security was in the 20th century. India is therefore strengthening its domestic exploration, overseas acquisition, processing capacity, recycling and international partnerships.

What are Critical Minerals?

Critical minerals are **non-fuel metallic or non-metallic minerals** that are essential for modern technologies but face high supply risks.

They are called **critical** because any disruption in their supply can affect:

- clean energy transition
- electric mobility
- semiconductor manufacturing
- defence production
- renewable energy storage
- artificial intelligence and advanced electronics
- industrial competitiveness
- national security

There is no single global definition of critical minerals. Each country identifies them based on its own economic needs, supply risks and strategic priorities.

India has identified **30 critical minerals**, including **lithium, cobalt, nickel, graphite, copper and rare earth elements**.

Why Critical Minerals are Strategically Important?

1. Foundation of Clean Energy Transition

Critical minerals are central to India's clean energy goals.

- **Lithium, cobalt and nickel:** used in lithium-ion batteries
- **Copper:** used in power systems, transmission and electric vehicles
- **Graphite:** used in battery anodes
- **Rare earth elements:** used in permanent magnets for wind turbines and electric motors
- **Silicon, tellurium, indium and gallium:** used in solar photovoltaic cells



As India expands solar power, wind energy, battery storage and electric mobility, demand for these minerals will rise sharply.

2. Essential for Advanced Manufacturing

Critical minerals are inputs for:

- semiconductors
- artificial intelligence hardware
- advanced electronics
- telecommunications
- aerospace systems
- precision manufacturing

Thus, critical mineral availability directly affects India's ambitions in **Make in India, semiconductor manufacturing and advanced industrialisation**.

3. Defence and National Security Importance

Defence systems require high-purity minerals and rare earth magnets for:

- missiles
- jet engines
- radar systems
- drones
- satellites
- AI-enabled military hardware

Therefore, critical mineral dependence can create strategic vulnerability.

4. Link with Sustainable Development Goals

Critical minerals support:

- **SDG 7:** Affordable and Clean Energy
- **SDG 9:** Industry, Innovation and Infrastructure
- **SDG 13:** Climate Action

However, mineral extraction must be sustainable, as mining can affect water, biodiversity, labour rights and local communities.

Global Supply Chain Concentration

- The global supply of critical minerals is highly concentrated.
- For **copper, lithium, nickel, cobalt, graphite and rare earth elements**, the

average market share of the top three refining countries increased from around **82% in 2020** to **86% in 2024**.

- China dominates global processing. It is the leading refiner in **19 out of 20 strategic minerals**, with an average market share of about **70%**.

China's Processing Dominance

Mineral / Product	China's Approximate Processing Share
Rare earths	Over **90%**
Graphite	Over **90%**
Cobalt	Nearly **75%**
Lithium chemicals	Around **70%**

This makes critical minerals not merely commercial commodities, but tools of **geopolitical influence**.

Geopolitical Risks in Critical Minerals

1. Export Controls and Supply Weaponisation

- China's rare earth export controls announced in **2025** created concerns across energy, automotive, defence, aerospace, artificial intelligence and semiconductor sectors.
- This shows how mineral supply chains can be used as geopolitical instruments.

2. Future Supply Shortfalls

Global clean energy transitions will require minerals beyond current production levels.

- The copper project pipeline indicates a possible **30% supply shortfall by 2035**.
- Lithium may remain better supplied in the near term, but rising demand could push it into deficit by the **2030s**.
- Rare earth demand will rise with wind power, electronics and magnets.

3. Friendshoring and Strategic Alliances

Major economies are trying to reduce dependence on concentrated suppliers.

- The **European Union Critical Raw Materials Act** sets 2030 targets of:
  - **10% domestic extraction**
  - **40% processing**
  - **25% recycling**
  - not more than **65% dependence on a single country**
- The **United States** is building diversified supply chains through strategic partnerships.
- Countries are adopting **China+1** and trusted-partner strategies.

India's Critical Mineral Demand and Domestic Potential

- India's clean energy and manufacturing ambitions are highly mineral intensive.
- Under a **net zero scenario**, India's cumulative demand for critical energy transition minerals could reach around **169 million tonnes by 2070**, about **51% higher** than under a current policy pathway.

Domestic Potential

India has reserves or occurrences of several critical minerals.

Mineral	Domestic Potential / Occurrence
Cobalt	Around **44.9 million tonnes**
Copper	Around **163.9 million tonnes**
Graphite	Around **211.6 million tonnes**
Nickel	Around **189 million tonnes**
Rare Earth Elements	Monazite deposits and rare earth oxides, especially in coastal and hard-rock regions
Lithium	Discovered in parts of **Karnataka** and **Jammu & Kashmir**

India also has rare earth potential in States such as **Andhra Pradesh, Karnataka, Odisha and Kerala**, while monazite sands in Kerala are rich in rare earth elements.

Why Reserves Alone Do Not Ensure Security

India has domestic mineral potential, but reserves have not yet translated into supply security.

Key Gaps

- India remains import dependent for **lithium, cobalt and nickel**.
- Graphite and rare earth processing remain vulnerable to China-dominated supply chains.
- India lacks adequate **high-purity processing and refining capacity**.
- Much of the value addition lies in the midstream stage: refining, separation, purification and chemical processing.

Thus, the major challenge is not only mining, but building a complete **mine-to-market value chain**.

India's Major Policy Initiatives

1. National Critical Mineral Mission

The **National Critical Mineral Mission** aims to develop the full critical mineral value chain.

It focuses on:

- exploration
- mining
- processing
- recycling
- research and development
- human resource development
- strategic stockpiling

Major Targets

- **1,200 domestic exploration projects** by 2030–31
- production of at least **15 critical minerals**
- acquisition of **50 overseas mining assets** by Indian companies
- creation of recycling capacity for critical minerals
- promotion of patents and Centres of Excellence

2. Identification of 30 Critical Minerals

- India has identified **30 critical minerals** to guide policy planning, investment and supply chain security.

3. MMDR Act Amendment, 2023

- The **Mines and Minerals (Development and Regulation) Act, 1957** was amended in 2023 to empower the Central Government to auction several identified critical minerals. This is expected to improve private participation and domestic production.

4. Overseas Mineral Acquisition through KABIL

- **Khanij Bidesh India Limited (KABIL)** has secured **15,703 hectares** in Argentina's Catamarca province for lithium exploration.
- This reflects India's effort to secure overseas resources in lithium-rich regions.

5. Rare Earth Corridors

The **2026–27 Budget** proposed rare earth corridors in:

- **Odisha**
- **Kerala**
- **Andhra Pradesh**
- **Tamil Nadu**

These corridors can support rare earth processing, value addition and industrial clustering.

6. India–U.S. Critical Minerals Framework

- The **India–U.S. critical minerals and rare earths framework** signed in **May 2026** provides a diplomatic lever for building resilient and diversified supply chains.

7. Quad and Trusted Supply Chains

- India is also part of wider strategic conversations with partners such as the **U.S., Australia and Japan** to develop secure and diversified mineral supply chains.

8. PLI Schemes and Manufacturing Linkages

- India's PLI schemes for **Advanced**

Chemistry Cell batteries, solar PV modules, electronics and semiconductors are linked to critical mineral security because these sectors depend heavily on mineral inputs.

Challenges to India's Critical Mineral Security

1. Heavy Import Dependence

- India is highly dependent on imports for lithium, cobalt and nickel. Rare earth magnets and high-purity processed products are also vulnerable to external supply disruptions.

2. Processing and Refining Gap

India's biggest weakness lies in the midstream stage. It lacks adequate facilities for:

- battery-grade lithium chemicals
- high-purity graphite
- rare earth separation
- advanced smelting
- chemical refining
- high-purity mineral inputs

Without processing capability, domestic reserves alone cannot create strategic autonomy.

3. China's Midstream Monopoly

- China's dominance in rare earths, graphite, cobalt and lithium processing exposes India to price shocks, export controls and supply disruption.

4. Shallow Exploration

India's exploration is still relatively shallow. Critical minerals often require advanced methods such as:

- airborne geophysical surveys
- hyperspectral mapping
- geochemical surveys
- AI-based geological modelling
- deep-seated exploration

5. Regulatory and Clearance Delays

- Mining projects often face delays due to environmental, forest and land-related approvals.

6. Weak Private Participation

- Critical mineral exploration and refining require high-risk, long-term capital. India still lacks a strong ecosystem of junior mining companies and risk-sharing mechanisms.

7. Remote Region Project Economics

- Many deposits are located in remote areas with weak logistics, power and water infrastructure, reducing commercial viability.

8. Weak Circular Economy

- Recycling of e-waste, lithium-ion batteries, end-of-life vehicles, mine tailings, fly ash and red mud remains limited due to weak collection systems and technology gaps.

9. Absence of Strategic Stockpiles

- Unlike strategic petroleum reserves, India does not yet have a comprehensive strategic reserve for critical minerals.

Global Approaches to Critical Mineral Security

Country / Bloc	Approach
China	Dominates mining, refining, processing and exports; uses minerals as geoeconomic leverage
United States	De-risks supply chains through alliances, friendshoring and overseas investments
European Union	Builds strategic autonomy through domestic extraction, processing, recycling and reduced dependence
Australia	Positions itself as a trusted supplier

	while expanding downstream processing
Japan	Uses resource diplomacy, overseas assets, long-term contracts and stockpiles
India	Moving towards a **mine-to-market strategy** using exploration, overseas acquisition, processing and partnerships

Way Forward for India

1. Make Processing a National Priority

- India must build refining, separation, purification and chemical processing capacity. Mineral processing parks and targeted incentives can help create value-added supply chains.

2. Strengthen Domestic Exploration

- India should expand deep-seated exploration using AI, 3D geological modelling, airborne surveys and advanced geophysical methods.

3. Attract Private Capital

Private investment needs:

- reliable geological data
- predictable approvals
- risk-sharing mechanisms
- faster clearances
- supportive infrastructure

4. Diversify Overseas Supply

- India should secure long-term supplies through KABIL and partnerships with countries such as **Australia, Argentina, Chile, Namibia and African nations**.

5. Create Strategic Mineral Stockpiles

- India should establish strategic reserves for minerals essential to batteries, defence, semiconductors and renewable energy.

6. Scale Recycling and Urban Mining

Recycling should be integrated into supply planning. India must strengthen recovery from:

- e-waste
- lithium-ion batteries
- end-of-life vehicles
- mine tailings
- fly ash
- red mud

7. Build Research and Innovation Ecosystem

- India needs applied R&D in metallurgy, mineral separation, battery chemistry, rare earth magnets and recycling technologies.

8. Adopt a National Critical Minerals Strategy

A comprehensive strategy should:

- define mineral-specific risk thresholds
- set measurable milestones
- coordinate ministries and industry
- integrate recycling and stockpiling
- monitor global supply risks
- align minerals with energy, defence and industrial policy

Conclusion

Critical minerals will define India's **energy transition, industrial competitiveness and strategic autonomy**. India has mineral potential, policy momentum and growing international partnerships, but the real challenge lies in execution. Domestic exploration must be converted into production, and reserves must be converted into high-purity processing capability. India's future strength will depend not only on owning minerals but on mastering the entire value chain — from **mine to market, recycling to refining, and diplomacy to domestic manufacturing**.

