

**UPSC and State PSC
Current Affairs
National and International Issues**

Current Affairs

JUNE - 2026

<https://t.me/kpiasacademy/6154>

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Polity & Governance

Can Election Commission decide who is an Indian citizen? What Supreme Court said in SIR verdict

Source: The Indian Express

Relevance: GS Paper II: Indian Polity, Election Commission of India, Electoral Reforms, Citizenship, Fundamental Rights

Important Keywords

For Prelims

- Special Intensive Revision, Election Commission of India, Article 324, Section 16 of RPA 1950, Citizenship Act 1955, Electoral Roll, Aadhaar, Booth Level Officer, D-Voter, Foreigners Tribunal

For Mains

- Free and fair elections, electoral integrity, right to vote, citizenship verification, procedural fairness, institutional restraint, disenfranchisement, burden of proof

Why in News?

The Supreme Court, in **Association for Democratic Reforms v. Election Commission of India**, upheld the Election Commission of India's order for **Special Intensive Revision** of electoral rolls.

- The case arose from the SIR conducted before the **November 2025 Bihar Assembly elections**. The Supreme Court held that the Election Commission has the power to conduct SIR and examine citizenship-related questions for electoral purposes.

- However, the Court clarified that the Election Commission cannot finally declare whether a person is an Indian citizen or not.

What is Special Intensive Revision?

Special Intensive Revision is a large-scale verification process conducted by the Election Commission to update and clean electoral rolls.

It is different from the normal annual summary revision because it involves deeper verification of voter details.

The process may include:

- House-to-house verification by Booth Level Officers
- Checking old voter roll links
- Correction of wrong entries
- Deletion of duplicate, shifted or dead voters
- Verification of citizenship declaration
- Publication of draft and final voter lists

In simple words, SIR is a detailed checking of the voter list to ensure that only eligible citizens remain registered as voters.

Background of the Case

- The Election Commission conducted SIR in Bihar before the 2025 Assembly elections. The process was challenged before the Supreme Court.

ECI & Citizenship: Supreme Court on SIR Verdict

★ Association for Democratic Reforms v. Election Commission of India ★

Current Affairs | Polity & Governance



1 Why in News?

- Supreme Court upheld ECI's order for Special Intensive Revision (SIR) of electoral rolls.
- Case arose from SIR before the November 2025 Bihar Assembly elections.
- Court: ECI can examine citizenship for electoral purposes.
- Court: ECI cannot finally decide who is an Indian citizen.

2 What is SIR?

- Large-scale verification of electoral rolls.
- Deeper exercise than routine annual summary revision.
- House-to-house verification by Booth Level Officers (BLOs).
- Checks old voter roll links and corrects wrong entries.
- Deletes duplicate, shifted and deceased voters.
- Publishes draft and final voter lists.

3 Legal Basis

- **Article 324:** ECI has superintendence, direction and control over elections.
- **Representation of the People Act, 1950:** Framework for preparation and revision of rolls.
- **Section 16, RPA 1950:** Non-citizens cannot be registered as voters.

4 Supreme Court's Main Observations

1. Power to Conduct SIR

- ECI is empowered to conduct SIR.
- ECI is best placed to decide technical modalities.
- Courts will not interfere unless safeguards are violated.

2. SIR Was Broadly Proportionate

- Concerns were addressed through interim safeguards.
- Aadhaar accepted as proof of identity.
- Deleted names must be published.
- Reasons for deletion must be given.
- Opportunity of hearing must be provided.
- Judicial officers may assist hearings.

3. Citizenship Check Allowed

- ECI can examine citizenship while revising rolls.
- Power is only "prima facie and contextual".
- Scrutiny is only for electoral eligibility.

5 Can ECI Decide Citizenship?

NO

- ECI may refuse enrolment or delete a name from the roll.
- Deletion does NOT amount to a final declaration of non-citizenship.
- Final decision must be taken by the competent authority under the Citizenship Act, 1955.

6 If ECI Doubts Citizenship

- Matter must be referred to the competent authority under the Citizenship Act, 1955.
- Notice must be given to the person.
- Opportunity of hearing must be provided.
- Person must get a fair chance to submit documents.
- Decision should be reasoned and timely.
- Preferably resolved before the next Parliamentary, Assembly or local body election.

7 Presumption from Electoral Roll

- A person already on the electoral roll enjoys a presumption of being a voter and citizen.
- This presumption is evidentiary, not absolute.
- It is rebuttable if valid material creates doubt.
- Electoral roll entry is not a permanent guarantee against future scrutiny.

8 Key Safeguards Ordered by the Supreme Court

- Publish deleted voters' names.
- Provide reasons for deletion.
- Accept Aadhaar as proof of identity.
- Give voters an opportunity to respond.
- Allow judicial officers to assist hearings.
- Refer doubtful citizenship cases to the competent authority.
- ECI cannot take the final citizenship decision.



9 Quick Takeaway

- SIR is valid.
- ECI can verify citizenship only for electoral purposes.
- ECI cannot finally decide citizenship.
- Final citizenship decision lies under the Citizenship Act, 1955.
- Safeguards are essential to prevent disenfranchisement.



Source: Indian Express

UPSC / APPSC / TGPSC Relevance: Polity, Electoral Reforms, Citizenship

- The petitioners argued that the process may lead to large-scale deletion of genuine voters. They also raised concerns about lack of transparency; strict documentation requirements and the burden placed on ordinary citizens.
- The Supreme Court examined whether the Election Commission had the authority to conduct SIR and whether it could examine citizenship-related issues while revising electoral rolls.

Legal Basis of SIR

The Election Commission gets its power mainly from:

Article 324 of the Constitution

- It gives the Election Commission the power of superintendence, direction and control over elections.

Representation of the People Act, 1950

- It provides the legal framework for preparation and revision of electoral rolls.

Section 16 of RPA, 1950

- It states that a person who is not a citizen of India cannot be registered as a voter.
- Therefore, the Election Commission can verify whether a person satisfies the legal conditions required for inclusion in the electoral roll.

Supreme Court's Main Observations

1. ECI Has Power to Conduct SIR

- The Supreme Court held that the Election Commission is empowered to conduct Special Intensive Revision.
- The Court said that the Commission is best placed to decide the technical method of revising electoral rolls.

- This means the judiciary will not normally interfere with the method chosen by the Election Commission unless it violates constitutional or legal safeguards.

2. SIR Was Held Broadly Proportionate

- The Court held that the SIR process was broadly proportionate.

It observed that many earlier concerns were addressed through interim directions of the Court.

These directions included:

- Acceptance of **Aadhaar** as proof of identity
- Publication of deleted voters' names
- Providing reasons for deletion
- Opportunity of hearing
- Assistance of judicial officers during hearings

The Court said these safeguards made the process more transparent and fairer.

3. ECI Can Examine Citizenship for Electoral Purposes

- The Supreme Court held that the Election Commission can examine citizenship while revising electoral rolls.
- This is because non-citizens are not allowed to be registered as voters under **Section 16 of the Representation of the People Act, 1950**.
- However, this power is limited. The Court described it as **prima facie and contextual**.
- This means the Election Commission can only check citizenship for the purpose of deciding whether a person can remain on the voter list.

Can the Election Commission Decide Who is an Indian Citizen?

No. The Election Commission cannot finally decide who is an Indian citizen.

- The Supreme Court clearly stated that if the Election Commission is not satisfied with a person's documents, it may refuse enrolment or delete the name from the electoral roll.
- But such deletion does not mean that the person is officially declared a non-citizen.
- The final decision on citizenship must be taken by the competent authority under the **Citizenship Act, 1955**.

What Happens if ECI Doubts Citizenship?

If the Election Commission deletes a person's name on the ground of doubtful citizenship, it must refer the matter to the competent authority under the Citizenship Act, 1955.

The competent authority must decide the matter according to law after giving:

- Notice to the person
- Opportunity of hearing
- Fair chance to submit documents
- Reasoned decision

The Supreme Court said that such decisions should be taken within a reasonable time, preferably before the next Parliamentary, Assembly or local body election in that constituency.

Presumption of Citizenship from Electoral Roll

- The Court accepted that a person already on the electoral roll enjoys a presumption of being a voter and citizen.
- However, this presumption is not absolute.
- It is only an evidentiary presumption. It can be questioned if valid material creates doubt.
- The Court said that inclusion in the electoral roll is not a permanent guarantee against future verification.

Key Safeguards Ordered by the Supreme Court

The Supreme Court introduced important safeguards to make the SIR process fair.

These include:

- Deleted voters' names must be published.
- Reasons for deletion must be provided.
- Aadhaar may be accepted as proof of identity.
- Voters must get an opportunity to respond.
- Judicial officers may assist in hearings.
- Citizenship-related cases must be referred to the competent authority.
- Final citizenship decision cannot be taken by ECI.

These safeguards aim to prevent arbitrary deletion of voters.

Significance of the Verdict

1. Strengthens Electoral Integrity

- The judgment supports the Election Commission's power to maintain clean and accurate voter lists.

It may help remove duplicate, false, dead or shifted voters from electoral rolls.

2. Clarifies the Limits of ECI's Power

- The verdict makes it clear that the Election Commission can examine citizenship only for electoral purposes.
- It cannot finally decide citizenship status.

3. Protects Procedural Fairness

- The Court emphasised notice, hearing, transparency and reasoned decision-making.
- This is important because deletion from electoral rolls can affect a citizen's right to vote.

4. Clears the Way for Nationwide SIR

- The verdict allows the Election Commission to continue SIR in other states and Union Territories.

This makes the judgment important for upcoming elections.

5. Balances Two Democratic Goals

The Court tried to balance two objectives:

- Clean and reliable voter lists
- Protection of genuine citizens from wrongful exclusion

Concerns and Challenges

1. Risk of Voter Disenfranchisement

- Genuine voters may lose their voting rights if their names are deleted due to clerical mistakes or lack of documents.
- This may affect poor, elderly, migrant and marginalised citizens more severely.

2. Burden Shifts to Citizens

- After deletion, the burden practically shifts to the individual to prove eligibility or citizenship.
- This can be difficult for people who do not have proper documents.

3. Minor Errors May Create Serious Problems

- Errors in names, age, parents' names, spelling, address or old voter roll details may lead to notices or deletion.
- In India, such errors are common in official documents.

4. Link Between Voter Roll and Welfare Benefits

- The Court clarified that deletion from the voter list does not mean loss of citizenship.
- However, if governments link welfare benefits with electoral roll status, excluded

persons may face practical difficulties.

5. Assam D-Voter Experience

The Assam experience shows the danger of long citizenship disputes.

- During the 1997 revision, several people were marked as doubtful voters and referred to Foreigners Tribunals.
- Many cases remained pending for years, creating uncertainty over citizenship and access to basic rights.

6. Administrative Burden

- If large numbers of deleted voters are referred for citizenship determination, the competent authorities may become overburdened.
- This may delay justice and create long-term uncertainty.

What Citizens Should Do During SIR

Citizens should carefully follow the SIR process.

They should:

- Verify pre-filled details in the SIR form
- Check name, address, EPIC number and photograph
- Provide correct details of parents or spouse
- Check legacy linkage, if required
- Submit the form within the deadline
- Track whether the form has been uploaded
- Check the draft electoral roll
- File correction or inclusion forms if the name is missing
- Appeal within the prescribed time if the name is deleted

This is important because failure to respond may result in exclusion from the voter list.

Way Forward

The Election Commission should conduct SIR in a

transparent and citizen-friendly manner.

- Minor clerical errors should not become a ground for harsh deletion. Special help desks should be created for elderly persons, migrants, poor citizens and people without easy access to documents.
- Deleted voters must receive clear reasons and proper opportunity to appeal. Citizenship-related cases must be referred only where there is genuine doubt and not merely because of spelling or data mismatch.
- Political parties, civil society organisations and the media should create awareness among voters. Governments should also ensure that welfare benefits are not denied merely because a person's name is removed from the electoral roll.
- The competent authority under the Citizenship Act should decide referred cases

quickly and fairly.

Conclusion

The Supreme Court verdict upholds the Election Commission's power to conduct Special Intensive Revision of electoral rolls. It also allows the Commission to examine citizenship-related questions for electoral purposes.

- However, the Election Commission cannot finally decide whether a person is an Indian citizen. Final citizenship determination belongs to the competent authority under the Citizenship Act, 1955.
- The verdict is important because it seeks to protect both electoral integrity and democratic rights. Its success will depend on fair implementation, transparency and protection of genuine citizens from wrongful disenfranchisement.

Water Governance in Rural India: Empowering Communities through Participatory Water Budgeting

Source: [PIB](#)

Relevance: UPSC GS Paper II - Governance, Government Policies and Local Self-Governance; GS Paper III - Water Resources, Agriculture, Environment and Disaster Management

Important Key Words

- **For Prelims:** Water Budgeting, Atal Bhujal Yojana, National Water Mission, Varuni Web Application, Jal Shakti Abhiyan, Jal Shakti se Jal Shakti, Participatory Water Governance, Groundwater Recharge, Watershed Management, Gram Sabha,
- **For Mains:** Rural water governance,

participatory water budgeting, demand-side water management, groundwater depletion, climate-resilient water planning, community-led conservation, water-energy-food nexus, agricultural water demand

Why in News?

The Ministry of Jal Shakti highlighted the importance of **water governance in rural India** through the idea of **participatory water budgeting**. Water budgeting is becoming important because India faces rising water demand, uneven water distribution, climate variability, groundwater depletion and increasing pressure from agriculture, domestic use and livestock. The article highlights how community-led planning, supported by

schemes such as **Atal Bhujal Yojana**, **National Water Mission**, State initiatives and digital tools such as the **Varuni Web Application**, can improve rural water governance

What is Water Budgeting?

Water budgeting is a systematic assessment of water availability and water demand within a defined geographical unit. This unit may be a village, watershed, block or district.

It compares:

- How much water is available, How much water is needed, Which sectors use water Whether the area has surplus water or water deficit, What actions are needed to manage water better

Need for Water Budgeting in Rural India

- Water budgeting is needed because rural India depends heavily on agriculture and groundwater.
- Agriculture accounts for around **80 to 90 percent** of water use in rural areas. Livestock also creates significant water demand for drinking, fodder production and related activities.

Many rural areas face:

- Declining groundwater levels, Seasonal water shortages, uneven rainfall, Droughts and floods, Conflicts over water allocation, Unsuitable cropping patterns, Over-dependence on borewells

Therefore, India needs to move from a **supply-driven approach** to a **demand-based and planned water management system**.

Water Resource Dynamics in India

- India has a large population and a large livestock base. It has about **17.5 percent of the global population** and around **11.6**

percent of the world's livestock.

- This creates significant pressure on available water resources.
- The average annual water availability depends on rainfall, geology, rivers, aquifers and climate. But per capita water availability depends on population size.
- As population increases, the amount of water available per person declines.
- Climate variability further increases the problem. Some areas may face floods, while others may face droughts in the same season. This makes local-level planning necessary.

Water Availability Includes:

- Rainfall, Surface inflows, Groundwater recharge, Water received from other geographical areas, Stored water in tanks, ponds and reservoirs

Water Demand Includes:

- Drinking water demand, Domestic water demand, Irrigation water demand, Livestock water demand, Industrial water demand, Environmental water needs

Water Losses Include:

- Evapotranspiration, Runoff, Groundwater discharge, Leakage, Inefficient irrigation losses

After calculating these elements, the community can identify whether the area is facing a **water surplus** or **water deficit**. This helps in choosing suitable crops, planning irrigation, restoring water bodies and regulating groundwater use.

Role in Agriculture and Livestock Management

- Water budgeting is highly useful for agriculture because crop choices must match local water availability.
- If farmers grow water-intensive crops in



water-scarce areas, groundwater depletion increases. This creates long-term risk for agriculture.

Water budgeting helps farmers in:

- Selecting suitable crops, Planning sowing based on local water conditions, reducing water-intensive crops in dry regions, promoting drip and sprinkler irrigation, improving productivity with efficient water use, Reducing crop failure risk during droughts

Livestock is also an important part of rural water demand. The livestock census showed an increase in livestock population, which means drinking water and fodder-related water demand also increase.

Therefore, water budgeting must include both **agriculture and livestock demand**.

Government Initiatives

1. Atal Bhujal Yojana

- The **Atal Bhujal Yojana** was launched in **2019** to promote community-led groundwater management.
- It focuses on water budgeting at the Gram Panchayat level. The programme is implemented in selected groundwater-stressed States.
- It covers **229 blocks in seven States**. The selected States and Gram Panchayats are chosen based on groundwater stress, institutional readiness and willingness to participate.

The scheme promotes:

- Annual water budgeting, Community participation, Groundwater recharge, Water conservation structures, Traditional water system revival, Demand-side water management

- During assessments conducted in 2023-24 and 2024-25, **180 out of 229 blocks** showed measurable improvement in groundwater levels.
- As of March 2026, around **81,700 water conservation and recharge structures** were created or restored. Around **8,203 water budgets** were completed across participating Gram Panchayats.

2. National Water Mission

- The **National Water Mission** recognises water budgeting as a foundational element of **Integrated Water Resources Management**.

It focuses on:

- Water conservation, Sustainability, Efficient use of water, Long-term water security, Community participation

The Mission also promotes women-led institutions and community groups in water management.

3. Nari Shakti se Jal Shakti

- Under the National Water Mission, **Nari Shakti se Jal Shakti** promotes women-led water conservation.
- Self-Help Groups, Water Users' Associations and Village Water and Sanitation Committees are encouraged to participate in water planning and conservation.

4. State-Level Initiatives

Several States have promoted water budgeting and water conservation through local programmes.

Important examples include:

- **Mukhya Mantri Jal Swavlamban Abhiyan** in Rajasthan
- **Jalyukt Shivar Abhiyan** in Maharashtra
- Community-led watershed management in Hiware Bazar

- Digital water budgeting using Varuni Web Application

5. Jalyukt Shivar Abhiyan, Maharashtra

- The **Jalyukt Shivar Abhiyan** was launched in **2014** by the Government of Maharashtra.
- It aims to provide sustainable long-term solutions to rural water scarcity.
- The programme uses geotagging and mobile applications developed by the Maharashtra Remote Sensing Application Centre.

It focuses on:

- Water conservation, Groundwater recharge, Village-level water budgeting, Real-time monitoring
- As a result, many villages were declared drought-free. Groundwater levels increased and agricultural productivity improved.

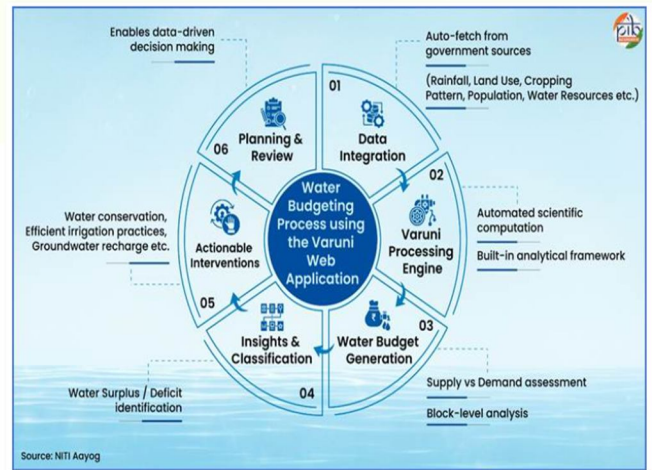
Role of Technology: Varuni Web Application

- The **Varuni Web Application** is a digital tool used for block-level water budgeting.
- It was developed under the Indo-German bilateral project **Water Security and Climate Adaptation in Rural India**.
- The project is implemented in collaboration with the **Ministry of Jal Shakti** and the **Ministry of Rural Development**, with technical support from **NITI Aayog**.
- The Varuni Web Application uses automatically sourced data from government portals.

It collects data related to:

- Rainfall, Land use, Cropping pattern, Population, Water resources
- The application processes this data through an in-built computational framework and generates structured water budget

assessments.



Significance

1. Promotes Evidence-Based Governance

- Water budgeting helps local bodies make decisions based on data rather than guesswork.

2. Supports Rural Water Security

- It helps villages plan water use according to local availability and demand.

3. Improves Agricultural Planning

- Farmers can choose crops based on local water conditions, reducing risk and improving productivity.

4. Reduces Groundwater Depletion

- Water budgeting encourages groundwater recharge, conservation and regulated extraction.

5. Strengthens Gram Panchayats

- It makes Gram Panchayats active institutions in local water governance.

6. Builds Climate Resilience

- Water budgeting helps communities prepare for droughts, floods and uncertain rainfall.

7. Promotes Community Participation

- The process involves Gram Sabhas, farmers, women's groups and local institutions.

8. Supports Sustainable Development

- It links water conservation with agriculture, livelihoods, food security and environmental protection.

Challenges

1. Fragmented Water Governance

- Water is governed by multiple departments such as irrigation, drinking water, rural development and environment. Lack of coordination weakens integrated planning.

2. Overuse of Groundwater

- Groundwater extraction remains poorly regulated. In many areas, borewell use has increased without proper recharge.

3. Unsuitable Cropping Patterns

- Water-intensive crops such as paddy and sugarcane are often grown in water-stressed areas due to market and policy incentives.

4. Poor Data Availability

- Local-level data on rainfall, groundwater, land use and water demand may not always be accurate or updated.

5. Limited Community Capacity

- Gram Panchayats and local communities may need training to prepare and use water budgets effectively.

6. Climate Variability

- Erratic rainfall, extreme heat, floods and droughts make water planning more difficult.

7. Weak Regulation

- Without rules on groundwater extraction

and water use, budgeting alone may not produce results.

8. Institutional Silos

- Departments often work separately without shared data and common ecological goals.

Way Forward

1. Institutionalise Water Budgeting

- Water budgeting should become a regular part of Gram Panchayat development planning.

2. Strengthen Gram Sabhas

- Gram Sabhas should be empowered to discuss water availability, crop choices and groundwater use.

3. Promote Demand-Side Management

- India must reduce excessive water demand through suitable crop planning, micro-irrigation and efficient water use.

4. Use Digital Tools

- Tools such as the Varuni Web Application should be expanded for block-level and village-level water planning.

5. Link Water Budgeting with Agriculture

- Crop planning should be aligned with local water availability and agro-climatic conditions.

6. Improve Groundwater Governance

- Groundwater should be treated as a common resource and not merely as private property linked to land ownership.

7. Encourage Women's Participation

- Women's groups, Self-Help Groups and Village Water and Sanitation Committees should be included in water budgeting.

8. Promote Nature-Based Solutions

- Traditional tanks, ponds, stepwells, wetlands and watershed structures should be restored.

9. Strengthen Capacity Building

- Local officials, Panchayat members and community volunteers should be trained in water accounting and planning.

10. Integrate Climate Adaptation

- Water budgeting should include climate risks such as droughts, floods and changing rainfall patterns.

Conclusion

Water budgeting is a practical and community-based tool for improving rural water governance in India. It helps villages understand their water availability, water demand and future risks. By linking water planning with agriculture, livestock, conservation and technology, it supports sustainable rural development. Institutionalising water budgeting at the **Gram Panchayat level** is essential for ensuring water security, climate resilience and inclusive rural growth.

Prison Overcrowding in India: The Growing Challenge of Undertrial Detention

Source: **The Hindu**

Relevance: GS Paper II - Fundamental Rights, Judiciary, Governance, Criminal Justice Reforms, Social Justice.

Important Key Words

- Prelims:** NCRB, Prison Statistics India 2024, Undertrial Prisoners, Occupancy Rate, Article 21, BNSS 2023, Model Prisons Act 2023, E-Prisons Project.
- Mains:** Prison Overcrowding, Bail Jurisprudence, Speedy Trial, Human Dignity, Criminal Justice Reform, Legal Aid, Undertrial Review Committees, Reformatory Justice

Why in News?

The **National Crime Records Bureau (NCRB)** released the latest **Prison Statistics India Report 2024**. The report shows that India's prison occupancy rate declined to a decade-low of **112.7%** in 2024. However, overcrowding continues to remain a serious structural problem in Indian

prisons. The issue is mainly driven by the high share of **undertrial prisoners**, slow judicial processes, limited prison capacity expansion and high staff vacancies.

Key Highlights of Prison Statistics India 2024

- India had around **1,333 jails** at the end of 2024.
- The total sanctioned capacity of prisons was about **4.53 lakh inmates**.
- The actual inmate population was over **5.11 lakh**.
- National prison occupancy rate stood at **112.7%**.
- More than half of the States and Union Territories recorded occupancy rates above **100%**.
- Undertrial prisoners accounted for around **73%** of total prison inmates in 2024.
- The share of convicts reduced from about **32% in 2016 to 26.6% in 2024**.

What is Prison Overcrowding?

Prison overcrowding means that the number of prisoners is higher than the sanctioned capacity of prisons.

For example, if a jail has space for 100 inmates but houses 150 inmates, its occupancy rate is 150%.

Overcrowding creates pressure on:

- Living space
- Food supply
- Sanitation
- Medical care
- Security
- Rehabilitation programmes
- Prison staff

It converts prisons from correctional institutions into spaces of congestion and deprivation.

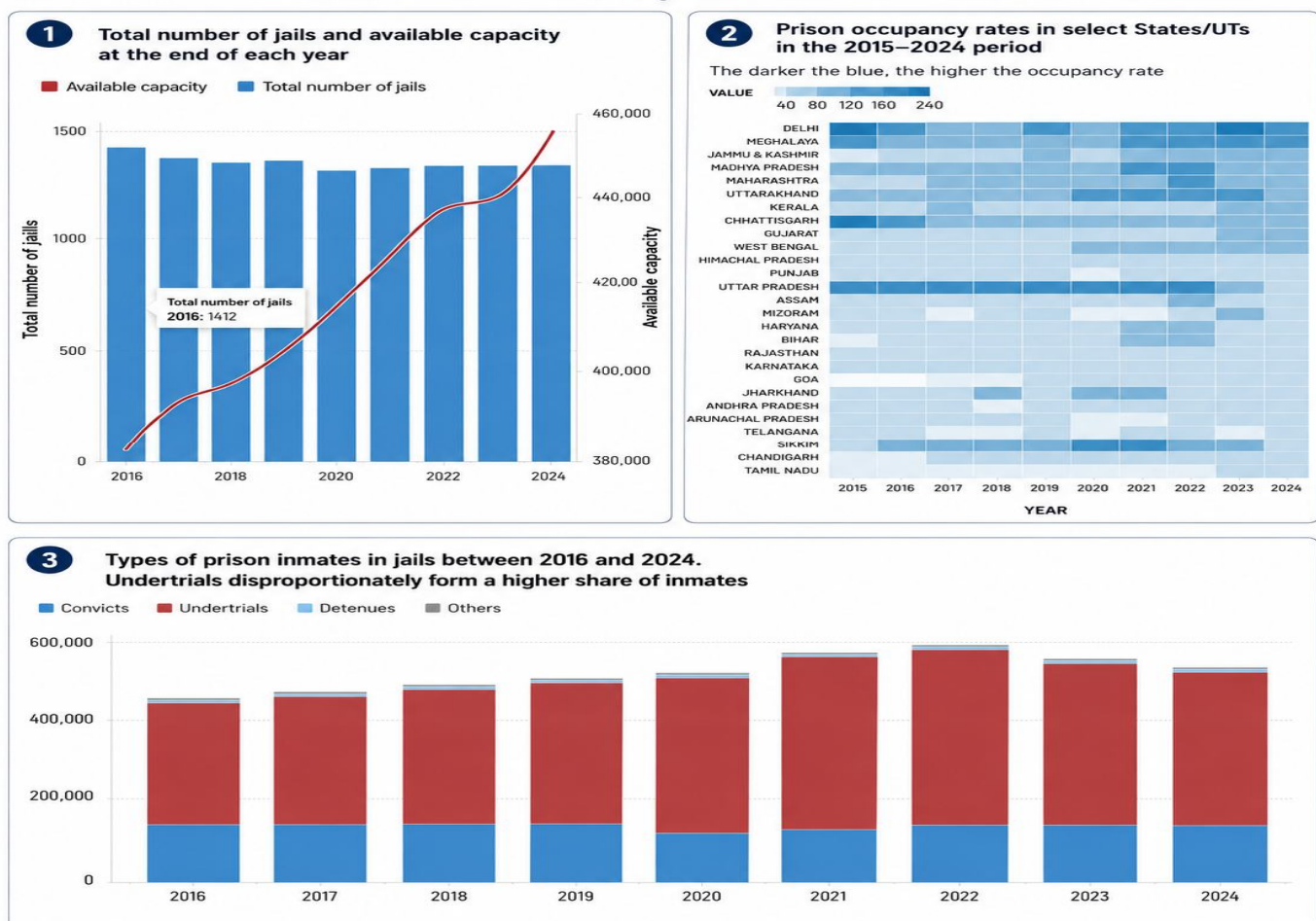
Why Undertrials are the Main Concern

- An **undertrial prisoner** is a person who is in jail while the case is still being heard and the court has not yet declared the person guilty.
- In 2024, undertrials formed nearly **73%** of India's prison population. This means that most prisoners in India are not convicts but persons awaiting trial.

This is a serious concern because:

- It weakens the principle of **presumption of innocence**.
- It turns pre-trial detention into punishment.

Prisons in India: Key Trends at a Glance



- It burdens poor and marginalised communities.
- It increases pressure on prisons.
- It reflects delay in investigation, trial and bail processes.

State-wise Concerns

Prison overcrowding is not uniform across India. Some States and Union Territories face much higher pressure.

- **Delhi** recorded the highest occupancy rate at around **194.6%** in 2024.
- **Meghalaya** recorded an occupancy rate of **163.5%**.
- **Jammu and Kashmir** recorded around **148.3%**.
- **Madhya Pradesh** recorded around **147.1%**.
- Jammu and Kashmir saw a sharp increase from **78% occupancy in 2015** to over **148% in 2023 and 2024**.
- Chhattisgarh improved significantly, reducing occupancy from **234% in 2015** to **127.6% in 2024**.

Delhi and Bihar had among the highest shares of undertrial prisoners, with over **87%** of their prison population being undertrials.

Staff Vacancies and Prison Administration

The Parliamentary Standing Committee on Home Affairs observed that staff vacancies are one of the most neglected areas of prison administration.

High vacancies affect:

- Security management
- Medical care
- Rehabilitation programmes
- Prison discipline
- Mental health support

- Legal aid coordination

Delhi and Jammu and Kashmir, which had high overcrowding and high undertrial shares, also had serious staff shortages. In some States and UTs, nearly half of sanctioned prison posts remained vacant.

Constitutional and Judicial Concerns

Article 21

- Article 21 guarantees the **right to life and personal liberty**. Prison overcrowding violates this right when prisoners are denied basic dignity, healthcare, sanitation and speedy trial.

Hussainara Khatoon v. State of Bihar, 1979

- The Supreme Court held that **speedy trial** is part of Article 21. Long undertrial detention violates this principle.

Sunil Batra v. Delhi Administration, 1980

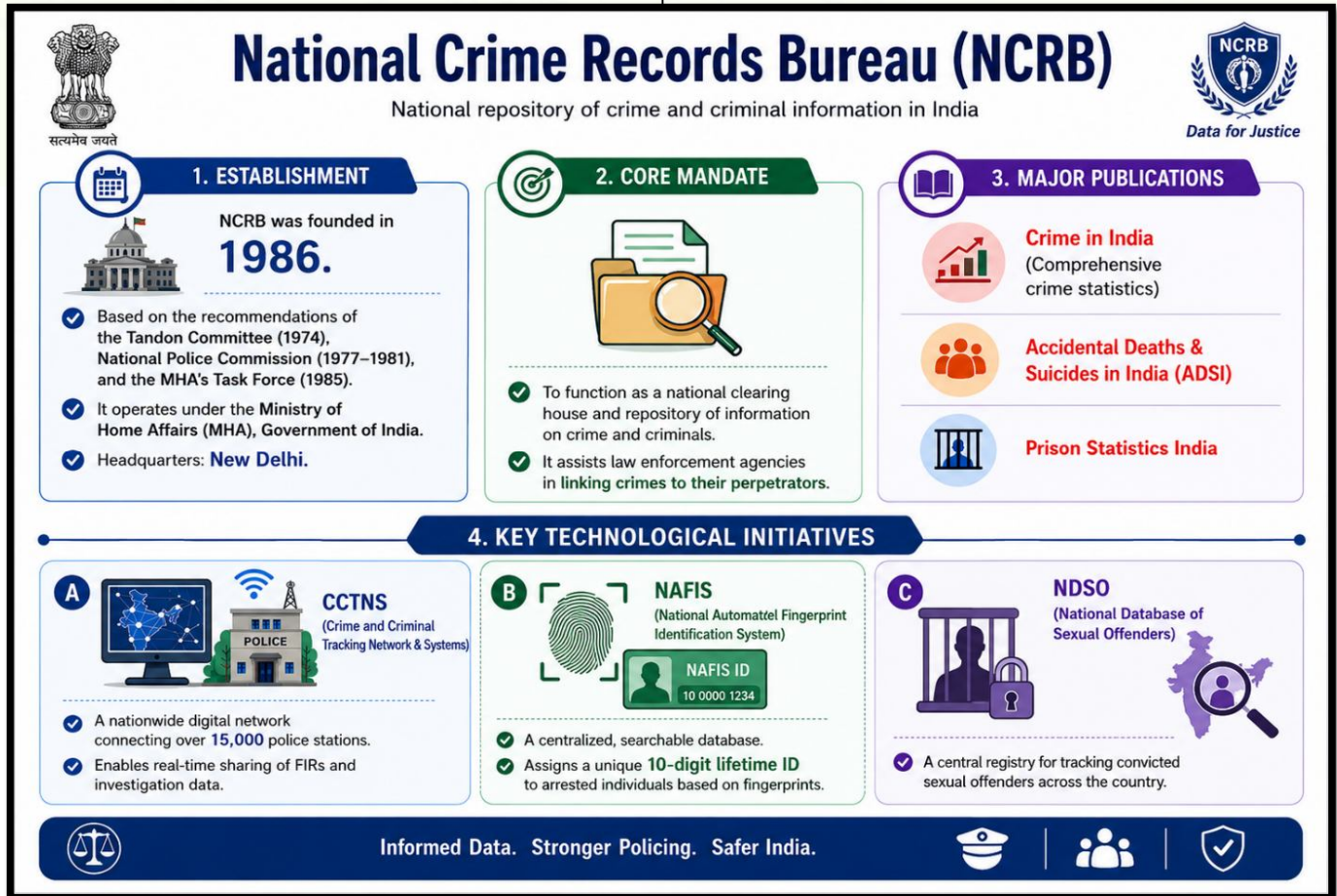
- The Supreme Court held that prisoners do not lose all fundamental rights after imprisonment. Their dignity must be protected.

Bail as the Rule

- Indian criminal law follows the principle that **bail is the rule and jail is the exception**. However, in practice, poor undertrials often remain in jail because they cannot provide bail bonds or sureties.

Causes of Prison Overcrowding

- High share of undertrial prisoners
- Delay in investigation and trial
- Limited access to bail
- Poverty and inability to provide sureties
- Mechanical remand by lower courts
- Unnecessary arrests



- Weak legal aid system
- Poor functioning of Under Trial Review Committees
- Slow prison capacity expansion
- Lack of open prisons
- Staff vacancies and weak prison administration

Impact of Prison Overcrowding

1. Violation of Human Dignity

- Overcrowded prisons reduce living space and affect privacy, sleep, sanitation and mental health.

2. Health Risks

- Crowded jails increase the spread of diseases such as tuberculosis, skin infections

and other communicable diseases.

3. Poor Rehabilitation

- Overcrowding reduces access to education, counselling, skill training and reform programmes.

4. Violence and Tension

- Congested prisons increase stress, conflicts and violence among inmates.

5. Impact on Poor Families

- Many undertrials are from economically weaker sections. Their detention affects family income and pushes households into debt.

6. "School of Crime" Effect

- When first-time offenders and petty



undertrials are lodged with hardened criminals, prisons may become spaces of criminal networking.

Government Measures

Bharatiya Nagarik Suraksha Sanhita, 2023

- **Section 479** provides relief for undertrials. First-time offenders who have served one-third of the maximum sentence may be released on bond.
- It also places responsibility on the jail superintendent to apply for release when an eligible prisoner reaches the time limit.

Model Prisons and Correctional Services Act, 2023

- This Act replaces the old colonial approach and shifts focus from punishment to **reformation and rehabilitation**.

Model Prison Manual, 2016

- It aims to standardise prison management, including classification of prisoners, medical care and vocational training.

E-Prisons Project

- It digitises prison records and links them with the criminal justice system. This can help track bail eligibility and prisoner status.

Support to Poor Prisoners Scheme

- This scheme provides financial support to poor prisoners who cannot pay bail amounts or fines.

Way Forward

- Enact a comprehensive **Bail Act** to reduce arbitrary and prolonged detention.
- Strengthen the principle of **bail as the rule and jail as the exception**.

- Ensure strict compliance with **Arnesh Kumar v. State of Bihar**, which discourages unnecessary arrests.
- Expand **fast-track courts** for petty offences.
- Strengthen **Under Trial Review Committees** and ensure regular review of eligible cases.
- Expand **open prisons**, especially for low-risk prisoners.
- Improve prison capacity through new buildings, barracks and better infrastructure.
- Fill vacancies in prison staff, especially medical and counselling staff.
- Strengthen free legal aid under **Article 39A**.
- Use digital systems and AI-based case tracking to identify prisoners eligible for bail.
- Promote skill training, education, counselling and rehabilitation inside prisons.
- Create special gender-sensitive facilities for women prisoners.

Conclusion

India's prison occupancy rate has declined, but overcrowding remains a serious governance and justice concern. The main reason is the large number of undertrial prisoners, many of whom remain in jail due to poverty, delayed trials and weak bail access.

- Prison reform must focus on **speedy trial, bail reform, legal aid, staff strengthening, open prisons and humane correctional administration**. A democratic society must ensure that prisons protect security without violating dignity, liberty and justice.

Preserving the record: On the right to be forgotten

Source: [The Hindu](#)

Relevance: UPSC: GS Paper II - Indian Polity, Indian Constitution, Fundamental Rights, Judiciary, Governance, Right to Privacy.

Important Key Words

For Prelims:

- Right to Be Forgotten, Right to Privacy, Article 21, Open Justice, Puttaswamy Judgment, Digital Personal Data Protection Act 2023, GDPR, Indian Kanoon Case.

For Mains:

- Informational Privacy, Public Interest, Judicial Transparency, Digital Accuracy, Freedom of Expression, Court Records, Data Erasure, Public Records.

Why in News?

The debate on the **right to be forgotten** has again come into focus after a **Delhi High Court order on May 29, 2026** concerning the removal or limited discoverability of certain judicial records from online searches.

The issue highlights a conflict between two important principles:

- **Right to informational privacy**, recognised by the Supreme Court in **Justice K.S. Puttaswamy v. Union of India, 2017**
- **Open justice**, which requires court proceedings and judicial records to remain accessible for public scrutiny

The case shows how digital access to court records can affect privacy, reputation and public memory.

What is the Right to Be Forgotten?

The **right to be forgotten** means the right of an

individual to request removal, deletion, de-indexing or restricted access to personal information available online when such information is outdated, irrelevant, inaccurate or harmful to privacy.

- It is also known as the **right to erasure** in European privacy law.
- In simple terms, it allows a person to say: "My past personal information should not remain easily searchable forever if it no longer serves any legitimate public purpose."

Background

In earlier times, court records were technically public, but access was limited. A person had to physically visit courts or legal archives to find records.

Digitisation changed this situation. Now, judgments and legal records can be easily found through:

- Search engines
- Online legal databases
- Automated archivers
- Court websites
- Digital repositories

This has improved transparency, but it has also created new privacy concerns. Even an old accusation, if searchable by name, can affect a person's employment, marriage, social life and reputation, even after acquittal or discharge.

Right to Privacy in India

In **Justice K.S. Puttaswamy v. Union of India, 2017**, the Supreme Court recognised the **right to privacy** as a fundamental right under **Article 21**.



RIGHT TO BE FORGOTTEN

Privacy vs Open Justice



1

WHY IN NEWS?



- Delhi High Court order (29 May 2026) revived debate on online judicial records.
- Issue: removal or limited discoverability of case details in search results.
- Highlights clash between privacy, reputation and public access.

2

WHAT IS IT?



- Right to seek removal, deletion, de-indexing or restricted access to personal information online.
- Used when data is outdated, irrelevant, inaccurate or harmful.
- Also called the "right to erasure" in European privacy law.

3

BACKGROUND



- Earlier, court records were public but hard to access physically.
- Digitisation made records easy to find through search engines, court websites and legal databases.
- Old accusations may continue to affect jobs, marriage, social life and reputation.

4

PRIVACY BASIS IN INDIA



- Puttaswamy (2017): Right to privacy is a Fundamental Right under Article 21.
- Includes informational privacy.
- But privacy is not absolute.
- It may be limited for public interest, legal claims, research, public health and free speech.

5

OPEN JUSTICE PRINCIPLE



- Justice must not only be done, but must also be seen to be done.
- Ensures transparency, accountability and public scrutiny.
- Helps public understanding of law.
- Court records are official public acts, not purely private documents.

6

CORE ISSUE

PROTECT PRIVACY



- Acquitted or discharged persons should not suffer forever.
- Limits digital stigma and reputational damage.

PRESERVE PUBLIC RECORD



- Judicial records are part of legal history.
- Public access supports transparency and trust.

VS



Balanced view: Keep records accurate, contextual and updated — especially by clearly showing acquittal or final outcome.

7 KEY JUDICIAL MILESTONES

1



Rajagopal v. State of Tamil Nadu (1994):
recognised right to be let alone; public records remain open.

2



K.S. Puttaswamy v. Union of India (2017):
privacy recognised as a Fundamental Right.

3



Dharamraj B. Dave v. State of Gujarat (2017):
denied removal of acquittal details from public records.

4



Delhi High Court (2021):
allowed limited removal from search results in a criminal case.

5



Supreme Court (2022):
asked for a mechanism to remove personal details in a marital dispute.

6



Kerala High Court (2023):
RTBF not automatic in ongoing proceedings.

7



Indian Kanoon matter (2024):
warned that obfuscation may affect the public record.

8

8 ARGUMENTS IN FAVOUR



- Protects dignity and informational privacy.
- Prevents lifelong punishment through digital memory.
- Helps acquitted persons rebuild life.
- Reduces misuse of outdated or irrelevant data.
- Important in sexual offences and sensitive cases.
- Prevents harm from incomplete or context-free online records.

9

WAY FORWARD



- Update digital records with final outcomes.
- Allow de-indexing by name in suitable cases.
- Anonymise sensitive personal details.
- Create a clear legal framework balancing privacy and transparency.



Key takeaway: The real challenge is not only access to records, but fair and contextual digital access.

- The judgment also recognised **informational privacy**, which means individuals should have some control over personal information about themselves.

However, the Court also made it clear that privacy is not an absolute right. It can be restricted for:

- Public interest
- Public order
- Legal claims
- Research
- Archiving
- Public health
- Freedom of expression

Thus, the right to be forgotten must be balanced with other constitutional values.

Open Justice Principle

The principle of **open justice** means that justice should not only be done but should also be seen to be done.

It allows:

- Public scrutiny of courts
- Transparency in judicial functioning
- Public understanding of law
- Accountability of the justice system
- Creation of historical legal records
- Access to court judgments and legal reasoning

Court records are not only personal documents. They are also **official acts of the State** and form part of the public record.

Delhi High Court Order

The Delhi High Court considered the privacy concerns of a person whose name was linked with court records available online.

- The Court observed that simply updating records may not be enough because search

engines may show small parts of a case without proper context. The Court also noted that open justice does not necessarily require every detail of a case to be searchable through the name of the accused person.

- However, this approach raises an important concern. If access to original records is restricted, the public record may become incomplete or difficult to verify.

Key Issue: Privacy vs Public Record

The central question is:

Should judicial records be hidden to protect privacy, or should they remain public with proper updates and context?

- One view says that if a person is acquitted or discharged, old accusations should not continue to damage their life.
- Another view says that court records are public documents and should not be erased or hidden because they are part of the history of justice administration.
- A balanced view is that the problem is not always **discoverability**, but **incompleteness**. If a person is acquitted, the digital record should clearly show the acquittal or final outcome instead of preserving only the accusation.

Judicial Precedents

1. Rajagopal v. State of Tamil Nadu, 1994

- The Supreme Court recognised the **right to be let alone**, but also held that public records, including court records, remain open to public comment.

2. Justice K.S. Puttaswamy v. Union of India, 2017

- The Supreme Court recognised privacy as a



fundamental right and acknowledged informational privacy.

3. Dharamraj Bhanushankar Dave v. State of Gujarat, 2017

- The Gujarat High Court denied removal of acquittal details from public records and emphasised the accessibility of court orders.

4. Orissa High Court, 2020

- In a case involving online sexual abuse, the Court noted the need for a serious debate on the right to be forgotten.

5. Delhi High Court, 2021

- The Court allowed limited removal from search results in a criminal case to protect the petitioner's social life and career.

6. Supreme Court Order, 2022

- The Court directed its registry to create a mechanism for removing personal details of a couple involved in a marital dispute from search engines.

7. Kerala High Court, 2023

- The Court held that the right to be forgotten cannot be applied automatically to ongoing court proceedings because of open justice and public interest.

8. Indian Kanoon Matter, 2024

- The Court warned that obfuscation of court records may have serious implications for the public record.

Arguments in Favour of the Right to Be Forgotten

- Protects individual privacy and dignity.
- Prevents lifelong punishment through digital memory.
- Helps acquitted persons rebuild their lives.

- Reduces misuse of outdated or irrelevant information.
- Protects victims of sexual crimes and sensitive cases.
- Supports control over personal data.
- Prevents reputational harm from incomplete online records.

Concerns and Challenges

1. Conflict with Open Justice

- Court records must remain accessible for transparency and public scrutiny.

2. Impact on Public Records

- Deleting or hiding judicial records may weaken the historical record of the justice system.

3. Lack of Uniformity

- Different High Courts have taken different approaches, creating legal uncertainty.

4. Freedom of Speech and Press

- Excessive removal may affect journalism, legal reporting and public debate.

5. Technical Difficulty

- Information copied across websites may not be fully removed from the internet.

6. Risk of Misuse

- Powerful persons may try to erase information of genuine public importance.

7. Lack of Statutory Clarity

- India does not yet have a clear law specifically dealing with the right to be forgotten in relation to court records.

Way Forward

- India needs a clear legal framework for the right to be forgotten.

- Courts should balance privacy with public interest on a case-by-case basis.
- Judicial records should not be erased casually.
- Instead of removing records, courts may prefer **updating, contextualising and redacting** sensitive personal details.
- Search results should show the final outcome of a case, such as acquittal, discharge or closure.
- Legal databases and search platforms should regularly refresh their records.
- Sensitive cases involving sexual offences, minors and private family disputes need special protection.
- Public interest must be considered in cases involving public officials, corruption, serious crimes and matters affecting society.
- The **Digital Personal Data Protection Act, 2023** should be harmonised with open justice and court record rules.

- An independent mechanism may be created to decide requests for erasure, de-indexing or redaction.

Conclusion

The right to be forgotten is an important part of privacy in the digital age, but it cannot be absolute. Court records serve a public purpose because they preserve the history of justice and allow public scrutiny of the judiciary.

- The better solution is not to erase judicial records, but to ensure **digital accuracy, proper context and timely updates**. If a person is acquitted or discharged, online records must clearly reflect that outcome. This approach protects both **privacy and open justice**.
- India must develop a balanced framework where personal dignity is protected without weakening transparency, public interest and the integrity of judicial records.

Ordinance Question Before the Supreme Court: Judicial Independence and Security of Tenure

Source: [The Hindu](#)

Relevance: UPSC: GS Paper II - Indian Polity, Indian Constitution, Judiciary, Separation of Powers, Executive-Legislature Relations, Constitutional Bodies.

Important Key Words

For Prelims:

- Article 123, Ordinance, Supreme Court, Collegium, Judicial Independence, Security of Tenure, NJAC, S.P. Gupta Case, Krishna Kumar Singh Case, D.C. Wadhwa Case.

For Mains:

- Judicial Independence, Separation of

Powers, Executive Overreach, Security of Tenure, Constitutional Morality, Open Constitutionalism, Checks and Balances.

Why in News?

Five judges were recently sworn in to the **Supreme Court of India** after the sanctioned strength of the Court was increased from **34 to 38** through a **Presidential Ordinance**.

- The issue has raised important constitutional questions about **judicial independence, security of tenure**, and the judiciary's institutional distance from the executive.
- The concern is not about the merit of the

judges. The concern is about whether the Supreme Court should accept appointments to posts created through an Ordinance when Parliament is yet to approve the law.

What is the Issue?

The Supreme Court currently has judges appointed against posts created by an Ordinance.

The key issue is this:

- If Parliament does not replace the Ordinance with a law, the sanctioned strength of the Supreme Court may revert to **34**. This may create uncertainty regarding the status of judges appointed to the Ordinance-created posts.

This raises a larger question:

"Can judicial independence appear secure if the continuance of judicial posts depends on executive action and later parliamentary approval?"



CJI Surya Kant administers the oath of office to Justice V. Mohana as a judge of the Supreme Court, in New Delhi on June 2. She is only the second woman to be elevated directly from the Bar to the court. PTI

Constitutional Provision: Article 123

Article 123 of the Indian Constitution gives the President power to promulgate Ordinances when Parliament is not in session.

- An Ordinance has the same force and effect as an Act of Parliament, but it is temporary. It must be placed before both Houses of Parliament and will cease to operate after **six weeks** from the reassembly of Parliament if it is not approved.
- In simple words, an Ordinance is an emergency law-making power of the executive, but it cannot become a substitute for regular parliamentary law-making.

Background of the Ordinance

The sanctioned strength of the Supreme Court was increased from **34 to 38 judges** through an Ordinance.

Out of the five judges sworn in:

- Four had served as **Chief Justices of High Courts**.
- One came from the **Bar**.
- Three appointments were against existing vacancies.
- Two appointments were directly linked to the newly created posts under the Ordinance.

The concern is that if the Ordinance lapses or is rejected, the constitutional status of the posts may become uncertain.

Collegium's Acceptance and Concerns

- The Supreme Court Collegium accepted the Ordinance-created increase in strength and recommended appointments.
- This has raised concerns because the judiciary has traditionally defended its independence from executive influence.
- The issue is whether accepting temporary

ORDINANCE QUESTION BEFORE THE SUPREME COURT

Judicial Independence, Security of Tenure & Article 123



1 Why in News?

- Supreme Court strength was raised from 34 to 38 through a Presidential Ordinance.
- Five judges were sworn in after the increase.



2 Core Issue

- Some appointments are linked to posts created by the Ordinance.
- If Parliament does not replace the Ordinance with a law, the Court's strength may revert to 34.
- This raises a key question: Can judicial independence appear secure if posts depend on executive action?

3 Article 123

- President can promulgate an Ordinance when Parliament is not in session.
- It has the force of law, but it is temporary.
- It ceases after 6 weeks from reassembly of Parliament if not approved.

4 Why the Concern?

- Security of tenure
- Institutional independence
- Separation of powers
- Public confidence in the judiciary

5 Key Judicial View

- D.C. Wadhwa (1986):** Ordinance power cannot become a parallel law-making route.
- Krishna Kumar Singh (2017):** Re-promulgation is unconstitutional.
- NJAC Case (2015):** Judicial primacy is part of judicial independence.



The issue is not about the merit of the judges. It is about whether the judiciary should rely on temporary Ordinance-created posts before Parliament approves them.

posts created by the executive may create an impression that the Court's institutional strength depends on executive goodwill.

- Even if the appointment of individual judges is valid, the larger concern is about the **appearance of independence**.

Judicial Independence and Security of Tenure

Judicial independence has two important aspects:

1. Actual Independence

- Judges must be free from pressure by the executive, legislature, media or powerful groups.

2. Appearance of Independence

The judiciary must also appear independent in the eyes of the public.

If judicial posts are created temporarily by

Ordinance and appointments are made before parliamentary approval, questions may arise about:

- Security of tenure
- Institutional independence
- Executive influence
- Separation of powers
- Public confidence in the Court

Security of tenure is a basic requirement for judicial independence. A judge should not feel that his or her continuation depends on the government's future action.

Important Supreme Court Judgments

1. D.C. Wadhwa v. State of Bihar, 1986

- The Supreme Court held that repeated re-promulgation of Ordinances is unconstitutional. Ordinance-making cannot become a parallel law-making power.

2. Krishna Kumar Singh v. State of Bihar, 2017

- The Supreme Court ruled that Ordinance-making power is not a substitute for legislative power. Re-promulgation of Ordinances without placing them before the legislature is against constitutional principles.

3. Supreme Court Advocates-on-Record Association v. Union of India, 2015

- The Supreme Court struck down the **99th Constitutional Amendment** and the **National Judicial Appointments Commission Act**. The Court held that judicial primacy in appointments is part of judicial independence.
- These judgments show that the Court has repeatedly protected judicial independence and limited executive overreach.

Larger Constitutional Question

The issue is not merely administrative. It is a question of constitutional principle.

The larger question is:

"Should the judiciary rely on Ordinance-created posts when the Ordinance itself depends on later approval by Parliament?"

- If the Ordinance is approved, the issue may disappear legally. But if it is not approved, uncertainty may arise.
- Even before such uncertainty arises, the very dependence on a temporary executive law-making instrument can create discomfort regarding the independence of the judiciary.

Challenges

1. Temporary Nature of Ordinance

- An Ordinance is not a permanent law. It needs parliamentary approval.

2. Security of Tenure

- Judges appointed to Ordinance-created posts may face uncertainty if the Ordinance lapses.

3. Executive Dependence

- The judiciary may appear dependent on executive action for its institutional expansion.

4. Constitutional Morality

- Ordinance power should be used only when immediate action is necessary, not as a routine law-making tool.

5. Institutional Trust

- Any appearance of executive influence may affect public confidence in the judiciary.

Way Forward

- The strength of the Supreme Court should preferably be increased through a regular parliamentary law, not by Ordinance.
- Ordinance-making power must be used only in genuine urgency.
- Judicial appointments should avoid situations that create uncertainty about tenure.
- Parliament must debate and decide such changes transparently.
- The Collegium should consider not only legal validity but also the institutional appearance of independence.
- Clear safeguards are needed when Ordinances affect constitutional institutions.
- Judicial manpower planning should be done in advance to avoid emergency-style

expansion.

Conclusion

The increase in Supreme Court strength may be necessary because of rising caseloads and vacancies. However, the method used to create additional posts is constitutionally sensitive.

- The judiciary must remain independent not only in reality but also in public perception. Ordinance-created judicial posts may create doubts about security of tenure and institutional autonomy. Therefore, matters affecting the composition and strength of the Supreme Court should ideally be handled through full parliamentary scrutiny and regular legislation.
- A strong judiciary requires adequate judges, but it also requires constitutional methods that preserve its independence, dignity and public trust.