Strengthening India's Space Sovereignty

Source: PIB

Relevance: **GS Paper III: Space technology, science and technology, indigenisation**

Important Keywords

Prelims:

- IN-SPACe, NSIL, Indian Space Policy 2023, NavIC, Gaganyaan, Chandrayaan-4

Mains:

- Space sovereignty, private space ecosystem, space economy, strategic autonomy, technology transfer, space-based services

Why in News?

Recently, the Government highlighted India's progress in strengthening its **space sovereignty** through reforms, private sector participation, start-up growth, satellite capabilities, launch systems, space applications and human spaceflight ambitions.

- India's space journey has moved from building basic capabilities to developing advanced and globally competitive space technologies. Reforms over the past decade have opened the sector to private enterprises, start-ups and global partnerships.

What is Space Sovereignty?

Space sovereignty means a country's ability to independently develop, launch, operate and use space technologies for national development and strategic autonomy.

It includes:

- indigenous launch vehicles;
- satellite manufacturing and operations;
- space-based communication and navigation;
- Earth observation capability;
- human spaceflight;
- private sector innovation;
- independent policy and regulatory framework.

For India, space sovereignty is important because space technology supports agriculture, disaster management, communication, defence, navigation, climate monitoring, infrastructure planning and digital governance.

How is India's Space Ecosystem Expanding?

India's space sector has seen rapid expansion in recent years.

Key indicators:

- Registered space start-ups increased from **1 in 2014** to around **440 in 2026**.
- India's space economy is valued at **USD 9 billion** as of August 2026.
- It is projected to reach **USD 40–45 billion** in the next decade.
- Private investment rose from **USD 100.5 million in 2021–22** to **USD 618.5 million by March 2026**.
- By mid-2026, **113 authorisations** were granted to **52 Non-Government Entities**, including 18 start-ups.

This reflects a shift from a largely government-led space programme to a broader national space ecosystem involving public agencies, private companies and start-ups.

What is the Earth Observation Public-Private Partnership?

The **Earth Observation Public-Private Partnership**

(EO-PPP) is a public-private framework launched by **IN-SPACe**.

- Its objective is to develop India's first privately owned **Earth observation satellite constellation**. It combines government oversight with private industry participation and is backed by around **₹1,200 crore** in private investment commitments.

Significance

- Encourages private investment in satellite systems.
- Improves Earth observation capabilities.
- Supports agriculture, disaster management, urban planning and climate monitoring.
- Reduces dependence on foreign satellite data.

What are the Major Space Sector Reforms?

1. Opening of Space Sector to Private Participation

- India opened its space sector to private participation in **2020**. This allowed industry and start-ups to participate in satellites, launch systems and space applications.

2. Indian Space Policy 2023

- The **Indian Space Policy 2023** expanded private participation across the space value chain. It defined the roles of **NewSpace India Limited (NSIL)** and **Indian National Space Promotion and Authorisation Centre (IN-SPACe)**.

3. Role of NSIL

- **NSIL** is the commercial arm of ISRO. It provides launch, satellite and space-based services and transfers ISRO technologies to Indian industry. Its revenue increased from **₹321.77 crore in FY 2021–22** to over **₹3,000 crore in FY 2024–25**.

4. Role of IN-SPACe

- **IN-SPACe** enables private space activities through a single-window mechanism. It facilitated technology transfers from ISRO to industry and start-ups.

5. Liberalised FDI Rules

In February 2024, FDI rules were liberalised for the space sector:

- Up to **74% FDI** under automatic route for satellite manufacturing and operations.
- Up to **49% FDI** for launch vehicles and spaceports.
- Up to **100% FDI** for satellite and ground-segment components.

6. Norms, Guidelines and Procedures 2024

- The **NGP 2024** created transparent authorisation and compliance requirements. It improves regulatory predictability and ease of doing business.

7. Targeted Financing

Targeted financing is supporting the private space ecosystem through:

- IN-SPACe Seed Fund Scheme;
- ₹1,000 crore Venture Capital Fund;
- ₹500 crore Technology Adoption Fund;
- ₹75 crore Satellite Bus as a Service Scheme.

What are India's Key Space Capabilities?

1. Indigenous Launch Vehicles

India has operationalised four indigenous launch vehicles:

- **PSLV**
- **GSLV**
- **GSLV Mk III**
- **SSLV**

These launch vehicles support Earth observation, communication, navigation, space science, exploration and commercial launches. During July 2023–June 2026, India completed **12 launch vehicle missions**, carrying 11 national satellites and 9

satellites for international customers.

2. Expanding Launch Infrastructure

- India is expanding launch infrastructure to meet national and commercial space demand.

Key developments:

- Sriharikota has **two operational launch pads**.
- A **third launch pad** is being established for next-generation launch vehicles.
- **Kulasekarapattinam, Tamil Nadu** is emerging as India's second rocket launch site for SSLVs and private-sector launches.

3. Lunar Exploration

India's lunar programme has achieved major milestones:

- **Chandrayaan-1 (2008):** Detected water molecules and hydroxyl on the lunar surface.
- **Chandrayaan-2 (2019):** Captured high-resolution lunar images from orbit.
- **Chandrayaan-3 (2023):** Made India the first country to soft-land near the Moon's south pole and the fourth nation to soft-land on the Moon.

4. Mars, Sun and Deep Space Missions

India has expanded beyond lunar exploration:

- **Mars Orbiter Mission:** Inserted into Martian orbit on 24 September 2014 and operated for over eight years.
- **AstroSat:** India's first dedicated astronomy mission.
- **Aditya-L1:** India's first space-based solar mission, positioned near the Sun-Earth L1 point.
- **XPoSat:** Launched in January 2024 for X-ray polarisation astronomy.
- **SPADEX:** In January 2025, India became the fourth nation to demonstrate autonomous space docking and undocking.

5. NavIC

- **Navigation with Indian Constellation (NavIC)** provides positioning, navigation and timing services across India and up to **1,500 km beyond India's boundary**. It strengthens navigation autonomy and supports civilian and strategic applications.

NavIC is being integrated into:

- power-grid synchronisation;
- real-time train tracking;
- Aadhaar geo-tagging;
- mobile chipsets.

What are India's Future Space Missions?

1. Gaganyaan

- The **Gaganyaan human spaceflight programme** was approved in January 2019. Its scope was expanded in September 2024 to a total outlay of **₹20,193 crore**, covering eight total missions.

Objectives:

- launch a crew of **3 Indian astronauts**;
- place them in a **400-km orbit**;
- conduct a **three-day mission**;
- first uncrewed experimental mission targeted in Q4 of 2026;
- crewed mission targeted by 2027.

2. Bharatiya Antariksh Station

- India is planning a five-module **Bharatiya Antariksh Station (BAS)**.

Key targets:

- **BAS-01** planned for launch by 2028;
- full operationalisation targeted by 2035;
- support for long-duration human spaceflight, microgravity research and advanced space operations.

3. Chandrayaan-4 and Chandrayaan-5/LUPEX

Future lunar missions include:

- **Chandrayaan-4:** To demonstrate lunar sample collection, ascent from lunar surface

and sample return to Earth; planned timeline 2027.

- **Chandrayaan-5/LUPEX:** Joint ISRO-JAXA mission to study lunar volatiles near the Moon's south polar region.

4. Venus Orbiter Mission

- The **Venus Orbiter Mission** is targeted for launch in March 2028. It will study Venus' geology, atmosphere and ionosphere and demonstrate aerobraking and thermal-management technologies.

What Advanced Technologies are Shaping India's Space Future?

India is developing advanced technologies for next-generation space capabilities.

Key technologies include:

- **200-tonne thrust semi-cryogenic engine**;
- semi-cryogenic booster stage for LVM3;
- booster recovery using **Vertical Take-off and Vertical Landing** technology;
- partially reusable **Next Generation Launch Vehicle** using LOX-Methane propulsion;
- winged orbital re-entry vehicle for the Reusable Launch Vehicle programme;
- air-breathing propulsion technology.

Significance

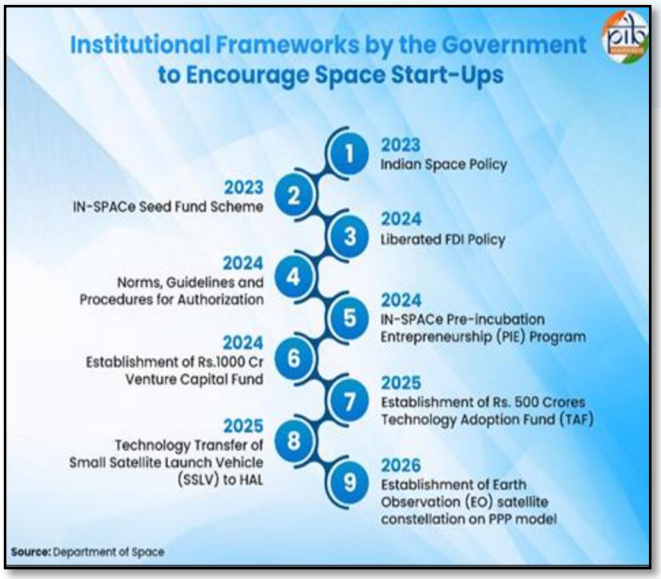
These technologies can:

- increase payload capacity;
- reduce launch costs;
- support reusable launch systems;
- improve India's competitiveness in the global launch market;
- support long-term human spaceflight and deep-space missions.

What is the Significance of India's Space Push?

1. Strengthens Strategic Autonomy

- Indigenous launch vehicles, NavIC and satellite systems reduce dependence on foreign technologies.



2. Expands Space Economy

- Start-ups, private investment and commercialisation through NSIL are expanding India's space economy.

3. Supports National Development

- Space applications support agriculture, weather forecasting, disaster management, communication, transport and governance.

4. Enhances Global Standing

- Foreign satellite launches increased from **35 before 2014** to **399 as of January 2026**, showing India's growing role as a global launch service provider. India also has more than **300 space cooperation agreements** across 61 countries and 5 multilateral organisations.

5. Promotes Innovation

- Private participation, start-up growth and funding mechanisms encourage innovation across satellites, launch systems and applications.

6. Builds Human Spaceflight Capability

- Gaganyaan, Axiom-4 experience, Bharatiya

Antariksh Station and docking experiments are creating the foundation for sustained human presence in space.

What are the Key Challenges?

- High cost of advanced space missions.
- Need for stronger private-sector manufacturing capacity.
- Dependence on critical technologies and components.
- Requirement of robust space regulation and liability frameworks.
- Rising global competition in the launch market.
- Need for skilled human resources.
- Space debris and orbital traffic management concerns.
- Cybersecurity risks for satellite systems.
- Balancing commercial growth with national security.

Way Forward

- Strengthen domestic manufacturing of critical space components.
- Encourage start-ups through predictable regulation and funding.
- Expand public-private partnerships in satellites, launch vehicles and applications.
- Improve space situational awareness and debris management.
- Promote NavIC adoption in civilian and strategic sectors.
- Build stronger university-industry-ISRO research linkages.
- Ensure timely execution of Gaganyaan, BAS and lunar missions.
- Strengthen international cooperation while protecting strategic autonomy.
- Develop skilled manpower for space science, engineering and policy.

Conclusion

India's space programme is entering a new phase. It is no longer limited to government-led missions but now includes private enterprises, start-ups, commercial services, international partnerships and human spaceflight ambitions.

India's space sovereignty should be understood as a combination of **self-reliance, strategic autonomy, innovation, private participation and global leadership**. With reforms, indigenous capabilities and ambitious future missions, India is moving towards becoming a major global space power.

NASA's Moon Base Programme: India's Role in the New Lunar Race

Source: The Hindu

Relevance: **UPSC GS Paper III: Space Technology, ISRO, Lunar Exploration, Emerging Technologies**

Important Keywords

Prelims Keywords:

- NASA Moon Base | Artemis Accords | Moon's South Pole | Chandrayaan-4 | ILRS

Mains Keywords:

- Space diplomacy | Lunar exploration | India-U.S. cooperation | Strategic technology partnership | Space Vision 2047

Why in News?

At the **ninth meeting of the India-U.S. Civil Space Joint Working Group**, held in Bengaluru on **August 5 and 6, 2026**, NASA formally invited **ISRO** to join its ambitious **Moon Base programme** under

the framework of the **Artemis Accords**.

- The invitation is important because India is already a member of the Artemis Accords since **2023**, and ISRO is preparing for future lunar missions, including **Chandrayaan-4** and a planned Indian crewed lunar mission by **2040**.



What is NASA's Moon Base Programme?

- NASA's **Moon Base programme** is an ambitious lunar outpost plan.
- It aims to establish a long-term human presence on the **Moon's south pole**.
- Astronauts are expected to live, work and conduct scientific activities from this lunar base over the next decade and beyond.
- The programme will involve both **crewed and uncrewed missions**.
- NASA and its international partners will execute the mission in a phased manner.
- The programme was announced on **March 24, 2026**, during NASA's **Ignition** event.
- The project is expected to cost more than **$20 billion**.

The Moon Base programme is being projected as one of the most ambitious human space exploration programmes after the Apollo era.

Phases of the Moon Base Programme

NASA plans to execute the Moon Base programme in **three phases**.

1. Phase One: Access and Understanding — till 2029

- The first phase has already commenced.
- It will continue till **2029**.
- The focus will be on gaining reliable access to the lunar surface.
- NASA will also try to build a deeper understanding of the Moon's south polar environment.
- This phase is crucial for mapping risks, testing technologies and preparing for longer missions.

2. Phase Two: Infrastructure Deployment — till 2032

- The second phase will continue till **2032**.
- NASA and its international partners will build on the lessons from Phase One.
- The aim will be to deploy the necessary infrastructure for continued lunar operations.
- This may include systems related to landing, mobility, communication, energy, scientific work and habitat support.

3. Phase Three: Long-Term Human Presence — from 2032 onwards

- The third phase is the most ambitious stage.
- It is expected to begin from **2032 onwards**.
- NASA plans to populate the lunar south polar region with astronauts who can live and work there for extended periods.
- This phase will mark a shift from short-duration lunar visits to an enduring human presence on the Moon.

Why the Moon's South Pole?

The Moon's south pole is scientifically and strategically important.

- It has a highly volatile environment.
- Temperatures can range from around **-203°C to 54°C**.
- Some regions near the south pole never receive sunlight.
- These permanently shadowed regions may hold clues about the Moon's origin and the evolution of the solar system.
- The hostile environment provides a testing ground for future exploration of Mars and Venus.

NASA sees the Moon as a stepping stone for deeper space exploration. Establishing a base at the south pole can help scientists study lunar geology, test survival technologies and develop systems needed for future planetary missions.

Global Lunar Race: U.S. and China-Russia Initiatives

- NASA's Moon Base programme is not the only major lunar base plan.
- Russia and China are also working on a lunar base project called the **International Lunar Research Station**.

International Lunar Research Station

- It is being planned by **Roscosmos** of Russia and the **China National Space Administration**.
- The base is expected to be established in the next decade.
- It is planned as a permanent lunar base with a lunar satellite constellation.
- China aims to land humans on the Moon by **2030**.
- Several countries have already shown interest in the ILRS framework.
- Russia has earlier indicated that it is open to India's participation in the ILRS.

This shows that lunar exploration is becoming a major arena of international space competition and cooperation.

What are Artemis Accords?

- The **Artemis Accords** are a framework for international cooperation in lunar and deep-space exploration.
- They are linked with NASA's Artemis programme.
- India signed the Artemis Accords in **2023**.
- India became the **27th country** to sign the Accords.
- The Accords provide a platform for collaboration in peaceful, transparent and responsible space exploration.

NASA's invitation to ISRO is being made within this larger Artemis cooperation framework.

Why NASA Wants India's Participation

NASA's invitation to ISRO is significant because India has emerged as a major space power.

1. India's Lunar Experience

- India has gained important experience through the **Chandrayaan missions**. The upcoming **Chandrayaan-4** mission is expected to collect lunar samples and bring them back to Earth.

2. Strategic Space Partnership

- India and the United States have been expanding cooperation in space through the **Civil Space Joint Working Group** and the **Artemis Accords**.

3. Human Spaceflight Linkages

- After signing the Artemis Accords, two Indian astronauts trained in the U.S. for the **Axiom-4 mission** to the **International Space Station**. Group Captain **Shubhanshu Shukla** eventually travelled to the ISS.

4. India's Long-Term Space Vision

- India's **Space Vision 2047** includes setting up the **Bharatiya Antariksha Station** by **2035** and carrying out an Indian crewed lunar mission by **2040**.

5. Scientific and Technological Value

- ISRO's participation can strengthen lunar science, mission planning, space robotics, sample-return technologies and human spaceflight experience.

Possible Role of ISRO

ISRO's exact role will depend on future discussions between India and the United States. However, based on India's capabilities and planned missions, ISRO may contribute in several areas.

- lunar science and surface studies
- data sharing from Chandrayaan missions
- robotic exploration technologies
- communication and navigation support
- sample-return mission experience through Chandrayaan-4
- astronaut training and human spaceflight cooperation
- research related to lunar resources and south polar conditions
- long-term experience-building for India's own crewed lunar mission

Participation in such a programme can give ISRO exposure to long-duration lunar habitation planning, international mission architecture and future space diplomacy.

Significance for India

1. Strengthens India-U.S. Space Cooperation

- The invitation marks another step in India-U.S. cooperation in advanced space technologies.

2. Supports India's Lunar Ambitions

- The programme aligns with India's plans for **Chandrayaan-4**, the **Bharatiya Antariksha Station** and a crewed lunar mission by **2040**.

3. Enhances Scientific Capability

- Working with NASA can help Indian scientists gain experience in lunar geology, polar exploration, space habitats and human survival technologies.

4. Boosts Space Diplomacy

- India can use space cooperation to strengthen its role in global technology partnerships.

5. Helps Future Mars and Deep-Space Missions

- The Moon can act as a testing platform for missions to Mars, Venus and other planetary bodies.

6. Expands Private Space Opportunities

- Long-term lunar programmes can create opportunities for Indian start-ups, space manufacturers and technology companies.

Challenges

1. Strategic Balancing

- India has to balance cooperation with NASA under the Artemis framework and possible engagement with other international lunar initiatives.

2. Cost and Technology Burden

- Lunar base participation involves advanced technologies, high expenditure and long-duration mission planning.

3. Human Spaceflight Readiness

- India is still building its human spaceflight ecosystem through missions such as Gaganyaan and future space station plans.

4. Technology Sharing Limits

- Sensitive technologies may be subject to restrictions, making the depth of cooperation dependent on policy and trust.

5. Long-Term Commitment

- A lunar base programme will require

sustained funding, institutional focus and scientific continuity.

6. Legal and Governance Questions

- Long-term lunar presence raises questions related to resource use, safety zones, scientific access and responsible space behaviour.

Way Forward

1. Define India's Role Clearly

- India should identify specific areas where ISRO can contribute without overextending resources.

2. Link with Chandrayaan-4

- Experience from Chandrayaan-4 should be used to strengthen India's lunar sample-return and surface-science capabilities.

3. Strengthen Human Spaceflight Capacity

- Gaganyaan, astronaut training and life-support technologies should be aligned with long-term lunar goals.

4. Build Indigenous Capabilities

- India should develop its own technologies in robotics, habitats, space medicine, energy systems and lunar surface mobility.

5. Encourage Private Sector Participation

- Indian private space companies should be integrated into lunar technology supply chains.

6. Maintain Strategic Autonomy

- India should cooperate internationally while preserving freedom to pursue its own space goals under **Space Vision 2047**.

Conclusion

NASA's invitation to ISRO to join the **Moon Base programme** marks a significant moment in India's space diplomacy. The programme aims to establish a long-term human presence at the Moon's south pole and may shape the next phase of global lunar exploration. For India, participation can strengthen lunar science, human spaceflight capability and international technological cooperation. However, India must align such cooperation with its own priorities — **Chandrayaan-4**, the **Bharatiya Antariksha Station**, and a crewed lunar mission by **2040**. A balanced approach can help India emerge as a major player in the new lunar era.

Gaganyaan's Thermal Shield: Protecting the Crew During Re-entry

Source: The Hindu

Relevance: **GS Paper III: Space technology, indigenisation and scientific achievements**

Important Keywords

Prelims:

- Re-entry, kinetic energy, heat flux, ablative TPS, carbon phenolic, PICA

Mains:

- Human spaceflight safety, thermal engineering, technological reliability, indigenous re-entry capability

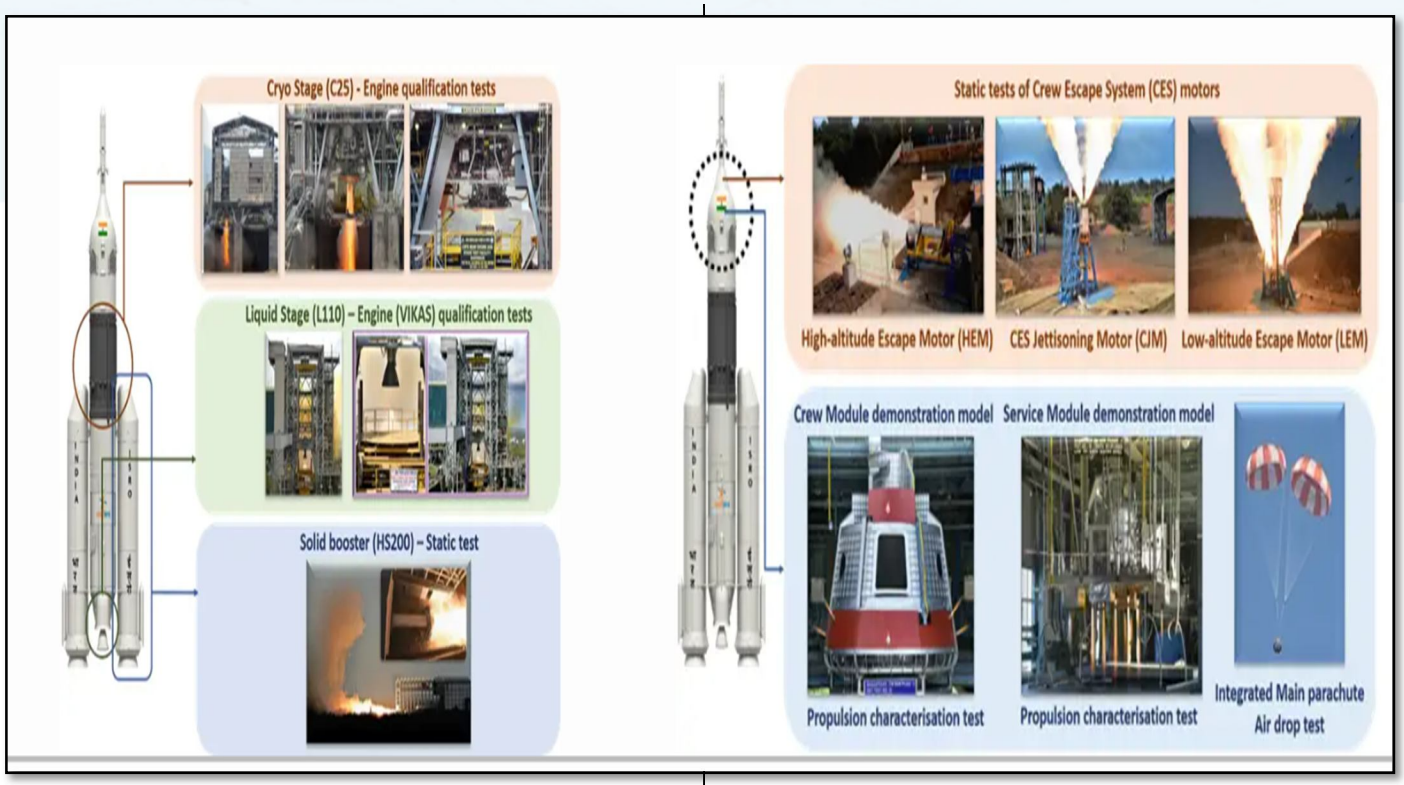
Why in News?