BHAVYA Portal Launched for Development of 100 Industrial Parks

Source: [PIB](#)

Relevance: UPSC: GS Paper II - Governance, Government Policies and Interventions, Centre-State Relations, GS Paper III - Industrial Growth, Infrastructure, Investment, Manufacturing, Employment and Digital Economy.

Important Key Words

For Prelims:

- BHAVYA, Bharat Audyogik Vikas Yojana, BHAVYA Portal, NICDC, DPIIT, Industrial Parks, Plug-and-Play Infrastructure, BIS, EIA, FSSAI.

For Mains:

- Industrial Infrastructure, Competitive Federalism, Ease of Doing Business, Manufacturing Growth, Global Value

Chains, Centre-State Partnership, Digital Governance, Viksit Bharat 2047.

Why in News?

Union Minister of Commerce and Industry **Shri Piyush Goyal** launched the **BHAVYA Portal** in New Delhi as a major step towards the implementation of the **Bharat Audyogik Vikas Yojana (BHAVYA)**.

- The scheme aims to develop **100 investment-ready, world-class industrial parks** across India over a period of **six years**. It has been approved by the Union Cabinet with an outlay of **₹33,660 crore**. The Minister also mentioned that around **₹34,000 crore** would help attract large investments and generate direct and indirect employment.



BHAVYA SCHEME

BHARAT AUDYOGIK VIKAS YOJNA

- Central Sector Scheme for development of **100 investment-ready plug-and-play industrial parks**
- Scheme duration: 6 years (FY 2026-27 to 2031-32) with financial outlay of **₹33,660 crore**
- Central Government funding **support upto ₹1 crore per acre**

Historic Decision by Modi Govt

What is BHAVYA?

BHAVYA stands for **Bharat Audyogik Vikas Yojana**.

It is the Government of India's flagship programme for developing modern industrial parks across States and Union Territories.

The aim is to create integrated industrial ecosystems with:

- Multimodal connectivity
- Reliable water and power supply
- Digital governance systems
- Worker-support facilities
- Testing infrastructure
- Sustainable development features
- Plug-and-play industrial facilities

In simple words, BHAVYA aims to provide ready industrial spaces where investors can start operations faster with fewer delays.

National Industrial Corridor Development Corporation Limited

- **Ministry:** It works under the **Department for Promotion of Industry and Internal Trade (DPIIT)**.
- **Parent Ministry:** Ministry of Commerce and Industry.
- **Main Role:** NICDC develops **world-class greenfield industrial smart cities**.
- **Objective:** To improve **manufacturing competitiveness**, attract investments and generate employment.
- **Current Work:** NICDC is implementing **20 projects across 13 States**.
- **Key Concept:** NICDC promotes **plug-and-play industrial parks**.
- **Plug-and-Play Meaning:** Industrial parks where **land, utilities, approvals and infrastructure** are already developed.
- **Benefit to Industries:** Industries can start operations quickly without delays in **land acquisition** or infrastructure creation.

What is the BHAVYA Portal?

The **BHAVYA Portal** is a digital platform developed by the **National Industrial Corridor Development Corporation (NICDC)**.

It will act as a single digital interface for the scheme.

The portal will support:

- Submission of Detailed Project Reports
- Project appraisal and evaluation
- Competitive selection of proposals
- Real-time monitoring of project progress
- Coordination among stakeholders
- Transparent reporting and accountability

It will help States, Union Territories and implementing agencies submit proposals in a structured manner.

BHAVYA SCHEME & PORTAL

Building India's Industrial Future



100 WORLD-CLASS INDUSTRIAL PARKS • ₹33,660 CRORE • 6 YEARS

WHY IN NEWS?

- Union Minister Shri Piyush Goyal launched the **BHAVYA Portal** in New Delhi.
- Major step towards implementation of Bharat Audyogik Vikas Yojana (**BHAVYA**).
- Aims to develop **100** investment-ready industrial parks across India.
- Approved with an outlay of **₹33,660 crore**.
- Expected to attract **large investments** and create direct & indirect employment.

WHAT IS BHAVYA?

BHAVYA – Bharat Audyogik Vikas Yojana

Flagship programme for developing modern industrial parks across States & Union Territories.



Multimodal Connectivity



Reliable Water & Power



Digital Governance



Worker Support



Testing Infrastructure



Plug-and-Play Facilities



Sustainable Development

Ready industrial spaces for faster operations and fewer delays.

ABOUT NICDC

- Works under **DPIIT**, Ministry of Commerce & Industry.
- Develops world-class greenfield industrial smart cities.
- Improves manufacturing competitiveness, attracts investments & generates employment.
- Implementing **20 projects** across **13 States**.
- Promotes **plug-and-play** industrial parks.
- Land, utilities, approvals & infrastructure are pre-developed for quick operations.

BHAVYA PORTAL

Digital platform by NICDC – Single digital interface for the scheme.

- ✓ Submit Detailed Project Reports
- ✓ Project appraisal & evaluation
- ✓ Competitive selection of proposals
- ✓ Real-time monitoring
- ✓ Stakeholder coordination
- ✓ Transparent reporting



Helps States, UTs & agencies submit proposals in a structured & transparent manner.

KEY FEATURES OF BHAVYA SCHEME



100 INDUSTRIAL PARKS

Across India to attract investment & create jobs



COMPETITIVE MODEL

Proposals based on strengths, land, investor interest, connectivity & infrastructure



SECTOR-SPECIFIC PARKS

For chemicals, manufacturing, data centres, startups, deep-tech, R&D & innovation-led sectors



PLUG-&-PLAY INFRASTRUCTURE

Reduces delays in land acquisition, approvals & infrastructure creation



FOCUS ON INNOVATION

Spaces for startups, deep-tech, R&D, technology-driven enterprises

SIZE & STRUCTURE OF PARKS

- 25 acres** – Hilly regions, smaller UTs & Northeastern States
- 100–500 acres** – Mid-sized States & regions
- Up to 1,000 acres** – Locations closer to cities & towns

IMPLEMENTATION MODEL



Land by State Governments



Infrastructure support by Government of India



NICDC to lead implementation & monitoring



Centre-State partnership (51:49 model)

INFRASTRUCTURE FACILITIES



Water Supply



Power Supply



Road & Rail Connectivity



Single-Window Clearances



Clear Land Titles



Air Connectivity (where feasible)



Worker Housing & Social Infra



Testing Facilities (BIS, EIA, FSSAI)

INTERNATIONAL ENCLAVES

Dedicated enclaves in partnership with countries:



Japan



Singapore



Republic of Korea



Switzerland



To attract foreign investment & support expatriate professionals.

ROLE OF DIGITAL GOVERNANCE

Allows investors to access information on:



Land Availability



Connectivity



Infrastructure



Sectoral Opportunities



Project Status



Clearances & Approvals



Digital & satellite-based mapping enables remote site examination & informed investment decisions.



BHAVYA – POWERING INDUSTRY. CREATING JOBS. BUILDING A VIKSIT BHARAT.



Key Features of BHAVYA Scheme

1. Development of 100 Industrial Parks

- BHAVYA aims to develop **100 industrial parks** across the country to attract investment and create jobs.

2. Challenge-based Competitive Model

States will submit proposals based on:

- Industrial strengths
- Land availability
- Investor interest
- Sectoral potential
- Connectivity
- Infrastructure readiness

The best proposals will be selected through a competitive framework.

3. Sector-specific Industrial Parks

Industrial parks will be designed according to the needs of different sectors such as:

- Chemicals
- Manufacturing
- Data centres
- Startups
- Deep-tech
- R&D
- Innovation-led enterprises

4. Plug-and-Play Infrastructure

- The parks will help investors start operations quickly by reducing delays in land acquisition, approvals and basic infrastructure creation.

5. Focus on Innovation

BHAVYA parks may include dedicated spaces for:

- Startups
- Deep-tech enterprises
- Research and development

- Technology-oriented businesses
- Innovation-led industries

Size and Structure of Industrial Parks

The size of industrial parks will vary according to geography and requirement.

- 25 acres:** Hilly regions, smaller Union Territories and Northeastern States
- 100 to 500 acres:** Mid-sized States and regions
- Up to 1,000 acres:** Locations closer to cities and towns

This flexible model allows industrial parks to be designed according to local needs and land availability.

Implementation Model

The scheme will be implemented through a **Centre-State partnership**.

- Land will be provided by State Governments.
- Infrastructure support will be provided by the Government of India.
- NICDC will lead implementation and monitoring.
- NICDC will partner with States under a **51:49 model**.

The **Department for Promotion of Industry and Internal Trade (DPIIT)** released operational guidelines for BHAVYA in May 2026.

Infrastructure Facilities in BHAVYA Parks

BHAVYA parks are expected to provide modern industrial infrastructure such as:

- Assured water supply
- Assured power supply
- Road connectivity
- Rail connectivity
- Digital single-window clearances

- Clear land titles
- Air connectivity where feasible
- Worker housing
- Social infrastructure
- Areas for Global Capability Centres
- Testing and quality certification facilities

Modern testing facilities will be developed in partnership with institutions such as:

- **Bureau of Indian Standards (BIS)**
- **Export Inspection Agency (EIA)**
- **Food Safety and Standards Authority of India (FSSAI)**

International Enclaves

The Government may explore dedicated international enclaves within BHAVYA parks in partnership with countries such as:

- Japan
- Singapore
- Republic of Korea
- Switzerland

These enclaves can help attract foreign investors and provide a familiar environment for expatriate professionals working in India.

Role of Digital Governance

The BHAVYA Portal will make the scheme more transparent and efficient.

It will help investors access information on:

- Land availability
- Connectivity
- Surrounding infrastructure
- Sectoral opportunities
- Project status
- Clearances and approvals

Digital and satellite-based mapping of industrial parks will allow investors to examine sites remotely and take informed decisions.

Significance

1. Boost to Manufacturing

- BHAVYA can strengthen India's manufacturing base by providing world-class industrial infrastructure.

2. Employment Generation

- The scheme is expected to create large-scale direct and indirect employment.

3. Ease of Doing Business

- Plug-and-play industrial parks can reduce delays in land acquisition, approvals and infrastructure development.

4. Competitive Federalism

- States will compete by showcasing their strengths, land availability and sectoral potential.

5. Support to MSMEs and Startups

- Dedicated spaces for startups, deep-tech, R&D and innovation-led enterprises can support new businesses and MSMEs.

6. Global Value Chain Integration

- Modern industrial parks can help India integrate more deeply with global value chains.

7. Balanced Regional Development

- Flexible Park sizes can help industrial development reach smaller States, hilly regions, Union Territories and Northeastern States.

8. Support to Viksit Bharat 2047

- The scheme supports India's long-term goal of becoming a developed economy by 2047.

Challenges

- States must provide suitable and dispute-

free land.

- Environmental clearances may take time.
- Coordination between Centre, States and agencies is essential.
- Infrastructure must be completed within timelines.
- Industrial parks must attract real investors, not remain underutilised.
- Smaller States may need technical support for preparing DPRs.
- Worker housing and social infrastructure should not be neglected.
- Sustainability must be ensured through water efficiency, clean energy and waste management.

Way Forward

- Ensure transparent and timely selection of proposals.
- Provide handholding support to States for DPR preparation.
- Use the BHAVYA Portal for real-time monitoring.
- Build sector-specific parks based on local strengths.

- Provide strong road, rail, port and airport linkages.
- Develop worker housing, healthcare and skill centres.
- Promote green infrastructure and sustainable industrial practices.
- Link BHAVYA parks with MSMEs, startups and export promotion councils.
- Ensure that international enclaves attract real investment and technology transfer.

Conclusion

The launch of the **BHAVYA Portal** marks an important step in India's next phase of industrial infrastructure development. By creating **100 investment-ready industrial parks**, the scheme aims to reduce investment delays, improve ease of doing business, attract domestic and foreign investment and generate employment.

- If implemented effectively, BHAVYA can strengthen India's manufacturing ecosystem, deepen integration with global value chains and support the national vision of **Viksit Bharat 2047**.

Why is Nicobar Debating Elections?

Source: [The Hindu](#)

Relevance: UPSC: GS Paper I - Indian society, Tribal Society, Social Diversity, Culture, GS Paper II - Governance, Decentralisation, Local Self-Government, Rights of Vulnerable Sections.

Important Key Words

For Prelims:

- Nicobar Islands, Nicobarese Tribe, Tribal Council, Village Council, Draft Election Rules, Andaman and Nicobar Islands,

Great Nicobar, Traditional Governance.

For Mains:

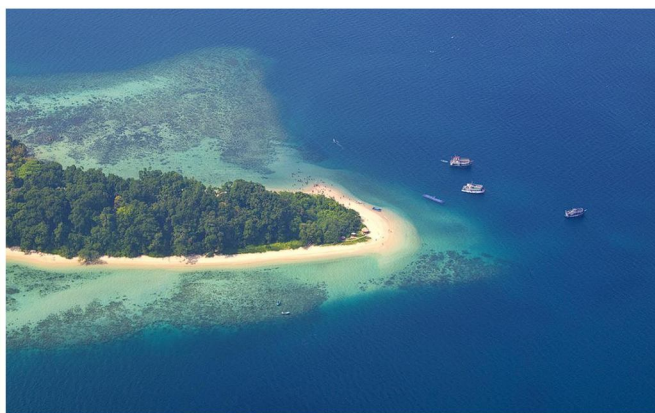
- Tribal Self-Governance, Customary Institutions, Decentralisation, Participatory Governance, Bureaucratisation, Cultural Autonomy, Consensus-Based Leadership, Indigenous Rights.

Why in News?

The administration of the **Union Territory of Andaman and Nicobar Islands** has proposed draft

rules to introduce formal elections for **Nicobarese Village Councils and Tribal Councils**.

- The draft **Andaman and Nicobar Islands Tribal Councils (Preparation of Electoral Rolls and Conduct of Elections) Rules, 2026** seek to create electoral rolls, constituencies and reservation provisions for women in tribal councils. This has triggered debate among Nicobarese leaders, who fear that the rules may alter their traditional consensus-based self-governance system.



The Tribal Welfare Department of the A&NI administration has said that it will wait till June 15 | Photo Credit: Getty Images

What do the Draft Rules Propose?

The draft rules propose a formal election system for Nicobarese tribal institutions.

Major Proposals

- Constitution of **Village Councils and Tribal Councils** through formal elections.
- Delimitation of constituencies.
- Preparation of electoral rolls.
- Reservation of seats and leadership positions for women.
- Election of five to nine **Captains** for each village.
- Direct voting for the post of **Chief Captain** of each Island Tribal Council.
- Election of other positions such as:
 - Vice-Chief Captain
 - First Captain
 - All First Captains of the Island
- Formal administrative supervision of the election process.

How do Nicobarese Tribal Councils Function Today?

- The Nicobarese community has a long tradition of **customary self-governance**.
- Each inhabited island in the Nicobar group has its own **Tribal Council**.
- Village leadership is usually headed by **Captains**.
- Captains are assisted by:
 - First Captain
 - Second Captain
 - Third Captain
- Tribal Councils represent Nicobarese communities in islands such as:
 - Car Nicobar
 - Nancowry



- Kamorta
- Teresa
- Little Nicobar
- Great Nicobar
- The traditional leadership structure evolved from community needs and customary practices.

How are Leaders Chosen Currently?

- Nicobarese leaders are generally chosen through **community consensus**.
- Villagers meet and discuss who should lead.
- Leadership is based on:
 - Community trust
 - Local reputation
 - Ability to communicate with officials
 - Education and exposure
 - Practical understanding of village issues
- Some villages use simple local voting methods, but the process remains rooted in community consultation.
- The focus is not on political competition but on collective acceptance.

Why are the Proposed Changes Causing Concern?

1. Fear of Bureaucratisation

- Tribal leaders fear that a formal election system may convert customary leadership into a bureaucratic process.
- They worry that traditional decision-making may be replaced by official procedures.

2. Threat to Customary Governance

- Existing systems are based on **consensus, consultation and village-level trust**.

- Formal electoral rules may weaken flexible customary practices.

3. Lack of Consultation

- Several leaders argue that the community has not been adequately consulted.
- They say draft rules must be explained properly in local languages before implementation.

4. Possibility of Political Interference

- Formal elections may introduce party-style competition into tribal society.
- This could disturb community harmony and traditional leadership values.

5. Link with Great Nicobar Concerns

- Some leaders suspect that formalisation may make tribal councils more favourable to Union government projects.
- This concern is especially strong in the context of the proposed **₹91,000 crore Great Nicobar transshipment port, airport and tourism project**.

Administration's Argument

The administration argues that formal elections may bring:

- Clear electoral rules.
- Better representation.
- Defined constituencies.
- Reservation for women.
- More structured tribal governance.
- Greater transparency in leadership selection.
- Stronger link between the administration and tribal councils.

However, tribal leaders believe that reforms should not disturb the core of Nicobarese self-governance.

Larger Context: Great Nicobar and Tribal



Rights

- Great Nicobar has become important due to proposed large infrastructure projects.
- These include:
 - Transshipment port
 - Airport
 - Tourism-linked development
 - Strategic infrastructure
- Nicobarese leaders have already raised concerns about environmental, social and cultural impacts.
- Therefore, changes to tribal council governance are being viewed with caution.
- The issue is not only about elections but also about **tribal autonomy, land, culture and decision-making power**.

Significance

- Highlights the tension between **formal democratic procedures** and **customary tribal governance**.
- Raises questions about how modern governance should interact with indigenous institutions.
- Shows the importance of consultation before changing tribal governance structures.
- Brings attention to the rights of island communities.
- Reflects the importance of decentralisation and local self-governance.
- Links governance reforms with larger development debates in Great Nicobar.

Challenges

- Balancing customary leadership with democratic accountability.
- Ensuring women's representation without weakening traditional institutions.
- Preventing political competition from

disturbing community harmony.

- Explaining draft rules clearly to local communities.
- Protecting tribal autonomy while improving governance transparency.
- Avoiding top-down decision-making.
- Ensuring that development projects do not bypass tribal consent.

Way Forward

- Conduct wide consultations with Nicobarese communities.
- Translate draft rules into local languages.
- Give enough time for tribal councils to understand and respond.
- Respect customary decision-making systems.
- Explore a hybrid model combining traditional consensus with democratic safeguards.
- Ensure women's participation through culturally sensitive methods.
- Protect tribal autonomy in all development decisions.
- Follow principles of participatory governance and informed consent.
- Avoid imposing uniform governance models on distinct tribal societies.

Conclusion

The debate over elections in Nicobar is not merely about electoral rules. It is about the future of **Nicobarese self-governance**, customary authority and tribal autonomy.

Formal elections may improve transparency and representation, but they should not weaken community-based governance. A balanced approach must protect indigenous traditions while ensuring accountability, gender inclusion and democratic participation.

Ease of Living: India's Journey of Inclusive Progress

Source: [PIB](#)

Relevance: UPSC GS Paper II: Governance, Welfare Schemes, Urban Development, Financial Inclusion and Citizen-Centric Administration.

Important Key Words

Prelims Keywords

- PMAY-U, PMAY-G, AMRUT, PMUY, Jal Jeevan Mission, Swachh Bharat Mission, SAUBHAGYA, PM Surya Ghar, UJALA, PMJDY, PMMY, PMGSY, Bharatmala, Vande Bharat, Amrit Bharat, UDAN, Metro Rail, Namo Bharat, Jan Vishwas Act, CPGRAMS, MyGov, PM GatiShakti.

Mains Keywords

- Ease of Living, Inclusive Development, Citizen-Centric Governance, Last-Mile Delivery, Basic Service Provision, Financial Inclusion, Infrastructure-Led Growth, Women's Empowerment, Digital Governance, Participatory Governance, Sustainable Urbanisation, Regional Connectivity, Quality of Life, Human Dignity, Welfare Convergence, Viksit Bharat 2047.

Why in News?

The Government highlighted India's progress in improving the **ease of living** through secure housing, clean cooking fuel, drinking water, sanitation, electricity, financial inclusion, transport infrastructure and digital governance.

- The initiatives reflect a shift towards **citizen-centric, mission-led and technology-enabled governance**, aimed at improving dignity, comfort, connectivity and access to opportunities.

Housing and Basic Amenities

Access to a secure **pucca house** is essential for dignity, safety and improved quality of life. To expand affordable housing, the government launched **PMAY-Urban in 2015** and **PMAY-Gramin in 2016**. These schemes also promote convergence with toilets, drinking water and electricity.

Pradhan Mantri Awas Yojana-Urban

- Launched:** 2015
- Objective:** Provide pucca houses to eligible urban households
- Beneficiaries:** EWS, LIG and MIG categories across urban India

PMAY-U 2.0

- Launched:** 2024
- Provides assistance of up to **₹2.5 lakh**
- Assistance is available under the **Beneficiary-Led Construction** component
- A female family member must be the **owner or co-owner**
- Promotes women's property ownership and housing security

Pradhan Mantri Awas Yojana-Gramin

- Launched:** 2016
- Objective:** Provide pucca houses to eligible rural households
- Assistance in plain areas: **₹1.20 lakh per house**
- Assistance in hilly and difficult areas: **₹1.30 lakh per house**

Progress, 2016-2026

- Target registered: **3.98 crore houses**
- Houses sanctioned: **3.91 crore**
- Houses completed: **3.05 crore**

- Around **75% of sanctioned houses** are owned by women or jointly owned

Convergence with Basic Services

PMAY-G houses are linked with:

- Toilets
- Drinking water
- Electricity connections

This makes the scheme more than a housing programme by integrating it with essential household amenities.

Atal Mission for Rejuvenation and Urban Transformation

- **Launched:** 2015
- **Objective:** Address basic service gaps in urban centres

AMRUT Phase I

- Covered **500 cities**
- Focus areas: Water supply, Sewerage, Green spaces, Urban transport

AMRUT 2.0

- **Launched:** October 2021
- Coverage expanded to all **4,800 statutory towns**
- The allocation was nearly three times higher than the original mission

Universal Access to Essentials

Before 2014, many households lacked clean cooking fuel, safe drinking water and sanitation. Women in rural areas were especially affected by smoke from traditional fuels, the burden of fetching water and inadequate sanitation. PMUY, Jal Jeevan Mission and Swachh Bharat Mission were launched to address these gaps at scale.

Pradhan Mantri Ujjwala Yojana

- **Launched:** May 2016
- **Objective:** Provide clean LPG connections to eligible households
- Initial target of **8 crore connections** achieved

by September 2019

- **Ujjwala 2.0**, launched in August 2021, targeted one crore additional connections
- Further expansions added **60 lakh, 75 lakh** and another **25 lakh approved connections**
- Total clean cooking gas connections provided: **Over 10.57 crore**

LPG Access Expansion

- National LPG coverage increased from **55.9% in April 2014** to **107.2% in April 2026**
- LPG consumers increased from **14.51 crore** to **33.39 crore**
- Rural access improved through expansion of distributorships and bottling infrastructure
- Clean cooking fuel reduced dependence on traditional biomass and improved household dignity

Jal Jeevan Mission

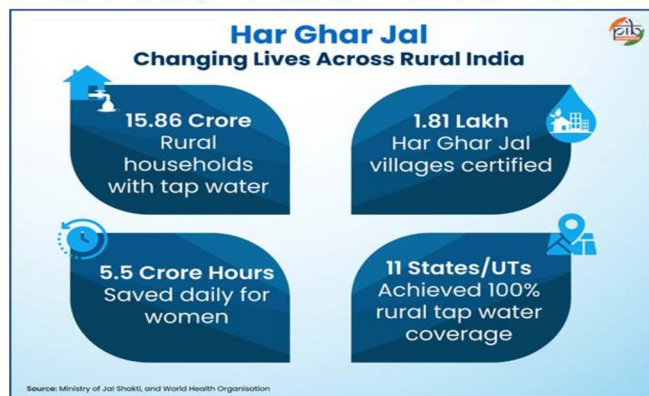
- **Launched:** 2019
- **Goal:** *Har Ghar Jal* through functional rural household tap connections
- Rural households with tap water at launch: **3.23 crore, or 16.72%**
- Coverage by June 2026: **15.86 crore households, or 81.94%**
- New connections added: Around **12 crore**
- Investment: **₹2.08 lakh crore**

Social Impact

- More than **9 crore women** were freed from the burden of fetching water
- Around **1.81 lakh villages** were certified as *Har Ghar Jal* by Gram Sabhas
- **11 States and Union Territories** achieved complete rural household coverage
- The mission improved access, health, convenience and water security

JJM 2.0

- Mission extended in March 2026 until **December 2028**



Swachh Bharat Mission–Gramin

- **Launched:** 2014
- **Objective:** Universal rural sanitation and elimination of open defecation
- Rural sanitation coverage increased from **39% in 2014** to **100% in 2019**

Progress by June 2026

- More than **12.14 crore household toilets** completed
- Around **2.76 lakh community sanitary complexes** created
- More than **5.69 lakh villages** declared **ODF Plus**
- **5.34 lakh villages** developed solid-waste management arrangements
- **5.55 lakh villages** developed liquid-waste management arrangements

Swachh Bharat Mission–Urban

- **Launched:** 2014
- **Objective:** Improve urban sanitation, toilet access and waste management

Progress, 2014–2026

- More than **63 lakh household toilets** constructed
- Around **six lakh community toilets** built
- Urban waste processing increased from **16% to 82%**
- Door-to-door waste collection increased from **43% to 98%**

- Urban Local Bodies in all **35 States and Union Territories** declared themselves ODF in October 2019

Power for All: Reliable, Affordable and Clean Energy

Reliable electricity supports household comfort, education, industry and economic activity. Between 2014 and 2026, India expanded power generation, transmission and last-mile electricity access while increasing the share of renewable energy.

Expansion of Installed Power Capacity

- Total installed power capacity increased from **248 GW in FY 2014** to over **532 GW by March 2026**
- Renewable sources account for more than half of installed capacity
- India has the **third-largest clean-energy capacity** in the world

Growth of Energy Sources

Energy Source	2014 Capacity	March 2026 Capacity
Renewable energy	76.38 GW	274.69 GW
Solar power	2.82 GW	150.26 GW
Wind power	21.04 GW	56.09 GW
Nuclear power	4.78 GW	8.78 GW
Hydro power	—	51.4 GW
Biomass and other sources	—	11.74 GW

- Wind capacity increased **2.66 times**
- Nuclear capacity grew by around **84%**
- Rapid solar expansion drove the growth of clean-energy capacity

Improved Electricity Availability

- Average rural supply increased from **12.5 hours per day in 2014** to **22.6 hours in 2026**
- Urban areas receive up to **23.4 hours of electricity daily**

- National energy shortage declined from **4.2% in 2013-14** to **0.03% in 2025-26**
- Per capita electricity consumption increased from **957 kWh in 2013-14** to **1,460 kWh in 2024-25**

SAUBHAGYA

The **Pradhan Mantri Sahaj Bijli Har Ghar Yojana** was launched in 2017 to provide free last-mile electricity connections to unelectrified rural and urban households.

Achievements

- Around **2.86 crore households** received electricity connections
- Scheme targets were achieved by March 2022
- The programme was closed after completing its intended household-electrification targets

PM Surya Ghar Muft Bijli Yojana

- **Launched:** February 2024
- **Objective:** Promote residential rooftop solar installations
- Eligible households can receive up to **300 free electricity units per month**
- Central subsidy of up to **₹78,000** is transferred directly to beneficiaries
- More than **40 lakh households** installed rooftop solar systems by May 2026

Benefits

- Reduces household electricity bills
- Enables families to generate their own clean electricity
- Allows households to earn by selling surplus power
- Promotes decentralised renewable-energy generation

UJALA

The **Unnat Jyoti by Affordable LEDs for All** programme promotes affordable and energy-efficient lighting.

Achievements

- Around **37 crore LED bulbs** distributed
- Estimated annual household savings: **₹19,153 crore**
- Reduced electricity consumption and household power expenses
- Supported energy efficiency and lower peak-power demand

Financial Inclusion and Empowerment

Since 2014, India has developed an interconnected financial ecosystem covering **savings, credit, insurance, pensions and welfare delivery**. The focus has been on bringing excluded citizens into the formal financial system, reducing dependence on informal lenders and improving economic security.

Pradhan Mantri Jan Dhan Yojana

PMJDY, launched in 2014, expanded universal access to banking and became the foundation of the **JAM Trinity – Jan Dhan, Aadhaar and Mobile**.

Key Features

- Zero-balance bank accounts
- Direct Benefit Transfer of welfare payments
- RuPay debit cards with accident-insurance cover
- Access to savings, payments and other financial services
- Transparent and leakage-free delivery of government benefits

Significance

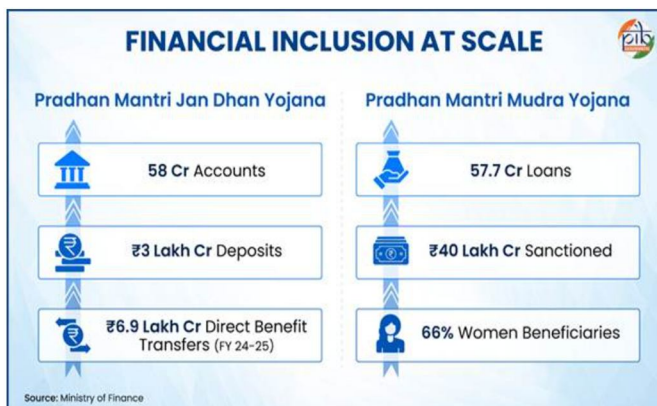
- PMJDY strengthened **financial inclusion, digital payments, welfare efficiency and household financial security**. It brought crores of previously unbanked citizens into the formal banking system.

Pradhan Mantri Mudra Yojana

- PMMY, launched in 2015, provides **collateral-free institutional** credit to micro and small enterprises that earlier depended heavily on informal lenders.

Key Features

- Loans for starting and expanding micro-enterprises
- Strong participation of women entrepreneurs
- Significant coverage of SC, ST and OBC beneficiaries
- **Tarun Plus** supports successful borrowers seeking higher-value loans
- Encourages enterprise growth, self-employment and job creation



Transport and Connectivity

Between 2014 and 2026, India's transport infrastructure expanded rapidly across highways, rural roads, tunnels, bridges and expressways. The focus shifted towards **faster mobility, reduced travel time, regional integration, logistics efficiency and improved access to markets and public services.**

Roads and National Highways

- India's road network reached **63.73 lakh km**, becoming the **second-largest in the world**
- National highways expanded by nearly **61%**

- Four-lane and wider highways increased substantially
- **3,644 km of access-controlled high-speed corridors and expressways** became operational
- Around **22,590 km of roads** were completed under **Bharatmala**
- Budgetary support for roads and highways increased almost tenfold

Landmark Connectivity Projects

- **Z-Morh/Sonamarg Tunnel:** Improved access to Ladakh and supported tourism
- **Sudarshan Setu:** Connected Okha with Beyt Dwarka
- **Maitri Setu:** Linked Tripura with Bangladesh
- **Atal Tunnel:** Provided all-weather connectivity between Manali and Lahaul-Spiti
- **Dr. Syama Prasad Mukherjee Tunnel:** Reduced Jammu-Srinagar travel time
- **Dhola-Sadiya Bridge:** Strengthened connectivity between Assam and Arunachal Pradesh
- **Delhi-Dehradun Economic Corridor:** Reduced travel time and included an elevated wildlife corridor
- **Ahmedabad-Dholera Expressway:** Improved logistics and regional connectivity
- **Dwarka Expressway and Urban Extension Road-II:** Reduced congestion and improved freight movement in Delhi-NCR
- **NH-31 Ganga Bridge:** Shortened routes for heavy vehicles in Bihar

Pradhan Mantri Gram Sadak Yojana

PMGSY provides **durable, all-weather rural road connectivity** and links villages with markets, schools, hospitals and economic opportunities.

Progress

- **99.6% of eligible habitations** connected
- Rural roads completed during 2014–26 exceeded the length completed during 2000–14

Significance

- Reduced rural isolation
- Improved access to healthcare and education
- Strengthened agricultural marketing
- Supported rural livelihoods and mobility
- Promoted balanced regional development

Railways: Speed, Safety and Modernisation

Since 2014, Indian Railways has focused on **electrification, safety, speed, comfort and capacity expansion**.

Electrification and Safety

- Electrification increased from **20% to 99.6%**, covering **69,873 route km**
- **Kavach**, India's indigenous Automatic Train Protection system, helps prevent collisions
- Train accidents declined from **135 in 2014–15 to 16 in 2025–26**
- Railway budgetary allocation rose nearly ninefold

Vande Bharat

- Indigenous semi-high-speed train launched in 2019
- **162 services** operational by March 2026
- Vande Bharat Sleeper introduced on the **Howrah–Guwahati** route

Amrit Bharat Trains

- Affordable, non-AC, high-capacity long-distance trains

Amrit Bharat Station Scheme

- Launched in 2023
- Focus on lifts, escalators, waiting halls, toilets and passenger information systems

High-Speed Rail

- Mumbai–Ahmedabad Bullet Train corridor under construction
- Length: **508 km**
- Designed speed: **320 kmph**
- Seven additional high-speed corridors proposed

High-Speed rail. These routes include:

- Mumbai–Pune
- Pune–Hyderabad
- Hyderabad–Bengaluru
- Hyderabad–Chennai
- Chennai–Bengaluru
- Delhi–Varanasi
- Varanasi–Siliguri

These announcements highlight the strategic role of high-speed rail in India's growth, integration, and sustainable development.

Governance Reforms

Governance reforms have focused on **reducing compliance burdens, strengthening accountability, improving transparency and making public services faster and citizen-friendly**.

Jan Vishwas Acts

- The **Jan Vishwas (Amendment of Provisions) Act, 2023** decriminalised minor procedural defaults across several Central laws by replacing imprisonment with civil penalties.

The **Jan Vishwas Act, 2026** expanded this reform by:

- Covering **784 provisions across 79 Central Acts**
- Decriminalising **717 provisions**
- Amending **67 citizen-facing provisions**
- Replacing imprisonment with warnings or monetary penalties
- Providing advisory notices for first-time violations



- Rationalising penalties according to the seriousness of offences
- Providing for Adjudicating Officers and Appellate Authorities
- Allowing periodic revision of fines and penalties

These reforms promote **trust-based regulation, voluntary compliance, proportional penalties and ease of doing business.**

CPGRAMS

The **Centralised Public Grievance Redress and Monitoring System** provides a common platform for citizens to submit and monitor grievances relating to Ministries, Departments, States and Union Territories.

- Around **six lakh grievances** were resolved between January 2025 and February 2026
- Nearly **69.8%** of evaluated resolutions were rated satisfactory
- Strengthens accountability, monitoring and citizen satisfaction

MyGov

- **Launched:** 2014
- Promotes citizen participation in policymaking and governance

- Has more than **60 million registered users**
- State-level platforms operate in **28 States and Union Territories**
- Supports public consultations, policy outreach and dissemination of scheme information

MyGov acts as a bridge between citizens and government, strengthening **participatory and interactive governance.**

PM GatiShakti National Master Plan

- **Launched:** 2021
- Brings together **58 Ministries and Departments**
- Uses a GIS-based platform containing **3,204 data layers**
- Enables integrated and coordinated infrastructure planning
- Covers transport, logistics, education, healthcare and other social sectors
- Open to public and private entities for wider participation

PM GatiShakti reduces duplication, improves coordination and supports **multimodal, data-driven infrastructure planning.**

Tightened FCRA Framework: Purpose-Based Funding, Geographic Controls and Focus on Religious Conversion

Source: [The Indian Express](#)

Relevance: UPSC GS Paper II: Government Policies, Civil Society Organisations, Fundamental Rights and Centre-State Relations.

Important Key Words

For Prelims

- FCRA, Prior Permission, Proselytisation, Compounding of Offences, Designated Authority

For Mains

- Regulatory Oversight, Foreign-Funding Transparency, Religious Freedom, Civil-Society Autonomy, National Interest

Why in News?

The Union Ministry of Home Affairs has issued two notifications tightening the regulation of foreign contributions received by NGOs and associations under the **Foreign Contribution Regulation Act.**

The changes:



- Link FCRA registration to specified purposes.
- Restrict activities to approved States or Union Territories.
- Explicitly exclude proselytisation from permitted religious activities.
- Expand reporting and disclosure requirements.
- Tighten conditions for renewal and utilisation of funds.
- Revise penalties for misuse and diversion of foreign contributions.

Separately, the **FCRA Amendment Bill, 2026** proposes a designated authority to manage foreign-funded assets when an organisation's registration is cancelled, surrendered or ceases to remain valid.

What is the FCRA?

The **Foreign Contribution Regulation Act** regulates the acceptance and utilisation of foreign donations and foreign hospitality by individuals, associations and organisations in India.

Historical Evolution

- **FCRA, 1976:** Enacted amid concerns that foreign powers could influence Indian affairs through financial support to independent organisations.
- **FCRA, 2010:** Replaced the earlier law and consolidated provisions regulating foreign contributions.
- **Subsequent amendments:** The law was amended in 2016, 2018 and 2020.
- **2020 amendment:** Strengthened government control and scrutiny over the receipt and use of foreign funds.

The central objective is to ensure that foreign contributions are not used in a manner detrimental to:

- National interest
- Sovereignty

- Public order
- Security
- The values of a sovereign democratic republic

How Does the Existing FCRA System Operate?

An NGO or association seeking foreign contribution must obtain either:

- **FCRA registration**, or
- **Prior permission** for a specific donor, amount and project.

Major Conditions

An organisation receiving foreign contribution must:

- Receive the funds through the designated **State Bank of India account in New Delhi**.
- Use the contribution only for the approved purpose.
- File annual returns.
- Maintain prescribed financial records.
- Follow the statutory limit on administrative expenses.
- Not transfer the contribution to another NGO.

Who Cannot Receive Foreign Contributions?

The law prohibits foreign contributions to categories including:

- Election candidates
- Political parties and their office-bearers
- Members of legislatures
- Judges
- Government servants
- Journalists
- Newspaper & broadcast-media companies
- Organisations of a political nature

New FCRA Notifications

What Does the First Notification Provide?

- The first notification amends the **Foreign Contribution (Regulation) Rules, 2011**.

Purpose-Specific Registration

- Organisations must select their activities from a government-prescribed Schedule containing **105 permissible purposes**.
- Foreign funds can be used only for the activities included in the organisation's registration.

Geography-Linked Approval

- FCRA registration must now specify the States or Union Territories where the organisation is authorised to operate.
- An organisation cannot freely extend foreign-funded activities to another State or Union Territory without approval.

Transition for Existing Organisations

Existing FCRA-registered associations have been given one year to identify:

- The purposes they wish to retain.
- The geographical areas in which they intend to continue operating.

Any later expansion will require fresh government approval.

How Has the Definition of "Key Functionary" Changed?

The rules now define "key functionary" more broadly.

The expression includes:

- Directors of companies
- Partners in firms
- Trustees
- Karta of a Hindu Undivided Family
- Office-bearers

- Members of governing bodies
- Any person controlling or managing the affairs of an association

This enables wider scrutiny of those who exercise actual influence over an organisation, even when they do not hold the title of chief functionary.

What Other Compliance Requirements Have Been Introduced?

Foreign Nationals in Management

- Organisations having foreign nationals in important management positions will ordinarily face restrictions in obtaining registration or prior permission.

Minimum Utilisation Requirement

The government has introduced a minimum utilisation threshold that may be considered while deciding:

- Renewal of registration
- Cancellation
- Continued eligibility to receive foreign funds

Release of Subsequent Instalments

- Conditions have been tightened for releasing further instalments of foreign contributions, particularly in cases involving prior permission.

Enhanced Annual Disclosures

Organisations must provide more extensive information, including:

- Detailed activity reports
- Social-media account details
- Information about ultimate donors
- Details of donor-advised funds
- Information regarding intermediary funding arrangements

These requirements seek to expose the complete



flow of money rather than only the immediate donor.

How Do the New Rules Differ from the 2011 Framework?

Earlier Framework

Under the 2011 Rules, organisations broadly identified themselves as carrying out:

- Cultural
- Economic
- Educational
- Religious
- Social activities

Registration was largely connected with broad programmes.

New Framework

The revised system is more prescriptive because:

- Organisations must choose from an approved list of activities.
- Registration is tied to each permitted purpose.
- Geographical areas become part of the licence.
- Expansion in purpose or area requires approval.
- Management structures and donor chains face deeper scrutiny.

The framework therefore shifts from broad, programme-based permission to **purpose-specific and geography-specific regulation**.

Religious Conversion and FCRA

Why Has Proselytisation Been Specifically Excluded?

The revised Schedule repeatedly uses the phrase “**excluding proselytisation**” while listing permissible religious activities.

Foreign contributions may continue to support activities such as:

- Religious education
- Theological study
- Preservation of religious traditions
- Religious gatherings
- Faith-based social activities

However, foreign funds cannot be used for conversion-oriented or proselytising activities.

The government is therefore drawing a distinction between:

- Supporting religious practice and education, and
- Financing efforts aimed at converting individuals to another religion.

What is the Constitutional Position?

Article 25

Article 25 of the Constitution guarantees freedom of conscience and the right to:

- Profess religion
- Practise religion
- Propagate religion

However, this freedom is subject to:

- Public order
- Morality
- Health
- Other Fundamental Rights

Rev. Stainislaus Case, 1977

In **Rev. Stainislaus v. State of Madhya Pradesh**, the Supreme Court held that the right to propagate religion does not include a Fundamental Right to convert another person.

The judgment distinguished between:

- Communicating or explaining one's faith, and
- Converting another person through force, fraud or inducement.

By excluding proselytisation, the government seeks to prevent foreign contributions from financing conversion-oriented activities.

Why is the Conversion Issue Politically Sensitive?

Foreign-funded religious organisations have long faced allegations of involvement in conversion activities.

Several Christian and faith-based institutions have previously faced FCRA-related action, including:

- Missionaries of Charity
- Compassion International
- World Vision India
- Evangelical Fellowship of India
- Organisations connected with the Church of North India

The government has maintained that regulatory action was based on specific violations of FCRA provisions.

- Critics, however, have alleged that some actions disproportionately affect Christian institutions and organisations serving minority communities.

The issue therefore lies at the intersection of:

- Religious freedom
- Foreign influence
- National interest
- Minority rights
- Regulatory accountability

Revised Penalties

What Does the Second Notification Provide?

- The second notification revises compounding penalties under **Section 41(1) of the FCRA**.
- Compounding allows an organisation to settle specified violations by paying a

prescribed penalty instead of immediately facing full criminal prosecution.

Excess Administrative Expenditure

Foreign contribution spent beyond the statutory **20% administrative-expense limit** will attract:

- ₹1 lakh, or
- 5% of the excess expenditure,

whichever is higher.

Speculative Investment

Using foreign contributions for speculative activities, including stock-market investments, will attract:

- ₹1 lakh, or
- 30% of the amount invested,

whichever is higher.

Returns earned from such investments may also be recovered.

Diversion of Funds

Using foreign contribution for purposes other than those for which it was received will attract:

- ₹1 lakh, or
- 30% of the amount involved,

whichever is higher.

Unapproved Purpose or Geography

Receiving or using foreign funds for:

- An activity not included in registration, or
- A State or Union Territory not authorised by the registration,

will invite similar penalties.

Significance

The revised system:

- Raises the financial cost of non-compliance.
- Encourages strict adherence to approved purposes.
- Provides a structured settlement mechanism.

- Reduces the need for criminal prosecution in compoundable cases.

Why Does the Government Consider the Changes Necessary?

Closing Compliance Gaps

- Officials argue that the previous system could not adequately establish whether funds were used strictly for approved programmes.

Tracking Geographic Use

- Making geography part of the licence allows the government to monitor where foreign-funded activities are being conducted.

Following the Ultimate Donor

- Disclosures relating to intermediary entities and donor-advised funds can help uncover the real source of foreign contributions.

Monitoring Influence Networks

- Social-media disclosures and detailed activity reports may allow authorities to assess both financial flows and organisational outreach.

Preventing Diversion

- Higher penalties and purpose-specific approvals seek to prevent the use of funds for unauthorised activities.

Managing Foreign-Funded Assets

The government has cited legal uncertainty over assets acquired through foreign funds when an organisation's registration:

- Expires
- Is cancelled
- Is surrendered
- Ceases for another reason

FCRA Amendment Bill, 2026

What Does the Bill Propose?

The proposed amendment creates a **designated authority** appointed by the Central government.

This authority would control, supervise and manage foreign contributions and assets when an FCRA certificate:

- Is cancelled
- Is surrendered
- Expires
- Otherwise ceases to remain valid

The proposal seeks to replace the existing Section 15 framework.

When Would a Registration Be Deemed to Have Ceased?

The certificate may be treated as having ceased when:

- No renewal application is submitted.
- The renewal application is rejected.
- Renewal is not obtained before the certificate expires.

The designated authority would then take control of the unutilised foreign contribution and related assets.

Can the Assets Be Returned?

The authority may return the funds and assets when the organisation:

- Secures renewal
- Obtains fresh registration
- Has its legal status restored

However, permanent control may follow when:

- The organisation does not obtain registration within the prescribed period.
- It ceases to exist.
- It becomes defunct or inoperative.

In such cases, the authority may:

- Transfer assets to a Central, State or local government body.



FCRA FRAMEWORK TIGHTENED

PURPOSE, GEOGRAPHY, PROSELYTISATION & PENALTIES

Two New Notifications + FCRA Amendment Bill, 2026

Stronger oversight of foreign contributions to protect national interest, ensure transparency and prevent misuse



WHY IN NEWS?

The Ministry of Home Affairs has issued two notifications tightening regulation of foreign contributions under the FCRA.

Key Changes:

- Link registration to specified purposes
- Restrict activities to approved States/UTs
- Explicitly exclude proselytisation
- Expand reporting & disclosures
- Tighten conditions for renewal & utilisation
- Revise penalties for misuse & diversion of funds

WHAT IS FCRA?

FCRA regulates acceptance & utilisation of foreign donations & hospitality by individuals, associations & organisations.

Historical Evolution

- 1976 Enacted amid concerns of foreign influence through funding
- 2010 Replaced earlier law; consolidated regulation
- 2016, 2018, 2020 Further amendments
- 2020 Strengthened govt. control & scrutiny over foreign funds

Objective:

Ensure foreign contributions are not used detrimentally to national interest, sovereignty, public order, security & values of a sovereign democratic republic.

HOW DOES THE SYSTEM OPERATE?

To receive foreign contribution, an NGO must obtain:



FCRA Registration

OR



Prior Permission for specific donor, amount & project

Major Conditions

- Receive funds via designated SBI, New Delhi account
- Use only for approved purpose
- File annual returns
- Maintain prescribed records
- Adhere to admin expense limit (20%)
- Do not transfer funds to another NGO

Who Cannot Receive Foreign Contributions?



Election Candidates



Political Parties & Office-bearers



Members of Legislature



Judges



Government Servants



Journalists



Media Companies



Organisations of a Political Nature

FIRST NOTIFICATION – KEY PROVISIONS



Purpose-Specific Registration

- Select activities from Schedule of 105 permissible purposes
- Funds can be used only for registered activities



Geography-Linked Approval

- Registration must specify States/UTs of operation
- Expansion to other States/UTs needs fresh approval



Transition for Existing NGOs

- One year to indicate purposes & areas to be retained
- Future expansion requires fresh approval



Tighter Release of Instalments

Stricter conditions for further instalments in prior permission cases



Expanded Definition of 'Key Functionary'

- Directors, partners, trustees, Karta of HUF, office-bearers, governing body members
- Any person controlling or managing affairs



Foreign Nationals in Management

- NGOs with foreign nationals in key roles face restrictions in getting registration or prior permission



Minimum Utilisation Requirement

Considered for renewal, cancellation & continued eligibility

HOW NEW RULES DIFFER FROM 2011 FRAMEWORK?

2011 FRAMEWORK	NEW FRAMEWORK
Broad heads: Cultural, Economic, Educational, Religious, Social	Choose from approved list of activities (105 purposes)
Registration linked to broad programmes	Registration tied to each specific purpose
Geography disclosed, not linked to licence	Geographical areas are part of the licence
Expansion easier	Expansion in purpose or area requires approval
Limited scrutiny of management & donors	Deeper scrutiny of management & donor chains

SECOND NOTIFICATION – REVISED PENALTIES (Compounding)

Violation	Penalty (Whichever is Higher)
Excess Administrative Expenditure (>20%)	₹1 lakh or 5% of excess expenditure
Speculative Investment (e.g., stock market)	₹1 lakh or 30% of amount invested Returns may be recovered
Diversion of Funds (Other than approved purpose)	₹1 lakh or 30% of amount involved
Unapproved Purpose or Geography	₹1 lakh or 30% of amount involved



Raises cost of non-compliance



Ensures strict adherence to approved purposes



Structured settlement mechanism



Reduces need for criminal prosecution

RELIGIOUS CONVERSION & FCRA



Why Exclude Proselytisation?

- "Excluding proselytisation" repeated in Schedule
- Allows religious education, study, traditions, gatherings, faith-based social activities
- Foreign funds cannot support conversion-oriented activities



Distinction:

- Support religious practice vs. financing conversion efforts



Constitutional Position

Article 25 guarantees freedom to:

- Profess
- Practice
- Propagate

Subject to public order, morality, health & other Fundamental Rights

Rev. Stalinlaus vs State of MP (1977)
Right to propagate religion does not include a Fundamental Right to convert another person. Distinguished communication from conversion through force, fraud or inducement.



Why Politically Sensitive?

Several Christian Institutions faced FCRA action:

- Missionaries of Charity
- Compassion International
- World Vision India
- Evangelical Fellowship of India
- Church of North India-linked organisations

Issue intersects:
Religious freedom, foreign influence, national interest, minority rights, regulatory accountability

FCRA AMENDMENT BILL, 2026 – KEY PROVISIONS

Designated Authority	When Registration Deemed to Have Ceased?	Can Assets Be Returned?	Places of Worship
Appointed by Central Govt. to control, supervise & manage foreign funds & assets when FCRA certificate: • Is cancelled • Is surrendered • Expires • Otherwise ceases	No renewal application Renewal rejected Renewal not obtained before expiry Authority takes control of unutilised funds & assets	Yes, when organisation: • Secures renewal • Gets fresh registration • Legal status restored Permanent control when: • No registration in prescribed time • Organisation ceases to exist • Organisation becomes defunct Authority may: Transfer to govt. body / public authority or dispose via sale or other process	Authority may entrust: Authority may entrust management to another person but must ensure religious character is preserved.

REGISTRATION, RENEWAL & CANCELLATION

How Registration Granted?	Validity & Renewal	Cancellation & Suspension
Apply online with documents Inquiries by MHA / Intelligence Agencies Applicant should not: • Fictitious / benami • Convicted for conversion • Promoted communal tension • Diverted or misused funds • Engaged in sedition Decision within prescribed period	Valid for 5 years Apply for renewal within 6 months before expiry If not renewed: • No new foreign funds • Existing funds cannot be used without govt. permission	Cancelled when: • False information • Violation of conditions • Fund diversion / misuse • Inactive for 2 years • Defunct organisation • Public interest Suspension (pending inquiry): • Receipt stopped • Funds frozen • Utilisation needs prior approval Orders can be challenged in High Court

BROADER IMPLICATIONS

- Greater traceability of funds & donor chains
- Stronger regulatory control over activities, areas, management, instalments & assets
- Reduced flexibility for NGOs
- Higher compliance burden for smaller organisations



Religious freedom debate: prevents coercion but risk of biased interpretation



Continuity of welfare activities may be affected during registration disputes

KEY CONCERNS

- Excessive executive discretion
- Unclear definition of proselytisation
- Delays in approvals & renewals
- High compliance burden on small NGOs
- Impact on minority-run institutions
- Reduced flexibility during emergencies
- Privacy concerns in social-media disclosures
- Selective / unequal enforcement
- No independent control over designated authority
- Need to distinguish procedural vs. deliberate misuse

WAY FORWARD

- Clearly define proselytisation
- Ensure time-bound decisions
- Independent review & judicial safeguards
- Proportionate penalties
- Protect essential services during disputes
- Digital compliance support for smaller NGOs
- Transparency in enforcement (publish data)
- Balance security needs with civil-society space



The new FCRA framework strengthens oversight through purpose-linked registration, geographic control, disclosures, penalties & asset management, with a focus on preventing conversion-oriented use of foreign funds.
Its success depends on balance between national interest, transparency, religious freedom and the autonomy of legitimate civil-society organisations.



- Transfer them to another public authority or agency.
- Dispose of the assets through sale or another prescribed process.

What Happens to Places of Worship?

The Bill provides that where an asset is a place of worship, the designated authority may entrust its management to another person.

- It must, however, ensure that the **religious character of the place of worship is preserved.**

Why Has the Bill Generated Controversy?

Concerns of Minority Institutions

Religious and civil-society organisations fear that loss or delay of FCRA registration could lead to government control over:

- Schools
- Hospitals
- Charitable institutions
- Community facilities
- Places of worship
- Other foreign-funded assets

Renewal Delays

Critics argue that an organisation could lose control over assets even when renewal remains pending or is not processed before expiry.

Centralisation of Power

- The Bill gives the Union government authority to appoint the body controlling foreign-funded assets.
- Opposition parties argue that this may provide excessive administrative discretion.

Impact on Social Services

Many foreign-funded institutions operate in:

- Education

- Healthcare
- Poverty alleviation
- Community welfare
- Disaster relief

Restrictions or interruptions in funding could affect service delivery.

Government's Position

The government states that the Bill addresses:

- Administrative uncertainty
- Lack of clear asset-management procedures
- Inconsistent penalties
- Multiple investigations
- Lack of timelines for utilisation
- Ambiguity during suspension or cessation

The government has also linked the proposal to preventing foreign-funded forcible religious conversion.

Registration, Renewal and Cancellation

How is FCRA Registration Granted?

Applications are submitted online with the prescribed documents.

The Ministry of Home Affairs may conduct inquiries, including through intelligence agencies, into the organisation and its functionaries.

An applicant should not:

- Be fictitious or benami.
- Have been convicted for forcible or induced conversion.
- Have promoted communal tension.
- Have diverted or misused funds.
- Have engaged in sedition or activities against national interest.

The Ministry is expected to approve or reject an application within the prescribed period.

How Long is Registration Valid?

FCRA registration is generally valid for **five years**.

Organisations are expected to apply for renewal within six months before expiry.

Failure to renew means that the organisation cannot:

- Receive new foreign contributions.
- Use existing foreign funds without government permission.

On What Grounds Can Registration Be Cancelled?

Registration may be cancelled when:

- False information was provided in the application.
- Conditions of registration were violated.
- Funds were diverted or misused.
- The organisation remained inactive for two consecutive years.
- The organisation became defunct.
- Cancellation is considered necessary in the public interest.

Before cancellation, the organisation must generally be given a reasonable opportunity to be heard.

Once cancelled, it ordinarily becomes ineligible for re-registration for three years.

What is Suspension?