The Gaganyaan crew module will use an **ablative thermal protection system** to protect its structure and astronauts from temperatures reaching approximately **1,800°C during atmospheric re-entry**.

What Is the Gaganyaan Programme?

Gaganyaan is India's indigenous human-spaceflight programme. It seeks to demonstrate the country's ability to send astronauts into a **400-km Low Earth Orbit** and return them safely to Earth.

The programme has three major flight components:



1. Human-Rated LVM3

- The **Human-Rated Launch Vehicle Mark-3 (HLVM3)** is a modified version of ISRO's LVM3 rocket. Its systems have been redesigned and tested to meet higher reliability and human-safety requirements.

It is:

- approximately 53 metres tall;
- about 640 tonnes in mass;
- a three-stage launch vehicle; and
- capable of carrying around 10 tonnes to Low Earth Orbit.

2. Orbital Module

The Orbital Module consists of:

- **Crew Module:** The pressurised and habitable section that accommodates the astronauts.
- **Service Module:** The unpressurised section containing propulsion, power, thermal-control, avionics and deployment systems.

3. Crew Escape System

- The Crew Escape System uses quick-acting solid motors to pull the Crew Module away from the launch vehicle during an emergency at the launch pad or during ascent. It protects astronauts before orbital injection and is different from the thermal shield used during re-entry. (ISRO)

Why Is Atmospheric Re-entry Dangerous?

A spacecraft in Low Earth Orbit travels at nearly **7,500–8,000 metres per second**. It cannot simply stop before entering the atmosphere. Instead, the atmosphere must reduce its speed.

During re-entry:

- the spacecraft strongly compresses the air ahead of it;
- the compressed gas becomes extremely hot;
- a high-temperature shock layer forms around the vehicle; and
- heat is transferred to the spacecraft through

radiation and convection.

Thus, re-entry heating is caused mainly by the **compression and heating of atmospheric gases**, not merely by ordinary friction.

- More than 99% of the module's kinetic energy is eventually dissipated into the surrounding atmosphere. However, even the small share transferred towards the spacecraft can damage or melt an unprotected structure.

Additional Operational Difficulties

- Re-entry cannot normally be aborted once it begins.
- Velocity, temperature and deceleration change rapidly.
- Communication may be temporarily disturbed by ionised gases.
- Astronauts have very limited time to correct failures manually.
- The module must maintain the correct orientation.
- The TPS, parachutes and recovery systems must operate in a fixed sequence.

What Is a Thermal Protection System?

A Thermal Protection System is the combination of heat-resistant materials, coatings and structural arrangements used to protect a spacecraft from extreme temperatures.

The Gaganyaan Crew Module has a **double-walled construction**:

- a pressurised metallic inner structure; and
- an unpressurised external structure carrying the TPS.

The TPS is approximately **30–35 mm thick** in critical regions. Its thickness and material distribution may differ across the surface because the entire module does not receive the same heat load.

Its main functions are to:

- prevent excessive heat from entering the cabin;
- preserve the module's structural strength;
- protect avionics and life-support equipment;
- withstand aerodynamic forces during re-entry; and
- keep conditions survivable for the astronauts.

Why Is the Crew Module Blunt-Shaped?

A blunt body produces a strong shock wave that remains at some distance from the spacecraft's surface. This **shock-wave stand-off distance** reduces the direct transfer of extreme heat to the module.

- A blunt shape also creates high aerodynamic drag. This allows the atmosphere to slow the spacecraft before the parachutes are deployed.

Therefore, the capsule's shape performs two connected functions:

- managing aerodynamic heating; and
- producing controlled deceleration.

How Does an Ablative Heat Shield Work?

An ablative shield protects the spacecraft by deliberately sacrificing its outer material.

Stage 1: Heat Absorption

- The shield absorbs a large quantity of incoming thermal energy. Its low thermal conductivity slows the movement of heat towards the spacecraft's internal structure.

Stage 2: Chemical Decomposition

- At high temperatures, the material undergoes **pyrolysis**, meaning heat-driven chemical decomposition. This process consumes part of the incoming energy.

Stage 3: Formation of Char

- A carbon-rich char layer forms on the surface. This layer acts as additional insulation and reduces heat transfer to the

structure beneath it.

Stage 4: Outgassing

- The decomposing material releases gases. These gases flow outward through the char and form a relatively cooler layer near the surface, reducing the effect of the hot external flow.

Stage 5: Surface Recession

- The heated outer material gradually burns, erodes or peels away. This carries absorbed heat away from the spacecraft.

Thus, the shield manages heat through:

- insulation;
- chemical decomposition;
- charring;
- outgassing; and
- controlled material loss.

Major Types of Thermal Protection Systems

Type	Method of heat management	Major characteristic
Ablative TPS	Decomposes and sacrifices surface material	Highly reliable; generally single-use
Radiative TPS	Releases absorbed heat as electromagnetic radiation	Suitable for reusable vehicles if the surface remains intact
Heat-sink TPS	Stores heat by increasing the material's temperature	Usually uses materials with high heat capacity
Insulating TPS	Restricts heat flow through low-conductivity materials	Protects the internal structure from external heating

A spacecraft may use more than one thermal-protection method because different areas experience different heating conditions.

Why Has Gaganyaan Selected an Ablative TPS?

The ablative system is suitable for Gaganyaan because:

- the Crew Module is designed primarily for one atmospheric re-entry;
- ablative materials can withstand very high and fluctuating heat loads;
- they provide protection even when external conditions vary from predictions;
- their functioning does not require active pumps or cooling machinery;
- ISRO already has experience with ablative re-entry materials; and
- they avoid the complicated inspection and refurbishment required by reusable shields.

Its main disadvantage is that the protective material is consumed. The shield must therefore be replaced rather than reused.

Materials Used in Ablative Protection

Common ablative materials include:

- **carbon phenolic**; and
- **silica phenolic**.

India's Space Capsule Recovery Experiment used carbon-phenolic material in the nose-cap region, which experienced high heat flux.

Phenolic resin decomposes under heating, while the reinforcing carbon or silica structure helps form an insulating char. The material, thickness and bonding method must be selected according to the expected local temperature, heat flux and pressure.

Gaganyaan's Re-entry and Recovery Sequence

The thermal shield is one part of a wider system for safe return.

1. De-orbiting
- The spacecraft performs a controlled manoeuvre to leave orbit and enter the atmosphere along a planned trajectory.

2. Separation
- The Crew Module separates from the Service Module because only the Crew Module is designed to return safely through the atmosphere.

3. Atmospheric Entry
- The module enters the denser atmosphere at very high speed. Its heat shield faces the direction of maximum heating.

4. Aerodynamic Deceleration
- Atmospheric drag reduces the module's velocity. The ablative shield protects it during this high-temperature phase.

5. Parachute Deployment
Once the speed and altitude fall sufficiently, the parachute system operates in sequence. It includes:
- apex-cover separation parachutes;
- drogue parachutes;
- pilot parachutes; and
- main parachutes.

Gaganyaan uses **ten parachutes belonging to four types**. They gradually reduce the module's velocity to permit safe sea landing. (ISRO)

6. Splashdown and Uprighting
- The Crew Module lands in the sea. The **Crew Module Uprighting System** ensures that the capsule remains in the correct position after splashdown.

7. Recovery
- Pre-designated recovery teams locate the capsule, reach it by sea or air and safely extract the astronauts.

Major Indian Technology Demonstrations

Space Capsule Recovery Experiment, 2007
SRE-1 demonstrated India's ability to:
- return a spacecraft from orbit;
- manage atmospheric re-entry;
- use thermal-protection materials;
- operate navigation and guidance systems;
- conduct parachute-assisted descent; and
- recover a capsule from the sea.

LVM3-X/CARE Mission, 2014
The **Crew Module Atmospheric Re-entry Experiment (CARE)** demonstrated:
- re-entry of a full-scale Crew Module;
- blunt-body re-entry aerodynamics;
- aerothermal performance;
- thermal-protection technology;
- apex-cover separation;
- clustered parachute deployment; and
- recovery operations.

CARE supplied important data for improving the Gaganyaan Crew Module. (ISRO)

Pad Abort Test, 2018
- The test demonstrated that the Crew Escape System could rapidly move the Crew Module away from the launch vehicle during an emergency at the launch pad.

TV-D1 Mission
The first Test Vehicle demonstration validated:
- the in-flight Crew Escape System;
- module-separation mechanisms;
- Crew Module characteristics;
- parachute-based deceleration; and
- recovery after splashdown.

Integrated Air Drop Tests
- The Integrated Air Drop Tests evaluated the complete parachute-based deceleration sequence under representative conditions. The second test successfully deployed all ten parachutes in the planned order.

Significance for India

Human-Spaceflight Capability

- Successful re-entry will demonstrate that India can independently launch astronauts, support them in orbit and return them safely.

Technological Self-reliance

- The programme promotes indigenous capability in advanced materials, human-rated launch systems, avionics, life support, guidance and recovery.

Wider Scientific Applications

- Research in heat-resistant materials can support launch vehicles, hypersonic systems, defence applications, aviation and high-temperature industries.

Foundation for Future Missions

- Experience from Gaganyaan will contribute to India's plans for the **Bharatiya Antariksh Station**, long-duration human spaceflight and future crewed exploration. BAS is planned as a five-module station, with the first module, BAS-01, approved for development and launch. (

Major Challenges

- Predicting heating under changing atmospheric conditions
- Preventing cracks, gaps and separation of TPS tiles or panels
- Achieving consistent material quality across the heat shield
- Maintaining the correct re-entry angle and module orientation
- Protecting interfaces around doors, windows and sensors
- Ensuring reliable operation after prolonged exposure to space
- Integrating the TPS with parachutes and recovery systems
- Meeting very high human-rating and mission-reliability standards

Way Forward

- Conduct successive uncrewed missions under realistic re-entry conditions.
- Test systems under both normal and off-nominal situations.
- Use temperature, pressure and strain sensors to obtain actual flight data.
- Strengthen non-destructive inspection of the completed heat shield.
- Improve computational models using data from CARE and uncrewed missions.
- Maintain redundancy in navigation, avionics and parachute systems.
- Conduct repeated recovery exercises with the Indian Navy and other agencies.
- Develop reusable thermal-protection technologies for future space vehicles.