The Ministry may suspend an organisation's registration pending inquiry.

During suspension:

- Receipt of foreign funds may be stopped.
- Existing funds may be frozen or restricted.
- Utilisation may require prior government approval.

Government orders can be challenged before the High Court.

Broader Implications

Greater Traceability

Purpose, geography and donor-chain disclosures can make the movement and utilisation of foreign contributions more transparent.

Stronger Regulatory Control

The government gains greater control over:

- Activities
- Areas of operation
- Management structures
- Instalment releases
- Asset utilisation

Reduced Organisational Flexibility

- NGOs may find it harder to respond quickly to new emergencies or expand projects into new regions without approval.

Compliance Burden

- Detailed reporting, social-media disclosures and donor identification may increase the administrative cost for smaller organisations.

Religious-Freedom Debate

- The exclusion of proselytisation may help prevent foreign-funded inducement or coercion, but critics fear that legitimate religious outreach may face broad interpretation and scrutiny.

Continuity of Welfare Activities

- Asset-control provisions may protect foreign-funded assets from misuse after an organisation closes, but they may also interrupt charitable services if registration disputes remain unresolved.

Key Concerns

- Possibility of excessive executive discretion
- Absence of clarity in defining proselytisation
- Risk of delays in approvals and renewals

- Increased compliance burden on smaller NGOs
- Potential impact on minority-run institutions
- Reduced operational flexibility during emergencies
- Concerns about privacy in social-media disclosures
- Possibility of selective or unequal enforcement
- Lack of independent control over the designated authority
- Need to distinguish procedural violations from deliberate misuse

Way Forward

Clearly Define Proselytization

- Rules should distinguish peaceful religious communication from conversion through force, fraud or inducement.

Time-Bound Decisions

- Applications for registration, prior permission and renewal should be decided within clear timelines.

Independent Review Mechanism

- Decisions involving cancellation, asset takeover and major penalties should be subject to effective administrative or judicial review.

Proportionate Regulation

Penalties should reflect:

- Nature of the violation
- Amount involved
- Intent
- Repetition
- Harm caused

Protect Essential Services

- Schools, hospitals, rehabilitation centres and welfare institutions should not face sudden disruption during regulatory disputes.

Digital Compliance Support

- Smaller NGOs should receive guidance and digital assistance to comply with complex reporting requirements.

Transparency in Enforcement

- The government should publish accessible information on registrations, cancellations, penalties and reasons for regulatory action.

Balance Security and Civil-Society Space

- Foreign-funding regulation must protect national interest without weakening legitimate charitable, educational and humanitarian work.

Conclusion

The new FCRA framework marks a shift from broad programme-based regulation to a closely monitored system in which foreign funding is tied to specific purposes, geographical areas and detailed disclosures.

The focus on proselytization reflects the government's concern that foreign contributions should not finance conversion-oriented activities. The penalty notification and proposed asset-management authority further strengthen enforcement.

- However, effective regulation must combine transparency and national-security safeguards with procedural fairness, religious freedom and the operational autonomy of legitimate civil-society organisations. The long-term credibility of the framework will depend on clear definitions, time-bound decisions, proportionate penalties and non-discriminatory enforcement.

India's Digital Sovereignty: Securing Technological and Strategic Autonomy

Source: [The Hindu](#)

Relevance

UPSC GS Paper II: Data Governance, Government Policies and International Relations

Important Key Words

Prelims Keywords

- Digital Sovereignty, Data Localisation, Sovereign Cloud, UPI, India Semiconductor Mission

Mains Keywords

- Strategic Autonomy, Technological Dependence, Software-Defined Warfare, Algorithmic Sovereignty, Digital Public Infrastructure

Why in News?

Recent incidents have highlighted India's dependence on foreign-controlled digital infrastructure.

- In April 2026, Indian CCTV networks were reportedly compromised through the Chinese software platform **EseeCloud**, raising concerns about access to information related to strategic defence assets.
- In 2025, Nayara Energy reportedly lost access to corporate email, collaboration tools and cloud data after Microsoft enforced sanctions linked to the company's Russian ownership.

These incidents have renewed calls for strengthening India's control over critical data, software, cloud platforms and digital networks.



What is Digital Sovereignty?

Digital sovereignty refers to a country's ability to independently control its:

- Digital infrastructure
- Data and communication networks
- Cloud and computing systems
- Critical software and algorithms
- Hardware and semiconductor supply chains

It has three major dimensions:

- Data sovereignty:** Control over the storage, processing and transfer of data.
- Computational sovereignty:** Control over cloud, AI and high-performance computing infrastructure.
- Technological autonomy:** Domestic capability in hardware, software and critical technologies.

Digital sovereignty does not mean technological isolation. It means reducing strategic vulnerabilities while maintaining trusted international cooperation.

Why Does India Need Digital Sovereignty?

National Security

- Modern defence systems—including fighter aircraft, missiles and radars—depend heavily on embedded software. Foreign manufacturers may retain control over upgrades, source codes and system configurations.
- The denial of precise GPS assistance during the **1999 Kargil conflict** demonstrated the risks of dependence on external technology.

Continuity of Government and Commerce

Foreign providers can suspend cloud, email, payment or authentication services due to sanctions, legal orders or geopolitical disputes. Such disruption could affect:

- Government administration
- Banking and trade
- Manufacturing
- Energy infrastructure
- Defence preparedness

Data Jurisdiction

- Storing data physically in India does not always guarantee Indian control. Foreign technology companies may remain subject to their home-country laws and could be required to provide data to foreign governments.

Algorithmic Sovereignty

Dependence on foreign AI systems may expose India to:

- External cultural and political biases
- Non-transparent algorithms
- Foreign control over strategic intelligence
- Limited access to proprietary source codes

Economic Competitiveness

- India's dependence on imported chips, cloud systems and software results in royalty payments, supply-chain vulnerability and transfer of valuable data and intellectual property abroad.

What Risks Arise from Foreign Digital Dependence?

Software-Defined Warfare

- Foreign-controlled software could theoretically limit operational range, targeting accuracy or access to battlefield intelligence during conflict.

Cloud and Platform Dependence

- Indian entities may lose access to their own digital operations when foreign corporations comply with sanctions or government directions.

Semiconductor Vulnerability

Dependence on imported semiconductors exposes India to:

- Export restrictions
- Supply-chain disruptions
- Hardware manipulation
- Geopolitical pressure

Proprietary Black Boxes

- India may not be able to inspect the source code of foreign software used in critical sectors such as power, banking, aviation and defence.

Cybersecurity Threats

- Foreign digital systems may contain vulnerabilities, backdoors or compromised software components that can be exploited by hostile entities.

What Steps Has India Taken?

Digital Public Infrastructure

India has developed indigenous and interoperable platforms such as:

- UPI
- RuPay
- Aadhaar
- DigiLocker
- ONDC

UPI and RuPay demonstrate that India can build large-scale alternatives to foreign-controlled financial platforms.

Semiconductor Ecosystem

- The **India Semiconductor Mission** seeks to promote domestic semiconductor manufacturing, assembly, testing and packaging.
- Commercial production at Micron Technology's ATMP facility in Gujarat reflects growing international cooperation in semiconductor manufacturing.

Sovereign Cloud and Software

- The government's **MeghRaj GI Cloud** aims to provide domestic cloud infrastructure for public services.
- The migration of email systems of some Union government departments to the Indian Zoho platform reflects efforts to reduce dependence on foreign productivity software.

Artificial Intelligence

- The **IndiaAI Mission**, Bhashini and BharatGen seek to create domestic computing infrastructure, language technologies and indigenous AI models.

Navigation and Defence Technology

- India developed its own satellite navigation capability after experiencing foreign dependence during the Kargil conflict.
- Programmes such as **BrahMos** and the private-sector participation model for the Advanced Medium Combat Aircraft demonstrate alternative approaches to technological self-reliance.

Legal and Cybersecurity Framework

- The Digital Personal Data Protection Act, the National Critical Information Infrastructure Protection Centre and cybersecurity mechanisms seek to strengthen data protection and critical infrastructure security.

What are the Major Challenges?

Low Research and Development Spending

- India's gross expenditure on R&D averaged about **0.74% of GDP between 2000 and 2020**, compared with a global average of around **2.07%**.
- Low investment limits innovation in semiconductors, AI, quantum technology and defence systems.

Dependence on Advanced Foreign Technology

India continues to depend on foreign:

- Semiconductor fabrication equipment
- Precision chemicals
- Cloud platforms
- AI computing infrastructure
- Software products
- Standard-essential patents

Shortage of Patient Capital

- Deep-tech projects require long-term investment and involve high risks. Indian



private investment often favours consumer technology with quicker returns.

Talent and Intellectual-Property Loss

- Highly skilled researchers frequently move abroad, while foreign venture funding may result in Indian intellectual property being registered outside the country.

Global Standard-Setting Gap

- Limited participation in global technology-standard institutions may force India to adopt foreign-designed telecom and digital architectures.

Public-Sector Limitations

- Excessive reliance on public-sector production has not always delivered advanced technologies within required timelines.

What Strategy Should India Adopt?

Build Indigenous Core Infrastructure

India should expand domestic capabilities in:

- Semiconductors
- Cloud computing
- Operating systems
- Cybersecurity tools
- AI foundation models
- Telecommunications
- Defence electronics

Adopt Sovereign Cloud Infrastructure

Critical government and strategic workloads should be hosted on infrastructure operating under Indian jurisdiction.

Encourage Private-Sector Innovation

- The government can provide research funding, assured procurement and long-term contracts to private firms developing

strategic technologies.

- This can create a cycle of innovation, production and national-security alignment.

Expand Trusted Partnerships

- India need not adopt technological isolation. Joint development with trusted countries can create mutual dependence and reduce the risk of unilateral denial.
- The BrahMos programme and India-U.S. semiconductor cooperation illustrate this approach.

Protect Critical Data

Data localisation must be supplemented by:

- Indian legal control
- Source-code audits
- Encryption standards
- Secure cloud architecture
- Restrictions on unauthorised foreign access

Strengthen Digital Public Infrastructure

- Open and interoperable platforms such as UPI and ONDC should be extended to cloud services, e-commerce, health, education and authentication.

Raise R&D Investment

- Public and private R&D expenditure must rise significantly to support long-term technological capability.

Way Forward

- Identify critical digital infrastructure requiring sovereign control.
- Reduce dependence on a small number of foreign technology companies.
- Expand sovereign cloud and domestic data centres.
- Build a trusted semiconductor supply chain.

- Promote indigenous AI and regional-language datasets.

Conclusion

Digital infrastructure now determines economic competitiveness, governance capacity and military preparedness. Dependence on foreign-controlled platforms can expose India to surveillance, sanctions, service denial and technological coercion.

- India's achievements in UPI, RuPay and digital public infrastructure show that

indigenous alternatives can operate at scale. However, comprehensive digital sovereignty requires greater R&D investment, domestic hardware and software capabilities, private-sector participation and trusted international cooperation.

- For India, digital sovereignty is not merely a technological objective; it is essential for **national security, economic resilience and strategic autonomy**.

Digital India: From Connectivity to Global Digital Public Infrastructure Leadership

Source: [PIB](#)

Relevance:

UPSC GS Paper II: Governance, Welfare Delivery, Education, Health, Transparency and Digital Inclusion

Important Keywords

Prelims

- Digital India, Digital Public Infrastructure, BharatNet, JAM Trinity, Aadhaar, UPI, DigiLocker, UMANG, ONDC, GeM, AgriStack, DIKSHA

Mains

- Digital inclusion, citizen-centric governance, paperless administration, platform economy, financial inclusion, interoperability, digital sovereignty, technology-enabled welfare, inclusive innovation

one of the world's largest **Digital Public Infrastructure ecosystems**, covering identity, payments, welfare, health, education, agriculture, commerce, skilling and public-service delivery. India has also emerged as a global leader in real-time digital payments and citizen-centric digital governance.

What is Digital India?

Digital India is a flagship programme launched in **2015** to transform India into a **digitally empowered society and knowledge economy**.

Its core objectives are to:

- Expand digital connectivity and infrastructure
- Deliver public services electronically
- Promote digital literacy and inclusion
- Improve administrative transparency and efficiency
- Strengthen electronics manufacturing
- Generate technology-based employment
- Build secure and interoperable digital platforms

Why in News?

The **Digital India Programme** completed **11 years** on **July 1, 2026**. Over this period, India developed

The programme has evolved from improving connectivity to creating a large, integrated system of digital identity, payments, data exchange and service-delivery platforms.

Evolution and Economic Impact

- Before 2015, many citizens depended on paperwork, physical verification and repeated visits to government offices.

Digital India accelerated the shift towards:

- Online applications and certificates
- Paperless document verification
- Direct Benefit Transfers
- Digital payments
- Telemedicine
- Online education
- Electronic taxation
- Digital procurement
- GIS-based infrastructure planning
- India now handles nearly **49% of the world's real-time digital-payment transactions** through UPI.
- The digital economy contributes approximately **12-14% of India's GDP** and is expected to account for nearly one-fifth of GDP over the coming decade.
- Digital India has also supported start-ups, innovation, cloud computing, cybersecurity and Artificial Intelligence.

Nine Pillars of Digital India

1. Broadband Highways

- Under **BharatNet**, more than 2.22 lakh Gram Panchayats were targeted for broadband connectivity.

By January 2026:

- Around **2.15 lakh Gram Panchayats**, nearly 97%, had been connected.

- Close to **7 lakh kilometres of optical fibre** had been laid.

This infrastructure supports rural e-governance, telemedicine, education, digital payments and entrepreneurship.

2. Universal Access to Mobile Connectivity

- India's broadband internet subscriber base reached approximately **106.58 crore** by March 2026. Wider mobile access has strengthened last-mile delivery of digital services.

3. Public Internet Access Programme

More than:

- **6.5 lakh Common Service Centres**
- **1.6 lakh post offices**

provide e-governance, banking and citizen services, particularly in rural and underserved areas.

4. e-Governance

Digital tools have made administration more integrated, paperless and citizen-oriented.

- Platforms such as **DigiLocker** and national sign-on systems simplify access to certificates, applications and public services.

5. e-Kranti

e-Kranti promotes electronic delivery of services through platforms such as:

- e-Hospital
- eSanjeevani
- e-Courts
- Online certificates
- Electronic welfare platforms

Under the e-Courts Mission Mode Project, more than **660 crore pages** have been digitised and over **1.07 crore cases** filed electronically.

6. Information for All

- Platforms such as **MyGov** and Open Government Data improve public access to

government information and promote participatory governance.

7. Electronics Manufacturing

- India's electronics production increased from approximately **₹1.9 lakh crore in 2014-15** to around **₹12 lakh crore by March 2026**.
- India has also become the world's **second-largest mobile-phone manufacturer**.

8. IT for Jobs

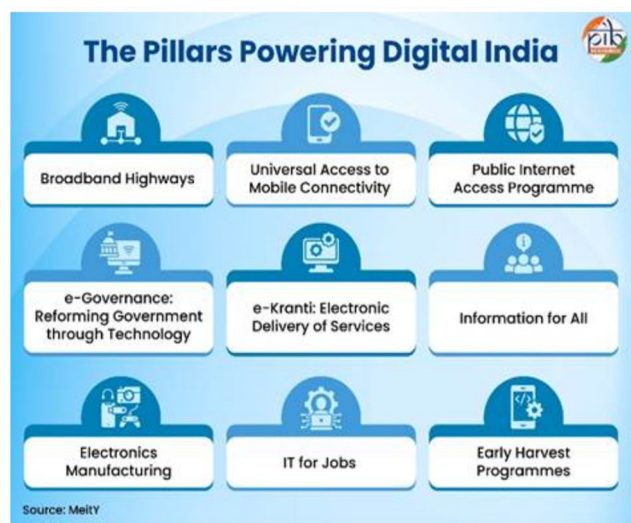
- The IT and ITeS sector generated an estimated **\$283 billion in revenue in FY 2024-25**.
- India's more than **2,100 Global Capability Centres** employ around **26 lakh professionals** in engineering, analytics, cybersecurity and AI-related roles.

9. Early Harvest Programmes

Early initiatives included:

- Biometric attendance
- Secure government email
- Public Wi-Fi
- e-Books
- SMS-based weather alerts
- Digital communication systems

These demonstrated the immediate value of technology-led governance.



Flagship Initiatives That Powered an Inclusive Decade

JAM Trinity: Foundation of Digital Governance

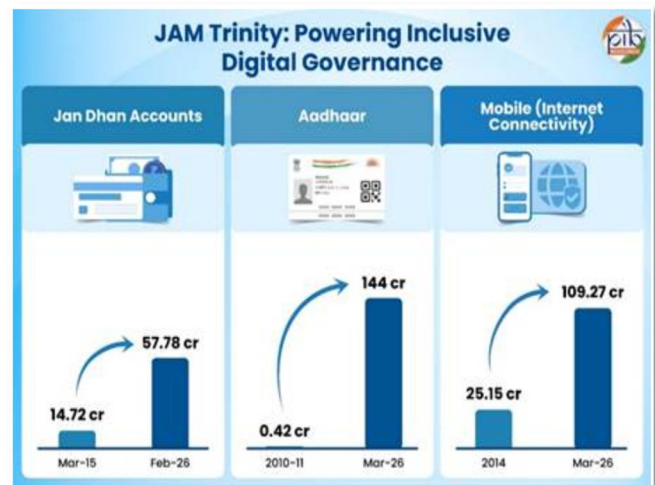
The JAM Trinity combines:

- Jan Dhan bank accounts
- Aadhaar
- Mobile connectivity

Together, they provide the foundation for digital identity, financial inclusion and welfare delivery.

Jan Dhan Yojana

- Jan Dhan accounts increased from **14.72 crore in March 2015** to **57.78 crore by February 2026**. Deposits increased from approximately **₹15,670 crore** to **₹2.94 lakh crore**.



Aadhaar

- Aadhaar provides a portable biometric identity for authentication, banking and welfare delivery. By March 2026, Aadhaar enrolments had crossed **144 crore**.
- More than 98% of foodgrain distribution under the Public Distribution System is Aadhaar-authenticated, while thousands of schemes and services use Aadhaar-based verification.

Direct Benefit Transfers

- By June 2026, benefits worth more than **₹51 lakh crore** had been transferred directly through digital systems.
- DBT reduces intermediaries, leakage and delays in welfare delivery.

Major Digital Public Infrastructure Platforms

Aadhaar

Aadhaar enables:

- Digital identity verification
- Bank-account opening
- e-KYC
- Welfare authentication
- Paperless service delivery

Its model is being studied by several countries as a scalable form of digital identity infrastructure.

DigiLocker

DigiLocker provides a secure digital wallet for official records.

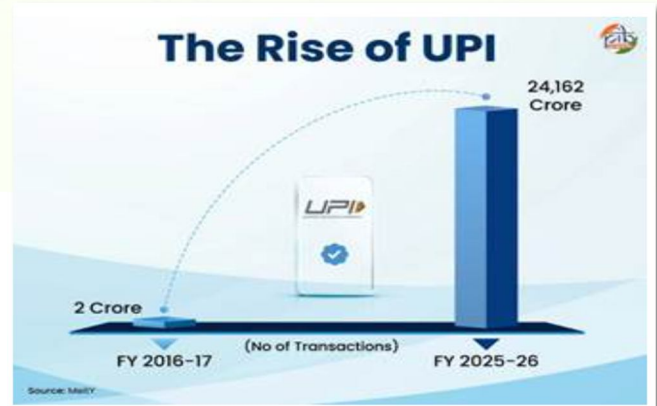
By March 2026, it had:

- More than **70 crore registered users**
- Over **850 crore issued documents**

It reduces physical paperwork, duplication and verification delays.

Unified Payments Interface

- UPI enables instant, interoperable and low-cost digital payments.
- Transactions increased from around **2 crore in FY 2016-17** to more than **24,000 crore in FY 2025-26**.
- UPI has also expanded internationally, strengthening India's digital and fintech diplomacy.



BHIM

- **BHIM**, developed by the National Payments Corporation of India, is a government-backed UPI application that enables instant bank-to-bank payments.

Sector-wise Digital Transformation

Digital Health

eSanjeevani

- The telemedicine platform has expanded remote access to doctors and specialists.
- By June 2026, it had facilitated more than **48 crore consultations** and onboarded over **2.3 lakh healthcare providers**.

Online Registration System and e-Hospital

- These platforms enable online appointments and digital hospital administration, reducing queues and paperwork.

CoWIN

- CoWIN managed more than **220 crore vaccine doses** and became an international example of digital public-health infrastructure.

Aarogya Setu

- Initially developed for pandemic-related health services, it later evolved into a broader national health application.

Tele MANAS

- Tele MANAS provides free mental-health counselling through a nationwide tele-support system.

MANAS

- MANAS enables anonymous reporting of drug trafficking and also supports counselling and rehabilitation services.

Digital Education**DIKSHA**

DIKSHA provides:

- Curriculum-linked digital content
- QR-coded textbooks
- Teacher training
- Indian Sign Language resources
- Accessible learning material

SWAYAM

- SWAYAM offers online courses from Class IX to postgraduate level.

SWAYAM Prabha

- SWAYAM Prabha delivers educational content through dedicated DTH channels, supporting learners with limited internet access.

PM e-Vidya

- PM e-Vidya integrates DIKSHA, SWAYAM, television, radio and other digital-learning platforms under a common framework.

APAAR

- APAAR provides students with a unique digital academic identity.
- By June 2026, over **33 crore APAAR IDs** had been generated.

Digital Agriculture**AgriStack**

AgriStack integrates farmer, land and crop information to improve access to:

- Credit
- Insurance

- Subsidies
- Procurement
- Personalised advisories

By March 2026, more than **9 crore Farmer IDs** had been generated.

Kisan e-Mitra

- It is an AI-enabled platform providing information on agricultural schemes and services.

Kisan Sarathi

- Kisan Sarathi connects farmers with Krishi Vigyan Kendras, ICAR institutions and agricultural universities for real-time guidance.

e-NAM

- e-NAM improves electronic trading, market access and price discovery for agricultural produce.

Digital Commerce and Public Procurement**Government e-Marketplace**

GeM has made public procurement paperless, transparent and competitive.

By June 2026:

- Cumulative Gross Merchandise Value exceeded **₹18 lakh crore**.
- More than **11 lakh MSMEs** had access to government markets.

Open Network for Digital Commerce

- ONDC is an open and interoperable digital-commerce network connecting buyers, sellers and service providers.
- It reduces dependence on closed digital marketplaces and expands access for small businesses.



eSaras and Indiahandmade

- These platforms connect self-help groups, artisans and weavers directly with digital markets.

Digital Public Services and Welfare

UMANG

- UMANG provides a unified digital gateway to government services. By June 2026, it offered more than **2,500 services** and had facilitated hundreds of crore transactions.

POSHAN Tracker

- It supports real-time monitoring of nutrition services through more than 13 lakh Anganwadi Centres and covers women and children across the country.

GST Network

- GSTN digitises tax registration, return filing, tax payment and e-invoicing.

PM GatiShakti

- PM GatiShakti uses GIS technology to coordinate infrastructure planning across ministries and sectors.

MY Bharat

MY Bharat connects youth with:

- Volunteering
- Internships
- Experiential learning
- Skill development
- Leadership opportunities
- National programmes

It has registered more than **2 crore young people**.

Digital Skills, Employment and Manufacturing

PMGDISHA

PMGDISHA trained rural citizens in:

- Smartphone use
- Internet access
- Digital payments
- Online public services

By March 2024, it had trained more than **6 crore rural citizens**.

FutureSkills Prime

The platform provides training in:

- Artificial Intelligence
- Cloud computing
- Cybersecurity
- Data analytics

Skill India Digital Hub

SIDH integrates skilling, certification and employment services on a common platform.

IndiaAI Mission

The IndiaAI Mission supports:

- AI infrastructure
- AI education and skilling
- Innovation
- Responsible AI adoption
- Research datasets and platforms

India also hosted the IndiaAI Impact Summit in 2026, strengthening its role in global AI discussions.

India's Global DPI Leadership

- India's Digital Public Infrastructure is increasingly influencing global digital-governance models.
- By February 2026, India had signed agreements with around **24 countries** for cooperation on India Stack and DPI systems.

Indian platforms attracting international interest include:

- Aadhaar
- UPI



- DigiLocker
- CoWIN
- GeM
- DIKSHA
- UMANG
- eSanjeevani
- India also launched the **India Stack Global** platform and the **Global DPI Repository** during its G20 Presidency.
- This has made DPI an important instrument of India's development partnership and digital diplomacy.

Significance of Digital India

Inclusive service delivery:

- Digital platforms expand access to banking, healthcare, education and welfare.

Reduction of leakages:

- DBT and digital authentication reduce intermediaries and improve targeting.

Ease of living:

- Citizens can access documents, appointments, payments and certificates remotely.

Economic formalisation:

- Digital transactions and taxation platforms improve transparency in economic activity.

Support for innovation:

- Open digital infrastructure enables start-ups, fintech firms and technology enterprises to build new services.

Rural empowerment:

- Connectivity, CSCs and digital platforms bring services closer to remote communities.

Global influence:

- India's DPI model is becoming a reference point for inclusive digital transformation.

Key Challenges

Digital divide:

- Access to devices, connectivity and electricity remains unequal.

Digital literacy:

- Many citizens cannot independently use digital services or identify online fraud.

Cybersecurity risks:

- Growing digital dependence increases vulnerability to data theft, ransomware and financial fraud.

Privacy concerns:

- Large-scale personal-data collection requires consent, accountability and data-protection safeguards.

Exclusion errors:

- Authentication failures or incorrect records may prevent eligible citizens from receiving benefits.

Language and accessibility barriers:

- Platforms must serve regional-language users and persons with disabilities effectively.

Platform concentration:

- Digital ecosystems must avoid excessive dependence on a few dominant intermediaries.

Institutional coordination:

- Data silos and non-interoperable systems can reduce administrative efficiency.

Way Forward

- Expand high-quality broadband and mobile connectivity in underserved regions.
- Strengthen digital literacy and cyber-awareness at the community level.
- Ensure multilingual, accessible and user-friendly digital platforms.

- Preserve assisted and offline service options for vulnerable citizens.
- Improve grievance redressal for authentication and service-delivery failures.
- Enforce strong data-protection and cybersecurity standards.
- Promote open standards and interoperability.
- Strengthen domestic electronics, cloud and semiconductor capabilities.
- Build advanced skills in AI, cybersecurity and data science.
- Ensure digital technology remains a means of empowerment rather than exclusion.

Conclusion

Digital India has transformed the relationship between citizens, markets and the State. Identity, payments, health, education, agriculture and welfare services are increasingly delivered through integrated digital infrastructure. Its next phase must move beyond scale towards **trust, safety, inclusion and accountability**. Digital India will contribute to **Viksit Bharat 2047** only when every citizen can access technology affordably, use it confidently and obtain services without exclusion.

International Relations

India-Oman CEPA: A New Trade Gateway to the Gulf and East Africa

Source: [PIB](#)

Relevance: UPSC GS Paper II: International Relations, India and West Asia, Bilateral Agreements

Important Key Words

For Prelims

- India-Oman CEPA, Comprehensive Economic Partnership Agreement, Gulf Cooperation Council, Most Favoured Nation, Tariff Liberalisation, Export Inspection Council, NPOP Organic Certification, SPS and TBT Measures, Tariff Rate Quota, Intra-Corporate Transferees, Sohar, Duqm and Salalah Ports

For Mains

- India's trade diplomacy, Gulf economic engagement, Export diversification, MSME competitiveness, Labour-intensive manufacturing, Services and professional mobility, Food and energy security, Global value chains, Viksit Bharat 2047, Strategic economic corridor

Why in News?

The India-Oman Comprehensive Economic Partnership Agreement (CEPA) came into force on 1 June 2026.

- It marks a major step in India's trade

diplomacy with the Gulf region. The agreement is expected to boost exports, create jobs, help MSMEs, support farmers and fishermen, and expand opportunities for Indian professionals in Oman.

- The agreement is also important because Oman acts as a strategic gateway to the wider GCC region and East Africa through its ports such as Sohar, Duqm and Salalah.



India-Oman trade deal

Background of India-Oman Relations

India and Oman share old civilisational, commercial and people-to-people ties. Indian merchant families have lived in Oman for nearly 200-300 years.

- Today, Oman is home to nearly 7 lakh Indians. Indian workers and professionals contribute to Oman's economy, while

remittances from Oman support many Indian families.

- Oman is also India's second-largest trading partner in the Gulf region. Bilateral trade between India and Oman reached **USD 11.18 billion in FY 2025-26**, showing steady growth in economic relations.

India-Oman CEPA

Comprehensive Economic Partnership Agreement

1 WHY IN NEWS?

- In force from **1 June 2026**
- Major boost to India-Oman trade ties
- Oman is a gateway to GCC and East Africa

2 BACKGROUND

- Strong civilisational and trade ties
- Nearly 7 lakh Indians live in Oman
- Bilateral trade: **USD 11.18 billion (FY 2025-26)**

3 WHAT IS CEPA?

- Trade pact beyond tariffs
- Covers goods, services, investment, mobility, and standards

4 KEY FEATURES

Duty-free access for 99.38% of India's exports by value

Covers 98.08% of Oman's tariff lines

Immediate tariff concessions

Oman opens 127 services sub-sectors

Faster pharma approvals: within 90 days for medicines approved by USFDA, EMA, UK MHRA, or TGA

5 KEY BENEFICIARIES

Textiles
 Leather & footwear
 Marine products
 Gems & jewellery

Food processing
 Engineering goods
 Pharmaceuticals
 Automobiles

6 WHY IT MATTERS

- Boosts exports and jobs
- Supports MSMEs, farmers and fishermen
- Expands scope for Indian professionals
- Deepens Gulf trade diplomacy

STRONGER PARTNERSHIP | SHARED PROSPERITY | SUSTAINABLE GROWTH

What is CEPA?

A **Comprehensive Economic Partnership Agreement (CEPA)** is a trade agreement between two countries that goes beyond simple tariff reduction.

It usually covers:

- Trade in goods
- Trade in services
- Investment
- Professional mobility
- Regulatory cooperation
- Customs procedures
- Non-tariff barriers
- Standards and certification

The India-Oman CEPA is therefore not only a tariff agreement. It creates a broader economic partnership between the two countries.

Key Features of India-Oman CEPA

1. Duty-Free Access for Indian Exports

- The agreement provides duty-free access for **99.38% of India's exports to Oman** by

KP's 21st Century IAS Academy

(64)

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value. It covers **98.08%** of Oman's tariff lines.

- Earlier, only about **15.33%** of India's exports entered Oman at zero duty under the MFN system. After CEPA, Indian exporters will get a major price advantage in Oman's market.

2. Immediate Tariff Benefits

- All zero-duty concessions under the agreement have come into effect immediately. This gives certainty to exporters and allows them to plan long-term trade strategies.

3. Boost to Labour-Intensive Sectors

The agreement is expected to benefit sectors that create large employment in India, such as:

- Textiles
- Leather and footwear
- Marine products
- Gems and jewellery
- Food processing
- Engineering goods
- Pharmaceuticals
- Automobiles

4. Services and Professional Mobility

Oman has made commitments in **127 services sub-sectors**. This is important for Indian professionals, startups and service providers.

Sectors that may benefit include:

- IT services
- Engineering
- Healthcare
- Education
- Accounting
- Construction
- Tourism
- Research and development

- Environmental services

5. Faster Market Access for Pharmaceuticals

- Indian medicines approved by regulators such as **USFDA, EMA, UK MHRA and TGA** will receive marketing authorisation in Oman within **90 days**.
- This will help Indian pharmaceutical companies enter the Omani market faster.

Sector-wise Benefits for India

Agriculture and Processed Food

India will benefit in products such as:

- Honey
- Sweet biscuits
- Cashew kernels
- Basmati rice
- Butter
- Eggs
- Condiments
- Mangoes
- Processed food items

India is already a major agricultural supplier to Oman. Duty elimination will make Indian farm and processed food products more competitive.

- The agreement also recognises India's **National Programme for Organic Production (NPOP)** certification. This will help Indian organic farmers access Oman's food market.

Marine Products and Fisheries

Marine products have large untapped potential in Oman.

Indian seafood products such as shrimp, fish and frozen cuttlefish will receive duty-free access. This can benefit coastal states such as:

- Andhra Pradesh
- Kerala

- Tamil Nadu
- Gujarat

The marine export sector can create jobs in fishing, processing, cold-chain logistics, packaging and export operations.

Gems and Jewellery

- India has strong capabilities in cut and polished diamonds, gold jewellery, silver jewellery and handmade jewellery.

Under CEPA, import duties on gems and jewellery have been removed. This gives Indian exporters a competitive advantage over suppliers from countries such as Italy, Turkey, Thailand and China. Important jewellery clusters that may benefit include:

- Surat
- Jaipur
- Mumbai
- Kolkata
- Chennai

The sector is expected to create new employment opportunities for artisans, designers, workers and small manufacturers.

Textiles and Apparel

- Textiles and apparel are labour-intensive sectors. The agreement can increase demand for Indian textiles in Oman.

Major textile clusters that may benefit include:

- Tirupur
- Surat
- Ludhiana
- Panipat
- Coimbatore
- Karur
- Bhadohi
- Moradabad
- Jaipur

- Ahmedabad

Increased exports can help weavers, artisans, garment workers and MSMEs.

Leather and Footwear

The leather and footwear sector is another employment-intensive sector.

The CEPA can help leather clusters in:

- Tamil Nadu
- Uttar Pradesh
- West Bengal
- Maharashtra
- Punjab
- Karnataka
- Madhya Pradesh

Removal of tariff barriers can improve India's export competitiveness in footwear, leather goods and related products.

Pharmaceuticals and Healthcare

- India is known as the "pharmacy of the world" because it supplies affordable medicines to many countries.
- The CEPA provides zero-duty access for medicines, vaccines and pharmaceutical ingredients. Faster regulatory approval will reduce delays and compliance burden.
- This is important because Oman's pharmaceutical market is expected to grow in the coming years. Indian pharma companies can use this opportunity to expand in the Gulf healthcare market.
- The agreement also creates space for cooperation in **traditional medicine**, including joint research.

Engineering Goods and Electronics

- All engineering products will receive zero-duty access in Oman.

Important products include:

- Machinery

- Electrical equipment
- Iron and steel
- Automobiles
- Industrial machinery
- Copper products
- Electronics components

This can benefit Indian manufacturers, including firms working under the **Production Linked Incentive (PLI)** framework.

- Engineering exports to Oman may increase because Indian products will become more price competitive.

Services and Mobility

- The services part of the agreement is highly significant.

Oman has given wide commitments in areas such as:

- Computer and IT services
- Professional services
- Healthcare
- Education
- Construction
- Financial services
- Tourism
- Telecommunications

Indian professionals such as doctors, engineers, teachers, accountants, IT experts and consultants are expected to benefit.

The agreement also provides improved temporary entry for:

- Business visitors
- Independent professionals
- Contractual service suppliers
- Intra-corporate transferees

The ceiling for intra-corporate transferees has been raised from **20% to 50%**. This will help Indian companies operating in Oman.

Benefits for MSMEs

The India-Oman CEPA is especially important for MSMEs because many beneficiary sectors are dominated by small and medium enterprises.

- MSMEs in textiles, leather, footwear, processed foods, gems and jewellery, marine products, engineering goods and industrial equipment may get larger international orders.

This can lead to:

- Higher production
- More exports
- New investment
- Job creation
- Better integration with global value chains

For small businesses, duty-free access can reduce price disadvantage and help them compete with larger foreign firms.

Benefits for Farmers and Fishermen

- The agreement creates opportunities for farmers by improving market access for agricultural and processed food products.
- It may increase demand for Indian farm produce such as honey, butter, eggs, cashews, mangoes and processed foods.
- Fishermen and coastal communities may benefit from higher exports of shrimp, fish and cuttlefish. This can create livelihood opportunities in fishing, cold storage, processing and export logistics.
- At the same time, India has protected sensitive agricultural products from tariff concessions.

Strategic Importance of Oman for India

Oman has high strategic value for India because of its location.

It is close to:

- Persian Gulf



- Arabian Sea
- Gulf of Oman
- East African markets
- Wider GCC region

Oman's ports at **Sohar, Duqm and Salalah** can help India expand trade connectivity with the Gulf and East Africa.

- This is important at a time when global supply chains are being restructured and countries are looking for trusted trade partners.

The agreement also strengthens India's Act West policy and deepens India's engagement with West Asia.

Safeguards for Indian Farmers and Domestic Industry

India has followed a calibrated approach. It has not given tariff concessions for several sensitive products.

Protected products include:

- Dairy
- Cereals
- Fruits
- Vegetables
- Edible oils
- Oilseeds
- Rubber
- Leather
- Spices
- Key agricultural products

This is important to protect Indian farmers, food security and rural livelihoods.

- The agreement also includes mechanisms such as **Tariff Rate Quotas** and **Minimum Import Price** for selected sensitive products.

Trade Facilitation Measures

The CEPA also aims to reduce non-tariff barriers.

Important measures include:

- Acceptance of certificates issued by India's Export Inspection Council
- Recognition of India's organic certification system
- Recognition of halal certification systems
- SPS and TBT cooperation
- Faster clearance for perishable goods
- Reduced duplicative testing and inspection

These steps can lower transaction costs and make exports faster and easier.

Significance of the Agreement

1. Strengthens India's Gulf Policy

- The agreement deepens India's economic engagement with the Gulf region. It also complements India's existing ties with the UAE and other West Asian countries.

2. Supports Viksit Bharat 2047

- By increasing exports, jobs, investment and competitiveness, CEPA supports India's long-term goal of becoming a developed economy by 2047.

3. Promotes Export Diversification

- Indian exporters can reduce dependence on traditional markets and access new opportunities in Oman, GCC and East Africa.

4. Helps Labour-Intensive Sectors

- Sectors such as textiles, leather, gems and jewellery, marine products and food processing employ many workers. Growth in these sectors can support inclusive employment.



5. Boosts Services Exports

- Oman's services commitments can help Indian professionals and startups expand their presence in the Gulf region.

6. Strengthens MSME Competitiveness

- Lower tariffs and easier market access can help small businesses participate in international trade.

Challenges and Concerns

1. Limited Market Size of Oman

- Oman is strategically important, but its domestic market is smaller than larger economies. India must use Oman as a gateway to GCC and East Africa.

2. Competition from Other Countries

- Indian exporters will face competition from countries such as China, Turkey, Thailand and European exporters.

3. Quality and Standards Compliance

- Indian firms must meet Omani quality, safety, packaging and certification standards.

4. Logistics and Awareness Issues

- Many MSMEs may not know how to use FTA benefits. They need guidance on rules of origin, documentation and export procedures.

5. Risk of Import Pressure

- Though India has protected sensitive sectors, continuous monitoring is needed to prevent harm to domestic producers.

6. Dependence on External Demand

- Export-led growth depends on external market conditions. Global slowdown or regional instability may affect trade.

Way Forward

India should take the following steps to fully use the CEPA:

- Create awareness among MSMEs about tariff benefits.
- Provide simple guidance on rules of origin and documentation.
- Strengthen export infrastructure and logistics.
- Help farmers and fishermen access export markets through cooperatives and FPOs.
- Improve quality testing, packaging and certification facilities.
- Promote Indian brands in Oman and the wider Gulf region.
- Use Oman's ports to expand trade with East Africa.
- Encourage startups and service firms to enter Omani markets.
- Monitor import flows to protect sensitive domestic sectors.
- Link CEPA with India's broader manufacturing and export strategy.

Conclusion

The India-Oman CEPA is an important milestone in India's trade diplomacy. It provides wide market access for Indian goods, opens opportunities for services and professionals, and strengthens India's strategic presence in the Gulf region.

The agreement can benefit farmers, fishermen, artisans, MSMEs, startups and professionals. It also supports India's goals of export diversification, job creation, manufacturing growth and integration with global value chains.

- In a world marked by protectionism and supply-chain uncertainty, the India-Oman CEPA shows India's confidence in building prosperity through partnerships, competitiveness and global engagement.

India-Myanmar Relations Strengthened During Myanmar President's Visit to India

Source: [PIB](#)

Relevance

UPSC: GS Paper II – International Relations, India and its Neighbourhood, Bilateral Relations, Act East Policy.

Important Keywords

Prelims Keywords:

- Myanmar, U Min Aung Hlaing, Kaladan Multi-Modal Transit Transport Project, India-Myanmar-Thailand Trilateral Highway, Rupee-Kyat Settlement Mechanism, Mekong-Ganga ICCR Scholarships, MAHASAGAR, Bodh Gaya, Mahabodhi Temple, Sittwe Port.

Mains Keywords:

- Neighbourhood First Policy, Act East Policy, Border Management, India's Northeast, ASEAN Connectivity, Security Cooperation, China's Influence, Critical Minerals, Buddhist Diplomacy, Realpolitik.

Why in News?

Myanmar's President **U Min Aung Hlaing** paid his first official visit to India from **30 May to 3 June 2026** at the invitation of Prime Minister **Narendra Modi**. During the visit, India and Myanmar issued a **Joint Statement** covering bilateral, regional and global issues. The discussions focused on **border security, trade, connectivity, development assistance, critical minerals, cultural ties and people-to-people relations**.

- The visit is significant because Myanmar is a critical pillar of India's **Neighbourhood First Policy, Act East Policy** and

MAHASAGAR approach. It is also vital for Northeast security, ASEAN connectivity, maritime interests and balancing China's influence in the region.

Background of India-Myanmar Relations

India and Myanmar share old civilisational, cultural and religious ties. Buddhism is a strong cultural bridge between both countries.

- Myanmar is India's only ASEAN neighbour that shares both a land **boundary and maritime boundary** with India. It shares a **1,643 km land border** with India across **Arunachal Pradesh, Nagaland, Manipur and Mizoram**.

Myanmar is important for India's:

- Northeast security
- ASEAN connectivity
- Bay of Bengal maritime interests
- Counter-insurgency cooperation
- Trade with Southeast Asia
- Act East Policy
- Indo-Pacific strategy

Key Highlights of the Visit

- Myanmar President **U Min Aung Hlaing** visited India from **30 May to 3 June 2026**.
- He held talks with Prime Minister **Narendra Modi** on **1 June 2026**.
- President **Droupadi Murmu** received the Myanmar President.
- External Affairs Minister **Dr. S. Jaishankar** and National Security Adviser **Ajit Doval** separately called on him.
- The Myanmar President visited **Bodh Gaya**,



including:

- Mahabodhi Temple
- Mahabodhi Meditation Centre
- Sujata Temple
- He addressed the **India-Myanmar Business Conclave** jointly organised by UMFCCI and CII.
- He visited the **NTPC Energy Technology Research Alliance (NETRA)** complex in Greater Noida to observe work in clean energy, renewable energy integration, energy efficiency and grid resilience.

Strategic Importance of Myanmar for India

1. Gateway to Southeast Asia

- Myanmar is India's geographical bridge to **Southeast Asia**. India's physical connectivity with ASEAN depends heavily on stable transit routes through Myanmar.

2. Security of Northeast India

- Myanmar shares a long and porous border with India's northeastern States. Insurgent groups such as **NSCN-K** and **ULFA** have historically used Myanmar's border regions.

Therefore, cooperation with Myanmar is important for:

- Counter-insurgency
- Intelligence sharing
- Border management
- Control of narcotics trafficking
- Prevention of illegal migration
- Control of small arms smuggling

3. Countering China's Influence

- China has expanded its presence in Myanmar through the **China-Myanmar Economic Corridor** and the **Kyaukpyu**

deep-sea port.

- India's engagement with Myanmar helps balance China's growing strategic presence in the Bay of Bengal and Indo-Pacific region.

4. Maritime Domain Awareness

- Myanmar's **Coco Islands** are located close to India's **Andaman and Nicobar Islands**. Continuous engagement is important to ensure that these areas are not used by hostile external actors.

5. Critical Minerals

- Myanmar has important mineral resources, including rare earth elements. These are useful for India's semiconductor, defence, clean energy and advanced manufacturing sectors.

Connectivity Projects

Connectivity was one of the major themes of the Joint Statement.

1. Kaladan Multi-Modal Transit Transport Project

- Both sides agreed to work closely for the completion of the **Kaladan Multi-Modal Transit Transport Project**.

This project connects India's eastern coast with Myanmar and India's Northeast through:

- Sea route
- River route
- Road route

It is important because it can improve access to the Northeast and reduce dependence on the **Siliguri Corridor**.

2. India-Myanmar-Thailand Trilateral Highway

- Both sides reaffirmed commitment to the **India- Myanmar - Thailand Trilateral**



INDIA–MYANMAR JOINT STATEMENT, 2026

Strategic significance of Myanmar for India's security, connectivity and Act East vision



Krishna Pradeep's Since : 2003
21st Century IAS
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A/C Campus

1 WHY IN NEWS?

- Myanmar President U Min Aung Hlaing paid his first official visit to India from 30 May to 3 June 2026.
- India and Myanmar issued a Joint Statement covering bilateral, regional and global issues.
- Focus areas: border security, trade, connectivity, development assistance, critical minerals, cultural ties and people-to-people relations.

2 BACKGROUND

- Myanmar is India's only ASEAN neighbour sharing both land and maritime boundaries.
- Land border: 1,643 km with Arunachal Pradesh, Nagaland, Manipur and Mizoram.
- Important for Northeast security, ASEAN connectivity, Bay of Bengal interests, trade with Southeast Asia and the Indo-Pacific strategy.

3 KEY HIGHLIGHTS OF THE VISIT

- Talks held with Prime Minister Narendra Modi on 1 June 2026.
- President Droupadi Murmu received the Myanmar President.
- Dr. S. Jaishankar and NSA Ajit Doval also met him.
- He visited Bodhi Gaya: Mahabodhi Temple, Mahabodhi Meditation Centre and Sujata Temple.
- He addressed the India–Myanmar Business Conclave.
- He visited NTPC NETRA, Greater Noida.

4 STRATEGIC IMPORTANCE OF MYANMAR FOR INDIA

- Gateway to Southeast Asia.
- Security of Northeast India.
- Countering China's influence.
- Maritime domain awareness near Coco Islands and Andaman & Nicobar.
- Access to critical minerals and rare earths.

5 CONNECTIVITY PROJECTS

- Kaladan Multi-Modal Transit Transport Project:** sea + river + road connectivity; improves Northeast access and reduces dependence on the Siliguri Corridor.
- India–Myanmar–Thailand Trilateral Highway:** links India's Northeast with Myanmar and Thailand; supports Act East Policy.

6 TRADE & ECONOMIC COOPERATION

- India is Myanmar's 4th largest trading partner.
- Bilateral trade: about USD 2.1 billion in FY25.
- Key sectors: agriculture, agro-processing, pharmaceuticals, petroleum, energy, mining, banking, construction, IT, communications, logistics and MSMEs.
- Indian medicines hold nearly 60% of Myanmar's pharmaceutical market.
- Rupee–Kyat settlement mechanism operational since May 2024.

7 SECURITY & BORDER MANAGEMENT

- Myanmar assured India that its territory will not be used against India's security interests.
- Cooperation important for counter-insurgency, intelligence sharing, border management, control of narcotics trafficking, illegal migration and arms smuggling.
- Mention: Operation Hot Pursuit (2015) and Operation Sunrise (2019).

8 CULTURAL, EDUCATIONAL & HUMANITARIAN TIES

- Deep Buddhist link highlighted by the Bodhi Gaya visit.
- ICCR Mekong-Ganga scholarships for Myanmar students increased from 36 to 100 from 2026.
- India supported restoration of Ananda Pagoda at Bagan.
- Humanitarian support through Operation Sadbhav (2024) and Operation Brahma (2025).

9 CHALLENGES

- Democracy vs security dilemma.
- Border management and suspension of Free Movement Regime.
- Delays in connectivity projects.
- Refugee spillover into border States.
- China's growing influence.
- Reputational concerns over engagement with military leadership.

10 WAY FORWARD

- Complete Kaladan and IMT Highway on priority.
- Create a permanent security dialogue mechanism.
- Strengthen smart border management with humanitarian sensitivity.
- Expand Rupee–Kyat settlement and economic cooperation.
- Deepen critical minerals cooperation.
- Strengthen Buddhist diplomacy, education and development projects.
- Engage Myanmar pragmatically while supporting peace, stability and reconciliation.

Myanmar is central to India's Neighbourhood First, Act East and MAHASAGAR policies.

Source: PIB

Highway.

- This highway aims to connect India's Northeast with Myanmar and Thailand. It supports India's **Act East Policy** and strengthens economic links with Southeast Asia.

Trade and Economic Cooperation

India and Myanmar agreed to expand bilateral trade and investment.

Important areas include:

- Agriculture, Agro-processing, Pharmaceuticals, Petroleum, Energy, Mining
- Banking, Construction, IT, Communications, Logistics, MSMEs.

- India is Myanmar's **4th largest trading partner**, with trade valued at about **USD 2.1 billion in FY25**.

India exports:

- Pharmaceuticals, Machinery, Vehicles, Cotton, Cereals, Electrical equipment

Myanmar exports:

- Pulses
- Agricultural products
- Wood products

Indian medicines hold nearly **60% of Myanmar's pharmaceutical market**, making pharmaceuticals an important area of cooperation.

Rupee-Kyat Settlement Mechanism

Both sides agreed to facilitate bilateral trade through the **Rupee-Kyat settlement mechanism**, which became operational in **May 2024**.

This mechanism helps:

- Reduce dependence on third-country currencies
- Promote direct trade transactions
- Support local currency settlement
- Improve financial integration
- Facilitate trade through Special Rupee Vostro Accounts

Security and Border Management

Security cooperation was a major focus of the visit. Myanmar assured India that its territory would not be allowed to be used against India's security interests. This is important because anti-India insurgent groups have historically used areas across the border.

Earlier, India and Myanmar cooperated through operations such as:

- **Operation Hot Pursuit, 2015**
- **Operation Sunrise, 2019**

Critical Minerals Cooperation

India and Myanmar agreed to strengthen cooperation in **critical minerals and rare earths**.

This is important because rare earths are used in:

- Semiconductors
- Defence equipment
- Electric vehicles
- Renewable energy systems
- Electronics
- Strategic technologies

Such cooperation can support India's technology security and reduce dependence on limited external sources.

Cultural and People-to-People Ties

The Myanmar President's visit to **Bodh Gaya** highlighted the deep Buddhist and spiritual connection between India and Myanmar.

India also announced that **Mekong-Ganga ICCR scholarships** for Myanmar students would be increased from **36 to 100** from **2026 onwards**.

This will strengthen:

- Educational cooperation
- Cultural exchange
- Youth linkages
- Buddhist diplomacy
- Long-term goodwill

India has also supported restoration of the **Ananda Pagoda at Bagan**, reflecting shared Buddhist heritage.

Humanitarian and Development Cooperation

India has acted as a first responder during crises in Myanmar.

Important examples include:

- **Operation Sadbhav, 2024**
- **Operation Brahma, 2025**

Through these efforts, India provided disaster relief and medical assistance to Myanmar.

India also supports development and welfare projects through:

- Border Area Development Programme
- Rakhine State Development Programme
- Health and education support
- Digital infrastructure cooperation

Major Challenges

1. Democracy vs Security Dilemma

- India faces the difficult task of balancing democratic values with national security interests. While many Western countries

maintain sanctions on Myanmar after the 2021 military coup, India's geographic proximity requires continued engagement.

2. Border Management and Free Movement Regime

- The **Free Movement Regime**, which allowed tribal communities to travel up to **16 km** across the India-Myanmar border without a visa, has been suspended by India due to concerns over illegal migration, narcotics trafficking and insurgent infiltration.
- However, local communities often view the border as an artificial colonial boundary that separates ethnic and ancestral ties.

3. Delays in Connectivity Projects

- Projects such as the **Kaladan corridor** have faced delays due to difficult terrain, security risks and the presence of ethnic armed organisations.

4. Refugee Spillover

- Internal conflict in Myanmar after the 2021 coup has led to refugee inflows into Indian border States such as **Mizoram and Manipur**.

5. China's Influence

- China's infrastructure and port projects in Myanmar increase India's strategic concerns in the Bay of Bengal and Indo-Pacific region.

6. Reputational Concerns

- India's engagement with Myanmar's military leadership creates criticism from human rights groups. India must balance strategic interests with humanitarian sensitivity.

Way Forward

- Complete the **Kaladan Project** and **IMT Trilateral Highway** on priority.
- Create a permanent security dialogue mechanism for real-time intelligence sharing.
- Strengthen border management through technology and local coordination.
- Deploy smart border systems while maintaining humanitarian sensitivity.
- Expand Rupee-Kyat trade settlement for smoother bilateral trade.
- Promote cooperation in pharmaceuticals, agriculture, energy, mining and MSMEs.
- Strengthen critical minerals and rare earth cooperation.
- Deepen Buddhist cultural diplomacy and educational exchanges.
- Support development projects in health, education and digital infrastructure.
- Engage Myanmar pragmatically while supporting peace, stability and reconciliation.

Conclusion

Myanmar remains a critical partner for India's security, connectivity and regional strategy. It is central to India's **Neighbourhood First, Act East** and **MAHASAGAR** policies.

The 2026 visit strengthened cooperation in trade, border security, connectivity, critical minerals, education and cultural ties. However, India must carefully balance strategic engagement with democratic values, humanitarian concerns and regional stability.

A practical policy based on **security cooperation, connectivity, economic development and soft power** can help India protect its Northeast, connect with ASEAN and maintain influence in the Bay of Bengal region.

A New Phase in India-Nepal Relations

Source: [The Hindu](#)

Relevance: GS Paper II - India and its Neighbourhood, Bilateral Relations,

Important Keywords

- **Prelims Keywords:** Kalapani, Lipulekh, Limpiyadhura, Treaty of Sugauli, Kailash Mansarovar Yatra, India-Nepal Open Border, Surya Kiran, UPI-NPI Linkage, Belt and Road Initiative.
- **Mains Keywords:** Neighbourhood First Policy, Boundary Dispute, Strategic Autonomy, Sovereign Equality, Open Border Security, Hydropower Cooperation, China Factor, People-to-People Ties.

Why in News?

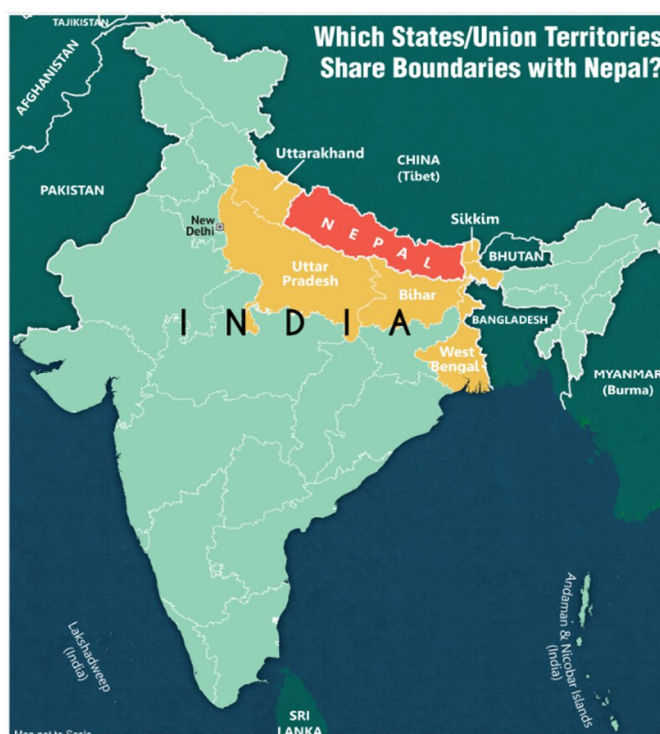
Nepal Prime Minister **Balendra Shah "Balen"** recently made remarks in Nepal's Parliament on the **Kalapani-Lipulekh-Limpiyadhura boundary dispute** with India. He indicated that the dispute should not be treated as a one-sided issue. According to him, both India and Nepal should examine the facts objectively and resolve the matter **amicably through diplomatic channels**. His remarks created protests in Nepal, but they also suggest a possible shift towards a more rational and practical approach in India-Nepal relations.

Historical Roots of the India-Nepal Boundary Issue

- The boundary disagreement between India and Nepal mainly relates to **Kalapani, Lipulekh and Limpiyadhura**.
- Its origin goes back to the **Treaty of Sugauli, 1816**, signed after the **Anglo-Nepalese War**

between Nepal and the British East India Company.

- The treaty recognised the **Kali or Mahakali River** as Nepal's western boundary, but it did not clearly mention the exact source of the river.
- This uncertainty over the river's origin later created different interpretations of the boundary.



Nepal's Position

- Nepal argues that the Kali River begins from the westernmost stream near Limpiyadhura.
- Based on this view, Nepal claims Kalapani, Lipulekh and Limpiyadhura as part of its territory.
- In 2020, Nepal amended its Constitution and adopted a new political map showing these areas within Nepal.
- It later strengthened this claim by issuing a

new NPR 100 banknote carrying the revised map.

India's Position

- India maintains that the Kali River originates near **Kalapani**, east of Limpiyadhura.
- Therefore, India considers the disputed region as part of **Pithoragarh district in Uttarakhand**.
- India also has administrative and military presence in the area.

Why the Region Matters

- The area is strategically sensitive because it lies close to **China**.
- Lipulekh Pass** is important for:
 - India-China trade
 - The **Kailash Mansarovar Yatra**
 - India's Himalayan security interests

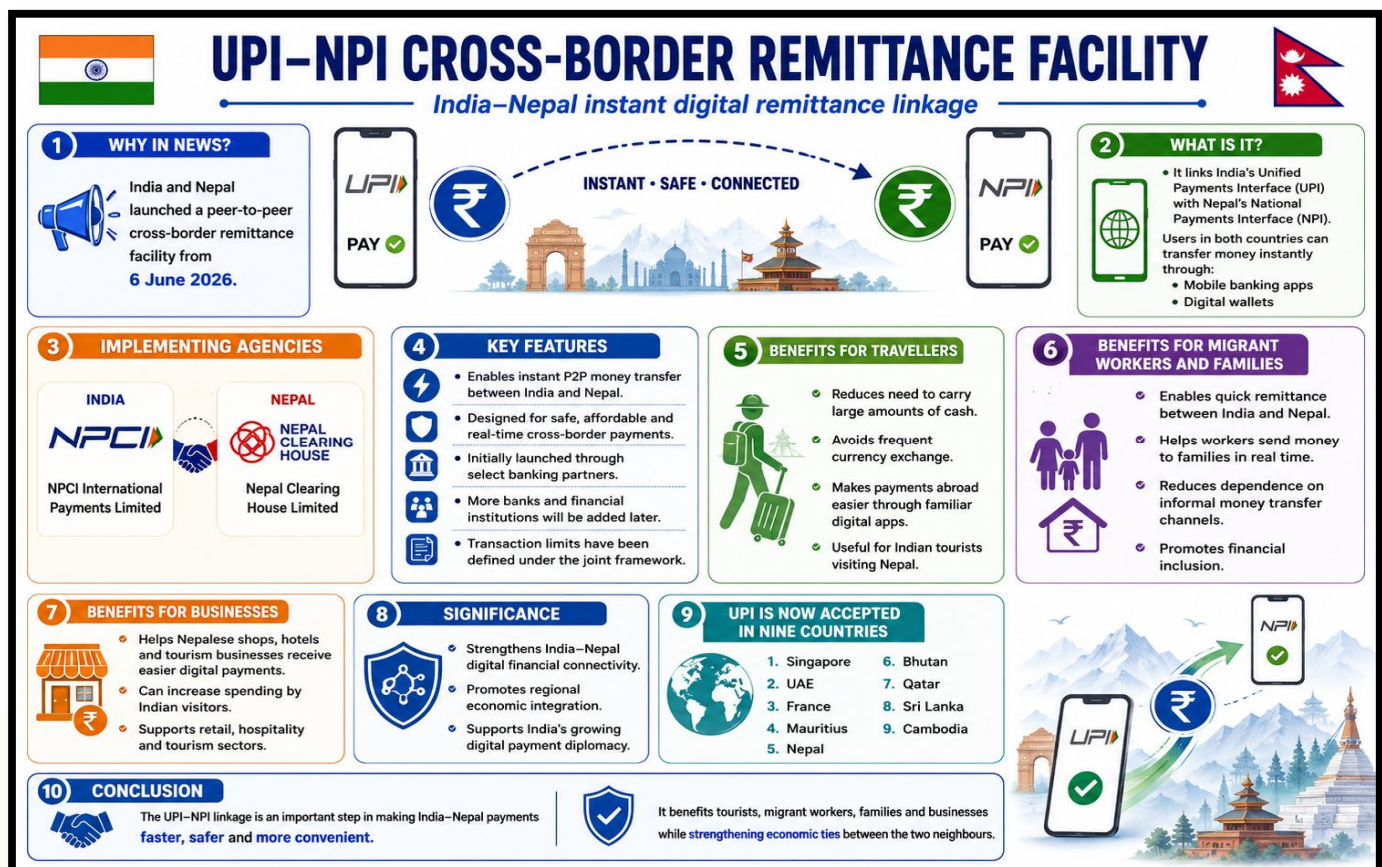
Nepal's Changing Approach Towards India

Shift Towards Practical Cooperation

- Nepal's foreign policy approach towards India is becoming more **practical and development-focused**.
- Instead of depending mainly on political slogans or ideological positions, Nepal is giving more importance to **economic cooperation**.
- The plan to export **10,000 MW of hydropower to India** over the next decade reflects this shift towards mutual economic benefit.

Demand for Equal Diplomatic Treatment

- Nepal is moving away from the older idea of a very informal "special relationship" with India.





- It now seeks a more formal and balanced relationship based on **sovereign equality**.
- This means Nepal wants diplomatic protocol, mutual respect and state-to-state parity to guide its relations with India.

Boundary Issues Through Dialogue

- Nepal appears to be taking a more measured approach to border disputes.
- Instead of turning boundary questions into emotional nationalist issues, Kathmandu is increasingly treating them as **technical and diplomatic matters**.
- This approach can create space for evidence-based discussion and peaceful resolution.

Search for Strategic Autonomy

- Nepal wants to follow an independent foreign policy.
- It does not want to be seen as merely balancing between India and China.
- Its focus is now on using **historical evidence, diplomacy and national interest** while dealing with sensitive issues.

Recent Positive Outcomes in India-Nepal Engagement

Digital Payment Connectivity

- India and Nepal launched a **Peer-to-Peer payment linkage**.
- This connects India's **Unified Payments Interface** with Nepal's **National Payments Interface**.
- It can help people make **real-time, low-cost cross-border payments**.
- It will also support remittances, financial inclusion and easier transactions between citizens of both countries.

Language Technology Cooperation

- An MoU was signed between **Digital India Bhashini** and **Kathmandu University**.
- The aim is to develop a **voice-based digital language translation platform** in Nepal.
- This can improve digital access and support people who use local languages.

Cooperation in Criminal Matters

- India and Nepal welcomed the implementation of the **Mutual Legal Assistance Agreement in Criminal Matters**.
- This will help both countries cooperate in dealing with **cross-border crime**, investigation and legal processes.

Development Partnership

- India handed over **72 health facilities** and **12 cultural heritage projects** to Nepal.
- These projects were completed under India's **post-2015 earthquake reconstruction assistance**.
- This reflects India's role as a development partner in Nepal's public health and cultural heritage restoration.

Strategic Importance of India-Nepal Relations

- **Himalayan Security:** Nepal lies between **India and China**, making it important for India's northern security and the safety of the Indo-Gangetic plains.
- **Siliguri Corridor:** Stability in Nepal helps protect the **Siliguri Corridor**, which connects mainland India with the Northeast.
- **Open Border:** The **1,751-km open border** promotes trade, culture and people-to-people ties, but also needs cooperation to prevent smuggling, illegal migration and cross-border crime.



- **China Factor:** China's growing presence through **BRI and infrastructure projects** makes India-Nepal connectivity and economic cooperation strategically important.
- **Water and Energy Security:** Nepal's rivers are vital for flood management in northern India, while its hydropower potential can support India's clean energy needs.

Key Challenges in India-Nepal Relations

- **China Factor:** Nepal's growing engagement with China through **BRI**, trans-Himalayan railway plans and Chinese-funded projects raises strategic concerns for India.
- **2015-16 Blockade Perception:** Nepal accused India of an unofficial blockade during the **Madhesi protests**, which India denied. This increased anti-India sentiment in Nepal.
- **Changing Diplomatic Approach:** Nepal's new leadership seeks **sovereign equality** and formal diplomatic protocol, moving away from the traditional "special relationship".
- **Open Border Security:** The **1,751-km open border** supports people-to-people ties but also enables smuggling, illegal migration, fake currency and cross-border crime.
- **Water-Sharing Issues:** Rivers like **Kosi, Gandak and Mahakali** remain sources of friction due to disputes over water sharing, flood control and project implementation.
- **Project Delays:** Delay in the **5,040 MW Pancheshwar Multipurpose Project** affects trust and slows down energy and water cooperation.

Measures to Strengthen India-Nepal Relations

- **Respect Sovereign Sensitivities:** India should engage Nepal with **mutual respect, non-interference and sovereign equality**.
- **Modernise Old Agreements:** Both countries should review the **1950 Treaty of Peace and Friendship** and address provisions viewed by Nepal as unequal.
- **Resolve Boundary Issues Diplomatically:** The **Kalapani-Lipulekh-Limpiyadhura** dispute should be handled through technical talks and Foreign Secretary-level dialogue, not public rhetoric.
- **Improve Project Delivery:** India should complete key projects such as the **Arun-III Hydropower Project**, cross-border rail links and pipeline expansion on time.
- **Expand Energy Partnership:** Nepal's plan to export **10,000 MW hydropower** to India should be supported with strong transmission infrastructure.
- **Strengthen Water Cooperation:** Both sides should fast-track the **Pancheshwar Multipurpose Project** and improve flood management on the **Kosi and Gandak** rivers.
- **Promote People-to-People Ties:** Open border, cultural links, educational exchanges and military cooperation should be used to build long-term trust.
- **Connectivity Over Competition:** India should counter external influence through better **rail, road, energy, digital and trade connectivity**, not through rivalry.

Conclusion

Nepal's new, pragmatic leadership gives India an opportunity to renew bilateral relations on a modern footing. By respecting Nepal's concerns over **sovereign equality**, reducing emotional nationalism, and prioritising **connectivity, trade,**



hydropower and economic cooperation, both countries can build a stable and future-oriented partnership. Such a balanced approach will protect

India's strategic interests in the Himalayas while supporting Nepal's development aspirations.

India at the G7 Summit 2026: Global South, Connectivity and Strategic Partnerships

Source: [Indian Express](#)

Relevance: UPSC GS Paper II: International Relations, Global Groupings, India's Bilateral Relations and Global Governance.

Important Key Words

For Prelims:

- G7, Outreach Session, Global South, IMPACT, IMEC, Global Skills Partnership, Strait of Hormuz, CEPA, GSOIA, IORA, BRICS, India-EU FTA.

For Mains:

- Global Trust Deficit, Inclusive Growth, International Solidarity, South-South Cooperation, Skilled Mobility, Supply-Chain Resilience, Connectivity Diplomacy, Multipolar World Order.

Why in News?

The Prime Minister of India attended the **52nd G7 Summit Outreach Session, 2026**, held at **Évian-les-Bains, France**, under the theme:

"Forging New Partnerships and Rebuilding International Solidarity"

India used the summit to:

- Represent the concerns of the Global South
- Call for rebuilding trust in international relations
- Seek financial support for vulnerable developing countries
- Propose new connectivity and skilled-mobility partnerships
- Hold bilateral meetings with major global

partners

India's Core Message at the G7

Addressing the Global Trust Deficit

India described mutual trust as a critical strategic asset and argued that many global problems arise from a shortage of trust rather than resources.

Reforming the Development Model

India called for moving beyond the traditional donor-recipient approach towards partnerships based on:

- Equality
- Mutual respect
- Shared responsibility
- National ownership

Voice of the Global South

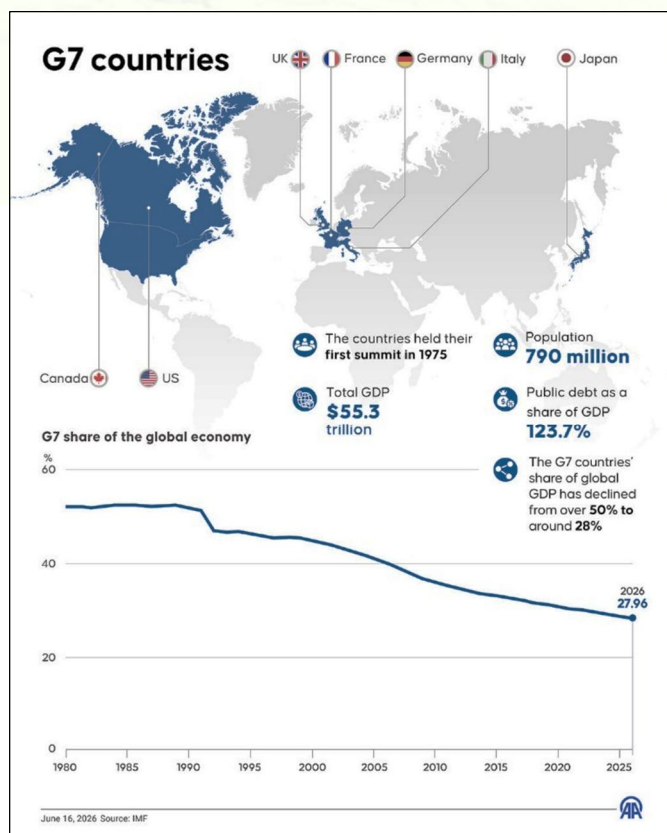
- India stated that developing countries seek not merely assistance, but meaningful participation in global governance and development frameworks.

India-Africa Cooperation

- India highlighted its partnership with Africa through targeted, high-impact initiatives based on South-South cooperation.

Global South and the West Asia Crisis

India warned that disruptions in fuel, fertiliser and food supply chains caused by the West Asia crisis would affect developing countries for a considerable period.



The disruption around the **Strait of Hormuz** affected supplies of:

- LPG
- LNG
- Diesel
- Petrol
- Fertilisers

India called upon international financial institutions to develop support mechanisms to help vulnerable countries:

- Absorb external shocks
- Maintain economic resilience
- Manage rising energy and food costs
- Avoid bearing the burden of wars alone

India stressed that economic growth must be examined through the questions:

- Growth for whom?
- Growth with whom?
- Growth in what direction?

India's Inclusive Development Model

India presented its development experience as one based on:

"Sabka Saath, Sabka Vikas, Sabka Vishwas, Sabka Prayas"

It highlighted:

- Inclusive growth
- Development at scale
- Democratic empowerment
- Shared development
- Partnership with the Global South

India also referred to its G20 Presidency and the launch of the **India-Middle East-Europe Economic Corridor** as examples of cooperative development.

IMPACT Connectivity Proposal

India proposed an:

International Mobilisation Partnership for Accelerating Connectivity and Trade – IMPACT

The proposed partnership would combine:

- **G7 capital**
- **India's talent**
- **Ownership of Global South countries**

It could support connectivity projects in:

- Africa
- Latin America
- Pacific Island countries

The proposal seeks to ensure that connectivity projects are based on partnership and local ownership.

Global Skills Partnership

India proposed a **Global Skills Partnership** to connect ageing developed economies with the young and skilled workforce of India and other Global South countries.



G7 – Prelims Perspective

— Quick Revision for Competitive Exams —



Krishna Pradeep's

21st Century IAS

Producing Next Generation Leaders for Good Governance

A/C Campus

1 Origin and Evolution

- 1975:** The G7 originated as the G6 in 1975 following the 1973 oil crisis.
- Original G6 members:** France, Germany, Italy, Japan, United Kingdom and United States.
- 1976:** Canada joined in 1976, creating the G7.
- 1998:** Russia joined in 1998, converting it into the G8.
- 2014:** Russia was removed in 2014 after its annexation of Crimea, and the grouping returned to the G7.

2 Members

- Canada**
- France**
- Germany**
- Italy**
- Japan**
- United Kingdom**
- United States**

3 European Union's Participation



- The European Union is not counted among the seven members.
- It participates as a non-enumerated member.

It is represented by the Presidents of:



European Council



European Commission

4 Nature of the G7

- Informal grouping of advanced industrial democracies
- Not established through an international treaty
- No permanent secretariat
- No formal headquarters
- Its decisions are generally political commitments and are not legally binding

5 Presidency



The presidency rotates annually among the seven members.

The country holding the presidency:

- Sets the agenda
- Organises ministerial meetings
- Hosts the annual leaders' summit
- Invites partner countries and international organisations

6 Major Areas of Cooperation

- Global economic governance
- International security
- Trade
- Energy
- Climate and development issues
- Democratic values
- Human rights

7 Economic Importance

- G7 countries account for around **10%** of the world's population.
- They contribute approximately **43%** of global nominal GDP.
- The grouping continues to exercise significant influence over global finance, trade and economic governance.

8 Outreach Sessions

- Outreach Sessions are not full membership meetings.
- The host country invites selected:
 - Partner countries
 - Developing economies
 - International organisations
- These sessions address specific regional and global issues.
- Participation in an Outreach Session does not make a country a G7 member.

9 Participants at the 2026 Outreach

International organisations included:

- World Bank**
- International Monetary Fund**
- Organisation for Economic Co-operation and Development**
- African Development Bank**



G7



It would focus on:

- Skill mapping
- Trusted skilled mobility
- Legal migration channels
- Matching workers with labour-market needs
- Cooperation between ageing and youthful societies

The proposal builds on India's mobility agreements with developed countries.

India-United States Meeting

The Indian Prime Minister met US President **Donald Trump** on the sidelines of the summit.

Areas Reviewed

The two sides reviewed cooperation in:

- Trade
- Energy
- Defence
- Technology
- People-to-people relations

They also reviewed progress under the **India-US COMPACT** and reaffirmed their commitment to the **Comprehensive Global Strategic Partnership**.

Trade Relations

- The US President stated that the two countries were close to concluding a trade deal and described the Indian Prime Minister as a tough negotiator.

Strait of Hormuz

India stressed that keeping the Strait of Hormuz open was vital for the global economy.

It also highlighted:

- Freedom of navigation
- Maritime trade
- Safety of civilians
- Protection of Indian seafarers

Skilled Professionals

- The US President indicated continued opportunities for highly skilled Indian professionals.



US President Donald Trump meets with India's Prime Minister Narendra Modi on the sidelines of the G7 summit, Wednesday, June 17, in Evian-les-Bains, France. (AP Photo)

India-Ukraine Meeting

The Indian Prime Minister met Ukrainian President **Volodymyr Zelenskyy**.

India reiterated that it would remain:

"On the side of peace, placing the values of humanity above everything else."

The two leaders discussed:

- Restoration of trade to pre-war levels
- Industrial cooperation
- Joint projects
- Expansion of bilateral relations
- Mutually beneficial economic engagement

Both sides agreed that their teams would work on the details of proposed projects.

India-European Union Engagement

The Prime Minister met:

- European Council President António Costa
- European Commission President Ursula von der Leyen

India-EU Free Trade Agreement

- The leaders welcomed the conclusion of negotiations for the India-EU Free Trade

Agreement and stressed its early signing and implementation.

The agreement is expected to support:

- Trade
- Investment
- Supply-chain diversification
- Economic cooperation

The European Commission President stated that the agreement would be signed by the end of 2026.

Other Areas

India and the EU also agreed to:

- Accelerate work on an investment agreement
- Strengthen security and defence cooperation
- Advance the India-Middle East-Europe Economic Corridor
- Promote a resilient multipolar global order

India-Germany Engagement

German Chancellor **Friedrich Merz** invited the Indian Prime Minister to Germany for the **8th India-Germany Inter-Governmental Consultations** later in 2026.

The leaders reviewed:

- Bilateral engagement
- Strategic partnership
- Recent progress in India-Germany relations
- India-EU economic cooperation

India-Canada Outcomes

Comprehensive Economic Partnership Agreement

- India and Canada agreed to expedite CEPA negotiations and aim to conclude them by the end of 2026.
- The objective is to double bilateral trade by 2030.

General Security of Information Agreement

- The two countries agreed to begin negotiations on a **GSOIA** to deepen defence and intelligence cooperation.

Raisina Americas

- The two sides announced **Raisina Americas**, a geopolitical platform intended to promote dialogue and Track 1.5 diplomatic exchanges.

IORA

- India expressed support for Canada becoming a Dialogue Partner of the **Indian Ocean Rim Association**.

Nuclear Energy Partnership

- The two sides advanced energy cooperation through a long-term uranium-supply agreement between Canada's Cameco and India's Department of Atomic Energy for the period **2027-2035**.

India-United Kingdom Outcomes

The leaders reviewed bilateral relations under the **India-UK Vision 2035** framework.

They reaffirmed their commitment to the early implementation of the **Comprehensive Economic and Trade Agreement**, with emphasis on:

- Technology
- Defence
- Education
- Trade cooperation

India-UAE Outcomes

Maritime Security

- India and the UAE expressed concern over disruptions in global trade and called for free and unimpeded navigation through the Strait of Hormuz.



BRICS Summit

- The Indian Prime Minister invited the UAE President to attend the **18th BRICS Summit**, to be hosted by India later in 2026.

Significance for India

Voice of the Global South

- India used the summit to raise concerns relating to energy, food, fertilisers and financial resilience.

Connectivity Diplomacy

- The IMPACT proposal extends India's emphasis on cooperative and locally owned connectivity.

Skilled Mobility

- The Global Skills Partnership can create legal pathways for Indian professionals.

Energy and Maritime Security

- India highlighted the strategic importance of the Strait of Hormuz and the safety of seafarers.

Trade Diplomacy

- Meetings with the US, EU, Canada and UK focused heavily on trade agreements and investment.

Strategic Autonomy

- India engaged with the US, Europe and Ukraine while continuing to advocate dialogue and peace.

Multipolar Global Order

- India supported a global system based on trust, shared values and the participation of developing countries.

Challenges

- Translating summit proposals into

operational programmes

- Ensuring adequate financial support for vulnerable countries
- Restoring disrupted energy and food supply chains
- Protecting maritime trade routes
- Concluding and implementing multiple trade agreements
- Balancing relations among competing global powers
- Ensuring skilled mobility without encouraging brain drain
- Securing ownership of connectivity projects by Global South countries
- Maintaining peace amid continuing geopolitical conflicts

Way Forward

- Develop a clear institutional framework for IMPACT.
- Create financial-support mechanisms for crisis-affected developing countries.
- Strengthen international cooperation for freedom of navigation.
- Protect civilians and seafarers in conflict zones.
- Finalise trade and investment agreements within agreed timelines.
- Develop transparent and trusted skilled-mobility systems.
- Strengthen South-South cooperation.
- Ensure connectivity projects reflect local priorities.
- Continue diplomatic engagement in support of peace.
- Reform global institutions to provide greater representation to the Global South.

Conclusion

India's participation in the G7 Summit 2026 demonstrated its expanding role as a representative of the Global South and a bridge between developed and developing countries.

- India combined criticism of unequal global burden-sharing with constructive proposals such as **IMPACT** and the **Global Skills**

Partnership. Its bilateral engagements also advanced trade, energy, defence, technology, connectivity and peace diplomacy.

- The effectiveness of India's outreach will depend on converting summit declarations into concrete financial, institutional and developmental outcomes.

India-France Innovation Roadmap 2030: Building a Trusted Technology Partnership

Source: [PIB](#)

Relevance

UPSC GS Paper II: International Relations, India-France Relations and International Cooperation

Important Keywords

- Prelims:** Horizon 2047, Trusted AI, CEFIPRA, IFIN, DEPA, MRQ, InnoXchange Bridge, FIC-LSH.
- Mains:** Strategic Autonomy, Technological Sovereignty, Human-Centric AI, Privacy-Preserving Data Sharing, Industry-Academia Cooperation and Research Mobility.

Why in News?

India and France adopted the **Innovation Roadmap 2030** to deepen cooperation in AI, research, education, health, startups and space. It builds on the **Horizon 2047 Roadmap** and the **India-France Year of Innovation 2026**, following the elevation of ties to a **Special Global Strategic Partnership** on 17 February 2026.

Background

India's **Viksit Bharat 2047** vision and France's

France 2030 strategy provide the foundation for greater cooperation in innovation and emerging technologies.

The roadmap aims to:

- Promote co-development in critical and emerging technologies.
- Strengthen trusted technology ecosystems.
- Increase academic and research mobility.
- Support technological and industrial sovereignty.
- Develop solutions for people, the planet and shared prosperity.



Major Pillars of the Roadmap

1. Partnership for Trusted Artificial Intelligence

India and France agreed to make **trusted AI** a central pillar of their innovation partnership.



FRANCE

LOCATION: Western Europe

CAPITAL: Paris

GEOGRAPHICAL POSITION: Between the Atlantic Ocean and the Mediterranean Sea

NORTHERN BOUNDARY: English Channel

MAJOR MOUNTAIN RANGES: Alps and Pyrenees

NEIGHBOURING COUNTRIES:
 Belgium, Luxembourg, Germany, Switzerland, Italy, Monaco, Spain and Andorra

LANDSCAPE:
 Plains, plateaus and mountain regions











INDIA-FRANCE



India-France defence exercises have expanded in scope and complexity.



JOINT DEFENCE EXERCISES



Bilateral Staff Talks between the three services are held regularly.



EXERCISE	SERVICE	KEY FACT	VISUAL
 SHAKTI	 ARMY	Bilateral exercise between the Indian Army and French Army	
 GARUDA	 AIR FORCE	Biennial exercise between the Indian Air Force and French Air and Space Force	
 VARUNA	 NAVY	Bilateral naval exercise between India and France	
 ORION	 TRI-SERVICE	Biennial exercise conducted by the French Armed Forces	


STRONGER TOGETHER FOR PEACE, SECURITY AND A PROSPEROUS FUTURE

The cooperation builds on:

- India-France Declaration on Artificial Intelligence, 2025
- AI Action Summit hosted by France in 2025
- AI Impact Summit hosted by India in 2026

Major Areas

- Development of safe, secure and trustworthy AI systems.
- Protection of democratic values and human rights.
- Prevention of discrimination and misinformation.
- Cooperation among regulators, standards bodies and technical experts.
- Risk-based governance of frontier and

generative AI models.

- Promotion of innovation without affecting national development.

Child Safety Online

India and France will prioritise child safety in AI-enabled digital services.

The cooperation will include:

- Privacy-preserving age assurance.
- Safety-by-design architecture.
- Outcome-based safety standards.
- Protection of children from AI-related online risks.

Privacy-Preserving Data Sharing

India's Data Empowerment and Protection Architecture – DEPA and France's trusted data



spaces and health-data platforms will support cooperation in:

- Research
- Healthcare
- Public services
- AI-based innovation

2. Academic Mobility and People-to-People Cooperation

India and France will strengthen cooperation in:

- STEM education
- Research partnerships
- Student mobility
- Talent mobility
- Institutional collaboration
- France aims to welcome **30,000 Indian students by 2030.**

Mutual Recognition of Qualifications

France became the first country to conclude a **Mutual Recognition of Qualifications agreement** with India in 2018.

Both countries will work towards expanding the agreement to cover:

- More academic disciplines
- Regulated professions
- Emerging technology sectors

The expanded framework will support:

- Student mobility
- Dual-degree programmes
- Doctoral co-supervision
- Professional mobility
- Research collaboration

Indian and French institutions have also agreed to promote student exchanges and research partnerships.

3. Technological Sovereignty and Innovation-Led Growth

India and France will promote closer cooperation

among:

- Governments
- Industries
- Startups
- Universities
- Research institutions

The aim is to build resilient and trusted supply chains in strategic sectors.

CEFIPRA

The **Indo-French Centre for the Promotion of Advanced Research—CEFIPRA** will continue to serve as a major platform for scientific cooperation.

Its role will be expanded towards:

- Innovation
- Co-development of technologies
- Scaling of strategically important technologies

India-France Innovation Network

- The **India-France Innovation Network—IFIN** will connect the innovation ecosystems of both countries.
- A joint Indo-French steering committee may be established to ensure its long-term governance.

Franco-Indian Campus in Life Sciences for Health

The **Franco-Indian Campus in Life Sciences for Health—FIC-LSH** will support cooperation in:

- Biomedical sciences
- Health research
- Academic collaboration
- Health innovation

Franco-Indian Campus for Aeronautics Training and Careers

- India and France will establish an aeronautical training campus in **Kanpur.**
- The campus will be developed in partnership with the **Ministry of Skill Development and Entrepreneurship.**



- It will promote training and skill development in the aeronautics sector.

India-France InnoXchange Bridge

- The proposed **India-France InnoXchange Bridge** will create a research and entrepreneurship corridor between the two countries.

It may provide startups and innovators with access to:

- Research laboratories
- Technology platforms
- Innovation clusters
- Investors
- Startup ecosystems

It will also support:

- Research residencies
- Innovation programmes
- Collaborative projects
- Soft-landing opportunities

Cooperation Among Small and Medium Enterprises

India and France will explore greater interaction between their small and medium enterprise ecosystems.

SMEs are recognised as important drivers of:

- Innovation
- Employment
- Inclusive economic growth

India-France Space Cooperation

India and France will strengthen cooperation between their public and private space ecosystems.

Two international space events will be held during the same week:

- **Bengaluru Space Expo:** 7-9 September, Bengaluru
- **International Space Summit:** 9-10 September, Paris

The countries will deepen cooperation in:

- Earth observation

- Human space exploration
- French Zero-G capabilities
- India's proposed future space station in Low Earth Orbit
- Private-sector space collaboration

4. AI and Research-Based Health Solutions

India and France will develop consent-based systems for secure health-data sharing.

The cooperation builds upon the pilot project involving:

- India's **Indian Council of Medical Research – ICMR**
- France's **Health Data Hub – HDH**

The two countries will work with:

- Data intermediaries
- Technical standards bodies
- Regulators
- Research institutions

The aim is to create interoperable and rights-protecting data systems for:

- AI innovation
- Healthcare research
- Public-interest research

These models may later be expanded to other sectors and shared with interested countries, including those in the Global South.

Conclusion

The India-France Innovation Roadmap 2030 makes innovation a major pillar of the bilateral relationship. Guided by mutual trust, shared democratic values, strategic autonomy, open and inclusive innovation, and human-centric technological development, the Roadmap seeks to convert bilateral cooperation into practical outcomes in artificial intelligence, education, research, healthcare, startups, aeronautics and space.

India-Seychelles Relations: Indian Ocean as a Shared Responsibility

Source: [The Hindu](#)

Relevance

UPSC GS Paper II: India's Neighbourhood, Bilateral Relations and Indian Ocean Diplomacy

Important Keywords

Prelims Keywords

- Seychelles, Mascarene Plateau, UPI, CDRI, Blue Economy

Mains Keywords

- SAGAR Vision, Maritime Security, Climate Justice, Development Partnership, Indian Ocean Diplomacy

Why in News?

Prime Minister Narendra Modi visited Seychelles from **June 27-29, 2026** and attended the country's **50th National Day celebrations** as the Guest of Honour. During talks with Seychelles President **Patrick Herminie**, both sides unveiled **19 outcomes** covering defence, maritime security, digital payments, space, healthcare, agriculture, education and infrastructure. The Prime Minister described the Indian Ocean as a **shared home**, whose security,

sustainability and prosperity are the common responsibility of regional countries.

Why is Seychelles Important for India?

Strategic Location

- Seychelles lies close to important maritime trade routes connecting Asia, Africa and the wider Indian Ocean region.

Maritime Security

It is an important partner in addressing:

- Piracy
- Illegal fishing
- Drug trafficking
- Maritime crime
- Search-and-rescue operations

SAGAR Vision

- Seychelles occupies a significant place in India's **SAGAR – Security and Growth for All in the Region – vision**.

Link with East Africa

- Greater connectivity with Seychelles can strengthen India's trade and strategic engagement with East Africa and other Indian Ocean countries.

Seychelles:

- Seychelles is an **archipelagic island country of 155 islands** in the western Indian Ocean.
- It lies northeast of Madagascar and off the eastern coast of mainland Africa.
- Its islands are located on the **Mascarene Plateau**.
- **Capital:** Victoria, situated on Mahé Island.
- It is Africa's smallest and least-populated country.
- **Languages:** English, French, Seychellois

Defence Cooperation:

- India and Seychelles conduct the biennial joint military exercise **LAMITIYE**.
- The exercise has been held since **2001**.



Historical and Migration Links

- The first recorded settlers in Seychelles arrived in **1770**, including **five Indians**, seven Africans and 15 French colonists.
- Regular Indian migration began in the **20th century**, mainly from:
 - Tamil Nadu
 - Puducherry
 - Gujarat
- Indians migrated as traders, labourers and construction workers.
- During British rule, Seychelles was administered for a period through the **Bombay Presidency**, strengthening shipping and trade links with India.

Indian Diaspora

- Persons of Indian Origin constitute about **5%** of Seychelles' population.
- Around **6,000 PIOs** hold Seychelles citizenship, mainly from Gujarati and Tamil communities.
- More than **9,000 NRIs** work in construction, trade and professional services.
- The Indian-origin community has an important role in commerce and construction.

Diplomatic Relations

- Diplomatic relations were established in **1976**, following Seychelles' independence.
- **INS Nilgiri** participated in Seychelles' Independence Day celebrations on June 29, 1976.

- **Indira Gandhi** became the first Indian Prime Minister to visit Seychelles in **1981**.
- Prime Minister Narendra Modi visited Seychelles in **2015** and again in **2026**.
- In 2026, India participated in Seychelles' 50th Independence Day celebrations through Armed Forces contingents and naval ships.

Cultural Relations

- A statue of **Mahatma Gandhi** was installed at Peace Park, Victoria, in 2022.
- Pravasi Bharatiya Samman recipients from Seychelles:
 - V. Ramadoss – 2006
 - Justice D. Karunakaran – 2015
- Cultural ties are strengthened by the Indian diaspora, Yoga and Indian cinema.

Development Partnership

India supports Seychelles through:

- Grants and concessional Lines of Credit
- Infrastructure development
- Healthcare
- Education
- Public transport
- Capacity building

More than **1% of Seychelles' population** has received professional training in India.

In 2026, India announced a **\$175 million Special Economic Package** for Seychelles.

Health Cooperation

- India is an important medical-tourism destination for Seychelles.
- Seychelles hospitals have institutional links with medical facilities in cities such as Chennai.

Strategic Importance

- Seychelles is a key maritime partner in the **western Indian Ocean**.
- It supports India in combating:
 - Piracy
 - Seaborne terrorism
 - Illegal fishing
 - Maritime crime
- Its location near Africa, West Asia and Asia gives it high geopolitical significance.
- Seychelles is important for India's **Vision MAHASAGAR – Mutual and Holistic Advancement for Security and Growth Across Regions**.
- The partnership also helps India balance China's expanding strategic presence in the Indian Ocean.

What Were the Major Outcomes?

Defence Assistance

India announced:

- Gifting of a fast patrol vessel
- Ten utility vehicles
- Five Laser Radial-class boats
- Refit of Coast Guard vessel PS Zoroaster
- Upgradation of a Dornier aircraft with a glass cockpit

These measures strengthen Seychelles' maritime surveillance and coastal-security capabilities.

Humanitarian and Development Support

India handed over:

- Six ambulances
- 500 tonnes of rice
- 8,500 tonnes of cement

A virtual ground-breaking ceremony was also held for a Professional and Technical Education Centre.

Digital and Financial Cooperation

An agreement between **NPCI International Payments Limited** and the Central Bank of Seychelles will facilitate the introduction of **UPI-based digital payments**.

Its significance includes:

- Faster digital transactions
- Improved payment connectivity
- Financial inclusion

INDIA-SEYCHELLES RELATIONS 2026

PM Modi's Seychelles Visit | Strategic Partnership in the Indian Ocean

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Current Affairs | International Relations | Indian Ocean Region

1 WHY IN NEWS?

- Prime Minister Narendra Modi visited Seychelles from 27-29 June 2026 and attended its 50th National Day celebrations as Guest of Honour.
- During talks with President Patrick Herminie, India and Seychelles unveiled **19 outcomes**.
- Key areas covered: defence, maritime security, digital payments, space, healthcare, agriculture, education and infrastructure.

2 SEYCHELLES AT A GLANCE

- Archipelagic island country of 155 islands in the western Indian Ocean
- Lies northeast of Madagascar and off the eastern coast of mainland Africa
- Islands located on the Mascarene Plateau
- Capital: Victoria (Mahé Island)
- Africa's smallest and least-populated country
- Languages: English, French, Seychellois

3 DEFENCE COOPERATION

- India and Seychelles conduct the biennial joint military exercise **LAMITIYE**
- Exercise has been held since 2001

4 HISTORICAL & MIGRATION LINKS

- First recorded settlers arrived in 1770: 5 Indians, 7 Africans and 15 French colonists
- Regular Indian migration began in the 20th century from Tamil Nadu, Puducherry and Gujarat
- Indians migrated as traders, labourers and construction workers
- During British rule, Seychelles was administered for a period through the Bombay Presidency, strengthening shipping and trade links with India

5 INDIAN DIASPORA

- Persons of Indian Origin form about **5%** of Seychelles' population
- Around **6,000** PIOs hold Seychelles citizenship, mainly from Gujarati and Tamil communities
- More than **9,000** NRIs work in construction, trade and professional services
- Indian-origin community plays an important role in commerce and construction

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7 CULTURAL RELATIONS

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- Pravasi Bharatiya Samman recipients from Seychelles: V. Ramadoss (2006) and Justice D. Karunakaran (2015)
- Cultural ties strengthened by the Indian diaspora, Yoga and Indian cinema

8 DEVELOPMENT PARTNERSHIP

- India supports Seychelles through grants and concessional Lines of Credit
- Focus areas: infrastructure, healthcare, education, public transport and capacity building
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- In 2026, India announced a **\$175 million** Special Economic Package for Seychelles

9 HEALTH COOPERATION

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- Seychelles hospitals have institutional links with medical facilities in cities such as **Chennai**

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- Seychelles is a key maritime partner in the western Indian Ocean
- Supports India in combating piracy, seaborne terrorism, illegal fishing and maritime crime
- Its location near Africa, West Asia and Asia gives it high geopolitical significance
- Important for India's Vision **MAHASAGAR** — Mutual and Holistic Advancement for Security and Growth Across Regions
- Partnership also helps India balance China's expanding strategic presence in the Indian Ocean

QUICK HIGHLIGHTS

155 Islands

Capital: **Victoria**

Exercise: **LAMITIYE**

PIOs: **~5%**

Special Package: **\$175 million**

Indian Ocean Partner



- Greater use of Indian digital public infrastructure abroad

Health and Agriculture Cooperation

Healthcare

India and Seychelles agreed to:

- Prepare for a new Seychelles National Hospital
- Supply affordable generic medicines and medical products under the **Jan Aushadhi Scheme**

Agriculture

ICAR and the Seychelles Agriculture Department signed a cooperation framework for:

- Joint research
- Training
- Agricultural education
- Technical studies during 2026-31

Space, Shipping and Legal Cooperation

Space

The two countries signed an agreement on the peaceful uses of outer space, covering:

- Satellite applications
- Space technology
- Capacity building

Shipping

- Seychelles agreed to recognise Indian seafarers' training and certification for employment on Seychelles-flagged vessels.

Extradition Treaty

- A new extradition treaty will strengthen cooperation against fugitives and transnational crime.

Development Finance

- An umbrella Line of Credit agreement worth **₹1,250 crore** was concluded between Seychelles and the Export-Import Bank of India.

- It will support priority projects under the Special Economic Package, particularly in infrastructure and social development.

Climate Action and Blue Economy

Prime Minister Modi highlighted that small island nations face severe consequences of climate change despite contributing little to global emissions.

He called for climate action based on:

- Fairness
- Responsibility
- Equity
- Climate justice

India and Seychelles also agreed to deepen cooperation in:

- Renewable energy
- Green hydrogen
- Marine conservation
- Sustainable fisheries
- Blue Economy

Seychelles also announced its decision to join the **Coalition for Disaster Resilient Infrastructure**.

Diplomatic and Cultural Significance

- The visit marked **50 years of diplomatic relations** between India and Seychelles.
- Prime Minister Modi became the first Indian Prime Minister to address an extraordinary sitting of the Seychelles National Assembly.
- He was also conferred the "**Guardian of the Blue Horizon**" honour for his green leadership, support for developing countries and promotion of the Blue Economy.
- India's participation through Army and Navy contingents in the National Day celebrations reflected close defence ties and military cooperation.

Significance for India

- Strengthens India's presence in the western Indian Ocean.
- Supports maritime-domain awareness and anti-piracy efforts.
- Expands India's digital public infrastructure abroad.
- Counters the influence of external powers in the Indian Ocean.
- Deepens engagement with African and island nations.
- Promotes India as a reliable development and security partner.
- Advances the SAGAR vision and Global South cooperation.

Way Forward

- Strengthen joint maritime surveillance and information sharing.
- Complete development projects within agreed timelines.
- Expand UPI and digital-public-infrastructure cooperation.

- Promote renewable energy and climate-resilient infrastructure.
- Support marine conservation and sustainable fisheries.
- Increase defence training and capacity building.
- Improve connectivity between India, Seychelles and East Africa.
- Expand youth, education, tourism and cultural exchanges.

Conclusion

India-Seychelles relations combine maritime security, development cooperation, climate action and people-to-people ties. Seychelles' strategic location makes it central to India's vision for a secure and prosperous Indian Ocean. The 2026 visit expanded cooperation from traditional defence and development assistance to digital payments, space, healthcare and renewable energy. Sustained partnership based on mutual trust and respect can transform the Indian Ocean into an **ocean of opportunity**.

India-South Korea Shipbuilding Partnership: Building a Competitive Maritime Industrial Base

Source: [The Hindu](#)

Relevance

UPSC GS Paper II: India-South Korea Relations and Strategic Partnerships

Important Keywords

Prelims

- Maritime India Vision 2030, Maritime Amrit Kaal Vision 2047, Shipbuilding Financial Assistance Scheme, Shipbuilding Development Scheme, Maritime

Development Fund, Sagarmala Finance Corporation Limited, KOMEA, Hong Kong Convention

Mains

- Shipbuilding clusters, technology absorption, supplier localisation, maritime industrialisation, green shipbuilding, circular maritime economy, strategic autonomy, long-term maritime finance

Why in News?

The visit of South Korean President **Lee Jae Myung** to India gave fresh momentum to bilateral cooperation in shipbuilding. Leading Korean companies have announced partnerships, investments and technology collaboration with Indian shipyards, strengthening India's ambition to become a major global shipbuilding nation.

India's Shipbuilding Sector

- India's maritime tradition dates back to the **Indus Valley Civilisation**. Archaeological evidence from **Lothal in Gujarat** indicates the existence of an early dockyard and organised maritime trade. Lothal's dock is regarded as one of the earliest known tidal docks in the world.
- The sector has a strong multiplier effect. Investment in shipbuilding generates additional employment and demand across several linked industries. It can also create large-scale livelihood opportunities in coastal, rural and remote regions.
- After Independence, Indian shipbuilding was mainly concentrated in public-sector yards such as:
 - **Mazagon Dock Shipbuilders Limited, Mumbai**
 - **Garden Reach Shipbuilders & Engineers Limited, Kolkata**
 - **Hindustan Shipyard Limited, Visakhapatnam**
- In recent years, private-sector participation, maritime reforms and investments in ports, inland waterways and coastal shipping have expanded the scope of the industry.
- A stronger shipbuilding sector is central to **Atmanirbhar Bharat** because it can reduce dependence on foreign vessels, strengthen

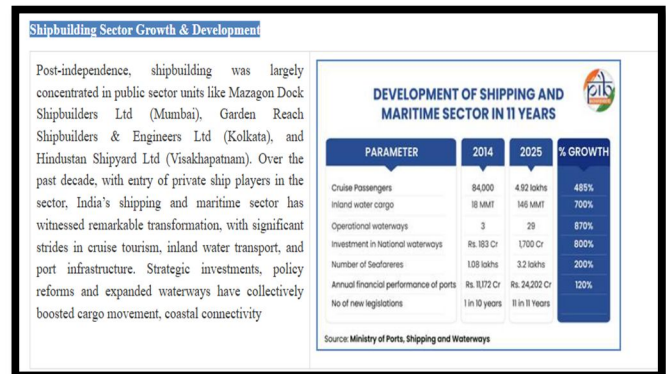
domestic manufacturing and improve national security.

Why is Shipbuilding Important for India?

Shipbuilding is known as the "**mother of heavy engineering**" because it supports industries such as steel, electronics, machinery, logistics and marine equipment.

Its strategic importance arises from the following:

- Nearly **95% of India's trade by volume** moves through maritime routes.
- Domestic shipbuilding reduces dependence on foreign-built vessels.
- It supports naval preparedness and maritime security.
- It generates skilled employment and promotes coastal industrialisation.
- It strengthens supply-chain resilience.
- It can help India enter high-value global manufacturing networks.



India's Shipbuilding Ambitions

India seeks to become:

- One of the **top 10 shipbuilding nations by 2030**
- One of the **top five shipbuilding nations by 2047**

These targets are part of the **Maritime India Vision 2030** and **Maritime Amrit Kaal Vision 2047**.



However, India currently accounts for less than 1% of global shipbuilding output and remains far behind China, South Korea and Japan.

How Can South Korea Support India?

1. Development of Mega Shipyards

South Korean participation can help India build large greenfield shipyards with modern dry docks, automated production systems and advanced fabrication facilities.

The proposed project at **Thoothukudi, Tamil Nadu**, is expected to support large-scale ship construction and create substantial direct employment.

2. Technology Transfer

Korean companies such as **HD Hyundai, Samsung Heavy Industries and Hanwha Ocean** possess expertise in:

- Ship design
- Yard automation
- Modular construction
- Green propulsion
- Offshore engineering
- High-value commercial vessels

Such collaboration can help Indian yards improve quality, reduce construction time and build sophisticated ships.

3. Localised Marine Supply Chains

The **Korea Marine Equipment Association**, representing over 300 firms, has established a presence in Mumbai.

This can support domestic production of:

- Marine engines
- Navigation equipment
- Propulsion systems
- Shipbuilding-grade steel
- Electrical and control systems

Supplier localisation can reduce import dependence and lower production costs.

4. Cluster-Based Development

India can adapt South Korea's **Ulsan model**, which integrates:

- Shipyards
- Ancillary industries
- Ports
- Training institutions
- Research centres
- Logistics networks

Such clusters create economies of scale and improve coordination across the value chain.

5. Skill Development and Research

Partnerships involving Indian and Korean maritime institutions can strengthen training in:

- Naval architecture
- Marine engineering
- Automated ship design
- Advanced welding
- Green propulsion
- Shipyard management

This is essential for India to absorb transferred technology rather than remain dependent on foreign expertise.

6. Defence Manufacturing

Joint work in naval and amphibious vessel construction can strengthen indigenous defence production under **Make in India** and improve India's maritime security capabilities.

Major Government Initiatives

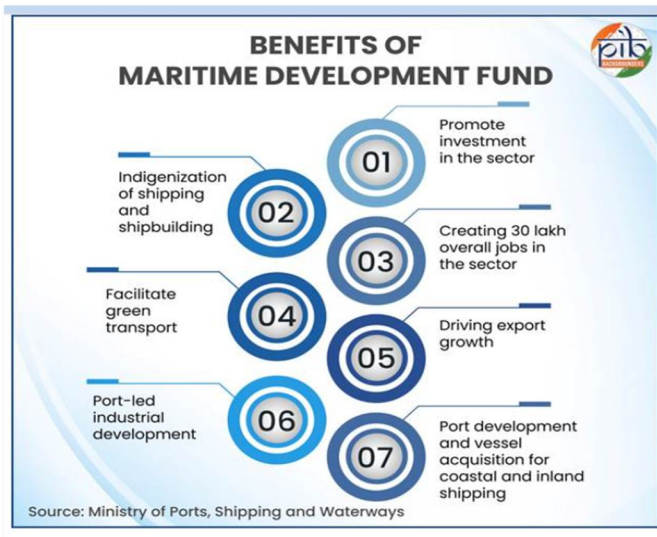
Maritime Development Fund

The proposed **₹25,000-crore Maritime Development Fund** aims to provide long-term and affordable capital.

It includes:

- **Maritime Investment Fund:** Equity support to attract institutional and private capital
- **Interest Incentivisation Fund:** Support for reducing borrowing costs on long-tenure loans

This is important because shipbuilding projects require large working capital and long repayment periods.



Shipbuilding Financial Assistance Scheme

- The scheme provides graded assistance to Indian yards to offset cost disadvantages against heavily subsidised foreign competitors. It supports domestic vessel construction and improves bidding competitiveness.

Shipbuilding Development Scheme

This scheme focuses on:

- Greenfield shipbuilding clusters
- Modernisation of existing yards
- Common infrastructure
- Credit-risk support
- Establishment of an India Ship Technology Centre

It aims to expand India's commercial shipbuilding capacity and promote indigenous technology.

Sagarmala Finance Corporation Limited

- The **Sagarmala Finance Corporation Limited** is India's first dedicated maritime-sector NBFC.
- It is intended to finance shipping, ports, shipbuilding and related infrastructure.

Green Tug Transition Programme

The programme encourages alternative propulsion systems such as:

- Battery-electric
- Hydrogen
- Methanol
- LNG
- Other low-emission fuels

India's Ship Recycling Advantage

India is a major global ship-recycling centre, led by the **Alang Ship Recycling Yard in Gujarat**.

Its global share in ship recycling increased significantly in 2025.

Policy support includes:

- Recycling of Ships Act, 2019
- Alignment with the Hong Kong Convention
- Modernisation of recycling yards
- Expansion of internationally compliant facilities

Major Challenges

1. Low Production Capacity

India's shipbuilding capacity remains small compared with global leaders.

The concentration of new orders among China, South Korea and Japan makes market entry difficult.

2. High Cost of Finance

Indian shipbuilders face:

- High interest rates
- Large working-capital requirements
- Limited long-term credit
- Weak sovereign guarantee mechanisms

This reduces competitiveness in international tenders.

3. Dependence on Imported Components

- India imports a large share of critical marine equipment.
- This increases costs, delays production and exposes shipyards to global supply disruptions.

4. Infrastructure Constraints

Many Indian shipyards lack:

- Mega dry docks
- Large fabrication areas
- Automated systems
- Integrated logistics

This prevents them from building ultra-large vessels.

5. Weak Domestic Demand

- Indian shipping companies often purchase cheaper second-hand foreign vessels instead of ordering newly built ships from domestic yards.

Without a steady domestic order book, Indian yards cannot achieve scale.

6. Underdeveloped Ship Repair Market

- India has a very small share in the global maintenance and repair market.

Indian vessels often go to Singapore, Dubai or Colombo for faster and more reliable servicing.

7. Skill Shortages

India lacks adequate numbers of specialists in:

- Advanced marine engineering
- Automated design
- Green propulsion
- Shipyard planning
- High-end vessel construction

8. Regulatory Delays

- Land acquisition, environmental clearances, legal uncertainty and inconsistent regulations can slow greenfield projects and discourage investors.

How Can India Strengthen the Sector?

Build Integrated Shipbuilding Clusters

- Shipyards, suppliers, research institutions, ports and training centres should be developed together to reduce costs and improve efficiency.

Localise Critical Components

Foreign partnerships should include:

- Local value addition
- Technology transfer
- Joint design capability
- Domestic supplier development
- Skill creation

India should aim to become a technology owner, not merely an assembly base.

Link Recycling with Manufacturing

- Steel and equipment recovered from recycled ships should feed domestic shipbuilding supply chains.
- This can reduce costs and support resource efficiency.

Create a Stable Domestic Order Book

- The **Right of First Refusal** for Indian-built and Indian-flagged vessels should be effectively implemented in government and public-sector cargo contracts.

Expand Maritime Finance

- Long-term, low-cost finance and risk guarantees are essential because shipbuilding has long gestation periods.

Develop Skilled Human Capital

- Maritime universities, IITs, research institutes and industry should jointly design specialised programmes in naval architecture, green propulsion and ship automation.

Promote Green Shipbuilding

- India should target vessels powered by hydrogen, methanol, ammonia and battery systems instead of competing only in conventional shipbuilding.

Improve Centre-State Coordination

- State governments must facilitate land, port connectivity, utilities, clearances and investor support for large shipyard projects.

Significance of India-South Korea Cooperation

Industrial capacity:

- Korean expertise can accelerate the modernisation of Indian shipyards.

Employment:

- Shipbuilding creates jobs across steel, engineering, logistics and marine services.

Technology absorption:

- Joint ventures can strengthen domestic design and manufacturing capability.

Maritime security:

- A stronger domestic shipbuilding base supports naval and commercial requirements.

Export competitiveness:

Modern shipyards can help India enter global vessel and repair markets.

Green transition:

- Collaboration can position India in the emerging low-emission shipping industry.

Conclusion

South Korea's rapid rise as a shipbuilding power demonstrates that success requires more than individual shipyards. It depends on integrated clusters, affordable finance, skilled workers, local suppliers and sustained policy support. India has the coastline, market, labour force and strategic need to emerge as a major maritime manufacturing nation. Korean cooperation can accelerate this process, but lasting success will depend on domestic capacity-building, technology absorption and supplier localisation. India's shipbuilding ambitions will succeed only when foreign collaboration is converted into a strong and self-reliant maritime industrial ecosystem.

Economy

Mission for Cotton Productivity

Source: [Indian Express](#)

Relevance: UPSC: GS Paper III - Indian Economy, Agriculture, Biotechnology, Cropping Pattern, Food and Fibre Crops, Agricultural Marketing, Intellectual Property Rights, Inclusive Growth.