Conclusion

Gaganyaan's ablative thermal shield is the spacecraft's primary defence during atmospheric re-entry. It protects the Crew Module through insulation, chemical decomposition, charring, outgassing and controlled surface loss. However, astronaut safety depends on the combined performance of the module's shape, guidance system, TPS, parachutes, uprighting mechanism and recovery network. Successful validation of this integrated system will mark a major step in India's transition from robotic space exploration to independent human spaceflight.

India's Defence Strength: Powering National Security through Self-Reliance

Source: PIB

Relevance: **UPSC GS Paper III – Security challenges, defence technology, indigenisation and achievements in science and technology**

Important Keywords

Prelims:

- Atmanirbhar Bharat, Defence Acquisition Council, AoN, DAP 2020, DPM 2025, Positive Indigenisation Lists, iDEX, ADITI, TDF, SRIJAN-DEEP, Defence Industrial Corridors, Defence Exim Portal

Mains:

- Defence indigenisation, strategic autonomy, military modernisation, defence exports, public-private partnership, innovation ecosystem, resilient supply chains

Why in News?

As India marks its **80th Independence Day**, the country's defence sector has recorded significant growth in budgetary support, indigenous production, exports, research and private-sector participation. These developments reflect India's transition from import dependence towards a more self-reliant and technologically capable defence ecosystem.

Transformation of India's Defence Sector

India's defence policy increasingly links national security with domestic industrial capability. Under **Atmanirbhar Bharat**, the government has focused on:

- modernising the armed forces;
- encouraging indigenous design and production;
- expanding private-sector participation;
- supporting start-ups and MSMEs;
- reducing dependence on imported equipment;
- promoting defence exports; and
- developing critical and emerging technologies.

The objective is not complete economic isolation but the creation of domestic capacity in strategically important systems.

Defence Investment and Military Modernisation

Growth in Defence Budget

- India's defence budget increased from **₹2.53 lakh crore in 2013–14 to ₹7.85 lakh crore in 2026–27**, representing approximately **3.1-fold growth**.

Growth in Capital Expenditure

Capital expenditure increased from **₹94,587.95 crore in 2014–15 to ₹2.19 lakh crore in 2026–27**, registering approximately **2.3-fold growth**.

Capital expenditure supports the purchase and development of:

- aircraft and helicopters;
- missiles and air-defence systems;
- warships and submarines;
- communication and surveillance equipment;
- artillery and armoured platforms; and
- supporting military infrastructure.

Defence Production and Exports

Record Indigenous Production

India's defence production reached a record **₹1.78**

lakh crore in 2025–26.

Producing segment	Share in total production
Public-sector entities	76%
Private-sector companies	24%

The public sector remains the principal producer, while private companies are acquiring a larger role in components, platforms, innovation and exports.

Expansion of Defence Exports

Defence exports increased from **₹686 crore in 2013–14 to ₹38,424 crore in 2025–26**. This represents approximately **56-fold growth** over 12 years.

Indian defence products now reach **more than 80 countries**.

Exporting segment	Exports in 2025–26	Share
Defence Public Sector Undertakings	₹21,071 crore	54.84%
Private sector	₹17,353 crore	45.16%

National Targets for 2029

The government aims to achieve:

- **₹3 lakh crore** in annual defence production; and
- **₹50,000 crore** in annual defence exports.

Research, Innovation and Testing Infrastructure

Defence Research and Development

- Defence R&D allocation increased from **₹13,716.14 crore in 2014–15 to ₹29,100.25 crore in 2026–27**, an increase of more than 112%.

Since 2022–23, **25% of the defence R&D budget** has been opened to:

- private industry;
- start-ups;
- MSMEs; and
- academic institutions.

This seeks to widen the country's defence-technology base beyond government laboratories.

Defence Testing Portal

Testing facilities across **24 DRDO laboratories** have been made accessible through the **Defence Testing Portal**.

The portal enables domestic manufacturers and start-ups to:

- identify specialised testing facilities;
- request paid access;
- validate products and components; and
- reduce the need to create expensive testing infrastructure independently.

Defence Acquisition Reforms

Defence Acquisition Council

- The **Defence Acquisition Council (DAC)** is the apex body responsible for major capital-acquisition decisions of the Ministry of Defence.
- It grants **Acceptance of Necessity (AoN)**, which formally recognises the armed forces' requirement and allows the procurement process to proceed.
- The DAC has granted AoN for more than **₹6 lakh crore** of systems designed by DRDO and intended to be manufactured by Indian industry.

Major approved indigenous acquisitions include:

- **97 Tejas Mk-1A fighter aircraft:** approximately ₹62,000 crore
- **156 LCH Prachand helicopters:** approximately ₹62,700 crore

Evolution of the Procurement Framework

Defence Procurement Procedure, 2016

DPP 2016:

- streamlined defence procurement;
- promoted Make in India; and

- created the foundation for later indigenisation reforms.

Defence Acquisition Procedure, 2020

DAP 2020:

- gives priority to indigenous procurement;
- encourages Indian design and development;
- increases opportunities for domestic companies; and
- supports greater indigenous content in defence equipment.

Defence Procurement Manual, 2025

- DPM 2025 governs revenue procurement required for the operation and maintenance of the armed forces.

It streamlined approximately **₹1 lakh crore** of procurement by:

- accelerating approvals;
- relaxing penalties for indigenous projects; and
- providing greater assurance of long-term orders.

Draft Defence Acquisition Procedure, 2026

The draft DAP 2026 proposes:

- simpler acquisition categories;
- stronger support for indigenous design and development; and
- indigenous-content requirements of up to **60%**.

Innovation-Support Schemes

Innovations for Defence Excellence

iDEX connects the armed forces with start-ups, MSMEs and independent innovators.

- Approved outlay: **₹498.78 crore**
- Start-ups, MSMEs and innovators engaged: **676**
- Design and development contracts by March 2026: **551**

It provides a pathway for innovative solutions to move from military problem statements to prototype development and possible procurement.

ADITI Scheme

The **Acing Development of Innovative Technologies with iDEX (ADITI)** scheme supports the development of strategically important and advanced defence technologies.

- Outlay: **₹750 crore**
- Implementation period: 2023–24 to 2025–26
- Implementing framework: Defence Innovation Organisation

Technology Development Fund

The **Technology Development Fund (TDF)** supports Indian industries in developing critical defence technologies.

- Maximum grant: **₹50 crore**
- Projects under implementation by June 2026: **80**
- Value of projects: **₹334 crore**
- Additional corpus for deep and emerging technologies: **₹500 crore**

Technology Transfer and Industry Participation

- DRDO is connecting public research with commercial manufacturing through its **Development-cum-Production Partner** framework.

Progress recorded by March 2026 included:

- technologies transferred to **134 partner companies**;
- **2,180 technology-transfer agreements** signed; and
- more than **2,780 intellectual property rights** opened for industry use.

Technology transfer enables companies to manufacture tested defence systems without independently developing every technology from the beginning.

Indigenisation and Domestic Manufacturing

Positive Indigenisation Lists

Positive Indigenisation Lists identify defence items that must be procured from domestic sources within prescribed timelines.

By May 2026:

- **10 lists** had been notified;
- five were issued by the Department of Military Affairs;
- five were issued by the Department of Defence Production; and
- the lists covered **5,521 items**.

They create predictable demand for Indian manufacturers while progressively restricting imports of listed items.

SRIJAN-DEEP Platform

The **SRIJAN Defence Equipment Empowerment Platform (DEEP)** is a digital repository supporting indigenous defence sourcing.

As of May 2026, it contained:

- more than **41,000 vendors**; and
- approximately **2.7 lakh products**.

It helps connect defence requirements with domestic suppliers and strengthens local supply chains.

Defence Industrial Corridors

Uttar Pradesh Defence Industrial Corridor

By April 2026, it had recorded:

- investment commitments of **₹42,057 crore**; and
- grounded investments of **₹4,409 crore**.

The **BrahMos Integration and Testing Facility in Lucknow** has also commenced missile manufacturing.

Tamil Nadu Defence Industrial Corridor

It had attracted:

- proposed investment of **₹32,699 crore**; and
- realised investment of **₹6,446 crore**.

The two corridors seek to create manufacturing clusters, common infrastructure, skilled employment and stronger linkages among large firms, MSMEs and research institutions.

Ease of Doing Business and Defence Trade

Industrial Licensing

The validity of industrial licences was extended:

- from seven years, extendable by three years;
- to 15 years, extendable by three years, providing a maximum of 18 years.

Licences under the Arms Act can now receive lifetime validity.

Defence Exim Portal

The revamped Defence Exim Portal provides:

- end-to-end digital processing;
- automated company verification;
- simplified registration;
- real-time application tracking; and
- secure payment integration.

It is intended to make defence exports and imports more transparent and efficient.

Foreign Direct Investment

The defence-sector FDI limit permits:

- up to **74% through the automatic route**; and
- up to **100% through the government route**.

By March 2026, the sector had attracted FDI inflows of **₹6,670.59 crore**.

Higher FDI limits are intended to bring capital, specialised technology, manufacturing capability and integration with global supply chains. However, strategically sensitive investments remain subject to government scrutiny.

Operational Self-Reliance in 2025–26

Ammunition Indigenisation

The Indian Army achieved approximately **91% self-sufficiency in ammunition** by indigenising **159 of the 175 ammunition variants** in its inventory.

This improves operational preparedness by:

- reducing dependence on external suppliers;
- enabling faster replenishment;
- limiting vulnerability to international disruptions; and
- supporting domestic production capacity.

Missiles and Emerging Technologies

Strategic and Precision-strike Systems

India successfully tested:

- Agni-4 Intermediate-Range Ballistic Missile;
- Agni-5 long-range surface-to-surface ballistic missile;
- TARA glide weapon; and
- RudraM-II air-to-surface missile.

These tests validated indigenous capabilities in long-range deterrence and precision strikes against ground targets.

Air-defence Systems

DRDO advanced:

- **Kusha Long-Range Air Defence Missile**;
- **Very Short-Range Air Defence System (VSHORADS)**; and
- an integrated air-defence system combining missile interceptors, short-range weapons and laser technologies.

A layered air-defence network uses different systems to intercept threats at different ranges and altitudes.

Hypersonic Technology

DRDO conducted a **12-minute ground test of an actively cooled scramjet combustor**.

A scramjet engine:

- uses oxygen from the atmosphere instead of carrying an oxidiser;
- maintains supersonic airflow through the combustion chamber; and
- can support sustained flight at hypersonic speeds.

Active cooling protects the combustor from the extreme heat generated during high-speed operation.

Maritime Defence and Strike Capabilities

Indigenous Naval Platforms

The Indian Navy commissioned **12 warships and submarines**, including:

- INS Surat;
- INS Nilgiri; and
- INS Vaghsheer.

INS Mahendragiri, a stealth frigate with more than **75% indigenous content**, also entered service.

Other developments included:

- launch of **SHACHI**, the first of 11 Next Generation Offshore Patrol Vessels;
- commissioning of **INS Dunagiri**;
- commissioning of **INS Sanshodhak**; and
- commissioning of **INS Agray**.

The completion of the indigenous **Sandhayak-class survey fleet** improves hydrographic surveying, maritime-domain awareness and support for naval operations.

Naval and Ballistic Missile Capabilities

DRDO successfully tested:

- the **Naval Anti-Ship Missile–Medium Range**; and
- a multi-layered **Ballistic Missile Defence** capability.