Important Key Words

For Prelims:

- Mission for Cotton Productivity, Bt Cotton, Bollgard, Bollgard II, GEAC, Cotton Seed Price Control Order, Trait Fee, Lint Productivity, ICAC, GM Crops.

For Mains:

- Agricultural Biotechnology, Seed Innovation, Cotton Productivity, Farmer Income, Textile Value Chain, Price Control, Intellectual Property Rights, Public R&D, Private Innovation, Technology Adoption.

Why in News?

The Union Cabinet approved the Mission for Cotton Productivity with an outlay of ₹5,659 crore for the period 2026-27 to 2030-31.

- The mission aims to raise India's cotton lint productivity from **441 kg per hectare** in the triennium ending **2025-26** to **755 kg per hectare by 2031**. The mission is important because India's cotton sector is facing

declining productivity, technological stagnation and growing import dependence.

What is the Mission for Cotton Productivity?

- The mission is a Central initiative to improve cotton productivity in India.
- It will run from **2026-27 to 2030-31**.
- Its approved outlay is **₹5,659 crore**.
- It aims to increase lint productivity from **441 kg/ha** to **755 kg/ha by 2031**.
- It seeks to address productivity stagnation in cotton cultivation.
- It is linked to India's textile economy, farmer income and agricultural competitiveness.



Had India continued on the production trajectory between 2002 and 2014, cotton output in 2026 would have reached 65.3 million bales. (Representative image/File photo)

India's Bt Cotton Success Story

- A major shift came in **2002**, when India

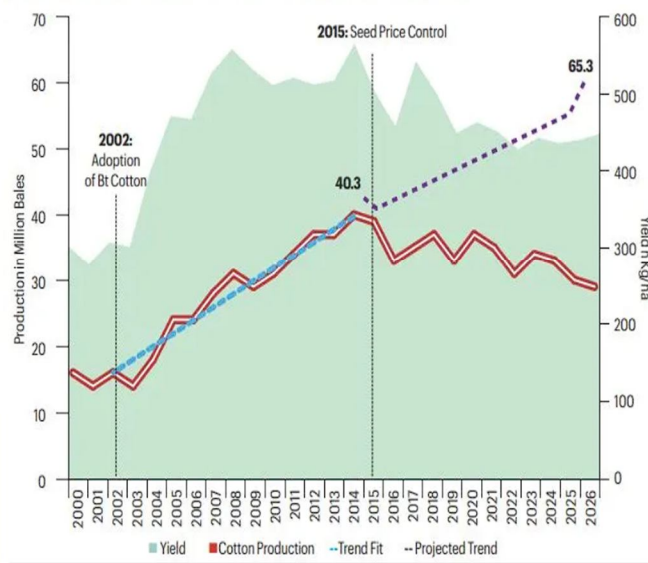
approved the commercial cultivation of **Bt cotton**.

- The approval was given after clearance by the **Genetic Engineering Appraisal Committee**.
- The first Bt cotton hybrids used the **Cry1Ac gene** to control bollworm infestation.
- In **2006, Bollgard II** was approved with two stacked genes for better pest resistance.
- Impact between **2002-03 and 2013-14**:

Indicator	2002-03	2013-14	Change
Cotton production	13.6 million bales	39.8 million bales	193% increase
Cotton area	7.6 million ha	11.9 million ha	56% increase
Productivity	302 kg/ha	566 kg/ha	88% increase

- India became the **largest cotton producer** and the **second-largest exporter** of cotton.
- This period showed how biotechnology can transform agricultural productivity and farmer incomes.

• PRODUCTION AND YIELD OF COTTON IN INDIA



Policy Reversal and Innovation Slowdown

- After Bollgard II, newer technologies such as **Bollgard II with Roundup Ready Flex** and **Bollgard III** were developed.
- These technologies included:
 - Three stacked genes
 - Herbicide-tolerant traits
 - Better pest management
 - Improved weed control
- However, these advanced technologies were not commercialised in India.

Role of Price Controls

Year	Policy Step	Impact
2006	Andhra Pradesh capped seed price at ₹750 per packet	Reduced seed company returns
2015	Cotton Seed Price Control Order	Trait fee reduced by 74%
2018	National seed price reduced further	Lowered commercial incentive
2020	Trait fee eliminated	Reduced incentive for private innovation

- Due to price controls and weak intellectual property protection, private biotechnology firms reduced interest in bringing advanced cotton technologies to India.
- This slowed down seed innovation and technological renewal in cotton farming.

Global Cotton Productivity Gap

India has the world's largest cotton-growing area, but its productivity is far below global competitors.



Basic Words Related to Cotton Productivity Mission

Prelims Perspective



1 Lint

- Lint means the soft cotton fibre separated from cotton seeds.
- Cotton productivity is often measured as lint yield per hectare.
- Example:** India's cotton lint productivity is around 441 kg/ha.



2 Bt Cotton

- Bt cotton is a genetically modified cotton variety.
- It contains genes from the bacterium *Bacillus thuringiensis*.
- It helps protect cotton plants from bollworm pests.
- Commercial cultivation of Bt cotton was approved in India in 2002.



3 Bollworm

- Bollworm is a major pest of cotton.
- It damages cotton bolls and reduces yield.
- Bt cotton was introduced mainly to control bollworm infestation.



4 GEAC

- Full form:** Genetic Engineering Appraisal Committee.
- It functions under the Ministry of Environment, Forest and Climate Change.
- It examines proposals related to genetically modified organisms.
- Bt cotton was approved after GEAC clearance.



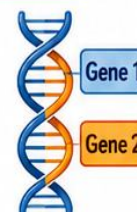
5 Bollgard

- Bollgard is a Bt cotton technology.
- It uses the *Cry1Ac* gene.
- It protects cotton from bollworm attack.



6 Bollgard II

- Bollgard II is a second-generation Bt cotton technology.
- It contains two stacked genes.
- It gives better protection against bollworm than the first version.
- It was approved in India in 2006.



7 Stacked Genes

- Stacked genes means using more than one useful gene in a crop variety.
- It helps improve pest resistance, disease resistance or herbicide tolerance.



8 Herbicide Tolerance

- Herbicide tolerance means the crop can survive certain weed-killing chemicals.
- It helps farmers control weeds more easily.
- Some advanced cotton technologies have herbicide-tolerant traits.



9 Trait Fee

- Trait fee is the amount paid for using a specific seed technology.
- In Bt cotton, companies charged trait fees for biotechnology traits.
- In India, trait fees were reduced and later eliminated.



**1. WHY IN NEWS?**

Union Cabinet approved Mission for Cotton Productivity.



Outlay: ₹5,659 crore for 2026-27 to 2030-31.



Aim: Increase lint productivity from **441 kg/ha** (TE 2025-26) to **755 kg/ha** by 2031.

2. INDIA'S BT COTTON SUCCESS STORY (2002-2014)

2002
Bt cotton approved for commercial cultivation



2006
Bollgard II (2 stacked genes) approved



Big Impact (2002-03 to 2013-14)

Production
13.6 million bales
↓
39.8 million bales
(193% increase)

Area
7.6 million ha
↓
11.9 million ha
(56% increase)

Productivity
302 kg/ha
↓
566 kg/ha
(88% increase)

India became the largest cotton producer and 2nd largest exporter.

3. POLICY REVERSAL & INNOVATION SLOWDOWN

After Bollgard II, new technologies (Bollgard II with RRF and Bollgard III) were developed but not released in India.

2006

Andhra Pradesh capped seed price at ₹750 per packet. Other states followed.

2015

Cotton Seed Price Control Order – Trait fee reduced by 74%.

2018

National seed price reduced further.

2020

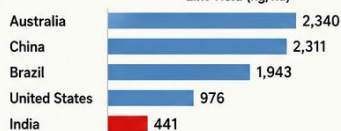
Trait fee eliminated.



Result: Private companies lost incentive to innovate. Advanced technologies were withdrawn.

4. GLOBAL PRODUCTIVITY GAP (TE 2025-26)

Lint Yield (kg/ha)



India has the largest cotton area but one of the lowest productivity.

5. EMERGING COTTON CRISIS IN INDIA

Production declining ~2% annually since 2014-15.



If earlier growth continued, output in 2026 would have reached 65.3 million bales.



Actual production in 2025-26: 29 million bales.



India is now importing ~4 million bales of cotton.

Policy failure over a decade cost India **36.3 million bales** of cotton production.

6. POLICY DILEMMA – THE WAY FORWARD**Revive Private Innovation**

- Review Cotton Seed Price Control Order.
- Protect intellectual property rights.
- Allow innovators to recover R&D costs.
- Encourage private investment in new technologies.

**Strengthen Public R&D**

- Increase public funding for cotton biotechnology.
- Develop indigenous seed technologies.
- Strengthen research institutions.
- Improve extension services.

**7. KEY TAKEAWAYS**

Technology and innovation drive productivity.



Regulatory clarity encourages investment.



Mission funds must be supported by science and policy.



Better seeds, R&D, extension and market access are essential.



Sustainable productivity growth needs a balanced policy for farmers, innovators and the nation.

Cotton Lint Yield: TE 2025-26

Country	Cotton Productivity
Australia	2,340 kg/ha
China	2,311 kg/ha
Brazil	1,943 kg/ha
United States	976 kg/ha
India	441 kg/ha

- The productivity gap reflects differences in:
 - Biotechnology adoption
 - Seed innovation
 - R&D investment
 - Regulatory support
 - Agronomic practices
- Brazil has achieved high productivity even though a large share of its cotton is rainfed.

Emerging Cotton Crisis in India

- India's cotton production has been declining at an average annual rate of around **2% since 2014-15**.
- If India had continued on the earlier growth path between **2002 and 2014**, cotton output in **2026** could have reached **65.3 million bales**.
- Actual cotton production in **2025-26** is around **29 million bales**.
- The gap of **36.3 million bales** shows the cost of productivity stagnation.
- India has moved from being a net exporter to importing around **4 million bales** of cotton.

- This raises concerns for:
 - Farmer income
 - Textile industry competitiveness
 - Cotton self-sufficiency
 - Export potential

Key Concerns with the Mission

- The target of **755 kg/ha by 2031** is ambitious.
- India currently lacks access to next-generation cotton biotechnology used by global competitors.
- Advanced GM cotton varieties remain unavailable to Indian farmers.
- Private-sector innovation has weakened due to price controls.
- Public-sector R&D remains underfunded.
- Regulatory approval for biotechnology remains long and uncertain.
- Even if India achieves **755 kg/ha**, it will remain far below Brazil, China and Australia.

Policy Dilemma

India faces two major choices.

1. Revive Private Innovation

- Reconsider the **Cotton Seed Price Control Order**.
- Strengthen intellectual property protection.
- Allow innovators to recover R&D investment.
- Encourage private seed companies to bring advanced technologies.

2. Expand Public Sector R&D

- Increase public funding for cotton biotechnology.
- Develop indigenous seed technologies.
- Strengthen agricultural universities and

research institutions.

- Improve extension services for farmers.
- Promote locally suitable, climate-resilient cotton varieties.

Significance

- Cotton is a major fibre crop and supports millions of farmers.
- It is closely linked with India's textile and garment industry.
- Higher productivity can reduce import dependence.
- Improved cotton output can support farmer incomes.
- Technology-led cotton growth can improve rural employment.
- Cotton productivity is important for India's export competitiveness.
- The mission can help revive India's position in global cotton markets.

Challenges

- Low cotton productivity compared to global competitors.
- Slow adoption of advanced biotechnology.
- Price controls reducing incentives for seed innovation.
- Weak public agricultural R&D funding.
- Pest resistance and weed management problems.
- Rainfed nature of much of India's cotton cultivation.
- Fragmented landholdings and uneven extension services.
- Regulatory uncertainty around GM crops.
- Risk of increased import dependence.

Way Forward

- Create a balanced seed policy that protects farmers and encourages innovation.
- Review trait fee and seed price regulation without hurting affordability.
- Strengthen the **GEAC** approval process with scientific transparency.
- Promote next-generation cotton technologies after proper biosafety evaluation.
- Increase public investment in cotton biotechnology and plant breeding.
- Improve extension services for pest management, irrigation and soil health.
- Promote climate-resilient and region-specific cotton varieties.
- Encourage public-private partnerships in seed research.
- Link the mission with textile value chain needs.
- Ensure farmer access to affordable and advanced seed technologies.

Conclusion

The **Mission for Cotton Productivity** recognises the seriousness of India's cotton crisis. Its target of raising productivity is welcome, but productivity cannot rise sustainably without technological renewal.

- India's cotton success between **2002 and 2014** showed the power of biotechnology. However, policy uncertainty, price controls and weak R&D have slowed innovation. The long-term revival of cotton requires a balanced framework that protects farmers, supports scientific innovation, strengthens public research and provides access to advanced seed technologies.
- Without addressing these structural issues, the mission may improve outcomes only partially and fail to restore India's global cotton competitiveness.

Infrastructure at the Core of India's Development

Source: [PIB](#)

Relevance

UPSC: GS Paper III - Infrastructure, Economic Development, Energy, Transport, Logistics, Digital Economy, Industrial Growth.

Important Keywords

- **Prelims:** PM Gati Shakti, National Logistics Policy, Bharatmala, Sagarmala, PMGSY, UDAN, Jal Jeevan Mission, PMAY, PM-WANI, BharatNet, Kavach, Vande Bharat, GAGAN, AMRUT, PM Surya Ghar.
- **Mains:** Infrastructure-led Growth, Multimodal Connectivity, Regional Integration, Logistics Efficiency, Inclusive

Development, Digital Public Infrastructure, Green Mobility, Ease of Living, Viksit Bharat 2047.

Why in News?

India has highlighted infrastructure as a key driver of economic growth, service delivery and regional connectivity. Over the past decade, large-scale investments in **railways, roads, airports, ports, housing, water, energy, logistics and digital networks** have strengthened India's transition towards a modern and integrated economy.

Initiatives such as **PM Gati Shakti, National Logistics Policy, Sagarmala, Bharatmala, UDAN, Jal Jeevan Mission and PM-WANI** have supported

better mobility, wider digital access, improved logistics efficiency and inclusive development.

Infrastructure as an Instrument of Nation Building

- Infrastructure is not only about physical assets. It directly shapes people's daily lives by improving access to roads, railways, airports, housing, water, electricity, digital services and markets.
- After **2014**, India's infrastructure policy shifted from fragmented project execution to **integrated planning and long-term capacity creation**.
- Public capital expenditure increased from about **₹2 lakh crore in FY2014-15 to ₹12.2 lakh crore in FY2026-27**. This shows a strong focus on infrastructure-led growth.
- Major programmes such as **Sagarmala, Bharatmala, PM Gati Shakti, PMAY, Jal Jeevan Mission, PM Ujjwala Yojana and UDAN** have linked infrastructure with household welfare, economic opportunity and regional development.

Railways under Transformation

Indian Railways has undergone large-scale modernisation since **2014**.

Major Developments

- Budgetary support increased from around **₹32,000 crore in 2014-15 to ₹2.78 lakh crore in FY2026-27**.
- Rail electrification increased from about **20% before 2014 to 99.6% by March 2026**.
- A total of **69,873 route kilometres** have been electrified.
- As of **April 2026**, **162 Vande Bharat train services** are operational.
- **60 Amrit Bharat Express services** are operational, supporting affordable long-

distance travel.

- **Vande Bharat Sleeper**, launched in **January 2026**, carried **1.21 lakh passengers** in its first three months.

High-Speed Rail

- The **Mumbai-Ahmedabad High-Speed Rail Corridor** is under construction.
- The corridor is **508 km** long and designed for speeds up to **320 kmph**.
- The Union Budget **2026-27** announced plans for **seven new high-speed rail corridors**.



Railway Safety

- **Kavach**, India's indigenous automatic train protection system, has been deployed across **3,103 route km**.
- Implementation is underway on **24,427 km** across major corridors.
- Train accidents declined from **135 in 2014-15 to 16 in 2025-26**.

Landmark Railway Projects

Project	Importance
Chenab Bridge, 2025	World's highest railway arch bridge; 359 metres above Chenab River
Anji Khad Bridge, 2025	India's first cable-stayed railway bridge

Pamban Bridge, 2025	India's first vertical-lift railway sea bridge
Bairabi-Sairang Line, 2025	Strengthens rail connectivity to Mizoram through difficult terrain

Roads and Highways

India has the **second-largest road network in the world**, with **63.73 lakh km**.

Key Developments

- National Highways increased from **91,287 km in FY14** to **1,46,566 km in March 2026**.
- Four-lane and above National Highways increased from **18,371 km in 2014** to **45,516 km**.
- 3,644 km** of access-controlled high-speed corridors and expressways have been operationalised.

Pradhan Mantri Gram Sadak Yojana

PMGSY has transformed rural connectivity through all-weather roads.

- Budgetary allocation increased from **₹386 crore in 2014-15** to **₹19,000 crore in 2026-27**.
- 99.6% of eligible habitations** have been connected.
- Completed roads increased from **3.86 lakh km during 2000-2014** to **4.11 lakh km during 2014-2026**.
- Completed bridges increased from **484** to **10,293**.

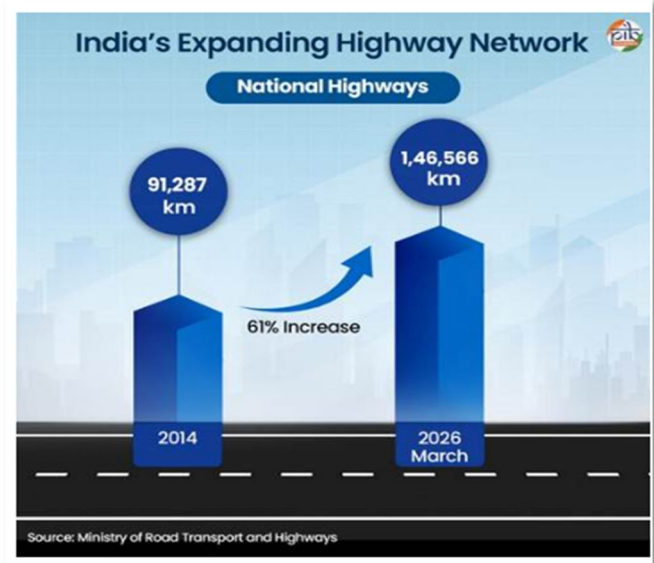
Bharatmala Pariyojana

Bharatmala Pariyojana, approved in **2017**, focuses on economic corridors, border roads, coastal roads and expressways.

- Under Bharatmala, **22,590 km** of roads have been completed till **31 March 2026**.

Landmark Road Projects

Project	Importance
Atal Tunnel, 2020	World's longest highway tunnel above 10,000 feet
Dhola-Sadiya Bridge, 2017	First permanent road link between Assam and Arunachal Pradesh
Maitri Setu, 2021	Connects Tripura with Bangladesh
Sudarshan Setu, 2024	Connects Okha with Beyt Dwarka
Z-Morh/Sonamarg Tunnel, 2025	Provides all-weather access in Jammu and Kashmir



Civil Aviation and Regional Air Access

Civil aviation has expanded regional connectivity after **2014**.

- Operational airports increased from **74 in 2014** to **165 in 2026**.
- Investments exceeded **₹1.4 lakh crore**.

UDAN Scheme

The **UDAN scheme**, launched in **2016**, improved affordable air travel.

- As of 2026, 665 routes connect 95 airports, heliports and water aerodromes.
- More than 1.64 crore passengers benefited.
- The Modified UDAN scheme, launched in 2026, has an outlay of ₹28,840 crore and aims to connect 120 new destinations.

Digital Aviation

- Digi Yatra is operational at 38 airports.
- It has benefited over 9.3 crore passengers.
- GAGAN, operationalised in 2015, is the world's first equatorial Satellite-Based Augmentation System.

Metro and Urban Transit Systems

India's metro network has expanded rapidly.

- Metro network length increased from 248 km in 2014 to more than 1,155 km in 2026.
- India now has the world's third-largest metro network.
- Cities with metro connectivity increased from 5 in 2014 to 26 in 2025.
- Daily metro ridership increased from around 28 lakh to more than 1.15 crore passengers.

Major Urban Transit Innovations

- Kolkata launched India's first underwater metro tunnel beneath the Hooghly River in 2024.
- Kochi Water Metro connected islands around Kochi using electric hybrid boats.
- Namoo Bharat Rapid Rail, 2025 on the Delhi-Meerut corridor introduced advanced signalling technology.

Ports, Shipping and Maritime Connectivity

Maritime transport handles about 95% of India's trade by volume and 70% by value.

Sagarmala Programme

Sagarmala, launched in 2015, supports port-led development.

- As of March 2026, 78 projects worth ₹5,356.75 crore were completed.



Inland Waterways

- National Waterways increased from 5 in 2014 to 111 in 2026.
- They span 20,187 km across 23 States and 4 Union Territories.
- Cargo movement rose from 29 MMT to 218 MMT.
- Ferry and Ro-Pax passenger movement reached 10.55 crore.

Industrial and Manufacturing Infrastructure

Industrial infrastructure supports investment, employment and manufacturing growth.

- As of May 2026, 4,220 industrial parks are mapped on the India Industrial Land Bank.
- These cover around 6.98 lakh hectares.
- Around 272 plug-and-play industrial parks are operational.
- 20 industrial smart cities and industrial areas are being developed under the National Industrial Corridor Development Programme.



BHAVYA Scheme

The **BHAVYA** scheme, approved in **March 2026**, aims to develop **100 new plug-and-play industrial parks** across India.

The Union Budget 2026–27 also proposed:

- **Three chemical parks**
- **Seven PM MITRA parks**
- **MSME clusters**
- **₹10,000 crore Biopharma SHAKTI programme**

Logistics and National Competitiveness

India has shifted towards multimodal and technology-driven logistics planning.

PM Gati Shakti

- Launched in **October 2021**.
- It is a GIS-based integrated infrastructure planning platform.
- It brings together **58 Ministries and Departments**.
- It uses more than **3,202 data layers** as of **June 2026**.

National Logistics Policy

- Launched in **September 2022**.
- India's rank in the **World Bank Logistics Performance Index** improved from **54 in 2014** to **38 in 2023**.
- India aims to enter the **top 25** by **2030**.

Digital Logistics Platforms

Platform	Purpose
ULIP, 2022	Integrates logistics data from multiple ministries
Logistics Data Bank, 2016	Tracks EXIM container movement
NETC FASTag, 2016	Enables electronic toll collection

PRAGATI

- Launched in **2015**. **382 projects** worth over **₹85 lakh crore** have been reviewed.
- **2,958 issues** have been resolved.

Water Infrastructure and Water Security

The creation of the **Ministry of Jal Shakti in 2019** brought drinking water, sanitation and water resources under a unified framework.

Jal Jeevan Mission

- Launched in **2019**.
- At launch, only **3.23 crore rural households** had tap water connections.
- As of **June 2026**, around **15.86 crore households** received tap water connections.
- Coverage reached **81.94%**.
- The mission has been extended till **2028**.

Other Water Programmes

- **PMKSY, 2015:** Improves irrigation and water-use efficiency.
- **Namami Gange, 2014:** Supports river rejuvenation and pollution control.
- **Ken-Betwa Link Project, 2021:** India's first river interlinking project under implementation.
- **Dam Safety Act, 2021:** Strengthens dam safety and monitoring.

Housing and Household Infrastructure

Housing development has focused on affordability, dignity and access to basic services.

PMAY-Urban

- Launched in **2015**.
- **PMAY-U 2.0**, launched in **September 2024**, aims to support **one crore additional urban beneficiaries** by **2028–29**.
- Out of **125.31 lakh sanctioned houses**,

around **98.10 lakh houses** were completed by **May 2026**.

- Around **96% of houses under PMAY-U 2.0** were allotted to women.

PMAY-Gramin

- Launched in **2016**.
- Aims to provide **4.95 crore houses** to eligible rural households by **March 2029**.
- As of **June 2026**, **3.91 crore houses** were sanctioned and **3.06 crore houses** completed.
- Around **75% of beneficiaries** are women.

SWAMIH Fund

- Launched in **2019**.
- Supports stalled affordable and mid-income housing projects.
- It has delivered more than **63,000 homes**.

Energy Security and Universal Electrification

India's energy policy has focused on electricity access, renewable energy, clean cooking, transmission infrastructure and efficiency.

Power Sector

- Power shortage declined from **4.2% in 2014** to **0.03% in 2025-26**.
- Average rural electricity availability increased from **12.5 hours** to **22.6 hours per day**.
- Installed power capacity reached **532.74 GW** by **March 2026**, compared to **248 GW** in **2014**.

Renewable Energy

India became:

- **3rd largest** clean energy capacity holder globally.
- **4th largest** in installed wind energy capacity globally.

Major Schemes

- **Saubhagya, 2017:** Electrified nearly **2.86 crore households**.
- **PM Surya Ghar: Muft Bijli Yojana, 2024:** Aims to provide rooftop solar systems to **one crore households**.
- **GOBARdhan, 2018:** Converts biodegradable waste into biogas and organic manure.
- **International Solar Alliance:** Includes **125 member countries**.
- **Global Biofuels Alliance:** Expanded to **33 countries** and **14 international organisations** as of **1 June 2026**.

Clean Cooking Access and LPG Infrastructure

Clean cooking access improved through LPG infrastructure and the **Pradhan Mantri Ujjwala Yojana**.

- LPG coverage increased from **55.9% in 2014** to **107.2% in 2026**.
- LPG consumers increased from **14.51 crore** to **33.39 crore**.
- LPG consumption increased from **17.6 MMT in FY2014-15** to **34 MMT in FY2025-26**.
- PMUY refill delivery reached around **49.21 crore cylinders** during **FY2025-26**.

Digital Connectivity and Public Digital Infrastructure

Digital infrastructure has become central to governance, payments, education, healthcare and citizen services.

Telecom and Internet Growth

- Tele-density increased from **75.23% in 2014** to **86.23% in 2025**.
- Internet connections increased from **25.15 crore** to **100.29 crore**.



- Broadband connections increased from **6.1 crore** to **99.56 crore**.
- Average monthly data consumption increased from **61.66 MB** to **24.01 GB per user**.
- Around **85.5% households** own at least one smartphone.

PM-WANI and 5G

- **PM-WANI**, launched in **2020**, expanded public Wi-Fi hotspots.
- As of **June 2026**, more than **4.10 lakh Wi-Fi hotspots** are operational.
- **5G services** are available in **99.9% of districts** with about **85% population coverage**.

Digital Public Infrastructure

- Aadhaar generation increased from **63.22 crore in 2014** to more than **144 crore** by **March 2026**.
- Jan Dhan accounts increased from **14.72 crore in 2015** to **57.71 crore in 2026**.
- In **March 2026**, UPI processed around **2,264 crore transactions** worth over **₹29.53 lakh crore**.
- UPI is operational across **eight countries**.

Citizen-Centric Digital Platforms

Platform	Role
DigiLocker	Secure access to digital documents
UMANG	Single platform for government services
CSCs	Rural and urban digital service delivery
eHospital	Digital healthcare services
DIKSHA	Digital education platform
SWAYAM	Online learning and DTH education channels

Significance of Infrastructure Development

- **Economic growth:** Better infrastructure reduces logistics cost and improves productivity.
- **Regional integration:** Roads, railways, airports and waterways connect remote regions.
- **Inclusive development:** Housing, water, electricity and digital access improve quality of life.
- **Employment generation:** Infrastructure projects create direct and indirect jobs.
- **Green transition:** Electrification, renewable energy and clean transport reduce emissions.
- **Industrial growth:** Industrial parks, corridors and logistics systems attract investment.
- **Digital governance:** Public digital infrastructure improves transparency and service delivery.
- **Strategic mobility:** Border roads, tunnels and bridges support defence preparedness.
- **Ease of living:** Better transport, housing, water and digital services improve citizen convenience.

Challenges

- Land acquisition delays.
- Environmental concerns in fragile areas.
- Cost overruns and time delays.
- Coordination issues among ministries and States.
- Maintenance of large infrastructure assets.
- Financing challenges for long-term projects.
- Regional imbalance in infrastructure access.
- Digital divide and affordability issues.

- Urban congestion despite metro expansion.
- Need for skilled manpower and advanced technology.

Way Forward

- Strengthen integrated planning through **PM Gati Shakti**.
- Improve real-time project monitoring using digital platforms.
- Promote multimodal logistics and reduce logistics cost.
- Ensure sustainable infrastructure in ecologically sensitive regions.
- Expand green transport, renewable energy and clean fuel systems.
- Improve last-mile connectivity in rural, tribal and border areas.
- Strengthen public-private partnerships where suitable.
- Focus on asset maintenance and life-cycle

management.

- Link infrastructure with employment, manufacturing and exports.
- Ensure inclusive access to digital, housing, water and energy infrastructure.

Conclusion

Infrastructure is the foundation of India's journey towards **Viksit Bharat 2047**. Expansion of railways, roads, airports, ports, housing, water, energy and digital networks has improved connectivity, welfare delivery and economic competitiveness.

- The next phase must focus on **sustainability, safety, affordability, regional balance and last-mile access**. A well-planned infrastructure ecosystem can strengthen national integration, inclusive development and India's position as a modern global economy.

FCNR(B) Deposits and RBI's Special Swap Facility

Source: [Indian Express](#)

Relevance: UPSC: GS Paper III - Indian Economy, External Sector, Banking, Monetary Policy, Capital Flows, Balance of Payments.

Important Key Words

For Prelims:

- FCNR(B) Deposits, NRI Deposits, NRE Account, NRO Account, RBI Swap Facility, CRR, SLR, FBIL Reference Rate, Basis Point, Hedging Cost.

For Mains:

- Foreign Capital Inflows, External Sector Stability, Rupee Stability, NRI Savings, Banking Liquidity, Exchange Rate Management, Interest Rate Differentials, RBI Intervention.

Why in News?

The Reserve Bank of India has announced a special facility allowing banks to mobilise fresh **three- to five-year Foreign Currency Non-Resident (Bank) deposits, or FCNR(B) deposits, until September 2026**.

- The RBI has also allowed banks to swap these deposits with the central bank at a concessional rate. This means the RBI will effectively absorb the hedging **cost**, making FCNR(B) deposits a more attractive overseas funding source for Indian banks.

Experts believe the move may attract around **\$50 billion to \$70 billion** in additional foreign capital, provided banks offer competitive interest rates to Non-Resident Indians.



FCNR(B) Deposits & RBI Special Facility

Quick Revision | Economy & Banking



1. Why in News?

- RBI has allowed banks to raise fresh 3–5 year FCNR(B) deposits till September 2026.
- Banks can swap these deposits with RBI at concessional terms, reducing hedging cost.
- Experts believe the move may attract \$50–70 billion if banks offer competitive rates.



2. What is FCNR(B)?

- Foreign Currency Non-Resident (Bank) deposit.
- Opened by NRIs, OCIs and PIOs.
- Held in foreign currency, not rupees.
- Common currencies: USD, Pound, Euro, Yen, Australian Dollar, Canadian Dollar.
- Interest is tax-free in India for eligible non-residents.



3. RBI Special Dispensation

- Fresh 3–5 year FCNR(B) deposits allowed till September 2026.
- Swap facility open till October 16, 2026 for eligible deposits mobilised till September 30, 2026.
- CRR and SLR exemption available.
- Lower cost of foreign currency funding for banks.



4. Why Higher Rates May Be Needed



- US dollar deposit rates abroad are still above 4%.
- Indian FCNR(B) rates are lower.
- Banks may need to raise FCNR(B) rates by at least 100 basis points (1%).
- Without attractive returns, NRIs may keep money in foreign banks.



5. Current FCNR(B) Rates

Bank	3–4 Years	4–5 Years / Above
SBI	3.35%	2.95%–3.05%
HDFC Bank	3.65%	~3.40%
ICICI Bank	3.00%	~2.90%

Note: Normal rupee FDs for similar tenures: ~6.3%–6.5%



6. FCNR vs NRE vs NRO

FCNR(B)	Foreign currency	Keep NRI deposits in foreign currency
NRE	Indian rupee	Park foreign earnings in India
NRO	Indian rupee	Manage income earned in India



7. Swap Facility: Key Terms

- Bank can use the facility once a week.
- Eligible amount based on FCNR(B) deposits mobilised in previous week(s).
- Banks can sell US dollars to RBI in multiples of \$1 million.
- First leg at FBIL Reference Rate.
- Second leg at the same rate; swap at par.



8. Important Terms

FBIL	FBIL: Financial Benchmarks India Pvt. Ltd.; publishes benchmark interest and forex reference rates.
CRR	CRR: Cash Reserve Ratio — cash banks must keep with RBI.
SLR	SLR: Statutory Liquidity Ratio — liquid assets such as cash, gold, government securities.



9. NRI Deposit Trends in FY26

	FCNR(B) inflows fell 86%: \$7.1 bn (FY25) → \$946 mn (FY26)
	Outstanding FCNR(B): \$33.8 bn
	Total NRI inflows: \$16.16 bn → \$14.41 bn
	Total NRI deposits outstanding: \$164.68 bn → \$165.65 bn



10. Shift Towards Rupee Deposits

- NRE deposits rose by \$7.94 bn; outstanding reached \$98.56 bn.
- NRO deposits rose by \$5.53 bn; outstanding reached \$33.33 bn.



This shows NRIs preferred rupee deposits due to higher domestic interest rates.



Bottom Line: RBI support makes FCNR(B) deposits attractive for banks, but success depends on competitive interest rates and NRI confidence.

What are FCNR(B) Deposits?

- **FCNR(B)** stands for **Foreign Currency Non-Resident (Bank)** deposits.
- These are fixed-term bank deposits opened in India by:
 - **Non-Resident Indians**
 - **Overseas Citizens of India**
 - **Persons of Indian Origin**
- These deposits are maintained in foreign currencies such as:
 - US dollar
 - Pound sterling
 - Euro
 - Japanese yen
 - Australian dollar
 - Canadian dollar
- Unlike normal rupee deposits, FCNR(B) deposits are held in foreign currency.
- Interest earned on FCNR(B) deposits is exempt from income tax in India as long as the depositor qualifies as a non-resident under Indian tax laws.

RBI's Special Dispensation

- Banks can mobilise fresh **three- to five-year FCNR(B) deposits** until **September 2026**.
- Banks can swap these foreign currency deposits with the RBI at a concessional rate.
- The swap facility will remain open up to **October 16, 2026** for eligible deposits mobilised until **September 30, 2026**.
- Banks are exempted from maintaining **Cash Reserve Ratio** and **Statutory Liquidity Ratio** on these deposits.
- This reduces the cost of raising foreign currency resources for banks.

Why Higher Interest Rates May Be Needed

The RBI's support reduces hedging costs for banks, but it may not be enough to attract large NRI

inflows.

- US dollar deposit rates in major markets are still above **4%**.
- Indian banks currently offer lower rates on FCNR(B) deposits.
- Bankers believe Indian banks may need to raise FCNR(B) rates by at least **100 basis points**.
- **100 basis points = 1 percentage point**.
- Without attractive rates, NRIs may prefer to keep their deposits in foreign banks.
- Therefore, regulatory support must be combined with competitive pricing.

Current FCNR(B) Deposit Rates

FCNR(B) rates are lower than regular rupee fixed deposit rates because they are linked to foreign currency interest rate conditions.

Bank	FCNR(B) Rate for 3-4 Years	FCNR(B) Rate for 4-5 Years / Above
SBI	3.35%	2.95% to 3.05%
HDFC Bank	3.65%	Around 3.40%
ICICI Bank	3.00%	Around 2.90%

In comparison, normal rupee fixed deposits for similar tenures offer around **6.3% to 6.5%**.

Difference Between FCNR(B), NRE and NRO Accounts

Account Type	Currency	Main Purpose
Foreign Currency Non-Resident (Bank) (FCNR) Account	Foreign currency	To keep NRI deposits in foreign currency
Non-Resident External-	Indian rupee	To park foreign earnings in



(NRE) Account		India
Non-Resident Ordinary-(NRO) Account	Indian rupee	To manage income earned in India

New Swap Facility: Terms and Conditions

- A bank can use the swap facility only **once in a week**.
- The maximum amount a bank can swap will be equal to eligible FCNR(B) deposits mobilised during the previous week or weeks.
- Banks can sell US dollars to the RBI in multiples of **\$1 million**.
- Banks will simultaneously agree to buy back the same amount of dollars at the end of the swap period.
- In the first leg, banks will sell dollars to the RBI at the **FBIL Reference Rate**.
- The second leg will take place at the same rate. The swap will be undertaken **at par**.

What is FBIL?

- **FBIL** stands for **Financial Benchmarks India Private Limited**.
- It publishes benchmark interest rates and foreign exchange reference rates for Indian financial markets.
- The **FBIL Reference Rate** is used for foreign exchange-related transactions.

What are CRR and SLR?

Cash Reserve Ratio

- **CRR** is the minimum percentage of deposits banks must keep with the RBI as cash.
- Banks cannot lend this amount.

Statutory Liquidity Ratio

- **SLR** is the minimum percentage of deposits banks must maintain in liquid assets such

as:

- Cash
- Gold
- Government securities
- Exemption from CRR and SLR improves the attractiveness of FCNR(B) deposits for banks.

NRI Deposit Trends in FY26

- FCNR(B) deposit inflows fell sharply by **86%** in **FY26**.
- Inflows declined from **\$7.1 billion** in **FY25** to **\$946 million** in **FY26**.
- Outstanding FCNR(B) deposits stood at **\$33.8 billion** at the end of March.
- Total NRI deposit inflows also declined from **\$16.16 billion** in **FY25** to **\$14.41 billion** in **FY26**.
- Total NRI deposits outstanding rose slightly from **\$164.68 billion** to **\$165.65 billion**.

Shift Towards Rupee Deposits

Although FCNR(B) inflows declined, NRE and NRO deposits increased.

- NRE deposits rose by **\$7.94 billion** in **FY26**.
- NRE outstanding deposits reached **\$98.56 billion**.
- NRO deposits rose by **\$5.53 billion**.
- NRO outstanding deposits reached **\$33.33 billion**.

This shows that NRIs preferred rupee-denominated deposits because domestic interest rates were more attractive.

Significance

- Helps attract foreign currency deposits from NRIs.
- Supports foreign exchange reserves and external sector stability.
- Provides banks with overseas funding.

- Can help stabilise the rupee during external pressure.
- Reduces hedging cost for banks.
- Encourages NRI participation in India's financial system.
- Supports liquidity and credit availability in the banking system.

Challenges

- FCNR(B) rates are currently lower than overseas dollar deposit rates.
- Higher rates may be needed to attract NRI funds.
- If banks raise rates too much, their cost of funds may increase.
- Foreign currency deposits carry exchange rate and maturity management concerns.
- Inflows may remain weak if global interest rates stay high.
- NRIs may prefer NRE and NRO deposits if rupee returns remain attractive.
- The facility may provide only temporary support unless rates become competitive.

Way Forward

- Banks should offer competitive FCNR(B) rates after factoring in RBI's hedging support.

- Deposit pricing should balance depositor attraction and bank profitability.
- RBI should monitor foreign currency liquidity and exchange rate risks.
- Banks should promote FCNR(B) deposits among NRIs through transparent communication.
- India should strengthen long-term foreign capital inflows beyond temporary deposit schemes.
- External sector stability should be supported through exports, remittances, FDI and prudent debt management.

Conclusion

The RBI's special FCNR(B) deposit swap facility is aimed at encouraging NRI dollar inflows and improving foreign currency liquidity. By absorbing hedging costs and exempting banks from CRR and SLR requirements, the RBI has made these deposits more attractive for banks.

However, the success of the move depends on whether banks offer competitive interest rates. With overseas dollar deposits still giving returns above 4%, Indian banks may need to raise FCNR(B) rates meaningfully. A balanced approach is needed to attract NRI funds, support external stability and protect bank margins.

Antyodaya in Action: Ensuring Dignity, Opportunity and Growth for All

Source: [PIB](#)

Relevance: UPSC GS Paper III: Inclusive Growth, Skill Development, Financial Inclusion and Livelihoods.

Important Keywords

- **Prelims Keywords:** Antyodaya, PM-JANMAN, PVTGs, PM-JUGA, Van Dhan Vikas Kendras, PM-AJAY, SHREYAS,

SHRESHTA, PM-DAKSH, VISVAS, PM VIKAS, NAMASTE, Tribal Research Institutes.

- **Mains Keywords:** Last-Mile Delivery, Saturation Approach, Social Inclusion, Tribal Development, Livelihood Security, Human Dignity, Convergence of Schemes, Financial Inclusion, Cultural Preservation, Viksit Bharat 2047.

Why in News?

The Government highlighted the progress of major welfare programmes aimed at ensuring **dignity, opportunity and growth** for deprived and marginalised communities.

- The approach is based on **Antyodaya**, or prioritising the person at the last mile. It covers tribal communities, Particularly Vulnerable Tribal Groups, Scheduled Castes, Other Backward Classes, Economically Backward Classes, minorities, nomadic groups, sanitation workers and waste pickers.

Antyodaya as a Governance Framework

Antyodaya means the rise and welfare of the poorest and most disadvantaged person.

The approach reflects Mahatma Gandhi's idea that public policy should be judged by whether it benefits the weakest person. It seeks to move governance:

- From fragmented welfare to **convergent delivery**
- From limited coverage to **saturation**
- From symbolic inclusion to substantive equality
- From welfare dependency to skills and livelihoods
- From remote administration to last-mile service delivery

Tribal habitations, aspirational districts and remote settlements are increasingly being placed at the centre of development planning.

Tribal Communities at the Centre of Development

Tribal communities possess rich cultural traditions, indigenous knowledge and strong community institutions. However, many habitations

historically lacked:

- Roads and transport
- Housing
- Drinking water
- Electricity
- Healthcare
- Education
- Digital connectivity
- Employment opportunities

Recent interventions seek to bridge these gaps through coordinated action across ministries.

Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan

PM-JANMAN

- **PM-JANMAN** was launched in **November 2023**.
- It targets **75 Particularly Vulnerable Tribal Group communities**.
- It covers **18 States and one Union Territory**.
- It includes **11 interventions implemented by nine ministries**.
- Total budgetary outlay: **₹24,104 crore**.

Major Interventions

- Pucca housing , Road connectivity , Piped drinking water , Electrification , Mobile medical units , Anganwadi centres , Hostels , Mobile towers , Multipurpose centres Van Dhan Vikas Kendras , Vocational skilling

Van Dhan Vikas Kendras

Van Dhan Vikas Kendras support tribal communities in:

- Collection of minor forest produce , Processing and value addition , Packaging and branding , Marketing , Local employment generation , Entrepreneurship development

The training is being supported by:

- **National Institute for Entrepreneurship**

and Small Business Development

- Indian Institute of Entrepreneurship
- TRIFED

PM-JUGA/ Dharti Aaba Janjatiya Gram Utkarsh Abhiyan

The **Dharti Aaba Janjatiya Gram Utkarsh Abhiyan**, now known as **PM-JUGA**, was launched in **October 2024**.

- It brings together the efforts of **17 ministries**.
- It focuses on tribal-majority villages and PVTG habitations.
- It shifts tribal development from isolated interventions to coordinated mission-mode delivery.

Scheme / Intervention	Impact Achieved
PMAY-G	7.60 lakh houses completed in tribal villages
Jal Jeevan Mission	28,303 tribal villages saturated with drinking water access
Revamped Distribution Sector Scheme (RDSS)	59,812 households and public institutions electrified
Universal Service Obligation Fund (USOF)	3,666 tribal villages covered under connectivity initiatives
Poshan 2.0 / Anganwadi Centres	657 Anganwadi Centres operationalised
Mobile Medical Units under NHM	154 Mobile Medical Units operationalised
Samagra Shiksha	692 hostels sanctioned for tribal students
Jan Shikshan Sansthan (JSS)	30 tribal skilling centres inaugurated
Jan Shikshan Sansthan (JSS)	21,713 beneficiaries enrolled in skilling programmes
Tribal Multipurpose Marketing Centres	78 centres approved across the country
Forest Rights Act (FRA) Cells	433 FRA Cells sanctioned across 20 States
Sickle Cell Disease Centres	Centres sanctioned across 15 States

Source – Ministry of Tribal Affairs

Support to Tribal Research Institutes

Tribal Research Institutes document and preserve:

- Tribal languages ,Oral histories , Cultural traditions ,Indigenous knowledge Community practices ,Traditional medicine , Forest rights and livelihoods
- TRIs are supported across **29 States and Union Territories**.
- They undertake research, publications, archives, museums, festivals and outreach activities. Their work is also supported

through the **Tribal Research, Information, Education, Communication and Events scheme**.

- Research institutions involved include IITs, IIMs, AIIMS, TERI and the Bhasha Research Institute.

Recognising Tribal Heritage and Freedom Fighters

In the past 12 years, the Government has sanctioned 11 Tribal Freedom Fighter Museums across 10 states to honour tribal leaders who fought against colonial rule. Four museums have been inaugurated in Jharkhand, Madhya Pradesh (2 museums), and Chhattisgarh. Seven more are under construction across Mizoram, Andhra Pradesh, Telangana, Kerala, Gujarat, Goa, and Manipur.

Janjatiya Gaurav Divas is observed every year on 15 November, the birth anniversary of Bhagwan Birsa Munda. It honours not just one leader, but the entire history of tribal resistance against colonial rule that mainstream India had long overlooked. The 150th Birth Anniversary of Bhagwan Birsa Munda was observed as Janjatiya Gaurav Varsh from 15th November 2024 to 15th November 2025.

Justice and Dignity for Scheduled Castes

The Scheduled Caste development strategy combines:

- Village infrastructure , Education , Skill development, Livelihood opportunities Financial inclusion , Social dignity , Targeted budgetary support

Pradhan Mantri Anusuchit Jaati Abhyudaya Yojana

PM-AJAY



- Launched in **2021**.

- Focuses on integrated development of SC-majority villages.
- Supports infrastructure, skills and livelihoods.
- Its **Adarsh Gram component** follows an area-based approach.
- It uses convergence, village plans and gap-filling assistance.

SHREYAS

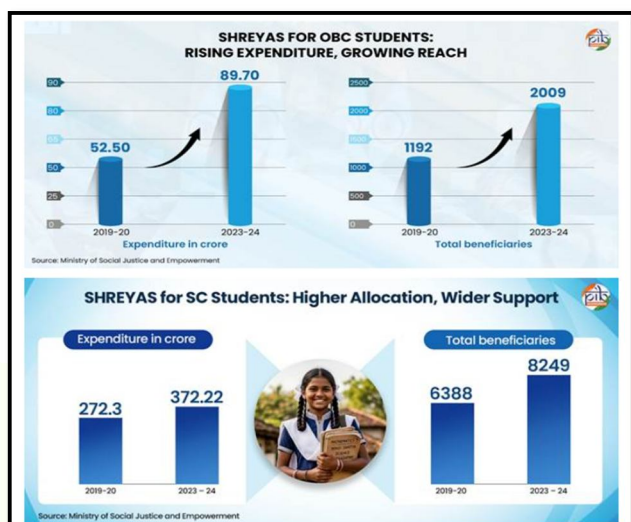
Scholarships for Higher Education for Young Achievers Scheme was launched in **February 2019**.

It supports SC, OBC and EBC students in:

- Higher education , Research , Competitive examinations , Overseas studies

Progress in 2025-26

- Top Class Education supported **4,156 SC students** in IITs, IIMs, AIIMS, NITs and other premier institutions.
- **30% of seats** were reserved for SC girls.
- Free Coaching Scheme assisted **990 students**.
- National Overseas Scholarship supported **72 students**.
- Research scholarships benefited:
 - **4,153 SC scholars**
 - **1,969 OBC scholars**



SHRESHTA

Scheme for Residential Education for Students in High Schools in Targeted Areas was launched in **June 2022**.

It supports SC students from low-income families studying in **Classes IX to XII**.

Two Modes

- **Mode I:** Admission of meritorious SC students to private residential schools through the National Entrance Test for SHRESHTA.
- **Mode II:** Support to residential schools run by voluntary organisations and institutions.

Eligible SC students with annual family income up to **₹2.5 lakh** can appear for NETS.

PM-DAKSH

Pradhan Mantri Dakshta Aur Kushalta Sampann Hitgrahi Yojana was launched in **2020-21**.

It provides free and certified skill training linked with wage employment and self-employment.

Beneficiaries

- Scheduled Castes – no income ceiling
- OBCs – family income up to **₹3 lakh**
- EBCs – family income up to **₹1 lakh**
- Denotified and Nomadic Tribes – no income ceiling
- Sanitation workers and waste pickers – no income ceiling

More than **2.08 lakh beneficiaries** have been trained.

VISVAS Yojana

Vanchit Ikai Samooch aur Vargon ko Aarthik Sahayata Yojana provides affordable credit to:

- Scheduled Castes
- Other Backward Classes
- Safai Karmacharis

The scheme offers an interest subsidy of up to **5% per annum** on eligible loans through Direct Benefit Transfer.



PM VIKAS

Pradhan Mantri Virasat Ka Samvardhan was launched in **2025** for the educational, economic and social development of minority communities.

It converges five earlier schemes:

- Seekho Aur Kamao , USTTAD ,Hamari Dharohar , Nai Roshni , Nai Manzil

Focus Areas

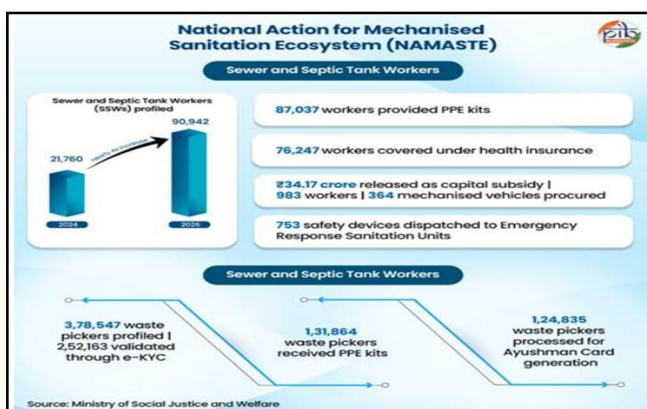
- Industry-oriented skill development , Employment , Entrepreneurship , Leadership
- Cultural preservation

Training covers areas such as:

- Airline cabin crew , Gardening and nursery management , Traditional hand embroidery , Graphic design ,Electrician work , Drone research and development Healthcare Agriculture , Media and entertainment

NAMASTE

The **National Action for Mechanised Sanitation Ecosystem** seeks to ensure safety and dignity for sewer and septic-tank workers.



Significance of the Antyodaya Approach

- Places vulnerable communities at the centre of development.
- Promotes convergence across ministries.
- Improves access to education, health, housing and infrastructure.
- Protects tribal culture and indigenous knowledge.
- Supports women-led livelihoods and SHGs.
- Promotes financial inclusion and entrepreneurship.
- Strengthens dignity and safety for sanitation workers.
- Links welfare with skills, employment and enterprise.
- Supports the goal of **Viksit Bharat @2047**.

Key Challenges

- Uneven implementation across States and districts
- Gaps in awareness and beneficiary identification
- Delays in infrastructure completion
- Shortage of trained field-level personnel
- Digital and documentation barriers
- Difficulty in reaching remote tribal habitations
- Need for better outcome monitoring
- Risk of excluding migrant, nomadic and undocumented groups
- Weak market linkages for tribal and community products
- Persistent discrimination and social exclusion

Way Forward

- Adopt saturation-based coverage in every eligible habitation.
- Strengthen Gram Sabha and community participation.
- Improve convergence between ministries

and State governments.

- Use local languages for awareness and service delivery.
- Expand market access for tribal and SHG products.
- Strengthen social audits and outcome monitoring.
- Ensure safe technology and mechanisation for sanitation workers.
- Improve scholarships, hostels and digital learning access.
- Protect tribal land, culture and intellectual traditions.
- Link welfare schemes with sustainable jobs and enterprises.

Conclusion

Antyodaya represents a shift from viewing disadvantaged communities as passive welfare recipients to recognising them as active participants in national development.

- Programmes such as **PM-JANMAN, PM-JUGA, PM-AJAY, SHREYAS, SHRESHTA, PM-DAKSH, VISVAS, PM VIKAS and NAMASTE** combine infrastructure, education, skills, credit, livelihoods and dignity. Continued progress will require transparent implementation, community participation and strong last-mile delivery so that social justice becomes a lived reality within **Viksit Bharat @2047**.

AI Boom, Memory-Chip Shortage and Inflation in India

Source: [Indian Express](#)

Relevance:

UPSC: GS Paper III - Indian Economy, Inflation, Science and Technology, Semiconductors, Supply Chains and Digital Economy.

Important Keywords

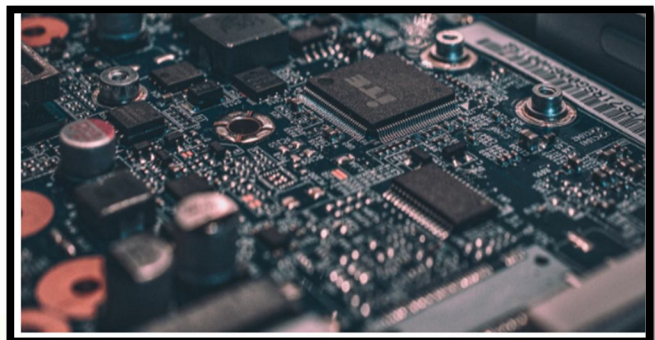
- **Prelims Keywords:** Memory Chip, DRAM, HBM, RAM, LPDDR4, Semiconductor Fabrication, CPI, Core Inflation, Bill of Materials.
- **Mains Keywords:** Technology-driven Inflation, Semiconductor Supply Chain, AI Infrastructure, Imported Inflation, Consumer Electronics, Digital Divide, Supply-Side Inflation.

Why in News?

- Prices of smartphones, laptops, TVs, refrigerators, washing machines, ACs, batteries, earphones, and storage devices are

rising due to a global shortage of memory chips.

- Semiconductor firms are prioritizing advanced High Bandwidth Memory (HBM) for AI and data centres, reducing the supply of conventional memory chips used in consumer electronics.
- Though these products account for only about 1% of India's CPI basket, their sustained price increases are contributing to higher retail and core inflation.



What are Memory Chips?

Memory chips are semiconductor components that

store data and provide quick access to information required by electronic devices.