These systems strengthen India's capacity to address aerial, ballistic and maritime threats.

Significance of Defence Self-Reliance

1. Strategic Autonomy

- Domestic production reduces dependence on foreign suppliers during wars, sanctions and global supply-chain disruptions.

2. Operational Preparedness

- Local manufacturing permits faster maintenance, repair, ammunition replenishment and technological upgrades.

3. Economic Development

- Defence production generates skilled employment and creates demand for metallurgy, electronics, aerospace, artificial intelligence and advanced materials.

4. Export Competitiveness

- Growing exports improve India's position as a reliable defence partner and support long-term strategic relationships.

5. Innovation Ecosystem

- Schemes such as iDEX, ADITI and TDF connect the armed forces with start-ups, academia, MSMEs and private companies.

6. Resilient Supply Chains

- Indigenisation lists, technology transfers and defence corridors help create domestic networks of component and subsystem manufacturers.

Conclusion

India's defence transformation represents a shift from import-led acquisition towards indigenous design, development and manufacturing. Higher investment, acquisition reforms, innovation schemes, indigenisation lists and industrial corridors have expanded domestic capability. Sustained progress will depend on converting research into timely procurement, mastering critical technologies and ensuring consistent quality. A competitive and technologically advanced defence-industrial base will strengthen India's military preparedness, strategic autonomy and role as a dependable security partner by 2047.

Generative Biology: When Artificial Intelligence Begins to Design Viruses

Source: The Hindu

Relevance: **UPSC: GS Paper III—Artificial intelligence, biotechnology, healthcare and security**

Important Keywords

Prelims:

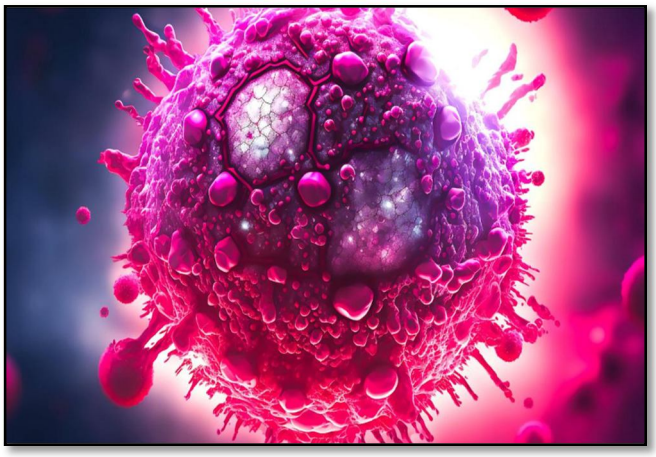
- Generative biology, Evo 1, Evo 2, phage therapy, viral vector, oncolytic virus

Mains:

- Capability amplification, functional DNA screening, trusted access, controlled acceleration

Why in News?

Stanford University and the Arc Institute used AI to design complete bacteriophage genomes. Of 285 designs tested in laboratories, 16 produced functional phages, some of which overcame bacterial resistance. The experiment marks AI's shift from analysing genomes to proposing biological designs, creating medical opportunities and biosecurity concerns.



Stanford–Arc Experiment

Researchers used **Evo 1 and Evo 2**, which are genome language models, to generate complete genomes of bacteriophages—viruses that infect bacteria.

Computational Stage

The AI models:

- studied thousands of phage genomes related to ΦX174;
- identified patterns within their genetic sequences;
- generated previously unseen ΦX174-like genomes; and
- proposed combinations of changes across entire genomes.

Laboratory Stage

Scientists:

- selected 285 AI-generated sequences;
- physically manufactured the corresponding DNA;
- introduced it into *E. coli* bacteria;
- observed whether bacterial machinery produced phage particles; and
- tested the functioning of the resulting phages.

Sixteen designs produced functioning phages. Some succeeded against bacterial strains that resisted the original ΦX174.

Therefore, the computer did not physically create a virus. AI proposed the genetic blueprint, while human researchers selected, synthesised and tested it.

About Bacteriophages

Bacteriophages, meaning **"bacteria eaters,"** are viruses that infect bacteria. They:

- are among the most abundant biological entities in nature;
- generally, target particular bacteria or bacterial strains;
- use bacterial machinery to reproduce; and
- may destroy the infected bacterial cell.

Their ability to target bacteria gives them potential value against infections that no longer respond to antibiotics.

Limitations of Phage Therapy

- A phage effective against one bacterial strain may fail against another.
- Bacteria can develop resistance to phages.
- Identifying a suitable natural phage may require extensive screening.

Generative biology may allow scientists to design customised phages rather than depend exclusively on those discovered in nature.

Why Is ΦX174 Important?

- ΦX174 is a small bacteriophage. In **1977**, it became the first complete DNA genome to be sequenced.
- By the early 2000s, scientists had demonstrated that known viral sequences could be chemically synthesised and used to recover functioning viruses.

Before the Stanford–Arc experiment, researchers already knew:

- the natural ΦX174 genome;
- how to synthesise its DNA;
- how to introduce that DNA into bacteria; and how to recover functioning phages.

The new development was the use of AI to decide what genome should be synthesised.

Evolution of Genomic Science

Stage	Period	Scientific development
Reading	1970s	Sequencing natural genomes
Writing	2000s	Chemically synthesising known DNA
Modifying	2010s	Targeted editing and gain-of-function research
Designing	Present	AI proposing coherent genetic blueprints

- Influenza gain-of-function experiments conducted in 2011–12 showed that genetic changes could alter properties such as

transmission in experimental animals.

- Such research presents a continuing dilemma: the same scientific capability may improve pandemic preparedness while creating biosafety and biosecurity risks. Generative biology adds speed and scale to this challenge.

What Is Generative Biology?

Generative biology combines artificial intelligence with synthetic biology.

Biological foundation models learn the grammar, structure and functional patterns of:

- DNA;
- RNA; and
- proteins.

They then generate new sequences or biological blueprints intended to perform specified functions. The broader field aims to design functional biological entities *de novo*, meaning from the beginning.

How Do Genome Language Models Work?

A conventional language model learns relationships among words. A genome language model studies patterns in biological sequences.

It learns from the DNA alphabet:

- **A:** adenine;
- **C:** cytosine;
- **G:** guanine; and
- **T:** thymine.

From large genomic datasets, the model learns:

- which genetic sequences commonly occur together;
- how different genomic regions are organised;
- which changes may remain compatible; and
- how a complete genome may preserve functional coherence.

The model can then generate new sequences based on these patterns. However, statistical pattern recognition does not amount to complete biological understanding.

DNA: Deoxyribonucleic Acid

- **DNA is the molecule that carries genetic information required for the development and functioning of organisms.**

Basic Structure

- DNA is made of **two linked strands**.
- These strands wind around each other to form a **double helix**.
- The structure looks like a **twisted ladder**.

Backbone of DNA

Each DNA strand has a backbone made of:

- **Deoxyribose sugar**
- **Phosphate group**

These sugar and phosphate units are arranged alternately.

Nitrogenous Bases

DNA contains four bases:

- **Adenine (A)**
- **Thymine (T)**
- **Cytosine (C)**
- **Guanine (G)**

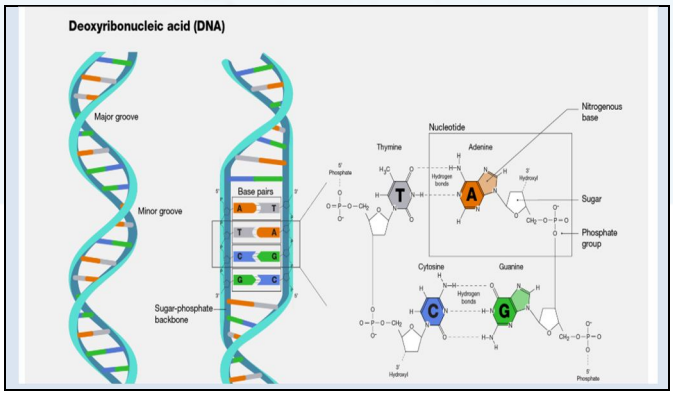
Base Pairing

The two DNA strands are connected by chemical bonds between bases.

Base	Pairs With
Adenine (A)	Thymine (T)
Cytosine (C)	Guanine (G)

Function

- DNA stores **biological information**.
- The sequence of bases acts like a code.
- This code gives instructions for making:
  - **Proteins**
  - **RNA molecules**



Scientific Significance

Whole-genome Design

- The models generated complete genomes rather than suggesting only individual mutations.

Coordinated Genetic Changes

- Biological functions often depend on several genetic changes working together. An AI-designed phage combined a viral protein with other modifications in a way that conventional engineering had struggled to achieve.

Wider Genetic Search

- AI can examine far more possible genetic combinations than researchers can manually test.

Designing Biological Function

- The significant shift is from predicting or analysing biological systems towards designing them for particular functions, such as overcoming bacterial resistance.

Medical and Scientific Opportunities

1. Combating Antimicrobial Resistance

Antimicrobial resistance is reducing the effectiveness of conventional antibiotics. AI-designed phages may support:

- treatment of multidrug-resistant bacteria;
- customised therapies for specific bacterial strains;
- new designs when bacteria develop phage resistance; and
- combinations that reduce bacterial escape.

Medicine may increasingly ask not only whether a suitable phage can be found, but whether the required phage can be designed.

2. Targeted Gene Delivery

AI may improve engineered viral vectors, including Adeno-Associated Viruses, that carry gene-editing tools such as CRISPR.

Better-designed vectors could:

- target selected organs or tissues;
- improve delivery efficiency; and
- reduce unwanted immune reactions.

3. Vaccine and Drug Discovery

Generative models can accelerate the design of:

- vaccine antigens;
- monoclonal antibodies;
- therapeutic proteins; and
- treatments against against emerging pathogens.

4. Precision Oncology

- AI may help design oncolytic viruses that selectively infect and destroy cancer cells while limiting harm to healthy tissues.

5. Pandemic Preparedness

- AI may shorten genomic analysis, modelling and experimental-design cycles. However, the same acceleration could also assist harmful biological engineering.

What the Experiment Does Not Prove

The study does not demonstrate that:

- AI independently manufactured viruses;
- researchers created a dangerous human pathogen;
- an ordinary chatbot can casually design a pandemic virus;

- AI fully understands complex viral behaviour; or
- human scientists and laboratory infrastructure are no longer required.

Complexity of Human Viruses

Dangerous human viruses must coordinate several biological properties:

- receptor binding;
- host range;
- tissue tropism;
- replication;
- immune escape; and
- transmission.

ΦX174 is far simpler. Nevertheless, complexity should not create false reassurance because researchers already understand many links between genetic changes and viral behaviour.

Principal Risk: Capability Amplification

The immediate concern is not that an untrained person can use a public chatbot to manufacture a dangerous virus. It is that advanced AI may make a knowledgeable and well-equipped laboratory substantially more capable.

AI could shorten:

- literature review;
- biological modelling;
- hypothesis generation;
- genome design; and
- experimental planning.

When combined with automated laboratories and accessible DNA synthesis, this acceleration could become profound.

Biosafety and Biosecurity Risks

Dual-use Potential

- The same model may support useful medicines or harmful biological designs.

Unpredictable Outcomes

- A sequence that appears coherent digitally may behave differently when introduced into living cells.

Lower Entry Barriers

- More capable models, automated laboratories and DNA-synthesis services may gradually make complex biological engineering accessible to more users.