They are used in:

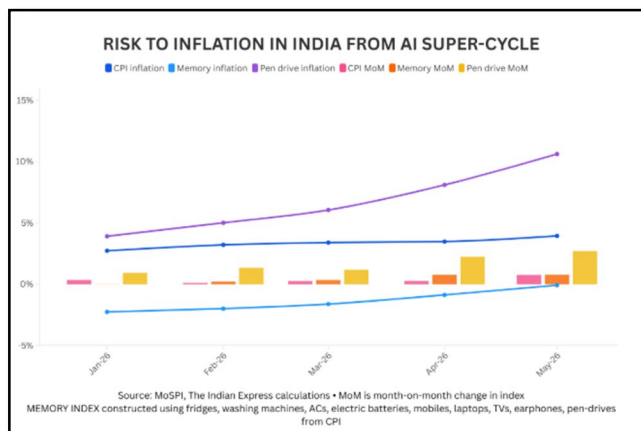
- Smartphones and laptops
- Servers and data centres
- Televisions and household appliances
- Electric batteries and medical devices
- Pen drives and hard disks
- Artificial intelligence systems

RAM

- **Random Access Memory** temporarily stores data that a processor needs immediately. It allows applications and operating systems to function quickly.

DRAM

- **Dynamic Random Access Memory** is the common working memory used in smartphones, computers and servers. It is relatively affordable and widely used.



How the AI Boom Created a Shortage

The global AI investment boom has increased demand for data centres and advanced computing systems.

Supply-chain mechanism

- **AI expansion → More data centres → Higher HBM demand → Production**

capacity shifted from conventional DRAM → Memory shortage → Higher component prices → Cost passed to consumers

- Major manufacturers such as **Samsung, SK Hynix and Micron** are increasingly allocating production capacity to advanced memory because it offers higher profit margins.
- Since semiconductor production capacity is limited, every production line or wafer used for AI-oriented memory reduces the capacity available for ordinary consumer electronics.

DRAM and HBM: Key Difference

Feature	DRAM	HBM
Full form	Dynamic Random Access Memory	High Bandwidth Memory
Main use	Phones, PCs and ordinary servers	AI processors and data centres
Structure	Conventional memory chips	Chips stacked vertically
Data transfer	Moderate	Very high
Cost	Relatively lower	Significantly higher
Demand driver	Consumer electronics	Artificial intelligence

HBM is placed close to AI processors and enables much faster data movement. It is therefore essential for training and running AI models.

Impact on Consumer Electronics

Rising memory-chip costs are affecting several consumer products:

- Smartphones
- Personal computers

- Tablets
- Smart televisions
- Refrigerators
- Washing machines
- Air conditioners
- Headphones and earphones
- Pen drives and hard disks

The price index of pen drives and hard disks increased sequentially in **15 of the previous 16 months** under the CPI series with **2023-24 as the base year**.

- Memory prices have more than tripled since **October 2025**, substantially increasing production costs.

Impact on India's Inflation

The affected electronics currently have a relatively small weight in the CPI basket. Therefore, their contribution to headline inflation remains limited.

However:

- Price increases have continued for several consecutive months.
- Monthly price increases for several appliances are approaching or exceeding **1%**.
- Pen drives and hard disks are recording monthly increases close to **3%**.
- Persistent increases can raise **core inflation**, which excludes food and fuel.
- The shortage may continue for **three to five years**, making the pressure structural rather than temporary.

The RBI expects CPI inflation to average around **5.9% in the final quarter of 2026**, close to the upper limit of its **2-6% tolerance band**.

Why Budget Devices are More Affected

Budget electronics operate with smaller profit margins. Therefore, a rise in component costs has a

greater impact on their retail price.

- Memory earlier accounted for less than **10%** of the total cost of a low-end phone.
- It has now increased to more than **40%**.
- Memory may account for around **43% of the Bill of Materials** of smartphones priced below ₹20,000.
- The total component cost of such devices may rise by as much as **25% in 2026**.

What is Bill of Materials?

- The **Bill of Materials** is the total cost of all components and materials required to manufacture a product. It generally excludes marketing, distribution and taxation costs.

Likely Industry Response

Electronics manufacturers may respond by:

- Increasing retail prices
- Reducing production of low-end models
- Lowering non-essential specifications
- Delaying new product launches
- Concentrating on premium products
- Reducing expected shipment targets

Global PC shipments are projected to decline, while smartphone sales may also contract sharply. Consumers are expected to retain devices for longer periods because replacement costs are rising.

Structural Nature of the Shortage

The shortage is not merely a temporary disruption.

- AI companies are signing multi-year supply agreements.
- Some buyers are pre-funding new semiconductor capacity.
- Cloud companies are securing long-term memory supplies.
- Conventional memory capacity is being redirected towards AI servers.



- Building new semiconductor fabrication capacity requires large investment and several years.

Analysts therefore expect demand to exceed supply for at least **three to five years**.

India-Specific Concerns

Dependence on Imports

India depends heavily on imported memory chips. Global shortages and price increases are therefore directly transmitted to domestic manufacturers.

Weak Long-Term Procurement

Some Indian electronics manufacturers have not provided chip suppliers with clear long-term demand commitments. This can reduce their priority in an extremely tight global market.

Impact on Digital Inclusion

Higher prices for affordable phones and computers may reduce access among:

- Low-income households
- Students
- Small businesses
- Rural users
- First-time digital consumers

Challenges

- Semiconductor fabrication is capital-intensive.
- Memory-chip technology is concentrated among a few global companies.
- New factories require skilled labour, reliable power and ultrapure water.
- India currently lacks a strong domestic memory-chip ecosystem.
- Rising costs may reduce demand for affordable electronics.
- Firms must balance higher component costs

with consumer price sensitivity.

- Monetary policy cannot directly remove a semiconductor supply shortage.

Way Forward

- Strengthen the **India Semiconductor Mission** and domestic chip manufacturing.
- Develop semiconductor packaging, testing and memory-related capabilities.
- Encourage Indian manufacturers to enter long-term supply agreements.
- Create strategic partnerships with major chip-producing countries.
- Support research in semiconductor design, materials and memory technology.
- Diversify sources of chip imports.
- Provide targeted support for affordable educational and digital devices.
- Promote repairability, software support and safe reuse of older devices.
- Monitor the effect of electronics prices on core inflation.

Conclusion

The global memory-chip shortage shows that the AI revolution has economy-wide consequences. Production capacity diverted towards advanced AI memory is raising the cost of ordinary electronics and gradually adding to inflation in India.

- The immediate challenge is to secure adequate memory supplies and protect affordable digital access. In the long term, India must build domestic semiconductor capabilities, strengthen strategic procurement and diversify supply chains. This is essential for price stability, digital inclusion and technological self-reliance.

Empowering India's Annadatas: Towards a Resilient and Farmer-Centric Agricultural System

Source: [PIB](#)

Relevance

UPSC GS Paper III: Agriculture, Irrigation, Farm Subsidies, MSP, Food Processing, Agricultural Marketing, Technology, Inclusive Growth and Food Security.

Important Keywords

Prelims Keywords:

- Agricultural GVA, PM-KISAN, PMFBY, MSP, Kisan Credit Card, PM-KMY, PMKSY, Soil Health Card, PM-KUSUM, e-NAM, AIF, FPO, PMFME, Digital Agriculture Mission.

Mains Keywords:

- Farmer Empowerment, Income Security, Agricultural Diversification, Institutional Credit, Risk Mitigation, Climate-Resilient Agriculture, Value Addition, Market Integration and Sustainable Farming.

Growth of Agriculture and Allied Sectors

- Agriculture and allied activities contribute around **18% of India's total Gross Value Added**.
- Agricultural and allied GVA increased from **₹20.9 lakh crore in 2014-15** to **₹48.7 lakh crore in 2023-24**.
- The sector recorded a compound annual growth rate of approximately **8.83% at current prices**.
- Crop-sector GVA increased from about **₹12.93 lakh crore** to **₹26.53 lakh crore** during the same period.
- Budget allocation for the Department of Agriculture and Farmers Welfare rose from **₹27,663 crore in 2013-14** to around **₹1.41 lakh crore for 2026-27**.

Crop Production and Food Security

- India's total foodgrain production increased from **265.05 million tonnes in 2013-14** to **357.73 million tonnes in 2024-25**, showing a substantial rise in agricultural output. This growth was driven by higher production of **rice, wheat, maize and coarse cereals**, including millets promoted as **Shree Anna**.
- The **National Food Security and Nutrition Mission** supported this expansion through improved seeds, better agronomic practices and wider adoption of technology in rice, wheat, pulses and coarse cereals.
 - India emerged as the **world's largest rice producer**, with production rising by **42.38%** since 2014-15.
 - Wheat production reached a record

Why in News?

The Government highlighted the transformation of India's agricultural sector through higher public investment, increased production, expanded credit, insurance, irrigation, market access, food processing, digital technologies and growth in allied activities.

- The policy approach has gradually shifted from limited welfare assistance towards a broader framework of **productivity, income stability, risk protection, value addition and long-term agricultural resilience**.

117.94 million tonnes in 2024–25.

- Maize production increased by nearly 79% during the same period.
- Oilseed production rose from 27.51 million tonnes in 2014–15 to a record 42.99 million tonnes in 2024–25, an increase of about 56%.
- Edible-oil import dependence declined from 63.2% in 2015–16 to 56.25% in 2023–24, indicating gradual progress towards self-reliance.
- The horticulture sector has also emerged as a major source of agricultural growth. It contributes nearly 37% of the crop sector's Gross Value Output, reflecting diversification towards high-value fruits, vegetables and other horticultural crops.

Farmer Welfare and Social Security

PM-KISAN

The Pradhan Mantri Kisan Samman Nidhi provides eligible farmer families with ₹6,000 annually through Direct Benefit Transfer. The scheme has reached more than 9.44 crore farmer families, with women receiving over 25% of the benefits.

Crop Insurance

- The Pradhan Mantri Fasal Bima Yojana provides affordable and comprehensive insurance against crop losses. It covers the entire crop cycle, including pre-sowing, standing crop and post-harvest risks.
- More than 4 crore farmers are insured annually, helping cultivators manage losses caused by natural disasters, pests and other uncertainties.

Pension Support

- The Pradhan Mantri Kisan Maan-Dhan Yojana provides eligible small and marginal farmers with a monthly pension of ₹3,000

after the age of 60. Around 24.95 lakh farmers were enrolled under the scheme by February 2026.

MSP and Public Procurement

The Minimum Support Price protects farmers against sharp falls in market prices by providing a pre-announced price for agricultural produce.

- MSP is announced annually for 22 mandated crops.
- Since 2018–19, MSP has been fixed at least 50% above the cost of production.
- Public procurement has expanded significantly.
- The total value of MSP procurement during 2014–2026 was about 3.5 times the value recorded during 2004–2014.

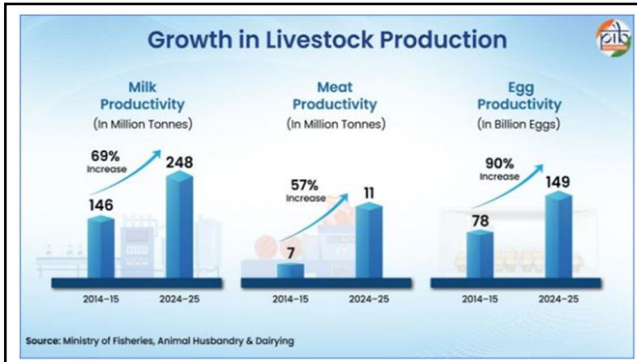
These measures have strengthened price assurance, market support and income security for farmers.

Agricultural Policy Reforms (2014-2026)



Livestock and Dairy: Drivers of Rural Economic Growth

India's livestock sector has recorded strong growth, with a **compound annual growth rate of 12.77% since 2014-15**. The sector has become an important source of rural income, nutrition and employment. India remains the **world's largest milk producer**, contributing nearly **25% of global milk production**.



- Milk production increased from **146.31 million tonnes in 2014-15** to **247.87 million tonnes in 2024-25**.
- This represents growth of more than **69%**.
- Per capita milk availability rose to **485 grams per day**, compared with the global average of **328 grams per day**.

Productivity Improvements

- Indigenous cattle productivity increased from **927 kg in 2014-15** to **1,292 kg in 2023-24**.
- Buffalo productivity increased from **1,880 kg to 2,161 kg**.
- Overall bovine productivity improved from **1,648.17 kg in 2013-14** to **2,079 kg in 2024-25**.

Poultry and Meat Production

India ranks **second in egg production** and **fourth in meat production** globally.

- Egg production increased from **78.48 billion** in 2014-15 to **149.11 billion** in 2024-25.

- Per capita egg availability rose from **62 to 106 eggs per year**.
- Meat production increased from **6.69 million tonnes** to **10.50 million tonnes**.

These trends show the growing role of livestock, dairy and poultry in diversifying farm incomes and strengthening rural livelihoods.

Fisheries and Aquaculture

India's fisheries sector has recorded an average annual growth rate of **8.74%** over the past decade.

- Total fish production increased from **9.58 million tonnes in 2013-14** to **19.78 million tonnes in 2024-25**.
- Inland fisheries and aquaculture production rose from **6.14 million tonnes** to **15.16 million tonnes**, an increase of about **147%**.

Emerging Opportunities in Beekeeping and Bio Energy

Beekeeping and Honey Production

The **National Beekeeping and Honey Mission**, launched in 2020, promotes scientific beekeeping, pollination services and rural livelihoods.

- Honey production increased from **0.081 million tonnes** to **0.152 million tonnes**.
- Honey exports rose by about **240%**.

Beekeeping provides additional income to farmers and supports crop productivity through pollination.

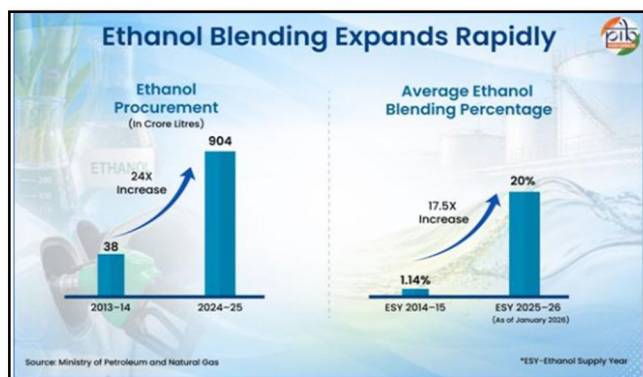
Bio-Energy and Ethanol Blending

Bio-energy has become an important part of agricultural diversification. It provides additional income to farmers while improving energy security. Ethanol is produced from sugarcane by-products and foodgrains. The **Ethanol Blended Petrol Programme** promotes its blending with petrol to reduce crude-oil imports and support domestic production.

Major Progress

- Ethanol procurement increased from **38 crore litres in 2013-14** to **904 crore litres in 2024-25**.
- The average blending level increased from **1.14% in 2014-15** to **20% in 2025-26**.
- Sugar mills earned more than **₹1.29 lakh crore** from ethanol sales.
- Investments of over **₹42,000 crore** were mobilised in the sector.

The programme supports farmer income, sugar-industry stability and India's clean-energy transition.



Agricultural and Processed Food Exports

India's agricultural and allied exports have expanded due to higher production, improved processing capacity and better access to global markets.

- Agricultural exports increased from **\$37.29 billion in 2013-14** to **\$51.1 billion in 2024-25**.
- This represents growth of nearly **37%**.

India is a major global exporter of:

- Rice
- Spices
- Marine products
- Cotton
- Sugar

Growth of Processed Food Exports

- The share of processed food in agricultural exports increased from **13.7% in 2014-15** to **20.4% in 2024-25**.
- This reflects greater value addition and improved global competitiveness.

Marine Exports

- Seafood exports increased from **\$3.64 billion in 2013-14** to around **\$7.52 billion in 2024-25**.
- This represents growth of about **106%**.
- Indian seafood now reaches more than **130 countries**.

These developments show that India's agricultural export basket is gradually moving from primary commodities towards **processed, diversified and high-value products**.

Digital Agriculture and Precision Technologies

Technology is increasingly transforming Indian agriculture by improving planning, service delivery, risk management and access to timely information. Digital platforms are helping farmers obtain accurate advisories, government benefits and market-related services.

Digital Agriculture Mission

The **Digital Agriculture Mission** aims to create an integrated digital ecosystem by linking:

- Farmer databases
- Land records
- Crop information
- Agricultural services
- Government benefit-delivery systems

These systems improve beneficiary identification, agricultural planning and transparent delivery of government support.

Namo Drone Didi

The **Namo Drone Didi initiative**, launched in 2023, promotes the use of drones in agriculture through women Self-Help Groups.

- Total outlay: **₹1,261 crore**
- Implementation period: **2023–24 to 2025–26**
- **500 drones** were distributed during 2023–24.

Women SHGs can provide drone-based agricultural services such as:

- Spraying fertilisers and pesticides
- Crop monitoring
- Precision application of inputs
- Field mapping

The initiative promotes modern farming while creating technology-based livelihood opportunities for rural women.

National Pest Surveillance System

The **National Pest Surveillance System** uses digital tools and field-level information to monitor pest attacks in real time.

Coverage

- **66 crops**
- More than **432 pest species**
- Over **10,000 field functionaries**

The system provides early warnings and crop advisories, helping farmers respond quickly to pest outbreaks and reduce crop losses.

Kisan e-Mitra

Kisan e-Mitra provides farmers with digital information on agricultural schemes, services and government programmes.

- More than **95 lakh queries** were handled by March 2026.
- The platform can process over **8,000 queries daily**.
- It is available in **11 regional languages**.

The multilingual platform improves the accessibility of agricultural information for farmers across different regions.

Agricultural Extension and Advisory Services

As agriculture becomes more technology-driven and climate-sensitive, farmer training and scientific advisory services have gained greater importance.

Extension services help farmers:

- Adopt improved farming practices
- Use new technologies
- Manage pests and diseases
- Respond to climate-related risks
- Improve productivity and resource efficiency

Krishi Vigyan Kendras

Krishi Vigyan Kendras, established by the Indian Council of Agricultural Research, serve as frontline agricultural training and knowledge centres.

- India has **731 KVKs**.

KVKs conduct:

- Farmer training programmes
- Field demonstrations
- Technology testing
- Agricultural advisories
- Skill-development activities

They connect agricultural research institutions with farmers at the field level.

Agricultural Technology Management Agency

- The **Agricultural Technology Management Agency** supports decentralised agricultural extension at the district level.
- Overall, approximately **1.27 crore farmers** were trained under ATMA between 2021 and 2025.

- ATMA strengthens district-level advisory services and promotes the adoption of locally suitable agricultural technologies.

Towards a Resilient Agricultural Ecosystem

India's agricultural policy is gradually shifting towards a more integrated, technology-driven and farmer-centric system.

This transformation is supported by:

- Higher agricultural production
- Expanded institutional credit
- Crop insurance
- Increased MSP and procurement support
- Digital agricultural infrastructure
- Improved farm-to-market linkages
- Growth of food processing
- Expansion of livestock, fisheries and other allied activities

Digital technologies and extension services are improving the connection between scientific research, government institutions and farmers.

These interventions are strengthening productivity, income stability and risk management while laying the foundation for a more **resilient, inclusive and sustainable agricultural sector**.

Measures to Empower India's Farmers

- **Income and Insurance:** Ensure timely PM-KISAN transfers and expand PMFBY coverage with faster claim settlement.
- **Institutional Credit:** Increase access to Kisan Credit Cards and affordable farm loans.
- **Infrastructure:** Develop warehouses, cold chains, processing units and farm-gate facilities.
- **Technology:** Promote Digital Agriculture, drones, Kisan e-Mitra, KVK and ATMA training.
- **Sustainability:** Expand natural farming, efficient irrigation, climate-resilient crops and solar pumps

Conclusion

Farmer empowerment requires an integrated approach combining **income support, credit, insurance, infrastructure, technology and sustainability**. The Centre must provide policy and financial support, while States and local institutions should adapt implementation to regional needs. Such coordination can improve productivity, resilience and income security.

Ashtalakshmi: The North-East at the Heart of India's Growth Story

Source: [PIB](#)

Relevance:

UPSC GS Paper II: Regional Development, Government Policies and Act East Policy.
UPSC GS Paper III: Infrastructure, Agriculture, Energy Security and Sustainable Development.

Important Keywords

- **Prelims:** Ashtalakshmi, PM-DevINE, NESIDS, Act East Policy, North Eastern

Council

- **Mains:** Connectivity-Led Growth, Strategic Integration, Inclusive Development, Green Growth, Regional Value Chains

Why in News?

The developmental transformation of India's North-Eastern Region between **2014 and 2026** has gained attention due to major improvements in

connectivity, infrastructure, clean energy, agriculture and social services.

The eight States, collectively described as **Ashtalakshmi**, are increasingly positioned as a key pillar of India's **Act East Policy** and the vision of **Viksit Bharat**.

Why is the North-East Called Ashtalakshmi?

In Indian tradition, Goddess Lakshmi has eight forms representing different sources of prosperity. Similarly, each of the eight Northeastern States possesses distinctive strengths.

The region's importance arises from its:

- Strategic location
- Cultural diversity
- Rich biodiversity
- Agricultural potential
- Forest-based resources
- Hydropower potential
- Tourism assets
- Connectivity with Southeast Asia

Together, these qualities make the North-East an important source of India's prosperity, security and regional integration.

How is the Act East Policy Integrating the Region?

The **Act East Policy** places the North-East at the centre of India's economic and strategic engagement with ASEAN countries.

Cross-Border Corridors

- **India-Myanmar-Thailand Trilateral Highway:** Connects Moreh in Manipur with Mae Sot in Thailand through Myanmar.
- **Kaladan Multi-Modal Transit Transport Project:** Links Sittwe Port with Paletwa through inland waterways and strengthens access between the North-East and

Myanmar.

These corridors seek to reduce travel time and logistics costs while improving the movement of people and goods.

Border Trade Infrastructure

- **Integrated Check Posts:** Facilities such as Moreh improve customs, immigration and cargo handling.
- **Border Haats:** Markets such as Kamalasagar and Bholaganj promote local trade, livelihoods and people-to-people relations.

Thus, the policy seeks to transform the region from a frontier into a bridge connecting India with Southeast Asia.

What Policy Architecture Supports Development?

PM-DevINE

- The **Prime Minister's Development Initiative for North East Region** is a fully centrally funded scheme supporting high-impact projects in infrastructure, livelihoods and social development.

NESIDS

The **North East Special Infrastructure Development Scheme** supports:

- Roads and bridges
- Remote-area connectivity
- Healthcare
- Education
- Power
- Water supply
- Strategic infrastructure

North Eastern Council

The **North Eastern Council** is the nodal body for the region's economic and social development. Its focus areas include:

- Bamboo and piggery-based livelihoods
- Tourism
- Healthcare
- Higher education
- Irrigation
- Flood control
- Science and technology

Special Development Packages

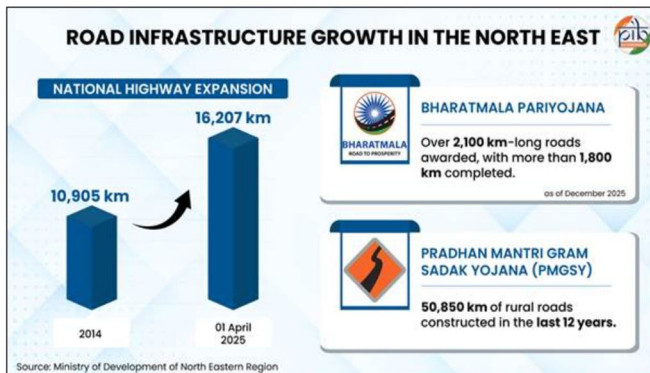
Packages for Assam and Tripura focus on employment, skills, entrepreneurship, tourism, social inclusion and peace-building.

This policy framework reflects a shift from general assistance to **mission-oriented and region-specific development**.

How Has Connectivity Reduced Regional Isolation?

Roads and Highways

Expansion of National Highways, Bharatmala corridors and rural roads under PMGSY has improved interstate mobility and last-mile access.



Railways

- Broad-gauge expansion, electrification and modern train services are integrating hill States with the national railway network.

Major Engineering Projects

- **Bogibeel Bridge:** Road-rail connectivity across the Brahmaputra.



- **Bhupen Hazarika Setu:** Permanent road connection between northern Assam and eastern Arunachal Pradesh.
- **Noney Bridge:** A major railway bridge in Manipur.
- **Sela Tunnel:** All-weather strategic connectivity on the Tezpur-Tawang route.

Air Connectivity

- The UDAN scheme has expanded airports and regional routes, reducing travel time for remote communities.

Inland Waterways

- The Brahmaputra and Barak rivers are being developed for cargo movement and river tourism through National Waterways.

Digital Connectivity

- BharatNet, mobile towers and high-speed internet services are improving access to digital governance, education and economic opportunities.

How is Green Energy Supporting Growth?

Hydropower

- Projects such as the **Dibang Multipurpose Project** and **Subansiri Lower Project** seek to harness the region's river systems for

renewable electricity and flood management.

North-East Gas Grid

- The integrated gas-pipeline network aims to connect all eight States with the national gas grid.
- A major engineering milestone is the natural-gas pipeline crossing beneath the Brahmaputra through **Horizontal Directional Drilling**.

Solar and Decentralised Energy

The region is witnessing expansion of:

- Solar parks
- Rooftop solar
- PM-KUSUM solar pumps
- Mini-grids
- Standalone energy systems
- Green-hydrogen initiatives

These measures can improve energy reliability while reducing dependence on diesel-based power.

How Have Basic Services and Human Development Improved?

Water and Sanitation

The Jal Jeevan Mission has expanded rural tap-water coverage, while all eight States have been declared Open Defecation Free.

Swachh Bharat Mission Phase II now focuses on:

- Solid and liquid waste management
- Plastic-waste management
- Faecal-sludge treatment
- ODF Plus villages

Women's self-help groups are also participating in village-level waste management.

Healthcare

Major improvements include:

- AIIMS Guwahati
- New medical colleges
- Ayushman Bharat coverage
- Health and Wellness Centres
- eSanjeevani telemedicine
- Jan Aushadhi Kendras

These initiatives have improved access to specialised, primary and affordable healthcare.

Education and Skills

- The expansion of universities, colleges, technical institutes, Eklavya Model Residential Schools and Atal Tinkering Labs is strengthening education and innovation.
- Apprenticeship and skill-development programmes are also improving employability.

Housing and Electricity

- PMAY has expanded pucca housing in rural and urban areas. Beneficiaries are linked with toilets, tap water, LPG and electricity.
- All eight States have achieved household electrification under Saubhagya.

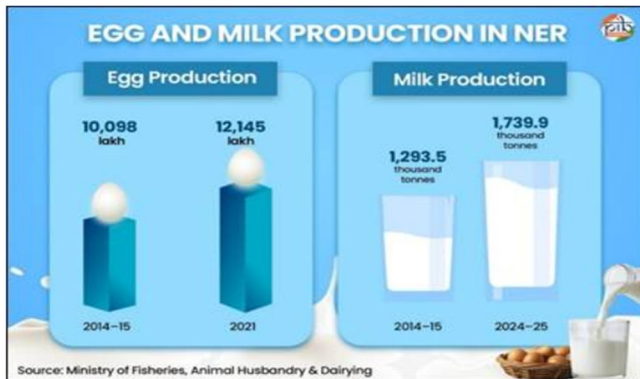
How are Agriculture and Rural Livelihoods Diversifying?

Fisheries

- Inland fisheries have recorded strong growth, led by Assam. Support includes Kisan Credit Cards, Fish Farmer Producer Organisations and ornamental fisheries.

Dairy and Livestock

- The establishment of the region's first cattle IVF laboratory in Guwahati supports improved livestock genetics and dairy productivity.



Agarwood Economy

- The North-East contains most of India's agarwood trees. Tripura has significant potential for agarwood cultivation, processing and exports.

Organic Farming

The Mission Organic Value Chain Development for North Eastern Region promotes:

- Organic cultivation
- Farmer Producer Organisations
- Processing
- Collective marketing
- Market linkages

Forest-Based Livelihoods

- The Van Dhan Vikas Yojana supports tribal gatherers and self-help groups engaged in forest produce.

GI Tags and Value Addition

Products such as:

- Queen Pineapple
- Lakadong Turmeric
- King Chilli
- Large Cardamom

reflect the region's unique agro-biodiversity and export potential.

NERAMAC supports FPOs, product marketing, skill development and cold-storage infrastructure.

What Challenges Remain?

- Difficult terrain and high logistics costs
- Delays in cross-border projects
- Uneven development among States
- Ecological fragility and disaster vulnerability
- Limited processing and market access
- Need for maintenance of new infrastructure
- Shortage of skilled employment
- Border-security concerns
- Need to protect local communities and biodiversity
- Balancing large energy projects with environmental sustainability

Way Forward

Complete Multimodal Connectivity

- Road, rail, air, waterway and digital networks should be integrated to reduce logistics costs.

Accelerate Cross-Border Projects

- The Trilateral Highway, Kaladan project, Integrated Check Posts and Border Haats require timely completion.

Promote State-Specific Value Chains

- Agricultural and cultural strengths should be developed through processing, branding and export-oriented marketing.

Strengthen Human Capital

- Healthcare, higher education, technical training and apprenticeships must support future growth.

Ensure Ecological Balance

- Infrastructure and energy projects should respect forests, river systems, biodiversity and local communities.

Empower Local Institutions

- Women's SHGs, tribal communities, FPOs and local bodies should participate in planning and implementation.

Improve Last-Mile Delivery

- Infrastructure creation must be supported by reliable services, maintenance and institutional accountability.

Conclusion

The transformation of the North-East reflects a shift from geographical isolation and a security-centred

approach towards **connectivity, strategic integration and inclusive development.**

- Targeted schemes, multimodal infrastructure, clean energy and livelihood diversification have positioned Ashtalakshmi as an important growth region and India's gateway to Southeast Asia. Sustaining this progress will require ecological sensitivity, stronger local enterprise and effective last-mile implementation.

Digital Agriculture in India: Promise, Exclusion and the Path to Inclusive Transformation

Source: [The Hindu](#)

Relevance

GS Paper III: Agriculture, Artificial Intelligence, Digital Infrastructure, Financial Inclusion and Rural Development

Important Keywords

Prelims Keywords

- Digital Agriculture Mission, AgriStack, Farmer ID, Crop Sown Registry, Krishi-DSS, Bharat-VISTAAR, National Pest Surveillance System, e-NAM, SATHI Portal, Digital Bharat Nidhi

Mains Keywords

- Digital divide, precision agriculture, farmer-centric digital ecosystem, data sovereignty, tenant farmer exclusion, phygital divide, digital literacy, interoperability, technology democratisation, inclusive agricultural transformation

Why in News?

The launch of **Bharat-VISTAAR**, an AI-enabled farm advisory platform, has renewed focus on India's digital agriculture push. While the ₹2,817-

crore Digital Agriculture Mission promotes AgriStack, AI tools and digital crop surveys, poor rural broadband, unequal smartphone access and low digital literacy may exclude many farmers and deepen existing inequalities.



What is Digital Agriculture?

Digital agriculture refers to the use of data, digital platforms and advanced technologies across the agricultural value chain.

It includes:

- Artificial Intelligence-based farm advisories
- Satellite and geospatial monitoring
- Internet of Things-based sensors
- Smart irrigation systems
- Drones and agricultural robots

- Digital crop and land records
- Online agricultural markets
- Automated pest surveillance
- Digital credit and insurance systems
- Seed and input traceability

Its purpose is to improve productivity, reduce input costs, conserve resources, enhance market access and make agricultural services more transparent.

Key Benefits of Digital Agriculture

1. Universal Farmer Identity and Easier Credit

The **AgriStack** framework seeks to create an integrated agricultural Digital Public Infrastructure.

Its principal components include:

- Farmers' Registry
- Geo-referenced village maps
- Crop Sown Registry

The Farmer ID can serve as a common digital credential for accessing:

- PM-KISAN benefits
- Kisan Credit Cards
- Minimum Support Price procurement
- Crop insurance
- Disaster compensation

By linking land, crop and beneficiary records, digital platforms can reduce paperwork, leakages and dependence on intermediaries.

However, such systems must recognise actual cultivators and not merely legal landowners.

2. AI-Based Precision Farming

AI platforms can combine:

- Satellite images
- Weather forecasts
- Soil data
- Field sensors
- Historical crop information

These platforms can provide plot-specific recommendations on:

- Crop selection
- Sowing time
- Irrigation schedule
- Fertiliser use
- Pest control
- Harvest planning

Such advisories can reduce resource wastage and increase productivity. Localised AI-based farming systems have demonstrated the potential to improve yields while conserving water.

3. Real-Time Pest Surveillance

- Digital image recognition enables farmers and extension workers to upload photographs of affected crops and obtain rapid pest diagnosis.
- The **National Pest Surveillance System** uses machine-learning models to support more than 65 crops and over 400 pest categories.

Real-time warnings can:

- Prevent large-scale crop losses
- Reduce indiscriminate pesticide use
- Improve the timing of interventions
- Support localised pest management

4. Scientific Use of Fertilisers

- Digital soil maps and automated soil analysis can help farmers apply nutrients according to the specific needs of a field.
- The government's **Soil Fertility Maps** provide spatial information on soil nutrient status.

This supports:

- Balanced fertiliser use
- Reduced chemical overuse
- Lower production costs
- Improved soil health
- Better long-term productivity

5. Democratisation of Farm Mechanisation

- Small and marginal farmers often cannot purchase drones, sensors or advanced machinery.
- Digital platforms linked with **Custom Hiring Centres** can enable farmers to rent equipment on a pay-per-use basis.
- The **Namo Drone Didi Scheme** seeks to provide drones to selected women self-help groups for offering agricultural rental services.

This can:

- Extend precision spraying to small farms
- Reduce labour costs
- Generate rural service employment
- Promote women-led agricultural enterprises

6. Transparent Agricultural Markets

The **National Agriculture Market**, or e-NAM, connects physical agricultural markets through an electronic trading platform.

Digital markets can improve:

- Price discovery
- Inter-mandi bidding
- Online settlements
- Market information
- Competition among buyers

Farmers can compare prices across markets and reduce dependence on local cartels and commission agents. However, benefits depend on access to storage, assaying, logistics and digital skills.

7. Seed Traceability and Quality Control

The **SATHI portal**—Seed Authentication, Traceability and Holistic Inventory—seeks to create a unified seed traceability system.

Through QR-based verification, farmers can check:

- Seed origin
- Certification
- Quality standards

- Production and distribution chain

This reduces the risk of purchasing counterfeit or poor-quality seeds.

8. Faster Disaster Relief and Insurance

Digital Crop Surveys, satellite imagery and geo-tagged crop-cutting experiments can improve damage assessment.

The **Digital General Crop Estimation Survey** digitises crop-cutting experiments and provides more reliable yield information.

Digital systems can help governments and insurers:

- Assess crop losses quickly
- Reduce field-level delays
- Transfer compensation directly
- Improve insurance settlement accuracy
- Strengthen climate-risk protection

Major Government Initiatives

Digital Agriculture Mission

The Digital Agriculture Mission serves as the umbrella framework for technology-based agricultural services.

AgriStack

It includes three core registries:

- **Farmers' Registry:** Provides a unique digital identity to farmers.
- **Geo-referenced Village Maps:** Digitally map agricultural land parcels.
- **Crop Sown Registry:** Records seasonal crop cultivation through Digital Crop Surveys.

Krishi Decision Support System

Krishi-DSS integrates:

- Satellite data
- Weather information
- Reservoir levels
- Soil conditions
- Groundwater trends
- Crop information



It provides a common geospatial platform for agricultural planning and policy decisions.

AI-Based Advisory Platforms

Bharat-VISTAAR

- It is an AI-powered agricultural helpdesk intended to provide farm-related information in multiple Indian languages.

Agri Param

- It is a domain-specific agricultural language model designed to convert complex agricultural data into localised advice.

Kisan e-Mitra

- It is a voice-based AI chatbot that answers questions regarding agricultural schemes in regional languages.
- These platforms can improve last-mile advisory delivery, particularly when designed for voice-based use.

Production and Market Platforms

Other major initiatives include:

- **National Pest Surveillance System:** AI-based pest detection and warning.
- **e-NAM:** National electronic agricultural market.
- **DGCES:** Digital crop-yield estimation.
- **SATHI:** Seed traceability.
- **SMAM:** Support for agricultural mechanisation and Custom Hiring Centres.
- **Namo Drone Didi:** Drone-based agricultural services through women SHGs.

Barriers to Digital Agriculture

1. Fragmented Landholdings

- Around 86% of Indian cultivators are small and marginal farmers.
- Small, scattered plots make high-cost technologies such as drones, GPS-guided

tractors and sensor networks difficult to use independently.

- Digital agriculture must therefore rely on shared-service and cooperative models.

2. Exclusion of Tenant Farmers

Many digital systems depend on land titles for identifying beneficiaries.

Tenant farmers and sharecroppers often lack:

- Registered leases
- Formal tenancy documents
- Land ownership records
- As a result, they may be excluded from Farmer IDs, institutional credit, insurance and agricultural subsidies. A landowner-centric digital system can reproduce and deepen existing inequalities.

3. High Cost of Technology

- Drones, soil sensors, automated irrigation systems and weather stations require significant capital. Returns from these investments may take several crop seasons to materialise. Private investment also tends to concentrate in digital marketplaces rather than in affordable farm-level hardware.

4. Rural Infrastructure Deficit

- Precision agriculture requires reliable electricity, broadband connectivity and uninterrupted data transmission. Yet only about **8% of rural households** reportedly have broadband connections, with most relying on mobile internet. Connectivity gaps are especially serious in remote and rain-fed agricultural regions.

5. Digital Literacy Gap

Digital access does not necessarily mean digital capability.

Survey findings indicate that:



- Around 39% of rural adults cannot use the internet for meaningful informational activities.
- Only 40% of smartphone-owning rural adults can undertake online transactions.
- Smartphone and internet access is lower among rural women, Scheduled Castes and Scheduled Tribes.

Without digital literacy, farmers may remain dependent on intermediaries even within supposedly direct digital systems.

6. Language and Accessibility Barriers

Many applications are initially developed in English or standard Hindi.

Farmers require:

- Regional-language interfaces
- Voice-based platforms
- Simple navigation
- Assisted access
- Offline functionality

Technology designed without local linguistic and cultural contexts may remain unused.

7. Fragmented Agricultural Data

Agricultural data is spread across multiple institutions:

- Weather data with the IMD
- Soil information with specialised and State agencies
- Insurance data under PMFBY
- Market data in APMC systems
- Land records with State governments

Lack of standardisation and interoperability weakens AI-based prediction and advisory systems.

8. Data Privacy and Federal Concerns

AgriStack involves collection of detailed information on farmers, land, crops and transactions.

Major concerns include:

- Unclear ownership of agricultural data
- Sharing of farmer data with private companies
- Inadequate informed consent
- Algorithmic profiling
- Predatory pricing
- Centre-State disagreements over data governance

Farmer data should not become a commercial asset without consent, accountability and benefit-sharing.

How Can Digital Agriculture Be Made Inclusive?

Strengthen Rural Connectivity

- Unused resources under **Digital Bharat Nidhi** should be deployed to expand broadband and fibre connectivity in remote agricultural areas. Rural internet must be treated as essential infrastructure, similar to roads, irrigation and electricity.

Recognise Actual Cultivators

Digital registries should include:

- Tenant farmers
- Sharecroppers
- Women cultivators
- Forest-dependent communities
- Oral lessees

Alternative verification methods should supplement formal land ownership records.

Convert KVKs into Digital Demonstration Centres

Krishi Vigyan Kendras can function as practical agri-technology hubs where farmers can directly experience:

- Drones
- Soil sensors



- Smart irrigation
- Digital marketplaces
- AI advisory systems
- Variable-rate fertiliser application

Demonstration and assisted use can build confidence and trust.

Promote Shared Technology Models

- Farmer Producer Organisations and Custom Hiring Centres should provide costly technologies through rental and pay-per-use arrangements. This can make advanced equipment accessible to smallholders without requiring individual ownership.

Train Digital Krishi Entrepreneurs

Rural youth can be trained as local technology service providers.

They can offer:

- Digital registration support
- Soil testing
- Drone spraying
- Crop imaging
- Advisory interpretation
- Cybersecurity assistance

This can create rural employment while solving last-mile implementation problems.

Establish Farmer Data Cooperatives

Farmer Producer Organisations can manage agricultural data collectively.

Data cooperatives can:

- Anonymise farm data
- Negotiate with agritech firms
- Protect farmer privacy
- Ensure benefit-sharing
- Generate community income

Farmers should have control over how their data is used.

Improve Interoperability and Data Governance

India needs common standards for agricultural databases and secure data exchange.

Digital systems should follow principles of:

- Informed consent
- Purpose limitation
- Data minimisation
- Transparency
- Accountability
- Farmer control

Combine Digital and Human Extension

Digital tools should supplement rather than replace agricultural extension workers.

The most effective model is likely to be **phygital** – combining digital platforms with local human assistance.

Conclusion

Digital agriculture can improve farm productivity, resource efficiency, market access, credit delivery and climate resilience. However, a technology-led transformation that depends on land ownership, expensive devices and advanced digital skills may exclude tenant farmers, women, smallholders and disadvantaged social groups. India must therefore move beyond merely creating platforms. It must build reliable rural connectivity, improve digital literacy, recognise actual cultivators, protect farmer data and promote shared access to technology. Digital agriculture will succeed only when it becomes **farmer-centric, inclusive, multilingual, affordable and accountable**.

Environment & Ecology, DM

India's Green Hydrogen Roadmap

Source: [The Hindu Business Line](#)

Relevance

GS Paper III - Energy Security, Industrial Growth, Environment, Climate Change, Infrastructure and Technology.

Important Keywords

Prelims Keywords:

- Green Hydrogen, Electrolyser, National Green Hydrogen Mission, SIGHT Scheme, Green Ammonia, SECI, Fuel Cell Electric Vehicles, Green Hydrogen Hubs, Renewable Energy.

Mains Keywords:

- Energy Security, Industrial Decarbonisation, Hard-to-Abate Sectors, Fossil Fuel Import Dependence, Green Premium, Delivered Cost, Modular Electrolysers, Hydrogen Economy

Why in News?

India's dependence on imported fossil fuels has renewed focus on long-term **energy security**. The deeper challenge is in industries such as **fertilisers, refineries, steel, ammonia and petrochemicals**, where fossil fuels are part of the production process. The **National Green Hydrogen Mission** should not focus only on production capacity. It must also make green hydrogen **commercially viable for industries** by reducing its **delivered cost**

and creating stable demand.



What is Green Hydrogen?

Green hydrogen is hydrogen produced by splitting water through **electrolysis** using renewable energy such as solar, wind or hydropower.

In this process:

- Water is split into **hydrogen and oxygen**.
- An **electrolyser** uses electricity for this process.
- If the electricity comes from renewable energy, the hydrogen is called **green hydrogen**.
- It produces almost no greenhouse gas emissions during production.

National Green Hydrogen Mission

Nodal Ministry

- Ministry of New and Renewable Energy

Objective

- Decarbonise energy, industry and mobility sectors
- Develop indigenous manufacturing capacity
- Create export opportunities for green hydrogen and its derivatives

Components

- Strategic Interventions for Green Hydrogen Transition Programme (SIGHT)
- Strategic Hydrogen Innovation Partnership (SHIP) for R&D

Expected Outcomes by 2030

- At least 5 MMT green hydrogen production per year
- Nearly ₹1 lakh crore fossil fuel import savings
- Around 6 lakh jobs
- About 50 MMT CO₂ emissions avoided annually
- More than ₹8 lakh crore investment

Types of Hydrogen

Type	Production Method	Energy Source	Carbon Footprint
Green Hydrogen	Electrolysis	Renewable energy	Nearly zero
Grey Hydrogen	Steam Methane Reforming	Natural gas	High
Blue Hydrogen	SMR with Carbon Capture	Natural gas	Lower than grey
Brown Hydrogen	Gasification	Coal	Very high

Green hydrogen is the cleanest form because it uses renewable energy.

Why Green Hydrogen is Important for India

India imports large quantities of fossil fuels. These imports affect energy security, foreign exchange reserves and industrial competitiveness.

Green hydrogen can help India:

- Reduce dependence on imported natural gas and oil.
- Decarbonise industries where direct electrification is difficult.
- Support India's Net Zero 2070 target.
- Build a new clean energy manufacturing ecosystem.
- Create high-skilled green jobs.
- Strengthen domestic technology and energy sovereignty.

Major Applications of Green Hydrogen

1. Steel Industry

- Steel is one of the most carbon-intensive sectors. Traditionally, coking coal is used to remove oxygen from iron ore.
- Green hydrogen can replace coking coal in the Direct Reduced Iron process. This can reduce emissions because the main by-product is water vapour.
- The Ministry of Steel has been allocated ₹455 crore for pilot projects using green hydrogen in the steel sector till FY 2029-30.

2. Fertiliser Sector

- India is the second-largest consumer and third-largest producer of fertilisers globally.
- Fertiliser production needs ammonia, and ammonia production depends heavily on hydrogen. At present, much of this

hydrogen comes from natural gas.

- Green hydrogen can be used to produce **green ammonia**, reducing natural gas imports. SECI has signed **10-year contracts** to supply **7,24,000 tonnes of green ammonia annually** to 13 fertiliser plants. This is expected to save around **\$2.5 billion** in foreign exchange over a decade.

3. Refineries and Petrochemicals

- Refineries use hydrogen for processes such as removing sulphur from fuels and upgrading crude oil.
- At present, most refinery hydrogen is **grey hydrogen**, produced from natural gas. Replacing it with green hydrogen can reduce direct industrial emissions.
- SECI is also supporting refinery-linked green hydrogen projects of around **30,000 tonnes per annum**.

4. Shipping and Ports

- Green hydrogen and its derivatives such as **green ammonia** and **green methanol** can be used as clean shipping fuels.

India has identified major ports such as:

- **Deendayal Port, Kandla**
- **V.O. Chidambaranar Port, Tuticorin**
- **Paradip Port, Odisha**

as Green Hydrogen Hubs. These hubs can support clean bunkering, storage and distribution.

5. Heavy-Duty Transport

- Battery electric vehicles are suitable for small vehicles, but heavy trucks and buses need longer range and faster refuelling.

Hydrogen fuel cells can help in:

- Long-distance buses
- Heavy trucks
- Industrial transport
- Difficult terrain routes

Under NGHM, pilot projects have been sanctioned for **37 hydrogen-fuelled buses and trucks** across 10 routes, supported by **9 hydrogen refuelling stations**.

6. Grid Balancing and Energy Storage

- Solar and wind power are intermittent. Green hydrogen can store surplus renewable electricity.
- During high renewable generation, extra electricity can produce hydrogen. Later, this hydrogen can be converted back into electricity when demand rises.

NTPC is developing a major green hydrogen hub at **Pudimadaka, Andhra Pradesh**, which can support large-scale renewable energy storage.

Key Issue: Delivered Cost Matters More Than Production Cost

- One of the most important arguments in the recent debate is that India must focus on the **delivered cost** of hydrogen, not only its production cost.

Even if hydrogen is produced cheaply, it may become expensive after adding:

- Transport cost
- Storage cost
- Purification cost
- Conversion losses
- Safety infrastructure cost
- Distribution cost

In advanced hydrogen markets, midstream and end-use infrastructure can account for **70-85%** of the final delivered cost. Therefore, India should not depend only on large coastal hubs and long-distance supply chains.

Need for Modular Electrolysers

Many small and medium industries need hydrogen in modest quantities near their production units.

For them, getting hydrogen from distant hubs may be costly.

Therefore, India should promote:

- Modular electrolyzers
- On-site hydrogen production
- Near-site hydrogen production
- Small-scale hydrogen systems for MSMEs
- Application-specific hydrogen engineering

A special SME window for **10 kW to 2 MW electrolyser stacks** can help small industries adopt green hydrogen without depending only on large centralised hubs.

Key Challenges

1. High Cost

- Green hydrogen is still costlier than grey hydrogen. As of 2026, green hydrogen costs around **₹397–₹560 per kg**, while grey hydrogen generally costs around **₹150–₹200 per kg**.

2. Green Premium

- Industries may not shift to green hydrogen voluntarily unless the cost gap is reduced through incentives, carbon pricing or purchase obligations.

3. High Capital Requirement

- Electrolyzers require advanced technology, high-precision manufacturing and costly materials.

4. Import Dependence

- India still depends on imported components such as specialised membranes, catalysts and electrolyser stacks.

5. Water Requirement

- Producing 1 kg of hydrogen through electrolysis needs around **9–11 litres of**

high-purity water. This can be a concern in water-stressed industrial regions.

6. Storage and Transport

- Hydrogen is difficult to store and transport because it is highly flammable and can weaken steel pipelines.

7. Weak Safety Standards

- India needs stronger safety rules for hydrogen production, storage, transport, refuelling and industrial use.

8. Global Competition

- Countries such as Australia, Chile and West Asian nations are also investing heavily in green hydrogen.

9. Limited R&D

- India's low R&D spending slows down innovation in hydrogen storage, transport, electrolyzers and industrial applications.

Measures Needed

1. Create Stable Industrial Demand

- The government should convert existing grey hydrogen and ammonia demand into long-term green hydrogen demand. Fertilisers and refineries should be the first priority because they already use hydrogen at scale.

2. Expand SIGHT Incentives

- The **Strategic Interventions for Green Hydrogen Transition** scheme should support both large projects and small modular electrolyzers.

3. Develop Hydrogen Valleys

- Hydrogen production and consumption should be located close to each other in

industrial clusters. This reduces transport, storage and purification costs.

4. Introduce Green Hydrogen Purchase Obligations

- Like Renewable Purchase Obligations, India can introduce **Green Hydrogen Purchase Obligations** for sectors such as fertilisers and refineries.

5. Improve Renewable Power Supply

- Electrolysers need renewable electricity that is cheap, reliable and dispatchable. India must improve transmission, storage and open access to renewable power.

6. Promote Indigenous Manufacturing

- India should support domestic production of electrolysers, PEM stacks, catalysts and other components through PLI, R&D support and public-private partnerships.

7. Build Hydrogen Infrastructure

- India needs hydrogen-ready pipelines, storage facilities, refuelling stations and port infrastructure.

8. Strengthen Safety Protocols

- A national hydrogen safety framework is needed for production, storage, transport and use.

9. Skill Development

- India must create trained engineers, technicians and safety professionals for the hydrogen economy.

10. Link with Carbon Market

- The Indian Carbon Market can make green hydrogen more attractive by increasing the cost of carbon-intensive alternatives.

Way Forward

India's green hydrogen strategy must shift from only capacity creation to market creation.

The next phase should focus on:

- Reducing delivered cost.
- Creating bankable demand.
- Supporting modular electrolysers for MSMEs.
- Locating production near industrial demand.
- Making renewable power reliable and affordable.
- Building hydrogen safety and transport infrastructure.
- Promoting domestic R&D and manufacturing.

This will make green hydrogen usable not only in large public-sector projects but also in ordinary industrial settings.

Conclusion

Green hydrogen is not merely an energy project. It is a major industrial transformation strategy for India.

- To make it viable, India must reduce delivered cost, create long-term demand, promote modular electrolysers, reform the power sector and build domestic manufacturing capacity. If implemented well, green hydrogen can reduce fossil fuel dependence, strengthen energy security, support industrial decarbonisation and help India move towards **Net Zero 2070**.

Great Nicobar task: Pursuing national security with ecological responsibility

Source: [Indian Express](#)

Relevance: UPSC GS Paper III: Environment, biodiversity, infrastructure, disaster management, maritime security

Important Key Words

For Prelims

- Great Nicobar Island, Andaman and Nicobar Islands, Galathea Bay, Six Degree Channel, Malacca Strait, International Container Transshipment Terminal, PVTG, Shompen, Nicobarese, Giant Leatherback Turtle, EIA, NGT, Indo-Pacific, Blue Economy, Diego Garcia, Act East Policy.

For Mains

- Maritime security, ecological responsibility, national security, tribal rights, environmental clearance, India's maritime strategy, Indo-Pacific geopolitics, blue economy, sustainable infrastructure, strategic chokepoints.

Why in News?

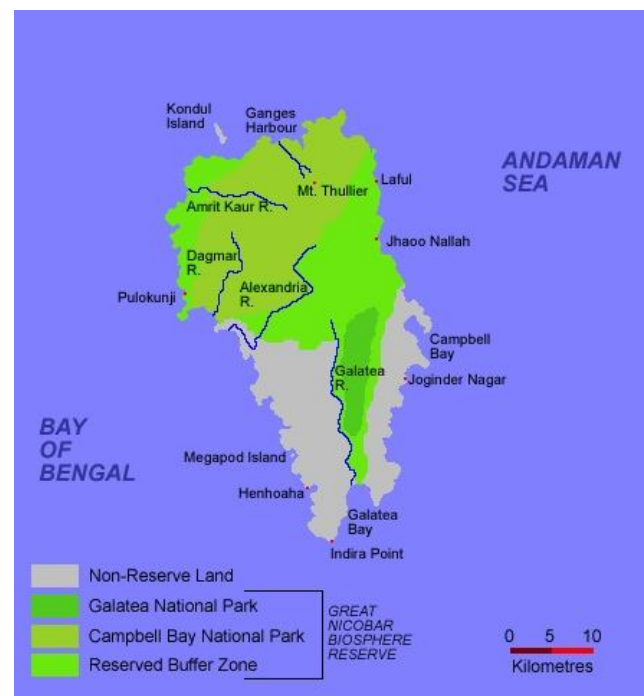
The **Great Nicobar Project** has again come into focus after a debate on how India should balance **national security, maritime development and ecological responsibility**.

- The issue became important because Great Nicobar is located close to some of the world's most important sea routes in the **Indo-Pacific region**. The project is being projected as a major step to strengthen India's presence in the **Andaman Sea, Malacca Strait region and wider Indian Ocean Region**.

- At the same time, concerns have been raised regarding **deforestation, tribal rights, biodiversity loss, environmental clearance and disaster vulnerability**.

Background: Why Great Nicobar Matters

Great Nicobar is the southernmost and one of the



largest islands in the **Andaman and Nicobar archipelago**. It is located close to the **Malacca Strait**, one of the busiest maritime chokepoints in the world.

The island lies near important shipping routes connecting:

- West Asia
- Africa
- South Asia
- Southeast Asia
- East Asia
- Europe

GREAT NICOBAR PROJECT AND INDIA'S MARITIME ASPIRATIONS

Pursuing National Security with Ecological Responsibility

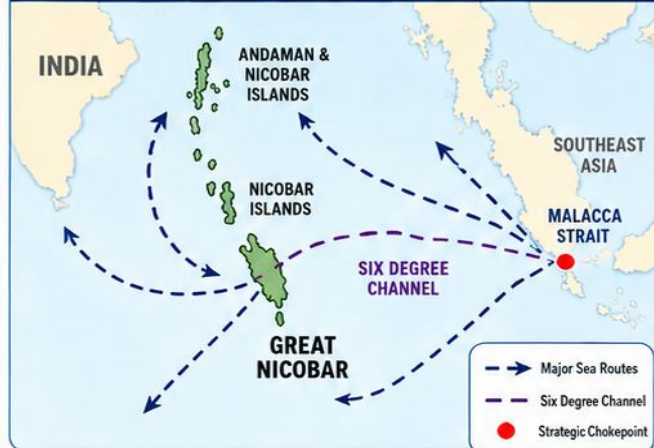
1. Why in News?