Model Limitations

- AI may generate unintended properties because it identifies statistical patterns without fully understanding biological causation.

Novel Harmful Sequences

- Traditional DNA screening generally checks whether an ordered sequence resembles a known pathogen or toxin. AI may generate a novel sequence that looks different but performs a similar harmful function.
- Screening must therefore assess not only **what a sequence resembles**, but also **what it may do**.

Safety Without Obstructing Science

Too little restriction can create security risks, while excessive restrictions can obstruct legitimate medical research.

A practical approach is **graduated and auditable access**, under which model capability is provided according to:

- the user's qualifications;
- institutional affiliation;
- research purpose;
- risk level;
- security verification; and
- audit requirements.

Verified researchers may receive stronger capabilities under appropriate institutional controls, while highly sensitive functions remain restricted.

Governance Across the Biological-Design Chain

Biosecurity cannot depend only on whether an AI system refuses to answer a question. Safeguards are required at every stage.

1. AI Model Governance

- Evaluate biological capabilities before deployment.
- Restrict functions capable of enabling high-risk design.
- Maintain logs for sensitive use.
- Provide advanced access only to verified users.

2. DNA-Synthesis Screening

- Compare orders with databases of pathogens and toxins.
- Verify customer identity and institutional purpose.
- Develop functional screening for novel sequences.
- Flag suspicious or unusually complex orders.

3. Laboratory Biosafety

- Conduct risk assessment before physical synthesis.
- Use appropriate containment.
- Monitor experiments involving enhanced functions.
- Maintain incident-reporting and emergency procedures.

4. Institutional Oversight

- Strengthen biosafety committees.
- Conduct dual-use research reviews.
- Require ethical and security clearance for high-risk work.
- Establish researcher and institutional accountability.

5. Data Security

- Protect sensitive pathogen datasets.
- Control access to high-risk biological information.
- Use secure computing systems.

6. International Cooperation

Common standards are required for:

- DNA-synthesis screening;
- reporting of high-risk research;
- responsible use of biological AI;
- biosecurity capacity-building; and
- prevention of regulatory arbitrage.

Implications for India

Generative biology can strengthen India's capabilities in:

- drug discovery;
- genomics;
- vaccines;
- protein engineering;
- antimicrobial-resistance research;
- precision medicine; and
- experimental design.

Risk of Scientific Dependence

- Smaller specialised models may be sufficient for many scientific tasks. However, Indian researchers should not be limited to weaker models merely because foreign organisations control frontier systems.
- If researchers elsewhere receive trusted access to advanced biomedical AI while Indian scientists rely on restricted public versions, India may face a growing disadvantage in medicines, vaccines, AMR research and genomics.

India's Required Capabilities

Biomedical AI

- India should develop biological and medical foundation models suited to its research

requirements.

Secure Computing

- Sensitive biological models and datasets require protected computing infrastructure.

High-quality Datasets

- Indigenous models need diverse, reliable and properly governed biological data.

Trusted Researcher Access

- Verified scientists should receive access to advanced models under auditable institutional safeguards.

Biosecurity Capacity

India must strengthen:

- DNA-synthesis screening;
- laboratory containment;
- institutional review;
- secure biological data governance; and
- dual-use risk assessment.

Role of the IndiaAI Mission

The IndiaAI Mission and indigenous foundation-model programmes should support:

- scientific and biomedical AI;
- secure computing capacity;
- high-quality biological datasets;
- trusted-access systems; and
- responsible research safeguards.

AI sovereignty without biosecurity could be reckless, while biosecurity without AI sovereignty could create scientific dependence.

Conclusion

The Stanford–Arc experiment marks a transition from reading, writing and modifying genomes to AI-assisted biological design. AI did not independently manufacture a dangerous virus; it proposed complete phage genomes that scientists physically synthesised and tested.

This capability may transform phage therapy, vaccines, gene delivery, drug discovery and cancer treatment. It may also accelerate harmful biological engineering. India must therefore build scientific capability and biosecurity together while helping shape international safeguards.

Public Health

National Animal Disease Control Programme (NADCP)

Source: PIB

Relevance: **GS Paper III – Agriculture, Animal Husbandry, Health Security, One Health, Pandemic Preparedness**

Important Keywords

NADCP | Foot and Mouth Disease | Brucellosis | Brucella abortus | Bharat Pashudhan Portal | NDLM | Sero-surveillance | Sero-monitoring | One Health | Zoonotic Diseases | Mobile Veterinary Units | LHDCP | Pandemic Fund Project | Antimicrobial Stewardship

Why in News?

PIB released a backgrounder on the **National Animal Disease Control Programme (NADCP)**, highlighting its role in reducing **Foot and Mouth Disease (FMD)** and **Brucellosis** through nationwide vaccination, surveillance, digital livestock registration and One Health-based animal health security.

Background

India has one of the world's largest livestock populations. As per the **20th Livestock Census 2019**, India has **535.78 million livestock**, including **302.79 million bovines**. Diseases such as **FMD** and **Brucellosis** cause economic losses by reducing milk yield, fertility, productivity and trade potential.

About NADCP

The **National Animal Disease Control Programme** was launched in **September 2019** by the Government of India to control and eradicate major livestock diseases.

Parameter	Details
Programme	National Animal Disease Control Programme
Ministry	Ministry of Fisheries, Animal Husbandry and Dairying
Launched	2019
Target Diseases	FMD and Brucellosis
Method	Vaccination, surveillance, digital monitoring
Umbrella Scheme	Livestock Health and Disease Control Programme
LHDCP Budget 2026–27	₹2,010 crore

Target Diseases

Foot and Mouth Disease

- **FMD** is a highly contagious **viral disease** affecting **cloven-hoofed animals** such as cattle, buffalo, sheep, goats and pigs.
- **Impact:** reduced milk production, slow

growth, poor reproduction, lower draft capacity and trade restrictions.

- **Important Serotypes: O, A and Asia-1**

Brucellosis

- **Brucellosis** is a reproductive disease caused by **Brucella abortus**. It mainly affects cattle and buffaloes.
- **Impact:** infertility, abortion, reduced lactation and loss in milk and meat production. Since there is **no curative treatment in bovines**, vaccination is the most effective measure.

Vaccination Strategy

Disease	Strategy
FMD	100% vaccination of eligible livestock **twice a year**
Brucellosis	One-time vaccination of **4–8 months old female bovine calves**

Key Components

- **Mass FMD vaccination** every six months.
- **Brucellosis vaccination** of female bovine calves.
- **Ear-tagging and livestock registration**.
- Data uploading on **Bharat Pashudhan Portal / NDLM**.
- **Sero-surveillance and sero-monitoring**.
- Vaccine and **cold-chain infrastructure**.
- Outbreak investigation, virus typing and quarantine.
- Public awareness and training of field officials.

Digital and Institutional Support

- **Bharat Pashudhan Portal:** Gives each animal a unique **12-digit Tag ID** for traceability and real-time monitoring.
- **Mobile Veterinary Units:** Provide doorstep veterinary services through toll-free number **1962**.
- **MAITRIs:** Rural technicians supporting farmer outreach and livestock services.
- **ICAR institutions:** Support vaccine research, quality testing, surveillance and disease modelling.

One Health Linkage

NADCP supports the **One Health approach**, which connects **human health, animal health and environmental health**.

It helps in:

- reducing zoonotic disease risk
- improving early disease detection
- promoting antimicrobial stewardship
- strengthening pandemic preparedness

Pandemic Preparedness Link

In **2024**, India launched the **Pandemic Fund Project** on **"Animal Health Security Strengthening in India for Pandemic Preparedness and Response."**

Feature	Details
Support	G20 Pandemic Fund
Value	US$25 million
Partners	ADB, FAO and World Bank
Focus Areas	Genomic surveillance, environmental surveillance, labs, cross-border collaboration

Conclusion

The **National Animal Disease Control Programme** is a major step towards a **disease-secure, productive and resilient livestock sector**. By combining vaccination, surveillance, digital livestock tracking and One Health preparedness, NADCP strengthens farmer livelihoods, food security and India's preparedness against future zoonotic disease threats.

History, Art & Culture

Revitalising India's Cultural Heritage

Source: PIB

Relevance: GS Paper I: Indian culture, heritage, art and architecture

Important Keywords

Prelims:

- Adopt a Heritage 2.0, PRASHAD, Swadesh Darshan, ASI, NMMA, Gyan Bharatam

Mains:

- Heritage conservation, cultural identity, digitisation of heritage, sustainable tourism, repatriation of antiquities, technology-enabled conservation

Why in News?

Recently, the Government highlighted major initiatives for **revitalising India's cultural heritage** through conservation, digitisation, tourism infrastructure and cultural preservation. These efforts aim to protect India's civilisational legacy while improving tourism, connectivity, visitor facilities and local economic development.The focus is not only on preserving monuments but also on making heritage accessible, digitally documented and economically useful for local communities.

What is the Importance of Cultural Heritage?

India's cultural heritage reflects its **civilisational continuity and national identity**. It includes monuments, antiquities, manuscripts, museums, sacred relics, languages, oral traditions, films and knowledge systems.

Cultural heritage is important because it:

- preserves India's historical memory;
- strengthens national identity;
- promotes tourism and local livelihoods;
- supports education and research;
- connects India with global civilisational networks;
- protects traditional knowledge for future generations.



What are the Major Government Initiatives for Heritage Preservation?

1. Adopt a Heritage 2.0

- **Adopt a Heritage 2.0** was launched in **September 2023** to develop and maintain visitor-friendly amenities at **Protected Monuments of National Importance**. As of March 2026, **30 MoUs** have been signed under the programme, and adopted monuments recorded **13.59 million visitors during FY 2024–25**.

Significance

- Encourages public-private participation.
- Improves visitor amenities at monuments.
- Helps in professional maintenance and tourism management.
- Makes heritage sites more accessible and tourist-friendly.

, 2. PRASHAD Scheme

- The Pilgrimage Rejuvenation and Spiritual, Heritage Augmentation Drive" (PRASHAD) focuses on developing pilgrimage and heritage destinations by improving infrastructure, sanitation, safety and visitor amenities. As of February 2026, **54 projects** have been sanctioned across **28 States and Union Territories**. By December 2025, **32 projects** were completed, with a total project cost of **₹1,726.74 crore**.

Significance

- Strengthens spiritual tourism.
- Improves basic facilities at pilgrimage sites.
- Supports local economies around religious and heritage centres.
- Helps balance faith, tourism and infrastructure development.

3. Swadesh Darshan

- **Swadesh Darshan** seeks to develop integrated tourism infrastructure across thematic tourist circuits. The scheme covers **15 thematic circuits**, including Buddhist, Coastal, Desert, Eco, Heritage, Himalayan, Krishna, North-East, Ramayana, Rural, Spiritual, Tirthankar, Tribal, Wildlife and Sufi circuits. As of March 2026, **76 projects** had been sanctioned with a total investment of **₹5,290.33 crore**, and **75 projects** had been completed.

Swadesh Darshan 2.0

- Under **Swadesh Darshan 2.0**, the approach has shifted from circuit-based development to a **destination-centric approach**. Under this version, **53 projects** have been sanctioned with a total investment of **₹2,208.31 crore**.

Significance

- Promotes thematic tourism.
- Supports destination-based planning.
- Improves infrastructure around tourist locations.
- Encourages sustainable and integrated tourism development.