- Debate on security vs ecology
- Great Nicobar seen as strategic Indo-Pacific hub
- Concerns: forests, tribes, biodiversity, disaster risks

2. Background: Why Great Nicobar Matters

- Southernmost large island in A&N
- Near Malacca Strait and Six Degree Channel
- Key route linking Asia, Africa and Europe
- Strategic maritime location for India

STRATEGIC MARITIME LOCATION



4. Strategic Significance

- Near major sea lanes
- India's maritime watchtower
- Helps monitor shipping and naval activity
- Counters extra-regional influence
- Strengthens Andaman and Nicobar Command

5. Economic Significance

- Reduces dependence on Colombo/Singapore/Port Klang
- Supports Blue Economy
- Improves logistics and supply chains
- Links with Act East Policy

3. What is the Great Nicobar Project?



6. Environmental Concerns

- Forest diversion and deforestation
- Threat to Giant Leatherback Turtle
- Risk to coral reefs, seagrass and mangroves
- Fragile island ecosystem

7. Tribal and Social Concerns

- Shompen PVTG may face habitat and cultural risks
- Nicobarese community concerns
- Need protection of rights and autonomy

8. Disaster Vulnerability

- Earthquake-prone region
- Tsunami risk
- Coastal subsidence and sea-level rise
- Need disaster-resilient planning

9. Legal and Institutional Angle

- Clearances granted but challenged
- NGT noted strategic significance
- Strict environmental compliance needed

10. Arguments in Support

- Strategic foresight
- Maritime security
- Economic independence
- Regional development
- Larger Indo-Pacific role

11. Arguments Against

- Ecological fragility
- Tribal vulnerability
- Disaster risks
- Inadequate environmental assessment concerns
- Development vs sustainability debate

12. The Central Debate



13. Way Forward

- Ecological safeguards
- Tribal protection and no-go zones
- Continuous environmental monitoring
- Disaster-resilient infrastructure
- Green port model
- Balanced strategic development

14. Conclusion

★ **GREAT NICOBAR CAN BE INDIA'S WATCHTOWER IN THE INDO-PACIFIC.** ★

DEVELOPMENT MUST BE WISE, RESPONSIBLE AND SUSTAINABLE.

This means ships carrying oil, gas, containers and other goods pass close to this region.

- In simple words, Great Nicobar is not just a remote island. It is a **strategic maritime location** that can help India monitor and influence important sea routes.

What is the Great Nicobar Project?

The Great Nicobar Project is a proposed mega infrastructure and strategic development project.

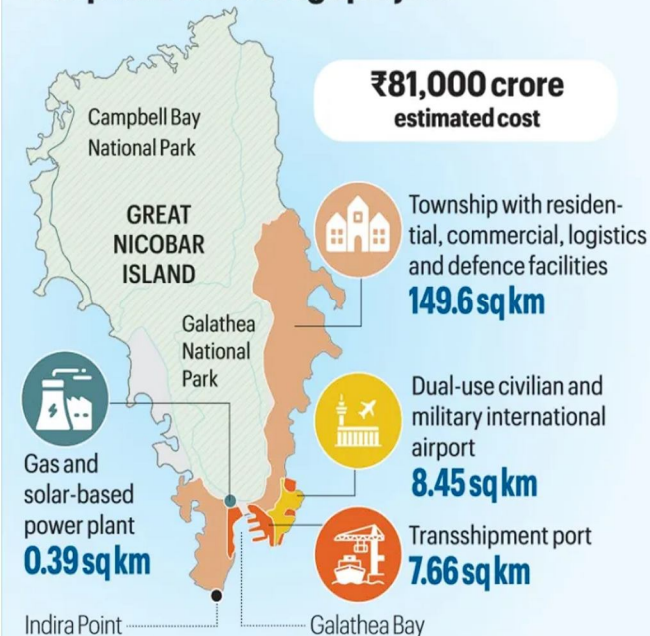
It includes:

- **International Container Transshipment Terminal** at Galathea Bay
- **Greenfield international airport**
- **Township development**
- **Power plant**
- Supporting logistics and infrastructure facilities

The aim is to develop Great Nicobar as a major maritime, economic and strategic hub.

The project is often described as a combination of **economic development, maritime security and strategic infrastructure**.

• The pillars of the mega project



Strategic Significance of the Project

1. Location Near Malacca Strait

- The **Malacca Strait** is one of the world's most important maritime chokepoints. It connects the Indian Ocean with the Pacific Ocean.
- A large volume of global trade and energy movement passes through this route.
- Great Nicobar's **Galathea Bay** is located close to the **Six Degree Channel**, which is linked with the Malacca route. This gives India a strong geographical advantage.

2. India's Maritime Watchtower

Great Nicobar can act as India's **maritime watchtower** in the Indo-Pacific.

It can help India monitor:

- Commercial shipping
- Naval movements
- Submarine activity
- Strategic sea lanes
- Energy routes
- Maritime security threats

In the Indo-Pacific century, control and monitoring of sea routes are extremely important for national security.

3. Countering China's Growing Presence

- The Indian Ocean Region is witnessing increasing activity by major powers, especially China.
- China has expanded its maritime presence through ports, logistics facilities, naval visits and strategic partnerships. This is often discussed in the context of the String of Pearls strategy.
- Developing Great Nicobar can help India strengthen its presence near critical sea lanes and counterbalance extra-regional influence.

4. Strengthening Andaman and Nicobar Command

The Andaman and Nicobar Command is India's only **tri-service command**, involving the Army, Navy and Air Force.

Better infrastructure in Great Nicobar can improve India's ability to conduct:

- Surveillance
- Maritime patrol
- Naval logistics
- Air operations
- Disaster response
- Strategic monitoring

This will improve India's defence preparedness in the eastern Indian Ocean.

Economic Significance

1. Reducing Dependence on Foreign Transshipment Hubs

At present, much of India's container cargo is transhipped through foreign ports such as:

- Colombo
- Singapore
- Port Klang

This increases logistics cost and creates dependence on external hubs.

- The proposed **International Container Transshipment Terminal** at Galathea Bay can help India reduce dependence on foreign ports.
- It can support Indian exporters, reduce cargo movement costs and improve supply-chain resilience.

2. Boost to Blue Economy

The project can support India's **Blue Economy**, which means sustainable economic use of ocean resources.

It may promote:

- Port-led development
- Logistics services
- Maritime trade
- Shipping services
- Tourism
- Marine-based industries
- Employment generation

3. Link with Act East Policy

- India's **Act East Policy** aims to strengthen relations with Southeast Asia and East Asia.
- Great Nicobar is geographically close to Southeast Asia. Developing it can help India strengthen trade, logistics and strategic cooperation with countries such as Indonesia, Thailand, Singapore and other ASEAN members.
- Thus, the project gives physical meaning to India's Act East vision.

Environmental Concerns

Great Nicobar is an ecologically sensitive island. Any large project here must be handled carefully.

1. Deforestation

- A major concern is the diversion of forest land.
- The project involves clearing a significant area of tropical rainforest. Critics argue that this may affect local biodiversity, endemic species and ecological balance.
- Reports have raised concerns over the possible felling of several lakh trees and the difficulty of replacing island biodiversity through compensatory afforestation elsewhere.

2. Threat to Giant Leatherback Turtle

- Galathea Bay is known as an important nesting ground for the **Giant Leatherback**

Sea Turtle, an endangered species.

- Construction of a port, dredging and increased ship movement may affect its nesting habitat.
- This is one of the most serious environmental concerns related to the project.

3. Impact on Coral Reefs and Marine Ecosystems

- The island has fragile marine ecosystems, including coral reefs and coastal habitats.

Port construction, sedimentation, dredging and pollution may damage:

- Coral reefs
- Seagrass beds
- Turtle nesting areas
- Mangroves
- Coastal biodiversity

Such ecosystems are difficult to restore once damaged.

Tribal and Social Concerns

1. Impact on Shompen Tribe

- The **Shompen** are a Particularly Vulnerable Tribal Group living in Great Nicobar. They are largely forest-dependent and live in relative isolation.

A large external population, construction activity and forest diversion may affect their:

- Habitat
- Health
- Culture
- Traditional livelihood
- Autonomy

Critics argue that their protection must be central to any development plan.

2. Impact on Nicobarese Community

- The Nicobarese community also has deep cultural and historical links with the island.
- Any project must ensure that development does not lead to displacement, cultural erosion or loss of community rights.

Disaster Vulnerability

Great Nicobar lies in a highly seismic zone.

It is vulnerable to:

- Earthquakes
- Tsunami
- Coastal subsidence
- Sea-level rise
- Cyclonic events

The 2004 Indian Ocean tsunami severely affected the Andaman and Nicobar region.

- Therefore, infrastructure in Great Nicobar must be designed with strong disaster-resilient planning.
- This includes elevated construction, natural buffers, tsunami warning systems and strict disaster risk assessment.

Legal and Institutional Angle

The Great Nicobar Project has received environmental and coastal regulation approvals, but these clearances have been challenged by environmental groups and activists.

- The **National Green Tribunal** considered challenges to the project. Reports state that the NGT refused to interfere with the environmental clearance after noting safeguards and strategic importance, while also requiring strict compliance with environmental conditions.

This shows that the project lies at the intersection of:

- Development
- Environment
- National security

- Tribal rights
- Judicial scrutiny

Arguments in Support of the Project

Supporters argue that the project is necessary for India's long-term national interest.

1. Strategic Foresight

- India cannot ignore its maritime geography when the Indo-Pacific is becoming the centre of global politics and trade.
- Great Nicobar gives India a rare strategic advantage near critical sea lanes.

2. Maritime Security

- The project can strengthen India's ability to monitor the Malacca route and nearby chokepoints.

3. Economic Independence

- A transshipment terminal can reduce India's dependence on foreign ports and improve logistics efficiency.

4. Regional Development

- Infrastructure can generate jobs, attract investment and improve connectivity.

5. Global Maritime Role

- The project can help India become a major maritime power in the Indo-Pacific.

Arguments Against the Project

Critics argue that the project may cause irreversible ecological and social damage.

1. Ecological Fragility

- Great Nicobar has unique biodiversity that cannot be easily replaced.

2. Tribal Vulnerability

- The Shompen and Nicobarese communities may face cultural and health risks due to

external population inflow.

3. Disaster Risk

- The island is located in a high seismic and tsunami-prone region.

4. Questionable Environmental Assessment

- Some experts have criticised the Environmental Impact Assessment process as inadequate for a project of this scale.

5. Development vs Sustainability

- There is concern that economic and strategic benefits may come at a high ecological cost.

The Central Debate

- The debate is not simply "development vs environment".

The real question is:

- Can India develop Great Nicobar for national security and economic growth while protecting ecology, tribal communities and disaster safety?

Way Forward

1. Ecological Responsibility

- The project must be implemented with strict ecological safeguards.

This includes:

- Minimum forest diversion
- Protection of turtle nesting sites
- Coral reef conservation
- Mangrove restoration
- Scientific biodiversity monitoring

2. Protection of Tribal Communities

The Shompen and Nicobarese communities must be protected through:

- No-go zones
- Health safeguards

- Cultural protection
- Legal protection of tribal reserves
- Prior consultation and transparency

3. Strong Environmental Monitoring

There should be continuous and independent monitoring of:

- Forest loss
- Marine pollution
- Turtle nesting
- Coral health
- Water quality
- Noise pollution

The data should be made publicly available.

4. Disaster-Resilient Infrastructure

- All infrastructure must be designed for earthquakes and tsunamis.
- Natural buffers such as mangroves should be protected and restored.

5. Green Port Model

The port should follow green port standards.

This may include:

- Shore-side electricity for ships
- Renewable energy use
- Waste recycling
- Low-emission logistics
- Strict pollution control

6. Balanced Strategic Development

India must pursue national security, but not through uncontrolled construction.

The right approach is **strategic development with ecological responsibility**.

Conclusion

The Great Nicobar Project is one of India's most important maritime development proposals.

It can help India strengthen its position in the Indo-Pacific, reduce dependence on foreign transshipment hubs and improve maritime security.

- However, Great Nicobar is also ecologically fragile and socially sensitive. The presence of tribal communities, rare biodiversity, turtle nesting sites and seismic risks makes the project highly challenging.
- India's task is not to choose blindly between development and environment. The real task is to pursue **national security with ecological responsibility**.
- In the Indo-Pacific century, Great Nicobar is not merely the edge of India. It can become India's watchtower at the gateway of the future – but only if it is developed wisely, responsibly and sustainably.

Jai Prakash Narayan Bird Sanctuary as India's 100th Ramsar site

Source: [The New Indian Express](#)

UPSC: GS Paper III – Environment, Biodiversity, Conservation, Wetlands, Climate Resilience.

Important Keywords

- **Prelims Keywords:** Ramsar Convention, Ramsar Site, Surha Tal, Jai Prakash

Narayan Bird Sanctuary, Ballia, Oxbow Lake, Central Asian Flyway, Montreux Record, World Wetlands Day.

- **Mains Keywords:** Wetland Conservation, Biodiversity Protection, Climate Resilience, Flood Buffer, Ecosystem Services, Community Conservation, Sustainable Livelihoods.

Why in News?

The **Jai Prakash Narayan Bird Sanctuary**, also known as **Surha Tal**, in **Ballia district of Uttar Pradesh**, has been declared **India's 100th Ramsar Site**. The announcement was made by Prime Minister Narendra Modi on **World Environment Day, 5 June 2026**.



The Jai Prakash Narayan Bird Sanctuary wetland is rich in avifaunal biodiversity, attracting several migratory

What are Ramsar Sites?

- **Ramsar Sites** are wetlands of international importance designated under the **Ramsar Convention**.
- A wetland may include marshes, fens, peatlands, lakes, rivers, floodplains, coastal wetlands and shallow marine areas up to six metres deep at low tide.
- The Ramsar Convention defines wetlands as areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with static or flowing water, fresh, brackish or saline.
- In India, the **Wetlands (Conservation and Management) Rules, 2017** exclude river channels, paddy fields, drinking water tanks and water bodies specifically created for aquaculture, salt production, recreation or irrigation.

Ramsar Convention

- The **Ramsar Convention** is also known as the **Convention on Wetlands**.
- It was adopted in **1971 in Ramsar, Iran** and came into force in **1975**. The convention works under the broad framework of international wetland conservation.
- Its main objective is the **conservation and wise use of wetlands**.

Key Facts

- **Adopted:** 1971
- **Place:** Ramsar, Iran
- **Came into force:** 1975
- **India joined:** 1982
- **World Wetlands Day:** 2 February
- **Largest Ramsar Site in the world:** Pantanal, South America
- **Largest Ramsar Site in India:** Sundarbans, West Bengal
- **Smallest Ramsar Site in India:** Vembanur Wetland Complex, Tamil Nadu

Montreux Record

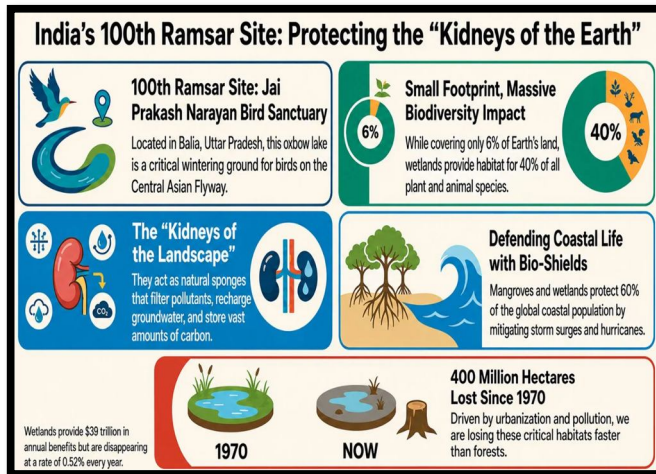
- The **Montreux Record** was adopted in **1990** at Montreux, Switzerland.
- It is a register of Ramsar Sites where ecological character has changed, is changing, or is likely to change due to human interference, pollution or other factors.
- It identifies Ramsar Sites that need priority conservation attention.

India and Ramsar Convention

- India became a contracting party to the Ramsar Convention in **1982**.
- With the addition of Jai Prakash Narayan Bird Sanctuary, India now has **100 Ramsar**

Sites.

- India's Ramsar network covers wetlands across all States and Union Territories and reflects the country's diverse wetland ecosystems such as lakes, marshes, mangroves, floodplains, coastal wetlands and high-altitude wetlands.



India's Ramsar Achievement

With **100 Ramsar Sites**, India has achieved an important global milestone.

Global Position

- India has the **highest number of Ramsar Sites in Asia**.
- India ranks **3rd globally**.
- The United Kingdom has the highest number of Ramsar Sites with **176 sites**.
- Mexico ranks second with **144 sites**.
- India ranks third with **100 sites**.

About Jai Prakash Narayan Bird Sanctuary

- Jai Prakash Narayan Bird Sanctuary is the **13th Ramsar Site in Uttar Pradesh**.
- Earlier in 2026, other Uttar Pradesh wetlands such as **Shekha Jheel Bird Sanctuary** in Aligarh district and **Patna Bird**

Sanctuary in Etah district were also added to the Ramsar list.

- The **Jai Prakash Narayan Bird Sanctuary** is located at **Surha Tal** in **Ballia district of eastern Uttar Pradesh**.
- It lies in the **middle stretch of the Ganga River basin**.
- The Uttar Pradesh government originally declared it a bird sanctuary in **1991**.

Formation and Ecology

- Surha Tal is a large natural **oxbow lake**. An oxbow lake is formed when a river changes its course and leaves behind a curved water body.
- The wetland was formed by the meandering course of the **Ganga River**.
- It receives freshwater inflow through three primary channels. During the monsoon season, it expands widely over floodplains and marshes.
- This makes Surha Tal an important floodplain wetland and a valuable habitat for birds, fish and other wetland-dependent species.

Biodiversity of Surha Tal

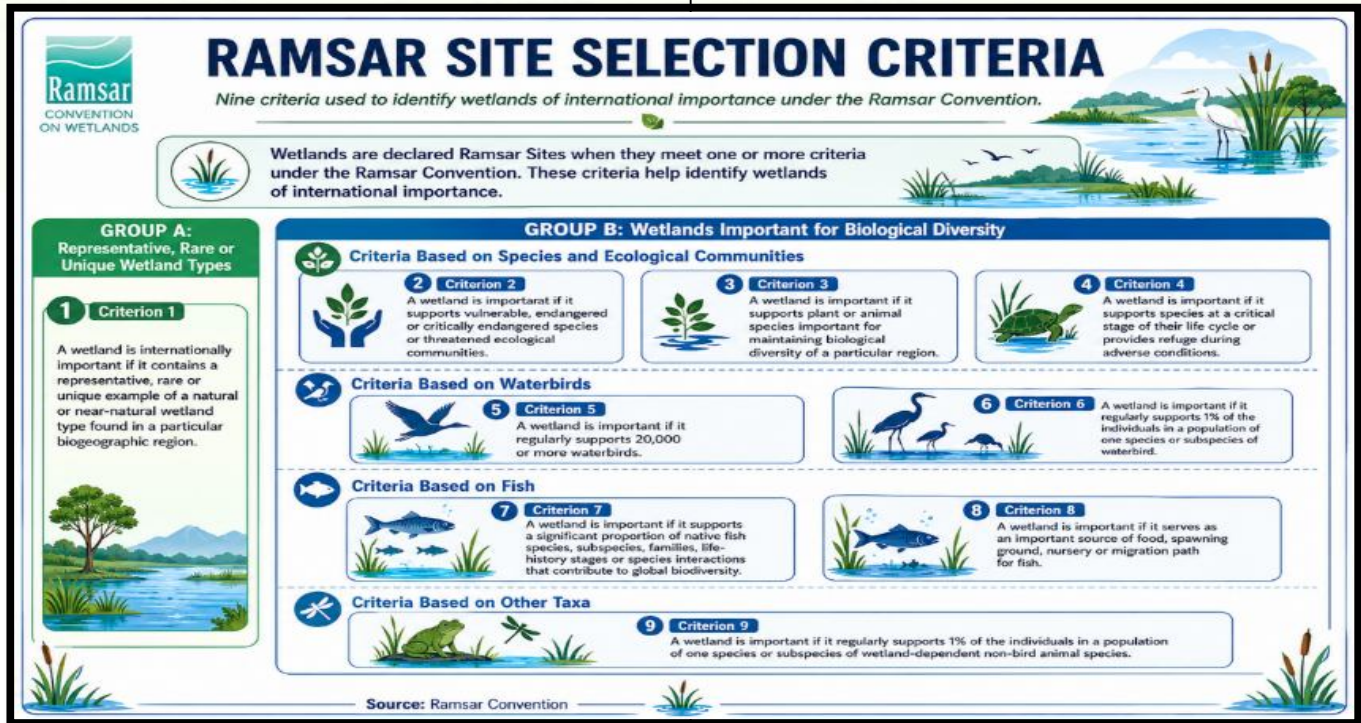
- Surha Tal is rich in avifaunal biodiversity and attracts both migratory and resident birds.

Avifauna

The sanctuary lies on the **Central Asian Flyway**. It serves as a critical stopover and wintering ground for migratory birds from **Siberia and Central Asia**.

Important bird species include:

- Common Pochard**
- Indian River Tern**
- Sarus Crane**
- Bar-headed Goose**



Aquatic Life

The wetland supports:

- More than **221 plant species**
- Around **66 fish species**

Important fish species include:

- **Wallago attu**
- **Bagarius bagarius**

Cultural Importance

- Surha Tal is linked with local historical, religious and traditional beliefs.
- This makes it not only an ecological site but also a **socio-ecological landscape** in eastern Uttar Pradesh.
- The Ramsar recognition can help promote conservation with local community participation and sustainable eco-tourism.

Importance of Wetlands

- Wetlands are among the most productive

ecosystems on Earth.

They provide many ecological and social benefits:

- Support biodiversity, provide habitat for migratory and resident birds, Recharge groundwater, Control floods, reduce drought impact, Store carbon, purify water, Support fisheries and livelihoods, protect communities from cyclones and extreme events, Contribute to water and food security

Wetlands are therefore important for **climate resilience, disaster risk reduction and human well-being**.

Recent Developments in Wetland Conservation in India

1. Wetlands of India Portal

- The **Wetlands of India Portal** was launched on **2 October 2021** by the Ministry of Environment, Forest and Climate Change.
- It provides information on India's wetlands, data repositories, capacity-building

materials and dashboards for States and Union Territories.

2. National Wetland Decadal Change Atlas

- Prepared by the **Space Applications Centre**, Ahmedabad, this atlas highlights changes in wetlands across India over the past decade.

3. Centre for Wetland Conservation and Management

- The **Centre for Wetland Conservation and Management** was established on **World Wetlands Day 2021**.
- It focuses on research, knowledge gaps and scientific support for wetland conservation.

4. Wetlands Rejuvenation Programme

- Launched by MoEFCC in **2020**, the programme aims to rejuvenate over **500 wetlands** across India through baseline information, stakeholder participation and management planning.

5. National Plan for Conservation of Aquatic Ecosystems

- In **2013**, the National Wetlands Conservation Programme and the National Lake Conservation Plan were merged to create the **National Plan for Conservation**

of Aquatic Ecosystems.

- It reflects a holistic government approach to protecting wetlands and lakes.

6. Amrit Dharohar Scheme

Launched in the Union Budget **2023-24**, the **Amrit Dharohar Scheme** aims to optimise wetland use over three years.

Its goals include:

- Enhancing biodiversity
- Increasing carbon stock
- Promoting eco-tourism
- Generating income for local communities

7. Integration with Namami Gange

- The **Namami Gange Programme** integrates wetland conservation with river basin management.
- This provides a model for linking river rejuvenation with wetland protection.

8. National Wildlife Action Plan

- The **National Wildlife Action Plan 2017-2031** emphasises conservation of inland aquatic ecosystems, including wetlands.
- It recognises wetlands as important habitats for biodiversity and ecosystem services.

Ramsar Sites in India: State-wise List

S.No	Ramsar Site	State/UT	Designated Year
1	Kolleru Lake	Andhra Pradesh	2002
2	Deepor Beel	Assam	2002
3	Kanwar (Kabar) Taal	Bihar	2020
4	Nagi Bird Sanctuary	Bihar	2023
5	Nakti Bird Sanctuary	Bihar	2023
6	Nanda Lake	Goa	2022
7	Khijadia WLS	Gujarat	2021
8	Nalsarovar BS	Gujarat	2012



9	Thol Lake	Gujarat	2021
10	Wadhvana Wetland	Gujarat	2021
11	Bhindawas WLS	Haryana	2021
12	Sultanpur NP	Haryana	2021
13	Chandra Taal	Himachal Pradesh	2005
14	Pong Dam Lake	Himachal Pradesh	2002
15	Renuka Lake	Himachal Pradesh	2005
16	Ranganathittu BS	Karnataka	2022
17	Magadi Kere Conservation Reserve	Karnataka	2024
18	Ankasamudra Bird Conservation Reserve	Karnataka	2024
19	Aghanashini Estuary	Karnataka	2024
20	Ashtamudi Wetland	Kerala	2002
21	Sasthamkotta Lake	Kerala	2002
22	Vembanad-Kol Wetland	Kerala	1905
23	Bhoj Wetland	Madhya Pradesh	2002
24	Sakhya Sagar	Madhya Pradesh	2022
25	Sirpur Wetland	Madhya Pradesh	2022
26	Yashwant Sagar	Madhya Pradesh	2022
27	Tawa Reservoir	Madhya Pradesh	2024
28	Lonar Lake	Maharashtra	2020
29	Nandur Madhameshwar	Maharashtra	2019
30	Thane Creek	Maharashtra	2022
31	Loktak Lake	Manipur	1990
32	Pala Wetland	Mizoram	2021
33	Ansupa Lake	Odisha	2021
34	Bhitarkanika Mangroves	Odisha	2002
35	Chilika Lake	Odisha	1981
36	Hirakud Reservoir	Odisha	2021
37	Satkosia Gorge	Odisha	2021
38	Tampara Lake	Odisha	2021
39	Beas CnR	Punjab	2019
40	Harike Wetland	Punjab	1990
41	Kanjli Wetland	Punjab	2002
42	Keshopur-Miani CmR	Punjab	2019
43	Nangal WLS	Punjab	2019



44	Ropar Wetland	Punjab	2002
45	Keoladeo National Park	Rajasthan	1981
46	Sambhar Lake	Rajasthan	1990
47	Chitrangudi BS	Tamil Nadu	2021
48	Gulf of Mannar Marine BR	Tamil Nadu	2022
49	Kanjirankulam BS	Tamil Nadu	2022
50	Karikili BS	Tamil Nadu	2022
51	Koonthankulam BS	Tamil Nadu	2021
52	Pallikaranai Marsh Reserve Forest	Tamil Nadu	2022
53	Pichavaram Mangrove	Tamil Nadu	2022
54	Point Calimere WLS & BS	Tamil Nadu	2002
55	Suchindram Theroor Wetland Complex	Tamil Nadu	2022
56	Udhayamarthandapuram BS	Tamil Nadu	2022
57	Vaduvur BS	Tamil Nadu	2022
58	Vedanthangal BS	Tamil Nadu	2022
59	Vellode BS	Tamil Nadu	2022
60	Vembannur Wetland Complex	Tamil Nadu	2022
61	Karaivetti Bird Sanctuary	Tamil Nadu	2024
62	Longwood Shola Reserve Forest	Tamil Nadu	2024
63	Nanjarayan Bird Sanctuary	Tamil Nadu	2024
64	Kazhuveli Bird Sanctuary	Tamil Nadu	2024
65	Rudrasagar Lake	Tripura	2005
66	Hokera Wetland	UT of Jammu & Kashmir	2005
67	Hygam Wetland CnR	UT of Jammu & Kashmir	2022
68	Shallbugh Wetland CnR	UT of Jammu & Kashmir	2022
69	Surinsar-Mansar Lakes	UT of Jammu & Kashmir	2005
70	Wular Lake	UT of Jammu & Kashmir	1990
71	Tso Kar	UT of Ladakh	2020
72	Tsomoriri	UT of Ladakh	2002
73	Bakhira WLS	Uttar Pradesh	2021
74	Haiderpur Wetland	Uttar Pradesh	2021
75	Nawabganj BS	Uttar Pradesh	2019
76	Parvati Arga BS	Uttar Pradesh	2019
77	Saman BS	Uttar Pradesh	2019
78	Samaspur BS	Uttar Pradesh	2019



79	Sandi BS	Uttar Pradesh	2019
80	Sarsai Nawar Jheel	Uttar Pradesh	2019
81	Sur Sarovar (Keetham Lake)	Uttar Pradesh	2020
82	Upper Ganga River (Brijghat to Narora)	Uttar Pradesh	2005
83	Asan Barrage	Uttarakhand	2020
84	East Kolkata Wetlands	West Bengal	2002
85	Sundarban Wetland	West Bengal	2019
86	Sakkarakottai Bird Sanctuary	Tamil Nadu	2025
87	Therthangal Bird Sanctuary	Tamil Nadu	2025
88	Khecheopalri Wetland	Sikkim	2025
89	Udhwa Lake	Jharkhand	2025
90	Khichan (Phalodi)	Rajasthan	2025
91	Menar (Udaipur)	Rajasthan	2025
92	Gokul Jalashay	Bihar	2025
93	Udaipur Jheel	Bihar	2025
94	Gogabeel Lake	Bihar	2025
95	Siliserh Lake	Rajasthan	2025
96	Kopra Jalashay	Chhattisgarh	2025
97	Patna Bird Sanctuary	Uttar Pradesh	2026
98	Chhari-Dhand	Kutch, Gujarat	2026
99	Shekha Jheel Bird Sanctuary	Uttar Pradesh	2026
100	Jai Prakash Narayan Bird Sanctuary	Uttar Pradesh	2026

Challenges

- Encroachment around wetlands
- Pollution from nearby settlements and agriculture
- Excessive fishing pressure
- Invasive species
- Siltation and reduction in water spread
- Climate change and irregular rainfall
- Lack of local awareness
- Poor inter-departmental coordination
- Risk of unregulated tourism
- Conflict between livelihood use and conservation needs

Way Forward

- Prepare a scientific management plan for Surha Tal.
- Monitor bird, fish and plant diversity regularly.
- Prevent encroachment and pollution.
- Promote community-based wetland conservation.
- Control invasive species.
- Regulate fishing and tourism.
- Strengthen local awareness programmes.

- Link wetland conservation with sustainable livelihoods.
- Use the Ramsar tag to promote research and eco-tourism.
- Ensure coordination among forest, irrigation, tourism and local governance departments.
- Integrate wetland conservation with river basin management and climate adaptation planning.

The designation of **Jai Prakash Narayan Bird Sanctuary / Surha Tal** as India's 100th Ramsar Site is a proud milestone in India's environmental journey. Wetlands are not wastelands. They are living ecosystems that support biodiversity, water security, climate resilience and local livelihoods. The success of this Ramsar recognition will depend on strong protection, scientific management, community participation and sustainable use. Surha Tal can become a model for conserving wetlands while supporting people and nature together.

Conclusion

Decentralised Solar Power in India: Why Subsidies Are Slowing Household Solar Adoption

Source: [Indian Express](#)

Relevance: **GS Paper III - Energy Security, Renewable Energy, Infrastructure, Environment and Climate Change.**

Important Keywords

Prelims Keywords:

- PM Surya Ghar Yojana, PM-KUSUM, Rooftop Solar, Decentralised Solar Power, Solar Pumps, Renewable Energy, Power Subsidy, Grid Power.

Mains Keywords:

- Clean Energy Transition, Decentralised Renewable Energy, Energy Subsidy Reform, Agricultural Power Subsidy, Solar Adoption, Climate-resilient Energy System.

Why in News?

India is rapidly expanding its renewable energy capacity, especially solar power. However, the adoption of **decentralised solar power** through schemes such as **PM Surya Ghar Yojana** and **PM-**

KUSUM remains below its full potential.

- A major reason is that many States already provide **free or highly subsidised electricity** to households and farmers. As a result, people have less incentive to spend money on rooftop solar panels or solar pumps.



Finding land for large solar parks is a problem. This is why decentralised power is important. Nirmal Harindran/File

What is Decentralised Solar Power?

Decentralised solar power means electricity generated close to the place where it is used.

Examples include:

- Rooftop solar panels on houses
- Solar pumps used by farmers
- Small solar plants on farmers' unused land
- Local solar systems connected to the grid

In simple terms, instead of producing all electricity in large solar parks and sending it through long transmission lines, decentralised solar allows households and farmers to become energy producers.

India's Solar Growth

- India has made strong progress in solar energy.
- Solar power now accounts for nearly **30% of India's total installed electricity capacity**. India added more than **50 GW** of solar energy capacity in the last two years. In **2025**, India added more solar capacity than any country except China.
- This shows that solar energy is becoming central to India's clean energy transition.

PM Surya Ghar Yojana

PM Surya Ghar Yojana aims to install rooftop solar units on **one crore households**.

Main features:

- Rooftop solar support for households
- Free electricity up to **300 units per month**
- Cash subsidy for solar equipment
- Encouragement to produce electricity locally
- Reduction in household electricity bills

The scheme is important for urban and semi-urban households.

PM-KUSUM Scheme

PM-KUSUM stands for **Pradhan Mantri Kisan Urja Suraksha Evam Utthan Mahabhiyan**.

It is aimed at farmers.

Main features:

- Support for small solar plants on unused land
- Installation of standalone solar water pumps
- Grid-connected solar pumps
- Reduction in diesel and electricity use
- Additional income by selling solar electricity
- Support for irrigation needs

The scheme helps farmers become both electricity consumers and producers.

PM-KUSUM Scheme

Launched in 2019, the Pradhan Mantri Kisan Urja Suraksha Evam Utthan Mahabhiyan (PM-KUSUM) scheme promotes solar energy use in agriculture by enabling farmers to become energy producers. The scheme consists of three components:

- Component A: Installation of small grid-connected renewable energy plants on barren or fallow land.
- Component B: Installation of standalone solar pumps in areas with limited grid access.
- Component C: Solarisation of existing grid-connected agricultural pumps, allowing farmers to feed surplus power into the grid.

Progress and Gaps

- **PM Surya Ghar Yojana** and **PM-KUSUM** have led to around **13 GW** of decentralised solar capacity.
- However, the target is around **40 GW** by the end of the current financial year. This shows that progress is still below expectation.
- The most successful part of PM-KUSUM has been standalone solar water pumps. More than **10.9 lakh solar pumps** have been installed against a target of **14 lakh**.
- But progress is uneven across States.

Better-performing States under rooftop solar include:

- Gujarat
- Maharashtra

- Uttar Pradesh
- Kerala
- Rajasthan

These five States account for nearly 70% of rooftop installations.

Why Power Subsidies Slow Solar Adoption

Power subsidies are one of the main reasons for low adoption in some States.

Many State governments provide:

- Free electricity to households
- Highly subsidised domestic power
- Free agricultural power for irrigation pumps

When electricity is already free or very cheap, people do not feel the need to invest in solar equipment.

For example, if a household already gets free electricity, rooftop solar does not appear financially attractive because:

- Solar installation has high upfront cost
- Recovery of investment takes time
- Savings are low when grid electricity is already cheap
- Excess solar power sale may not be enough to attract consumers

The same problem affects farmers under PM-KUSUM. If agricultural power is already free, farmers may not prefer solar pumps unless additional incentives are given.

Examples from States

Punjab

Punjab provides 300 units of free electricity to domestic consumers every month and completely free power for agricultural tubewells. It also spends

heavily on power subsidies. As a result, adoption of solar schemes has remained low.

Tamil Nadu, Karnataka and Delhi

These States also have subsidy structures that reduce the financial attraction of rooftop solar.

Gujarat, Kerala and Maharashtra

These States have relatively higher electricity tariffs for some consumers. Therefore, rooftop solar becomes more attractive because households can save more money.

Importance of Decentralised Solar Power

1. Reduces Pressure on Land

- Large solar parks require huge land areas. Finding land is becoming difficult. Rooftop and local solar systems reduce pressure on land.

2. Reduces Power Subsidy Burden

- If households generate their own electricity, governments may save money on recurring electricity subsidies.

3. Supports Farmers

- Solar pumps can reduce dependence on diesel and unreliable grid power. Farmers can also earn by selling surplus electricity.

4. Helps During Peak Demand

- Summer electricity demand is rising due to heatwaves and cooling needs. Solar power is useful during daytime peak demand.

5. Climate Resilience

- Decentralised solar can reduce stress on the grid during high-demand periods and improve energy security.

6. Supports Clean Energy Transition

- It reduces dependence on fossil fuel-based



electricity and helps India meet climate goals.

Link with Heat and Power Demand

- India's electricity demand is rising sharply during hot months. Earlier, hydropower helped meet additional summer demand, but large hydropower capacity has stagnated.
- In recent peak demand periods, especially during April and May, solar power played a major role in meeting daytime demand.
- In years of low rainfall and high temperatures, decentralised solar becomes more important because:
 - Hydropower generation may be affected.
 - Cooling demand rises.
 - Grid pressure increases.
 - Local solar generation can support households and farms.

Challenges

- High upfront cost of rooftop solar systems.
- Free or subsidised grid electricity reduces consumer interest.
- Lack of awareness among households and farmers.
- Uneven progress across States.
- Delays in subsidy disbursement and approvals.
- Net metering and grid connection issues.
- Quality concerns in equipment and installation.
- Limited access to easy credit.
- Need for maintenance support.

Way Forward

- Provide targeted upfront support for poor and middle-class households.
- Offer easy loans and EMI-based solar models.
- Simplify rooftop solar approvals and net metering.
- Encourage States to give one-time solar incentives instead of recurring electricity subsidies.
- Promote solar pumps in areas dependent on diesel irrigation.
- Create local maintenance and repair networks.
- Improve awareness through panchayats, DISCOMs and farmer groups.
- Link solar adoption with reduction in State subsidy burden.
- Promote domestic solar manufacturing.
- Use decentralised solar as part of heatwave and peak demand planning.

Conclusion

Decentralised solar power is essential for India's clean energy transition. It can reduce dependence on large solar parks, lower power subsidy burdens, support farmers, and help meet rising summer electricity demand. However, free and highly subsidised grid electricity has reduced the financial attraction of rooftop solar and solar pumps in many States. The solution lies in shifting from recurring electricity subsidies to smart, one-time solar incentives. This can make households and farmers energy producers while supporting India's long-term renewable energy goals.

India's Ethanol Push Needs a Sustainability Rethink

Source: [The Hindu](#)

Relevance

UPSC GS Paper III: Energy Security, Agriculture, Biofuels, Water Resources, Environment, Infrastructure and Sustainable Development.

Important Keywords

- **Prelims:** E20, Ethanol Blended Petrol Programme, 1G Ethanol, 2G Ethanol, Flex-Fuel Vehicles, Feedstock, Interest Subvention, Distillery Capacity
- **Mains:** Water Footprint, Food-Fuel Competition, Import-Substitution Paradox, Energy Density, Life-Cycle Emissions, Stranded Assets.

Why in News?

India has rapidly expanded ethanol production and achieved the **E20 blending target**. The programme has supported farmers, sugar mills, rural investment and fuel diversification.

- However, ethanol production capacity now exceeds the demand required for E20. This has raised concerns about **surplus capacity, water intensity, grain diversion, vehicle compatibility, indirect imports and life-cycle emissions**.
- The debate is therefore shifting from how to produce more ethanol to how to make the programme economically and environmentally sustainable.

What is Ethanol Blending?

Ethanol blending refers to mixing ethanol, a plant-based biofuel, with petrol.

Blend Composition

Blend	Composition
E10	10% ethanol and 90% petrol
E15	15% ethanol and 85% petrol
E20	20% ethanol and 80% petrol
E85	51–83% ethanol; requires a flex-fuel vehicle
E100	Pure ethanol fuel

Different engines are designed for different ethanol concentrations. Higher blends may require changes in fuel lines, seals, engine calibration and sensors.



How is Ethanol Produced?

First-Generation Ethanol

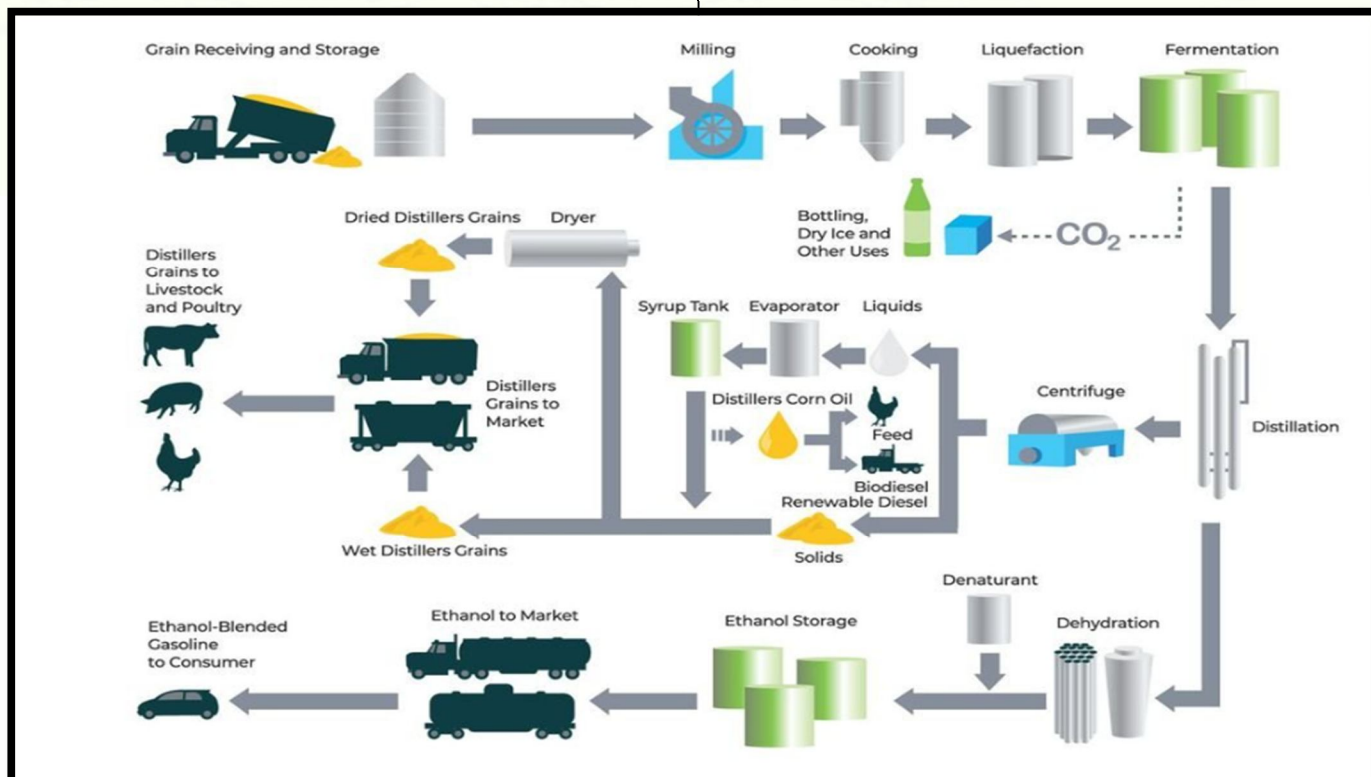
1G ethanol is produced from sugar- and starch-based feedstocks such as:

- Sugarcane juice, Molasses, Maize, Rice

The process includes:

Feedstock preparation → Fermentation → Distillation → Dehydration

- Yeast converts fermentable sugars into ethanol. Water is then removed to obtain



anhydrous ethanol suitable for petrol blending.

Second-Generation Ethanol

2G ethanol is produced from lignocellulosic biomass such as:

- Rice straw, Wheat straw, Bagasse, Bamboo

It requires an additional pre-treatment stage to break down tough plant fibres before fermentation. It can reduce dependence on food crops and convert agricultural waste into fuel.

Regulatory Framework

National Policy on Biofuels, 2018

- It provides the main framework for ethanol production, feedstock use, pricing and distribution.

Roadmap for Ethanol Blending, 2020-25

- It advanced India's E20 target from 2030 to 2025.

Financial Support

The government supported ethanol expansion through:

- Soft loans
- Interest-subvention schemes
- Administered procurement prices
- Support for molasses-, grain- and dual-feed distilleries

Higher ethanol blends have also received tax support to encourage future adoption.

Expansion of Ethanol Capacity

India requires approximately **10-11 billion litres of ethanol** to meet E20 blending norms.

However:

- Installed production capacity approached **20 billion litres** by November 2025.
- Capacity may increase by another **15%** as new projects become operational.
- Current E20 demand absorbs only about

half of installed capacity.

- India has close to **500 ethanol distilleries**.

The programme has reportedly generated investment opportunities exceeding **₹40,000 crore**.

- This creates a new policy challenge: underused distilleries face high fixed costs, lower returns and the risk of becoming **stranded assets**.
- Higher blending targets may therefore be driven partly by the need to utilise capacity already created.

Benefits of the Ethanol Programme

1. Reduction in Crude-Oil Dependence

- India imports more than **85% of its crude-oil requirements**.

Ethanol blending replaces part of petrol consumption and reduces exposure to:

- International oil-price volatility
- OPEC production decisions
- Geopolitical supply disruptions

The programme is reported to have:

- Saved around **₹1.84 lakh crore** in foreign exchange
- Reduced crude-oil imports by over **302 lakh metric tonnes**

2. Support to Farmers

- Demand for sugarcane, maize and rice creates an assured market for farmers.
- The programme reportedly generated more than **₹1.58 lakh crore** in direct income for the farming community.

It reflects the idea of transforming farmers from **Annadatas to Urjadas**.

3. Support to Sugar Mills

- Sugar mills earned more than **₹1.29 lakh crore** from ethanol sales over the past decade.

This helped:

- Manage sugar surpluses
- Improve mill finances
- Clear sugarcane dues
- Diversify revenue

4. Rural Investment and Employment

- Expansion of distilleries generated investment and employment in rural and semi-urban regions.

5. Fuel Diversification

- Ethanol expands India's transport-fuel basket and reduces exclusive dependence on petrol.

6. Emission Reduction

- Ethanol generally burns cleaner than petrol and can lower tailpipe emissions such as carbon monoxide and hydrocarbons.
- The programme is reported to have avoided more than **909 lakh metric tonnes of carbon dioxide emissions**.

7. Waste-to-Wealth

- 2G ethanol can convert crop residues into fuel, reducing stubble burning and supporting a circular bio-economy.
- India's bamboo-based bioethanol plant at **Golakganj/Golaghat, Assam**, represents progress towards non-food feedstocks.

Major Concerns

1. Supply-Demand Mismatch

India has built significantly more ethanol capacity than is required for E20.

This means:

- The policy has moved from building supply

ETHANOL

Production, feedstocks, blends, history and key concepts

1 WHAT IS ETHANOL?

- Ethanol is a clear and colourless alcohol produced from biomass.
- Biomass materials used to produce ethanol are called feedstocks.
- Common feedstocks include:
 - Corn
 - Sorghum
 - Barley
 - Sugar cane
 - Sugar beet
- A denaturant is added to fuel ethanol to make it unfit for drinking.

2 PRODUCTION OF ETHANOL

- Fermentation is the most common method of ethanol production.
- Yeast converts sugars into alcohol.
- In starch-rich crops such as corn:
 - Starch is converted into sugar.
 - Sugar is fermented into ethanol.
- Sugar cane and sugar beet are easier to process because they already contain fermentable sugar.

3 MAJOR PRODUCERS AND FEEDSTOCKS

- The United States is the world's largest fuel ethanol producer and mainly uses corn starch.
- Brazil is the second-largest producer and mainly uses sugar cane.
- Many vehicles in Brazil can operate on pure ethanol or petrol-ethanol blends.

4 CELLULOSIC ETHANOL

- Cellulosic ethanol is produced by breaking down cellulose present in plant fibres.
- Major potential sources include:
 - Corn and rice stalks
 - Poplar and willow trees
 - Switchgrass
 - Biomass in municipal solid waste

ADVANTAGES

- Uses agricultural residues and waste.
- Requires comparatively less water, fertiliser and energy.
- Can use land unsuitable for food crops.
- Reduces competition between food and fuel production.

LIMITATION

- Commercial production remains expensive and economically difficult.

5 ETHANOL-PETROL BLENDS

Fuel	Ethanol Content	Use
E0	No ethanol	Boats, tools and certain petrol engines
E10	10% ethanol	Suitable for ordinary petrol vehicles
E15	15% ethanol	Used in compatible modern vehicles
E85	51-83% ethanol	Used only in flexible-fuel vehicles

The ethanol content of E85 may vary according to location and season.

6 HISTORICAL DEVELOPMENT

- 1850s:** Ethanol was widely used as a lighting fuel.
- Civil War period:** A liquor tax made ethanol expensive and reduced its use. Repeal of the tax helped ethanol production recover.
- 1906:** Henry Ford designed the Model T to run on a mixture of petrol and alcohol.
- 1919:** Ethanol was restricted during Prohibition in the United States.
- 1933:** Its use as a fuel resumed after Prohibition ended.
- World War II:** Ethanol use increased because of petroleum shortages.
- 1970s:** Oil embargoes, rising oil prices and dependence on imported oil renewed interest in ethanol.
- Later:** Tax incentives and cleaner-fuel regulations increased ethanol production and consumption.

7 KEY TERMS

Biomass: Organic material obtained from plants and waste.

Feedstock: Raw material used to manufacture a product.

Fermentation: Conversion of sugar into alcohol by microorganisms such as yeast.

Cellulosic ethanol: Ethanol produced from cellulose-rich plant fibres and agricultural waste.

Flexible-fuel vehicle: A vehicle capable of running on petrol or high-ethanol fuel blends.

Ethanol is an important biofuel that supports cleaner energy, flexible fuel use and reduced dependence on fossil fuels.

to creating demand.

- Low-capacity utilisation may reduce financial viability.
- Pressure may increase for higher blending targets.
- Policy decisions may prioritise distillery economics over resource efficiency.

2. Import-Substitution Paradox

Ethanol lowers crude-oil demand, but the full production chain requires:

- Fertilisers
- Natural gas, Potash, Phosphatic inputs, Electricity, Irrigation

Many of these inputs are imported.

- Increased cultivation of sugarcane, maize and rice may also reduce land available for pulses and oilseeds, where India already has high import dependence.

Thus, lower crude imports may be offset by greater

imports of:

- Fertiliser inputs. Natural gas, Edible oils, Pulses, Grain feedstocks

The programme may shift external dependence rather than eliminate it.

3. Food-Feed-Fuel Competition

Maize and rice are used for food, animal feed and industry.

Rapid growth of maize ethanol has placed pressure on the poultry and livestock sectors.

- Poultry consumes nearly **60% of India's maize**.
- Maize prices reportedly increased to around **₹26-₹30 per kg**.
- Distilleries faced an estimated maize shortfall of **17 million tonnes**.
- India has moved from being a maize exporter towards importing maize to manage shortages.

During poor harvests, fixed blending requirements may increase food inflation or create a need to import ethanol or feedstocks.

4. Cropping-Pattern Distortion

Assured procurement and administered ethanol prices may draw acreage towards:

- Sugarcane, Maize, Rice

This may reduce cultivation of:

- Pulses, Oilseeds, Less water-intensive crops

Cropping choices may therefore be shaped by ethanol incentives rather than local agro-climatic conditions, nutrition needs and water availability.

5. Water Intensity

The water footprint of ethanol is one of its most serious environmental concerns.

Feedstock	Estimated Water Use per Litre of Ethanol
Sugarcane	Around 2,860 litres
Maize	Around 4,093 litres
Rice	Up to 10,790 litres

These estimates include cultivation and processing.

- The exact footprint varies according to rainfall, irrigation efficiency, yield and location, but the figures show that grain-based ethanol is not necessarily less water-intensive.
- In Maharashtra, sugarcane occupies less than **10% of cropped area** but consumes a disproportionately high share of irrigation water. Expanding ethanol-linked crops can worsen regional water stress.

6. Lower Fuel Efficiency

Ethanol has lower energy density than petrol.

Therefore:

- More fuel may be required to travel the same distance.
- Vehicle mileage may decline.

- Fuel savings may be partly offset by higher consumption.
- Consumers may face greater operating costs.

7. Vehicle Compatibility

Higher blends may affect older and non-compatible vehicles.

Possible concerns include:

- Corrosion of fuel-system components, Damage to rubber seals and fuel lines, Reduced engine durability, Higher maintenance costs, Lower mileage

Consumer uncertainty may increase if fuel grades and vehicle compatibility are not clearly communicated.

8. Technological Challenges of 2G Ethanol

Although 2G ethanol avoids direct competition with food crops, its production remains difficult because plant residues are resistant to breakdown.

Major challenges include:

- Expensive pre-treatment, Complex enzymes, High capital costs, Biomass collection and storage, Seasonal feedstock supply, High energy consumption

Distillation alone may account for a large share of the total energy used in 2G production.

9. Upstream Emissions

Ethanol may reduce tailpipe emissions, but its complete carbon footprint includes emissions from:

- Fertiliser production, Irrigation, Farm machinery, Feedstock transportation, Fermentation and distillation, Coal-based electricity, Land-use changes

10. Storage and Logistics

Ethanol is **hygroscopic**, meaning it absorbs moisture from the atmosphere.

It therefore requires:

- Sealed transportation, Moisture-controlled storage, Dedicated logistics, Quality testing, Proper handling at retail outlets

Poor storage can reduce fuel quality and damage engines

Flex-Fuel Vehicles

Flex-Fuel Vehicles can operate on different combinations of petrol and ethanol, including E20, E85 and sometimes E100.

Advantages include:

- Consumer flexibility, Greater ethanol demand, Reduced petrol dependence, Easier transition to higher blends

However, FFVs require:

- Corrosion-resistant materials, Modified fuel systems, Advanced sensors, Engine recalibration

Without adequate incentives, they may remain more expensive than conventional vehicles.

Measures Needed

- Prioritise 2G ethanol:** Shift incentives from food-based feedstocks to crop residues to reduce food-fuel competition and stubble burning.
- Adopt regional feedstock planning:** Select crops based on water availability, soil, rainfall and local food needs.
- Conduct life-cycle assessment:** Evaluate water use, emissions, fertilisers, land use, imports and food-price impacts.
- Create biomass hubs:** Collect, store and pre-treat crop residues for 2G plants while ensuring income for farmers.
- Build multi-grade fuel infrastructure:** Provide clearly marked E20, E25, E85 and E100 pumps.
- Promote flex-fuel vehicles:** Support

compatible engines, fuel lines, sensors and calibration systems.

- Develop retrofit technology:** Create affordable certified kits for older vehicles.
- Reform ethanol pricing:** Combine farmer protection with crude-price and sustainability-linked incentives.
- Improve storage and transport:** Develop moisture-controlled tanks, dedicated tankers and quality-testing systems.
- Protect pulses and oilseeds:** Prevent ethanol incentives from weakening food and edible-oil security.
- Diversify clean transport:** Use ethanol alongside electric mobility, public transport, rail freight and green hydrogen.