4. Challenge Based Destination Development

- **Challenge Based Destination Development (CBDD)** was introduced in **March 2024** under Swadesh Darshan 2.0. It focuses on sustainable tourism through a competitive, challenge-based framework. Its focus areas include holistic planning, innovation, community participation and destination development. Under CBDD, **38 projects** have been sanctioned with a total investment of **₹697.94 crore**.

Significance

- Encourages competition among destinations.
- Promotes innovation in tourism planning.
- Gives importance to community participation.
- Supports sustainable destination development.

How is India Strengthening Archaeology and Monument Conservation?

1. Archaeological Survey of India

- The **Archaeological Survey of India (ASI)** is the premier organisation for archaeological research and conservation of India's cultural heritage. It functions through around **38 circles** across the country and safeguards **3,686 centrally protected monuments**. In FY 2024–25, **₹374 crore** was allocated for conservation and maintenance of protected monuments. Over the last five years, ASI issued **121 permissions** for archaeological projects.

Importance of ASI

- Conserves nationally important monuments.
- Conducts archaeological research.
- Supports scientific restoration.
- Protects heritage from decay and encroachment.
- Helps in heritage documentation and management.

2. National Mission on Monuments and Antiquities

- The **National Mission on Monuments and Antiquities (NMMA)** is implemented by the ASI. It focuses on creating a comprehensive national database of monuments and antiquities for conservation planning and management. As of March 2026, it documented **1.84 lakh monuments** and **17.20 lakh antiquities** across India.

Significance

- Creates a national-level heritage database.
- Helps in tracking and protecting antiquities.
- Supports evidence-based conservation.
- Reduces risk of illegal trafficking and loss of heritage objects.

3. HRIDAY Scheme

- The **Heritage City Development and Augmentation Yojana (HRIDAY)** aimed to integrate urban development with heritage conservation while preserving the unique character of heritage cities. It focused on water bodies, green spaces, smart technology, safety and local livelihoods through tourism. It covered **12 heritage cities** and concluded on **31 March 2019**.

Key Outcomes

- Improved cleanliness, tourism and community development in **Ajmer, Amaravati and Badami**.
- Promoted heritage revitalisation and economic growth in **Amritsar, Gaya and Varanasi**.
- Improved tourism infrastructure and public amenities in **Warangal and Puri**.
- Strengthened safety and urban infrastructure in **Kancheepuram and Mathura**.
- Advanced environmental sustainability and heritage conservation in **Velankanni**.
- Developed heritage zones and the Bet Dwarka Darshan Circuit in **Dwarka**.

What Steps are Being Taken to Reclaim Cultural Treasures?

India has intensified efforts to bring back sacred relics and antiquities taken abroad through colonial exploitation, foreign occupations and illegal trafficking.

Major Repatriation Achievements

- **Piprahwa Relics of Lord Buddha** returned in 2025 after **127 years**.
- **Goddess Annapurna idol** repatriated from Canada in 2021 after **108 years**.
- **Rama, Sita and Lakshmana bronze idols** returned from the UK in 2020.
- Sacred and cultural objects have also been returned from **Australia, USA, UK,**

Germany, Singapore and Canada.

Repatriation of Antiquities

During the last five years, **615 antiquities** were retrieved up to 30 June 2026. Some verified objects were handed over to organisations and institutions, including IGNCA, the National Museum and the Indian Institute of Heritage.

Significance

- Corrects historical injustice.
- Restores cultural pride.
- Strengthens India's diplomatic efforts.
- Protects heritage from illegal trafficking.
- Reconnects sacred and cultural objects with their civilisational context.

How is India Using Sacred Relics for Cultural Diplomacy?

India has expanded the international exposition of sacred Buddha relics to strengthen civilisational and cultural ties.

Recent expositions include:

- **Vietnam, 2025:** Over **15 million devotees**.
- **Kalmykia, Russia, 2025:** Over **90,000 visitors**.
- **Bhutan, 2025:** Exposition during the **Global Peace Prayer Festival**.
- **Sri Lanka, 2026:** Exposition at **Gangaramaya Temple, Colombo**.

Domestic exhibitions were also organised in **New Delhi** and **Ladakh** in 2026, showcasing the reunited Piprahwa relics.

How are Museums and Cultural Infrastructure Being Strengthened?

1. Museum Grant Scheme

- The **Museum Grant Scheme** provides financial assistance for establishing new museums and strengthening existing museums at regional, state and district levels. It supports modernisation, digitisation of collections and capacity building of museum professionals. It has also supported virtual museums, theme-based museums and Virtual Experiential Museums. In the last five financial years, **₹184.39 crore** was sanctioned and **₹101.19 crore** was utilised.

2. India's First Archaeological Experiential Museum at Vadnagar

- India's first **Archaeological Experiential Museum** at **Vadnagar, Gujarat** combines history and excavation. It is spread over **12,500 square metres** and built at a cost of **₹298 crore**. It displays over **5,000 artefacts**, including food grains, DNA samples and skeletal remains. It also includes a **4,000 sq. m. open excavation site** showing remains at **16–18 metres depth**.

Significance

- Makes archaeology accessible to the public.
- Promotes experiential learning.
- Helps students understand excavation-based history.
- Strengthens heritage tourism.

What is India's Global Heritage Recognition?

India has expanded its global heritage recognition. It now has **45 UNESCO World Heritage Sites** and hosted the **46th UNESCO World Heritage Committee Session in New Delhi in 2024**.

Significance

- Enhances India's global cultural profile.
- Promotes international tourism.
- Supports conservation standards.
- Strengthens India's role in global heritage governance.

How is Digitisation Preserving India's Knowledge Heritage?

1. Gyan Bharatam Mission

- The **Gyan Bharatam Mission** was launched in **2025** to preserve, digitise and promote access to India's manuscript heritage. It uses modern technologies for long-term preservation and global accessibility.

2. National Manuscript Survey

- The **National Manuscript Survey** was launched in **March 2026** to identify, document and create a national database of manuscripts. More than **1.19 crore manuscripts** have been reported. Over **8 lakh manuscripts** have been digitised across India, and more than **4.40 lakh manuscripts** are available on the Gyan Bharatam portal. The mission has an approved outlay of **₹482.85 crore** for 2024–31.

Significance

- Protects fragile manuscripts from physical loss.
- Expands public access to knowledge.
- Supports research in history, literature, religion and philosophy.
- Helps preserve India's intellectual traditions.

How are Museum Collections Being Digitised?

- The Ministry of Culture is digitising museum collections and archival resources through **JATAN software**, developed with technical support from **C-DAC, Pune**. A **National Digital Repository** has been created through the Museums of India portal. The portal hosts digitised collections from **8 National Level Museums, 2 ASI Site Museums and Dr. Babasaheb Ambedkar Museum, Pune**. As on 15 July 2026, **3,75,707 artefacts out of 4,88,983 artefacts** had been digitised and made available online.

Significance

- Improves public access to museum collections.
- Supports digital education.
- Helps in cataloguing and protection of artefacts.
- Reduces dependence on physical access alone.

What is the Role of Technology and AI in Heritage Conservation?

Modern technologies such as **LiDAR scanning, GIS-based mapping and drone surveys** are being used for heritage documentation and conservation. Artificial Intelligence is also being used to support digitisation, documentation and accessibility of cultural assets and heritage data.

AI-based Cultural Preservation

India is using AI to preserve languages, manuscripts and cultural heritage.

Important initiatives include:

- **BHASHINI:** Launched in 2022; supports **22 languages in voice** and **36 languages in text**, with more than **350 AI models** and over **4 billion language transactions**.
- **BharatGen:** Developing AI models for **22 Scheduled Languages**.
- **Adi-Vaani:** AI-based platform for tribal languages such as **Santali, Bhili, Mundari and Gondi**.
- Platforms like **Anuvadini, e-KUMBH, SPPEL, Sanchika and Gyan-Setu** support multilingual education and traditional knowledge preservation.
- More than **5 crore learners** are connected through digital education platforms such as SWAYAM.

Significance

- Supports linguistic diversity.

- Preserves tribal and endangered languages.
- Makes knowledge accessible in Indian languages.
- Strengthens inclusive education and cultural continuity.

What is the Vedic Heritage Portal?

The **Vedic Heritage Portal** was launched in **March 2023** under the **Indira Gandhi National Centre for the Arts (IGNCA)**. It aims to preserve, document and provide digital access to India's Vedic knowledge traditions. It covers **Rigveda, Yajurveda, Samaveda and Atharvaveda** traditions, with more than **500 hours of recordings** integrated into the platform.

- The **Tradition of Vedic Chanting** is recognised as **UNESCO Intangible Cultural Heritage**, and **Rigveda manuscripts** are included in UNESCO's **Memory of the World Register**.

How is India Conserving Cinematic Heritage?

1. National Film Heritage Mission

- The **National Film Heritage Mission (NFHM)** was launched in **2015** to preserve, digitise and restore India's cinematic heritage. It covers feature films, short films and documentaries across Indian languages. As of December 2025, **1,469 titles**, equal to **4.3 lakh minutes of films**, had been digitised.

2. National Museum of Indian Cinema

- The **National Museum of Indian Cinema (NMIC)** was inaugurated in **2019** with a project cost of **₹140.61 crore**. It showcases more than **100 years of Indian cinema** through artefacts, vintage equipment, photographs, memorabilia, interactive exhibits and multimedia displays. It recorded over **17,000 visitors** in May 2026.

What is the Significance of India's Heritage Initiatives?

1. Strengthening Cultural Identity

- These initiatives protect India's civilisational memory and strengthen national identity.

2. Promoting Tourism

- Improved infrastructure, visitor amenities and destination development increase tourism potential.

3. Supporting Local Economy

- Heritage tourism creates livelihood opportunities for local guides, artisans, transport services and small businesses.

4. Improving Public Access

- Digitisation makes manuscripts, museum collections and cultural resources available to students, researchers and citizens.

5. Strengthening Cultural Diplomacy

- Repatriation of relics and global expositions of sacred objects strengthen India's civilisational links with other countries.

6. Preserving Knowledge Systems

- The Gyan Bharatam Mission, Vedic Heritage Portal and AI tools help preserve traditional knowledge, languages and manuscripts.

Challenges

- Physical decay of monuments due to age and environmental stress.
- Encroachment and urban pressure around heritage sites.
- Shortage of trained conservation professionals.
- Need for regular maintenance after project completion.
- Illegal trafficking of antiquities.

- Digital divide in accessing online heritage resources.
- Need for better coordination between Centre, States and local bodies.
- Balancing tourism promotion with heritage protection.

Way Forward

- Strengthen scientific conservation and regular maintenance of monuments.
- Expand digital documentation through GIS, LiDAR and drone mapping.
- Improve visitor amenities without damaging heritage character.
- Train local youth as heritage guides.
- Promote community participation in heritage protection.
- Strengthen anti-trafficking measures for antiquities.
- Integrate heritage conservation with urban planning.
- Promote multilingual digital platforms for inclusive access.
- Develop sustainable tourism models around heritage sites.
- Encourage schools and colleges to use heritage sites as learning spaces.

Conclusion

India's cultural heritage is a living link between the past, present and future. Government initiatives in conservation, digitisation, tourism infrastructure, repatriation, museums, language preservation and cinematic heritage show a broad approach to safeguarding this legacy.the theme is important because heritage is not only about monuments. It is linked with identity, education, tourism, diplomacy, technology and local development. A sustainable heritage strategy must therefore combine preservation, public access, scientific conservation and community participation.