Conclusion

India's ethanol programme has delivered important gains in fuel diversification, farmer income, sugar-mill viability, rural investment and foreign-exchange savings.

However, the programme has entered a new phase in which installed capacity, rather than inadequate supply, has become the central concern. Increasing blending merely to absorb surplus capacity may intensify water stress, distort cropping patterns and shift import dependence from crude oil to fertilisers, grains and edible oils.

- The future strategy must therefore prioritise **2G ethanol, resource-efficient feedstocks, life-cycle assessment, flexible pricing, compatible vehicles and region-specific planning**. Ethanol can contribute to India's energy transition only when it is aligned with **food, water, environmental and fiscal security**.

Why do Indian cities get polluted in summer

Source: [The Hindu](#)

Relevance:

UPSC: GS Paper III - Environment, Air Pollution, Climate Change, Disaster Management, Urbanisation.

Important Keywords

- **Prelims Keywords:** PM10, PM2.5, Ozone, NO_x, VOCs, GRAP, CAQM, NAAQS, CAAQMS, AQEWS, Dust Storms, Loo, Andhi.
- **Mains Keywords:** Urban Air Pollution, Summer Pollution, Photochemical Smog, Public Health, Construction Dust, Vehicular Emissions, Early Warning System, Air Quality Governance.

Why in News?

Although summer is usually seen as a cleaner season compared to winter, several Indian cities recorded serious air pollution episodes in 2026. In Delhi, the Commission for Air Quality Management (CAQM) reimposed **Stage-I restrictions under the Graded Response Action Plan (GRAP)** in May 2026. This highlighted the

emerging concern of **summer air pollution** in urban India.



What is Summer Air Pollution?

Summer air pollution refers to air quality deterioration during hot months due to pollutants such as **PM10** and **ground-level ozone**.

Unlike winter smog, which is mainly linked with trapped fine particles, summer pollution is driven by:

- Dust storms, Road dust, Construction activity, Vehicular emissions, Industrial emissions, Strong sunlight, High temperature, Ozone formation

Summer Pollution vs Winter Pollution

Feature	Summer Pollution	Winter Pollution
Main Pollutants	Mainly caused by coarse particulate matter (PM10) , dust, and ground-level ozone .	Mainly caused by fine particulate matter (PM2.5) , dense smog, and smoke particles.
Weather Conditions	Heatwaves, strong sunlight, dust storms, dry weather, and fast-moving winds increase pollution.	Cold air, fog, low wind speed, and temperature inversion trap pollutants near the ground.
Major Sources	Road dust, construction dust, wind-blown dust, vehicle emissions, and pollutants reacting under sunlight.	Stubble burning, biomass burning for heating, industrial emissions, and trapped vehicular smoke.

How Pollution Forms	Dust gets suspended in the air, while strong sunlight helps form ozone through chemical reactions.	Pollutants accumulate because cold and stable air prevents their proper dispersion.
Peak Pollution Time	Pollution is usually more severe during midday and hot afternoons , when ozone formation is high.	Pollution is usually more severe during early mornings and late nights , when inversion is stronger.
Main Seasonal Factor	High temperature and sunlight-driven atmospheric reactions.	Cold weather, fog, and stagnant air conditions.

AIR POLLUTANTS

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Major pollutants, sources, formation and health impacts

1 Sulphur Dioxide (SO₂)

- Released by burning fossil fuels such as coal, oil and natural gas.
- Reacts with water vapour and forms acid rain.
- Impact:** Causes respiratory problems.

2 Nitrogen Dioxide (NO₂)

- Released from vehicles, industries and power plants.
- Helps in the formation of ozone and particulate matter.
- Impact:** Causes chronic lung diseases.

3 Ozone (O₃)

- It is a secondary pollutant.
- Formed when NO_x and VOCs react in sunlight.
- Impact:** Irritates eyes and respiratory tract; may trigger asthma.

4 Carbon Monoxide (CO)

- Formed due to incomplete combustion of carbon-based fuels.
- Reduces oxygen supply in the body.
- Impact:** Causes fatigue, confusion and dizziness.

5 Ammonia (NH₃)

- Produced from biological and agricultural processes.
- Can irritate eyes, nose, throat and lungs.
- Impact:** High exposure may cause lung damage.

6 Lead (Pb)

- Released from some industrial and metal extraction processes.
- It is a toxic heavy metal.
- Impact:** Causes anaemia, weakness, kidney damage and brain damage.

7 Particulate Matter (PM)

- Tiny solid or liquid particles present in air.
- PM10: Particles of 10 micrometres or smaller.
- PM2.5: Fine particles of 2.5 micrometres or smaller.
- Sources: Construction dust, unpaved roads, fields and fires.
- Impact:** Causes asthma, irregular heartbeat and reduced lung function.

Why Does Ozone Rise in Summer?

Ground-level ozone is not directly emitted from vehicles or factories. It is formed through chemical reactions in the atmosphere.

Ozone forms when:

- **Nitrogen oxides (NO_x)** from vehicles and industries
- **Volatile Organic Compounds (VOCs)** from vehicle exhaust, paints, solvents and

industries

react under **strong sunlight and high temperature**.

Hot and sunny days create favourable conditions for ozone formation. Ground-level ozone is harmful because it can irritate the lungs and worsen respiratory illnesses.

What Causes PM10 Spikes?

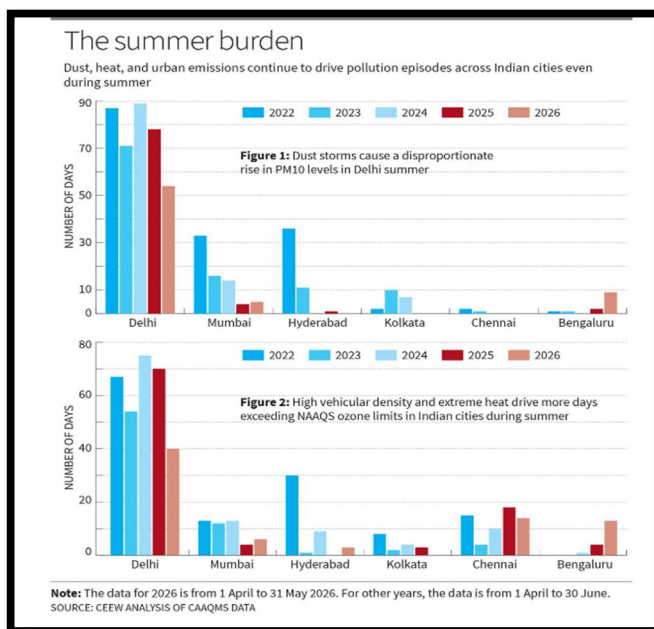
PM10 refers to particulate matter with a diameter of **10 micrometres or less**. These are coarser than

PM_{2.5} particles and often come from dust.

Major reasons for PM₁₀ rise in summer include:

- Dust storms
- Dry soil and loose dust
- Construction and demolition activity
- Broken roads
- Vehicle movement on dusty roads
- Industrial emissions
- Local thunderstorms

PM₁₀ levels can remain high for several days during large dust episodes.



Role of Dust Storms

During summer, hot conditions over the Indian subcontinent create a low-pressure zone. This interacts with surrounding high-pressure areas and produces hot, windy conditions.

These winds may carry dust from:

- West Asia
- Thar Desert
- Dry regions of North India

Such winds can raise PM₁₀ levels across large areas.

Two common types of dust-related events are:

1. Loo-type Dust Storms

- Common in North India.
- Hot winds carry dust over long distances.
- They can affect air quality for several days.

2. Andhi

- Short, localised dust storms.
- Often linked with thunderstorms.
- Strong downward air hits the ground and lifts loose dust.
- Usually lasts for a shorter period.

Cities such as Mumbai and Hyderabad may experience dusty episodes due to local thunderstorms.

Role of Human Activities

Natural dust cannot be fully controlled, but human activities worsen the situation.

Important human-made contributors include:

- Construction and demolition work
- Poor dust control at construction sites
- Broken roads
- Road dust resuspension by vehicles
- Traffic emissions
- Industrial emissions
- Waste burning
- Use of paints and solvents
- Idling of vehicles at traffic signals

When winter restrictions are lifted, construction work often resumes. Without proper dust management, it increases PM₁₀ pollution.

Impact on Public Health

Summer pollution can harm public health in several ways.

- PM₁₀ can irritate the nose, throat and lungs.
- Ozone can worsen asthma and other respiratory diseases.

- Children, elderly people and persons with lung diseases are more vulnerable.
- Heatwaves combined with air pollution increase health risks.
- High pollution can reduce outdoor working capacity and quality of life.

Thus, summer pollution is not only an environmental issue but also a public health concern.

Government and Institutional Measures

CAQM and GRAP

The **Commission for Air Quality Management** uses the **Graded Response Action Plan** to impose pollution control measures in Delhi-NCR.

Air Quality Early Warning System

- Delhi's **Air Quality Early Warning System (AQEWS)** was created after severe dust storms and smog episodes. It now provides forecasts for multiple pollutants.

It gives:

- Weather information
- Air quality forecasts
- Pollution alerts
- Three-day AQI forecasts for many Indian cities

The system has also been extended to cities such as **Jaipur and Mumbai**.

IMD Forecasts

- The **India Meteorological Department** issues weather forecasts several times a day. These can be used to warn citizens about dust storms, heatwaves and poor air quality.

Mumbai AQDSS

- The **Brihanmumbai Municipal Corporation's Air Quality Decision Support System**, developed with CEEW,

helps monitor construction sites. It has helped authorities take measures against more than **1,000 construction sites** since October 2025.

Challenges

- Summer pollution receives less attention than winter smog.
- Construction dust control is weak in many cities.
- Road dust management remains poor.
- Vehicle emissions continue to increase ozone-forming gases.
- Industrial compliance is uneven.
- Cities lack summer-specific clean air action plans.
- Public awareness about ozone pollution is low.
- Dust storms are natural, but preparedness is limited.
- Monitoring of VOCs is still weak in many cities.

Way Forward

- Prepare **summer-specific clean air action plans** for all major cities.
- Use early warning systems to issue dust storm and ozone alerts.
- Enforce dust control at construction and demolition sites.
- Repair broken roads and improve road sweeping.
- Reduce heavy vehicle movement near construction zones.
- Control NO_x and VOC emissions from vehicles and industries.
- Promote cleaner public transport and electric mobility.
- Encourage behaviour such as switching off

vehicles at red lights.

- Strengthen monitoring of ozone, PM10, NOx and VOCs.
- Link air pollution alerts with public health advisories.
- Treat summer and winter pollution with equal seriousness.

Conclusion

Indian cities are no longer facing air pollution only in winter. Summer brings a different pollution pattern driven by **PM10, dust storms, heat and**

ozone formation.

- While natural dust events cannot be fully prevented, their impact can be reduced through forecasting, public alerts and strong control of human-made sources. Cities need year-round clean air strategies that address both winter smog and summer pollution. Effective control of construction dust, road dust, vehicular emissions and industrial pollutants is essential for protecting public health.

Sustainable Agriculture in India: Building Climate Resilience and Farm Viability

Source: [The HINDU](#)

Relevance

GS Paper III: Sustainable Agriculture, Climate Change, Irrigation, E-Technology, Agricultural Marketing and Food Security

Important Keywords

- **Prelims:** Sustainable Agriculture, Crop Rotation, Carbon Sink, Drip Irrigation, IPM, PKVY, PMKSY, Soil Health Card, NAFCC, NABARD, e-NAM, FPOs, PGS-India, PM-KUSUM, Seed Bank.
- **Mains:** Climate Resilience, Resource-Use Efficiency, Environmental Health, Economic Profitability, Social Equity, Ecosystem Services, Carbon Sequestration, Digital Divide, Subsidy Distortion, Seed Sovereignty.

Why in News?

India faces growing pressure to shift towards sustainable agriculture because of climate change, resource-intensive farming and declining ecological health.

- The transition requires **realigned farm incentives, higher R&D funding, better lab-to-field technology transfer, AI-based weather forecasting, efficient soil and water management, stronger market linkages and recognition of ecosystem services.**

What is Sustainable Agriculture?

- Sustainable agriculture is that form of agriculture which attempts to produce sufficient food to meet the needs of present-day population without exhausting soil fertility and irreversibly damaging the environment.
- Sustainable farming systems are those that are least toxic and least energy intensive and yet maintain productivity and profitability i.e. low input agriculture or organic farming.

Methods of Sustainable Agriculture

Sustainable farming methods should be selected according to **local topography, soil, climate, pests,**

available inputs and farmers' objectives. The major methods are diversified cropping, crop rotation, crop-livestock integration, soil management and varietal improvement.

1. Diversified Cropping

Mixed Cropping

- **Risk Reduction:** Two or more crops are grown together so that failure of one crop does not cause total crop loss. Crops with different maturity periods, water needs and nutrient requirements improve resource use.

Legume-Based Cropping

- **Natural Nitrogen Fixation:** Legumes grown with the main crop fix atmospheric nitrogen and improve soil fertility. This reduces chemical-fertiliser use and cultivation costs.

Intercropping and Polyculture

- **Resource Complementarity:** Different crops, such as cereals and legumes, are grown together to improve nutrient use and reduce pest risks. **Polyculture** also supports natural predators and may give higher combined yields than monoculture.

Polyvarietal Cultivation

- **Genetic Diversity:** Different varieties of the same crop are grown together to reduce vulnerability to pests, diseases and climatic stress.

Limitation of Monoculture

- **High Input Dependence:** Growing a single crop over a large area requires greater use of fertilisers, pesticides and water. Though productive initially, it can create long-term environmental and economic problems.

2. Crop Rotation

Meaning

- **Planned Crop Sequence:** Different crops are grown successively on the same field to

maintain soil fertility, control pests and diseases and reduce soil erosion.

Role of Legumes

- **Soil-Nitrogen Restoration:** Leguminous crops such as **green gram** should follow non-leguminous crops. They fix nitrogen and reduce the need for chemical fertilisers.

Principles

- **Balanced Sequencing:** A legume should follow a non-legume, a low-water crop should follow a high-water crop, and a low-manure crop should follow one requiring more manure.

Major Patterns

- **Crop Sequences:** Green gram-wheat-moong; groundnut-wheat-moong; arhar-sugarcane-wheat-moong; and paddy-wheat-moong.

Multiple Cropping

- **Higher Land Use:** Two or three crops may be grown successively within a year. However, continuous intensive cropping without proper nutrient management can reduce long-term productivity.

3. Integrated Crop-Livestock Farming

- **Nutrient Recycling:** Crop residues provide animal feed, while livestock manure improves soil fertility. This creates a **closed-loop farming system**.
- **Soil Conservation:** Crops may be grown on level land and fodder or pasture on slopes, helping reduce soil erosion.
- **Income Stability:** Livestock can use crop residues during low-rainfall years and provide additional income, cushioning farmers against crop failure and price fluctuations.

4. Soil Management

- **Healthy Soil:** Productive and disease-

SUSTAINABLE AGRICULTURE

Ecologically regenerative, economically viable, and climate-resilient farming

Quick Revision | Current Affairs | Agriculture

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1 WHAT IS SUSTAINABLE AGRICULTURE?

- Produces enough food for present needs without exhausting soil fertility or damaging the environment.
- Promotes low-input, low-toxicity, resource-efficient farming.
- Focuses on productivity, profitability, soil health, water security, and biodiversity.

2 METHODS OF SUSTAINABLE AGRICULTURE

A. DIVERSIFIED CROPPING

- mixed cropping
- legume-based cropping
- intercropping/polyculture
- polyvarietal cultivation
- reduces risk and improves resource use.

B. CROP ROTATION

- planned crop sequence
- legumes restore nitrogen
- controls pests and disease
- examples like paddy-wheat-moong

C. INTEGRATED CROP-LIVESTOCK FARMING

- crop residues as feed
- manure improves soil
- income stability
- closed-loop nutrient recycling

D. SOIL MANAGEMENT

- cover crops
- compost
- reduced tillage
- mulching
- balanced nutrients

E. VARIETAL IMPROVEMENT

- higher yield
- better quality
- pest resistance
- climate resilience

3 WHY INDIA NEEDS IT

- Soil health and carbon sequestration
- Biodiversity and pollinator protection
- Nutrition and public health
- Water security and reduced pollution
- Economic resilience for farmers

4 WHAT STEPS HAS INDIA TAKEN?

NMSA

climate-resilient farming, soil and water management

National Mission on Natural Farming (NMNF)

₹4,000/acre/year for 2 years; by Mar 2026 covered 18,000+ clusters, 8.8 lakh ha, 18.19 lakh farmers

PMKSY

micro-irrigation, "Per Drop More Crop"

PKVY

organic farming support

Soil Health Card Scheme

plot-specific nutrient advice; about 20 crore cards

NAFCC

climate adaptation support

e-NAM

transparent markets; 1,650+ mandis by Feb 2026

PM-KUSUM

solar-powered irrigation

RKVY

state-specific agricultural projects

5 PERSISTING CHALLENGES

- Labour-intensive practices
- Weak soil-carbon monetisation
- Limited consumer awareness
- Greenwashing in agri-tech
- Land-tenure disincentives
- Digital divide
- Weak cold chain and post-harvest infrastructure
- Fertiliser-subsidy bias toward urea

6 WAY FORWARD

- Shift from input subsidies to outcome-based incentives
- Protect farmers during transition
- Strengthen grassroots extension and field demonstrations
- Simplify certification through PGS-India
- Strengthen FPOs and market linkages
- Invest in solar irrigation, micro-irrigation, storage and seed sovereignty
- Balance ecology with farmer income and stable productivity

7 QUICK KEYWORDS / SNAP REVISION

Crop Rotation

Inter-cropping

Soil Health

Natural Farming

PMKSY

Soil Health Card

e-NAM

PM-KUSUM

FPOs

Climate-Resilient Agriculture

Sustainable agriculture is essential for food security, climate resilience, and long-term farmer prosperity.

resistant crops depend on healthy soil, adequate water and balanced nutrients.

- **Cover Crops and Compost:** These improve organic matter, soil fertility and biological activity.
- **Reduced Tillage:** Minimal soil disturbance protects soil structure, moisture and organic carbon.
- **Mulching:** Dead mulch reduces evaporation, suppresses weeds and improves the soil's water-holding capacity.

5. Varietal Improvement

- **Higher Yield:** Improved varieties increase production from limited agricultural land.
- **Better Quality:** Plant breeding can improve protein quality in pulses, baking quality in

wheat, preservation quality in fruits and vegetables and oil quality in oilseeds.

- **Biotic-Stress Resistance:** Disease- and pest-resistant varieties reduce crop losses and pesticide dependence.
- **Abiotic-Stress Tolerance:** Climate-resilient varieties can withstand **heat, cold, frost, drought and waterlogging**, improving production stability.

Why Does India Need Sustainable Agriculture?

- **Soil Health and Land Preservation:** Practices such as **crop rotation** and organic manuring restore soil microbes and nutrients. Healthy soil acts as a **carbon sink**, helping sequester atmospheric carbon and



mitigate climate change.

- **Biodiversity and Ecosystem Resilience:** Sustainable farming promotes **agro-biodiversity**, mixed cropping and hedgerows. These support natural pest-control cycles and protect pollinators, which are essential for more than 75% of global food crops.
- **Nutrition and Public Health:** Sustainable agriculture promotes nutrient-dense crops and lowers pesticide residues in the food chain. It therefore supports safer diets and reduces long-term health risks linked to chemical exposure and poor nutrition.
- **Water Security and Quality: Drip irrigation** and precision farming optimise water use. Reduced dependence on toxic chemicals also prevents contamination of drinking-water sources and protects aquatic ecosystems from nutrient-runoff-induced dead zones.
- **Economic Resilience for Farmers:** Local inputs such as organic compost and indigenous seeds reduce the **input-output cost gap**. Diversified production also makes farmers less vulnerable to global input and commodity-price fluctuations.

What Steps Has India Taken?

- **National Mission for Sustainable Agriculture:** NMSA promotes climate-resilient farming through better soil and water management. Its objective is to maintain long-term ecological balance and agricultural viability under changing climatic conditions.
- **National Mission on Natural Farming:** Launched in November 2024, NMNF provides **₹4,000 per acre per year for two years** to support natural farming and

livestock-based bio-inputs. By March 2026, more than **18,000 clusters**, **8.8 lakh hectares** and **18.19 lakh farmers** had been covered.

- **Pradhan Mantri Krishi Sinchai Yojana:** PMKSY promotes micro-irrigation through drip and sprinkler systems under the motto **Per Drop More Crop**. It offers subsidies of up to **55% for small and marginal farmers** and aims to benefit **22 lakh farmers**, especially in water-stressed areas.
- **Paramparagat Krishi Vikas Yojana:** PKVY provides financial support for organic farming and helps move farmers away from chemical-intensive cultivation. Between 2015 and 2025, organic initiatives covered **15 lakh hectares**, formed **52,289 clusters** and supported **2.53 million farmers**.
- **Soil Health Card Scheme:** The scheme provides plot-specific nutrient recommendations and discourages blanket application of urea. Around **20 crore cards** have been issued using geo-tagged samples, supported by laboratories, portals and a national nutrient map.
- **National Adaptation Fund for Climate Change:** Established in 2015 and administered by NABARD, NAFCC provides **100% central grants** for climate-adaptation projects in vulnerable States and Union Territories. It has sanctioned **30 projects across 27 States and UTs** with a total project cost of **₹847 crore**.
- **Digital Agriculture and e-NAM:** e-NAM connects farmers to transparent and wider markets while digital tools support precision farming and real-time crop monitoring. As of February 2026, it had integrated over **1,650 mandis**, registered **1.80 crore farmers** and **2.72 lakh traders**, onboarded **4,724 FPOs**, and facilitated trade



worth ₹4,82,350 crore involving 13.22 crore metric tonnes of produce.

- **PM-KUSUM:** The scheme promotes solar-powered irrigation and reduces dependence on diesel pumps. It lowers greenhouse-gas emissions, reduces input costs and allows farmers to sell surplus power to the grid, with support intended for more than 35 lakh farmers.
- **Rashtriya Krishi Vikas Yojana:** Launched in 2007, RKVY enables States to design and implement location-specific agricultural projects. It promotes decentralised planning and higher investment in agriculture.

What are the Persisting Challenges?

- **Labour-Sustainability Paradox:** Practices such as mulching, intercropping and manual weed control are more labour-intensive than chemical-based farming. With rural migration and mechanisation levels of only about 40–45% in advanced agricultural regions, these methods may become costly for smallholders.
- **Weak Soil-Carbon Monetisation:** Soil carbon can provide an additional income stream, but smallholders face high costs for monitoring, reporting and verification. Fragmented landholdings and registration expenses exclude many of the 86% of farmers who are small or marginal from emerging carbon markets.
- **Consumer Value Disconnect:** Many consumers view organic produce only as a premium health product and do not fully recognise its ecological benefits. Limited awareness reduces willingness to pay and prevents sustainable produce from becoming mainstream.
- **Greenwashing in Agri-Tech:** Some startups

merely optimise chemical delivery while claiming sustainability. This blurs the distinction between improving efficiency within industrial agriculture and genuinely reducing chemical dependence.

- **Land-Tenure Disincentives:** Tenant farmers on short-term or informal leases have little incentive to invest in long-term practices such as soil restoration and agroforestry. The future benefits often accrue to landowners rather than cultivators.
- **Ecosystem-Service Devaluation:** Sustainable farms provide public benefits such as groundwater recharge, biodiversity protection and reduced nitrogen runoff, but farmers are rarely compensated. Wildlife activity may be about 30% higher on ecological farms, yet India lacks a broad system of payments for ecosystem services.
- **Digital Divide:** Although India had over one billion broadband subscriptions by late 2025, smart farming requires stable connectivity, technical literacy and costly equipment. These capabilities remain concentrated among large or corporate farms, widening the sustainability gap.
- **Weak Cold Chain and Post-Harvest Infrastructure:** Sustainable produce is often highly perishable and lacks dedicated storage and segregated logistics. India loses food worth nearly ₹1.53 trillion annually, while existing supply chains are largely designed for bulk, chemically treated commodities.
- **Fertiliser-Subsidy Bias:** Urea remains heavily subsidised and price-controlled, making chemical nitrogen cheaper than organic and biological alternatives. The fertiliser-subsidy estimate for 2025–26 was



revised upward from ₹1.68 lakh crore to ₹1.86 lakh crore, reinforcing dependence on chemical inputs.

What Measures are Needed?

- **Realign Financial Incentives:** Support should move from subsidising inputs to rewarding environmental outcomes such as improved soil organic carbon, water conservation and biodiversity. Such result-based incentives can make sustainable practices financially attractive.
- **Protect Farmers During Transition:** Sustainable or organic conversion may cause a yield decline for three to five years. Direct income support is needed to cushion this transition and prevent farmers from returning to chemical-intensive cultivation.
- **Strengthen Grassroots Extension:** The seeing-is-believing model should replace classroom-only training. Farmer-to-farmer learning and side-by-side field demonstrations can provide local proof of productivity and cost savings.
- **Simplify Certification:** Group certification through PGS-India should be expanded and subsidised. Mobile records and blockchain-based traceability can reduce costs and help smallholders access premium urban and export markets.
- **Improve Market Linkages:** Decentralised, solar-powered cold storage at village or cluster level can reduce post-harvest losses and strengthen bargaining power. Better storage enables farmers to delay sales and seek better prices.
- **Strengthen FPOs:** Farmer Producer Organisations can aggregate produce, negotiate prices and invest in shared technology such as community composting

or laser land levellers. Collective scale can make sustainable farming more commercially viable.

- **Invest in Climate-Resilient Infrastructure:** Solar irrigation, micro-irrigation, water harvesting and local storage should be expanded. Scaling up PM-KUSUM can reduce fossil-fuel dependence and improve water-use efficiency.
- **Promote Seed Sovereignty:** Regional seed banks should conserve climate-resilient indigenous varieties. Such seeds often need fewer chemical inputs and are better adapted to local climatic shocks.
- **Support Long-Term Research:** Studies comparing sustainable and conventional systems should extend over ten years or more. Long-term evidence is necessary to establish profitability, yield stability and ecological benefits.

Way Forward?

- **Outcome-Based Support:** Agricultural policy must reward environmental services rather than only subsidise fertilisers, power and other inputs.
- **Smallholder-Centred Transition:** Since most Indian farmers are small or marginal, finance, certification, technology and markets must be designed around their needs.
- **Integrated Infrastructure:** Research, extension, seed systems, irrigation, cold chains and market platforms must function as a connected ecosystem rather than isolated interventions.
- **Ecology-Income Balance:** Sustainable farming will succeed only when ecological gains are matched by lower risk, stable productivity, remunerative prices and

adequate farmer income.

Conclusion

India must transition towards sustainable agriculture to reduce climate risks and secure long-term food and nutritional security. By shifting from input-based subsidies to ecosystem-oriented

incentives, investing in climate-resilient infrastructure, strengthening certification and market access, preserving indigenous seeds and empowering FPOs, India can build an agricultural system that is both ecologically regenerative and economically viable.

Biochar: Turning India's Farm Smoke and Organic Waste into 'Black Gold'

Source: [The Hindu](#)

Relevance: UPSC GS Paper III: Agriculture, Soil Degradation, Stubble Burning, Climate Change, Carbon Markets, Renewable Energy and Waste Management.

Important Keywords

Prelims

- Biochar, Pyrolysis, Syngas, Bio-oil, VM0042 Methodology

Mains

- Carbon-Negative Agriculture, Circular Economy, Climate Resilience, Carbon Credits, Waste-to-Wealth

Why in News?

Biochar is emerging as a possible **carbon-negative solution** to India's interconnected problems of crop-residue burning, declining soil fertility, climate vulnerability and growing organic-waste generation. By converting agricultural and biodegradable waste into a stable carbon-rich material, India can reduce farm smoke, improve degraded soils, produce renewable-energy by-products and create additional income through carbon credits.

What Problem Can Biochar Address?

- India produces more than **500 million tonnes of crop waste annually**, but a

significant quantity is treated as a disposal problem.

- Punjab and Haryana alone burn more than **20 million tonnes of paddy straw** in open fields every year because of short post-harvest periods and limited practical alternatives.



This causes:

- Greenhouse-gas emissions
- Fine particulate pollution
- Loss of valuable organic matter
- Decline in regional air quality
- Wastage of a potential soil resource

At the same time, agricultural lands ranging from Maharashtra's black soils to Kerala's red soils suffer from:

- Low soil organic carbon

- Poor water-holding capacity
- Rapid nutrient loss
- Declining productivity

Crop-residue burning and soil degradation therefore reflect a common failure to recycle natural resources efficiently.

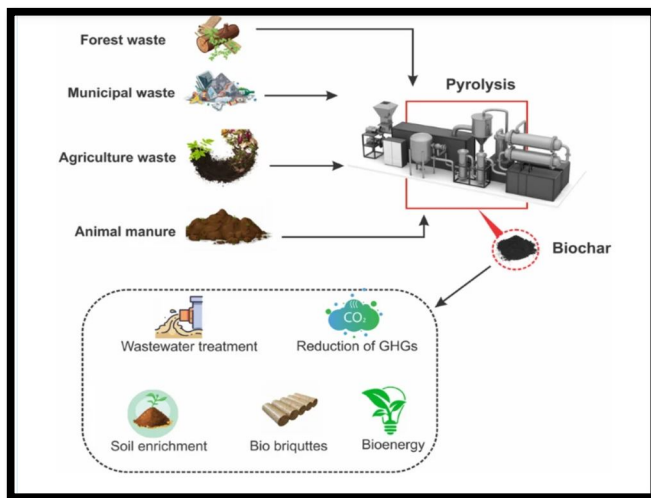
What is Biochar?

Biochar is a highly porous, carbon-rich material resembling charcoal, produced through the thermal decomposition of organic biomass.

Its feedstock may include:

- Agricultural residues
- Forestry waste
- Food-processing waste
- Biodegradable municipal waste
- Sewage sludge

Biochar decomposes very slowly after being added to soil, allowing carbon to remain stored for long periods.



How is Biochar Produced?

Pyrolysis

Biochar is produced through **pyrolysis**, in which biomass is heated in an oxygen-depleted environment at temperatures generally ranging from 300°C to 700°C.

The process produces three valuable outputs:

- **Biochar:** A stable, solid carbon-rich material
- **Syngas:** A combustible gas that can be used for energy generation
- **Bio-oil:** A liquid fuel that can substitute some conventional fossil fuels

Thus, pyrolysis converts waste into soil inputs, energy products and climate benefits.

How Does Biochar Improve Agriculture?

Soil Structure

- Its porous structure aggregates soil particles and improves the physical condition of degraded soils.

Water Retention

- Biochar may increase water-holding capacity by **10% to 25%**, helping crops withstand drought, heat waves and moisture stress.

Crop Productivity

- Studies indicate that biochar application can improve crop productivity by **10% to 30%**, particularly in nutrient-deficient soils.

Beneficial Microorganisms

- Its pores provide a suitable habitat for beneficial soil microbes that support nutrient cycling and plant growth.

Nutrient Efficiency

- Biochar helps retain nutrients in the root zone, reducing nutrient loss and dependence on external inputs.

Long-Term Soil Health

- Because it decomposes slowly, biochar can maintain higher soil organic carbon, fertility and crop output over long periods.

What Do Indian Field Trials Show?

Maharashtra

- Biochar produced from **maize stalks** and applied to black soils in Akola district improved soil organic carbon and overall fertility.

Kerala

- Biochar made from **coconut leaf stalks** improved soil quality under different cropping systems.
- These trials demonstrate the importance of using locally available biomass suited to regional soils and cropping systems.

How Can Biochar Support Climate Action?

Biochar contributes to climate mitigation in two ways:

- It prevents emissions that would have resulted from burning or decomposition of organic waste.
- It locks carbon into a stable form that may remain in soil for centuries.

One tonne of biochar can potentially sequester approximately **2.5–3 tonnes of carbon-dioxide equivalent**.

Biochar is therefore recognised as a **persistent carbon-dioxide removal technology** and a nature-based climate solution.

Its soil benefits also support adaptation by helping crops cope with:

- Drought
- Heat waves
- Erratic rainfall
- Declining soil moisture

These benefits are particularly important for small and marginal farmers exposed to climatic and economic risks.

Can Biochar Generate Carbon-Credit Income?

Biochar activities can be linked with carbon markets by accounting for:

- Avoided emissions from crop-residue burning
- Long-term carbon sequestration in soils

VM0042 Methodology

- The **VM0042 agricultural land-management methodology** measures both avoided emissions and carbon stored through biochar application.
- Each tonne of certified biochar may generate around **2–2.8 tonnes of carbon-dioxide-equivalent credits**.

Depending on carbon-market prices, this can provide additional income to:

- Farmers
- Rural communities
- Cooperatives
- Project developers

Projects using the **KISAN kiln developed by IIT Kharagpur** are testing how smallholders can convert and monetise farm waste.

What are Biochar's Energy Applications?

The pyrolysis of biomass produces syngas and bio-oil in addition to solid biochar.

Syngas

- Biochar production in India could generate approximately **20–30 million tonnes of syngas**.
- It could produce around **8–13 terawatt-hours of electricity annually**.

Bio-oil

Pyrolysis may generate approximately **24–40 million tonnes of bio-oil**.

This could substitute about **12–19 million tonnes of diesel or kerosene**, helping to:

- Reduce crude-oil imports
- Lower fossil-fuel consumption
- Cut fossil-fuel emissions by more than 2%

Biochar production can therefore link agricultural waste management with renewable-energy generation.

How Can Biochar Support Urban Waste Management?

India generates around **62 million tonnes of municipal solid waste annually**, of which more than **50% is biodegradable**.

Suitable organic feedstock such as:

- Food waste
- Biodegradable municipal waste
- Sewage sludge
- Crop residues

can be converted into biochar.

This can:

- Divert organic waste from landfills
- Reduce methane emissions
- Produce useful agricultural inputs
- Improve municipal waste management
- Connect urban waste streams with rural soil restoration

It reflects the principles of a **circular economy**, where waste is converted into productive economic value.

What are Biochar's Other Applications?

Water Purification

Chemically modified biochar can be used in wastewater treatment to filter toxic heavy metals such as:

- Chromium
- Arsenic

- Lead

Its porous structure allows it to absorb and retain contaminants.

Construction Sector

Adding approximately **2–5% biochar to concrete** can:

- Improve mechanical strength
- Increase heat resistance by about 20%
- Capture nearly **115 kg of carbon dioxide per cubic metre**

This expands biochar's role beyond agriculture into low-carbon construction.

What Do International Experiences Show?

Kenya

- Rice husks have been converted into biochar, producing certified carbon credits while improving soil pH and phosphorus content.

Thailand

- National programmes link biochar use with soil rehabilitation, carbon management and access to the national carbon registry.

Brazil

- Brazil's Embrapa Institute has reported high carbon retention and major yield improvements from biochar produced using sugarcane bagasse.
- These experiences show that biochar can be scaled when production technology, certification, soil management and carbon markets operate together

What Limits Biochar Adoption in India?

- **Low Farmer Awareness:** Biochar remains unfamiliar to many cultivators.
- **Pilot-Scale Use:** Most applications remain

confined to research trials.

- **Technology Gaps:** Affordable and decentralised pyrolysis units are not widely available.
- **Collection Challenges:** Biomass must be collected, transported and processed efficiently.
- **Certification Costs:** Carbon-credit projects require credible measurement, reporting and verification.
- **Weak Market Linkages:** Farmers need buyers for biochar and access to carbon markets.
- **Limited Investment:** Innovation, entrepreneurship and commercial production remain fragmented.
- **Affordability:** Small farmers require cost-effective access to biochar and processing technologies.

Way Forward

Develop Decentralised Pyrolysis Units

- Appropriately scaled plants should be established near farms and organic-waste generation centres to reduce transport costs.

Integrate with Agricultural Programmes

- Biochar should be connected with natural farming, soil-health management, climate-resilient agriculture and carbon-farming initiatives.

Strengthen Carbon-Market Access

- Farmers and cooperatives need institutional support for aggregation, certification and measurement, reporting and verification.

Promote Local Feedstock

- Regional residues such as paddy straw, maize stalks, coconut leaf stalks and sugarcane bagasse should be used

according to local availability.

Demonstrate Farm Benefits

- Field trials and farmer demonstrations should communicate improvements in soil fertility, water retention and crop productivity.

Encourage Multiple Applications

- Policy should support biochar use in agriculture, renewable energy, wastewater treatment and low-carbon construction.

Build an Integrated Ecosystem

- Technology providers, farmers, researchers, cooperatives, municipalities, investors and carbon markets must be connected through a common framework.

Conclusion

Biochar offers India a practical pathway to convert crop residues and biodegradable waste into valuable **“black gold.”** It can improve degraded soils, conserve water, raise crop productivity, generate renewable energy, purify wastewater and reduce the carbon footprint of construction.

Its large-scale success, however, will depend on affordable pyrolysis technology, farmer awareness, credible carbon accounting, investment and strong market linkages. An integrated biochar ecosystem can simultaneously advance **waste-to-wealth, climate action, energy security and agricultural resilience.**

S & T, Internal Security

Stockholm International Peace Research Institute Yearbook 2026 Yearbook 2026

Source: [The Hindu](#) / [SIPRI Yearbook 2026](#)

Relevance

UPSC: GS Paper III - Defence, Internal Security, Cyber Warfare, Nuclear Deterrence, Science and Technology.

Important Keywords

Prelims Keywords:

- SIPRI, SIPRI Yearbook 2026, Nuclear Warheads, Nuclear-Armed States, Operation Sindoor, No First Use, Nuclear Command Authority, New START Treaty, MTCR, NSG.

Mains Keywords:

- Nuclear Deterrence, Credible Minimum Deterrence, Nuclear Modernisation, Strategic Stability, India-China Rivalry, India-Pakistan Conflict, Cyber Warfare, Arms Control, Defence Indigenisation.

Why in News?

The **Stockholm International Peace Research Institute** released the **SIPRI Yearbook 2026**, which assesses global trends in **armaments, disarmament and international security**.

- The report estimated that India's nuclear arsenal increased to around **190 warheads by early 2026**. It also noted that India's nuclear modernisation is increasingly focused on developing **longer-range**

weapons capable of reaching targets across China, while continuing to address security concerns related to Pakistan.



SIPRI estimated India's military expenditure at \$92.1 billion, an increase of 8.9% over the previous year. File | Photo Credit: The Hindu

What is SIPRI?

- SIPRI** stands for **Stockholm International Peace Research Institute**.
- It is an independent international institute based in **Stockholm, Sweden**.
- It studies:
 - Military expenditure
 - Arms transfers
 - Nuclear weapons
 - Disarmament
 - Armed conflicts
 - International security
- Its annual **SIPRI Yearbook** is widely used for defence and security analysis.

Global Nuclear Trends

- SIPRI stated that all **nine nuclear-armed states** continued to modernise their nuclear arsenals.

Nuclear-Armed States

United States | Russia | United Kingdom | France
| China | India | Pakistan | North Korea | Israel

- The nine countries possessed around **12,187 nuclear warheads** at the start of **2026**.
- Around **9,745 warheads** were in military stockpiles for potential use.
- More than **4,000 warheads** were deployed with missiles and aircraft.
- The **United States and Russia** together held around **86%** of global nuclear warheads.
- SIPRI warned that disarmament is slowing because countries are adding new and modernised warheads even as older weapons are dismantled.



Key Findings on India

Nuclear Arsenal

- India's nuclear stockpile was estimated at around **190 warheads** by early 2026.
- India had around **12 deployed warheads** and **178 warheads in reserve/storage**.
- India's nuclear modernisation is increasingly focused on longer-range

delivery systems.

Military Spending

- India was the **world's fifth-largest military spender** in 2025.
- India's military expenditure was estimated at **USD 92.1 billion**.
- This was an increase of **8.9%** over the previous year.
- India ranked after:
 - United States
 - China
 - Russia
 - Germany

TOP 15 MILITARY SPENDERS, 2025

Country	Spending (US\$ b.)	Change (%), 2024-25
1 United States	954	-7.5
2 China	[336]	7.4
3 Russia	[190]	5.9
4 Germany	114	24
5 India	92.1	8.9
6 United Kingdom	89.0	-2.0
7 Ukraine	[84.1]	20
8 Saudi Arabia	[83.2]	1.4
9 France	68.0	1.5
10 Japan	62.2	9.7
11 Israel	48.3	-4.9
12 Italy	48.1	20
13 South Korea	47.8	2.6
14 Poland	46.8	23
15 Spain	40.2	50
Subtotal top 15	2 304	..
World	2 887	2.9

Arms Imports

- India remained the **second-largest importer of major arms** during 2021-25.
- India accounted for **8.2%** of global arms imports.
- The five largest arms importers were:

- Ukraine
- India
- Saudi Arabia
- Qatar
- Pakistan

India's Nuclear Modernisation

India's nuclear modernisation is shaped by two major security concerns.

1. China Factor

- SIPRI noted that India is focusing more on **longer-range nuclear delivery systems**.
- This reflects India's strategic need to maintain deterrence against China.
- China's estimated nuclear stockpile is much larger than India's.

2. Pakistan Factor

- India also continues to address its long-standing security rivalry with Pakistan.
- SIPRI described the **May 2025 India-Pakistan military confrontation**, known as **Operation Sindoor**, as an unusually severe military crisis between two nuclear-armed neighbours.
- The report noted that both sides took measures to prevent further escalation.

Cyber Warfare and Modern Conflict

- SIPRI observed that India and Pakistan integrated **cyber operations** into active military conflict for the first time during the 2025 crisis.
- This shows that modern warfare is becoming multi-domain.
- Conflicts today may involve:
 - Conventional military operations
 - Nuclear deterrence
 - Cyber attacks

- Drone warfare
- Information warfare
- Space-based systems

- This underlines the need for India to strengthen **cyber defence** along with conventional and nuclear capabilities.

India's Nuclear Doctrine

India officially adopted its nuclear doctrine in 2003.

Core Principles

- **Credible Minimum Deterrence:** India maintains only the level of nuclear capability needed to deter nuclear threats.
- **No First Use:** India will use nuclear weapons only in retaliation to a nuclear attack on Indian territory or Indian forces.
- **Massive Retaliation:** Any nuclear attack on India would invite massive retaliation to cause unacceptable damage to the aggressor.
- **Civilian Political Control:** Nuclear weapons can be authorised only by civilian political leadership through the **Nuclear Command Authority**.
- **Negative Security Assurance:** India has pledged not to use nuclear weapons against non-nuclear weapon states.
- **Commitment to Disarmament:** India supports universal, verifiable and non-discriminatory nuclear disarmament.

Major Arms Trade Trends, 2021-25

SIPRI identified **162 states** as recipients of major arms during 2021-25.

- The **USA remained the world's largest arms exporter**.

SIPRI YEARBOOK 2026

Global trends in armaments, disarmament and international security

★ ★ Released by the Stockholm International Peace Research Institute (SIPRI) ★ ★



1 WHY IN NEWS?

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3 INDIA IN FOCUS



- India's estimated nuclear arsenal: around 190 warheads (early 2026).
- India ranks 5th in global military spending in 2025.
- Military spending: US\$ 92.1 billion.
- Change in 2024–25: +8.9%.
- India is the 2nd largest recipient of major arms in 2021–25 with an 8.2% global share.



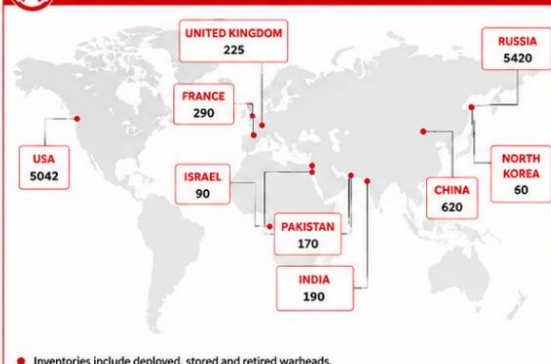
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15 Spain	40.2	50
Subtotal top 15	2304	-
World	2887	2.9

Figures in brackets are SIPRI estimates.



GLOBAL NUCLEAR WEAPON INVENTORIES, JANUARY 2026



• Inventories include deployed, stored and retired warheads.



MAIN SUPPLIERS AND RECIPIENTS OF MAJOR ARMS, 2021–25

TOP SUPPLIERS		TOP RECIPIENTS	
Global share of exports (%)		Global share of imports (%)	
1 USA	42	1 Ukraine	9.7
2 France	9.8	2 India	8.2
3 Russia	6.8	3 Saudi Arabia	6.8
4 Germany	5.7	4 Qatar	6.4
5 China	5.6	5 Pakistan	4.2
6 Italy	5.1	6 Japan	3.9
7 Israel	4.4	7 Poland	3.6
8 UK	3.4	8 USA	2.9
9 South Korea	3.0	9 Kuwait	2.8
10 Spain	2.3	10 Australia	2.8



IMPORTS OF MAJOR ARMS BY REGION

Recipient region	Global share (%), 2021–25	Change (%) in volume of imports from 2016–20 to 2021–25
Africa	4.3	-41
Americas	5.6	12
Asia and Oceania	31	-20
Europe	33	210
Middle East	26	-13

8 KEY TAKEAWAYS



The USA remains the largest military spender and the top arms supplier.



Russia and the USA still dominate total nuclear inventories.



Europe's arms imports rose sharply, while Asia and Oceania remained a major import region.



India features prominently in spending, arms imports and nuclear modernisation.

Source: SIPRI Yearbook 2026

- Its arms exports increased by 27% between 2016–20 and 2021–25.
- The US share in global arms exports rose from 36% to 42%.
- Russia's arms exports declined sharply by 64%, reducing its global share to 6.8%.
- Russia's share is now lower than at any time since 1950.
- European NATO members' arms exports increased by 36%.
- They accounted for 28% of total global arms exports during 2021–25.
- France's arms exports rose by 21%, giving it a 9.8% global share.

- Germany's exports increased by 15%, giving it a 5.7% global share.

Major Arms Importers

- The five largest arms importers were Ukraine, India, Saudi Arabia, Qatar and Pakistan.
- Together, they accounted for 35% of total global arms imports.
- Ukraine became the world's largest arms importer.
- Ukraine's arms imports were around 100 times higher in 2021–25 than in 2016–20.
- At least 36 countries supplied major arms to Ukraine, mostly as military aid.

- China's arms imports declined by 72%, making it the 20th largest arms importer.

THE MAIN SUPPLIERS AND RECIPIENTS OF MAJOR ARMS, 2021-25

Supplier	Global share exports (%)	Recipient	Global share imports (%)
1 USA	42	1 Ukraine	9.7
2 France	9.8	2 India	8.2
3 Russia	6.8	3 Saudi Arabia	6.8
4 Germany	5.7	4 Qatar	6.4
5 China	5.6	5 Pakistan	4.2
6 Italy	5.1	6 Japan	3.9
7 Israel	4.4	7 Poland	3.6
8 UK	3.4	8 USA	2.9
9 South Korea	3.0	9 Kuwait	2.8
10 Spain	2.3	10 Australia	2.8

Regional Import Trends

IMPORTS OF MAJOR ARMS, BY REGION

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Africa	4.3	-41
Americas	5.6	12
Asia and Oceania	31	-20
Europe	33	210
Middle East	26	-13

Nuclear Command Authority

The Nuclear Command Authority has two councils.

Political Council

- Chaired by the **Prime Minister**.
- It is the only body authorised to order the

use of nuclear weapons.

Executive Council

- Chaired by the **National Security Advisor**.
- It provides inputs to the Political Council and implements its directions.

Evolution of India's Nuclear Posture

Peaceful Nuclear Phase: 1947-1974

- India's nuclear programme initially focused on energy self-reliance.
- It was shaped by leaders such as **Homi J. Bhabha** and **Jawaharlal Nehru**.
- China's nuclear test in **1964** increased India's security concerns.

Pokhran-I: 1974

- India conducted its first nuclear test on **18 May 1974**.
- It was officially described as a **Peaceful Nuclear Explosion**.
- The test was code-named **Smiling Buddha**.

Weaponisation Phase: 1974-1998

- India faced international pressure and restrictions after 1974.
- Concerns over China and Pakistan shaped India's security calculations.
- India did not sign the **NPT** or **CTBT**.

Pokhran-II: 1998

- India conducted five underground nuclear tests in May **1998** under **Operation Shakti**.
- India formally declared itself a nuclear-weapon state.
- National Technology Day** is observed on **11 May** to commemorate Operation Shakti.

Established Nuclear Power: 1998-Present

- India drafted its nuclear doctrine in **1999**.
- It officially operationalised the doctrine in

2003.

- The **2008 India-US Civil Nuclear Agreement** and NSG waiver helped India enter global nuclear commerce despite being outside the NPT.

India and Global Nuclear Treaties

NPT

- India has not signed the **Nuclear Non-Proliferation Treaty**.
- India argues that the NPT is discriminatory because it recognises only some countries as nuclear-weapon states.

CTBT

- India has not signed the **Comprehensive Nuclear-Test-Ban Treaty**.
- India supports disarmament but wants it to be universal and non-discriminatory.

TPNW

- India opposes the **Treaty on the Prohibition of Nuclear Weapons, 2017**.
- India argues that it lacks a strong verification mechanism.

Export Control Regimes

India is a member of three major export control regimes:

- **Missile Technology Control Regime**
- **Wassenaar Arrangement**
- **Australia Group**

India continues to seek membership in the **Nuclear Suppliers Group**.

Significance for India

- Strengthens India's **credible minimum deterrence**.
- Reflects India's response to a two-front nuclear security environment.

- Shows a gradual strategic shift from Pakistan-focused deterrence to a wider China-linked posture.
- Highlights India's need for advanced delivery systems and command-control capabilities.
- Shows the growing importance of cyber warfare in nuclear crisis management.
- Underlines the need for defence indigenisation because India remains a major arms importer.
- Reinforces the importance of responsible nuclear behaviour and crisis stability.

Challenges

- Nuclear modernisation may intensify arms race concerns in South Asia.
- India faces simultaneous strategic pressure from China and Pakistan.
- Cyber operations may increase the risk of miscalculation during crises.
- Heavy arms import dependence affects strategic autonomy.
- Rising defence expenditure must be balanced with development needs.
- Absence of strong global arms control frameworks increases nuclear risks.
- Expiry of the **New START Treaty** without replacement may weaken global nuclear stability.

Way Forward

- Maintain India's doctrine of **credible minimum deterrence**.
- Strengthen nuclear command, control and communication systems.
- Improve cyber security of military and strategic infrastructure.
- Build crisis communication mechanisms



with nuclear neighbours.

- Reduce dependence on arms imports through **Atmanirbhar Bharat** in defence.
- Invest in drones, AI, cyber defence, space systems and missile defence.
- Continue support for universal and non-discriminatory nuclear disarmament.
- Promote responsible nuclear diplomacy at global platforms.

Conclusion

The SIPRI Yearbook 2026 shows that India's

nuclear and defence posture is evolving in response to a complex security environment involving China, Pakistan, cyber warfare and global nuclear modernisation.

- India must maintain credible deterrence while avoiding unnecessary escalation. A balanced strategy based on **responsible nuclear policy, defence indigenisation, cyber preparedness, crisis stability and diplomatic engagement** is essential for long-term national security.

Building India's Space Future

Source: [PIB](#)

Relevance: GS Paper III - Science & Technology, Space Technology, Indigenisation, Innovation and Disaster Management

Important Keywords

Prelims:

- Chandrayaan-3, Aditya-L1, SPADEX, Gaganyaan, Bharatiya Antariksh Station

Mains:

- Strategic Autonomy, Space Commercialisation, Public-Private Partnership, Space-Based Governance, Responsible Space Power

Why in News?

Over the past twelve years, India's space programme has evolved from a government-led scientific initiative into a strategic ecosystem supporting **deep-space exploration, human spaceflight, private innovation, commercial services, international cooperation and citizen-centric development**. Major achievements include **Chandrayaan-3, Aditya-L1, SPADEX**, preparations for **Gaganyaan** and the **Bharatiya Antariksh**

Station, and rapid growth of private space start-ups.

What Has Driven India's Space Transformation?

India's space progress has been shaped by three broad pillars:

Expanding Space Capability

- India has strengthened its capacity in lunar science, planetary exploration, solar observation, human spaceflight, space docking and launch-vehicle development.

Building National Capacity

- Space applications now support agriculture, water management, connectivity, disaster response, healthcare, education, governance and livelihoods.

Strengthening Global Partnerships

- India has expanded cooperation with major space agencies and partner countries in joint missions, research, training, data sharing and peaceful uses of outer space.



India's Space Capability

How Has the Chandrayaan Programme Advanced Lunar Exploration?

Chandrayaan-1

Launched in **2008**, Chandrayaan-1 was India's first lunar mission. It:

- Detected evidence of water molecules and hydroxyl on the Moon
- Improved understanding of lunar resources
- Studied the lunar exosphere through the Moon Impact Probe

Chandrayaan-2

Launched in **2019**, its orbiter:

- Operated from an altitude of about 100 km
- Provided high-resolution lunar images
- Captured surface details as fine as 30 centimetres

Chandrayaan-3

On **23 August 2023**, India became:

- The first country to soft-land near the lunar south pole
- The fourth country to soft-land on the Moon, after the United States, Russia and China

The Vikram lander touched down near **69.3° South latitude**. Scientific instruments conducted in-situ

studies and confirmed the presence of **sulphur** through direct elemental analysis.

Future Lunar Missions

- **Chandrayaan-4:** Planned for 2027; aims to land, collect lunar samples and return them to Earth.
- **Chandrayaan-5/LUPEX:** A joint mission with Japan to study water and volatile materials in permanently shadowed regions near the lunar south pole.

What Was the Significance of Mangalyaan?

The **Mars Orbiter Mission**, or Mangalyaan, entered Martian orbit on **24 September 2014**.

India became:

- The first country to reach Mars orbit on its maiden attempt
- The fourth space agency to place a spacecraft around Mars

Designed for six months, it functioned for more than **eight years** and generated data on:

- Martian atmosphere
- Exosphere
- Surface features
- Interaction with solar winds

The mission demonstrated India's capacity to execute complex interplanetary missions efficiently.

What Has Aditya-L1 Achieved?

- **Aditya-L1** is India's first dedicated solar observatory.
- Launched in 2023, it was placed in a halo orbit around the **Sun-Earth L1 Lagrange Point**, nearly **1.5 million km** from Earth.

It studies:

- Solar corona
- Solar winds

- Space weather
- Solar activity affecting Earth and technological systems

It functions as a proposal-driven observatory, and more than **27 TB of solar data** has been released for scientific research.

How Has India Expanded Space Astronomy?

AstroSat

- India's first multi-wavelength space observatory completed a decade in orbit in September 2025 and has contributed to major astronomical discoveries.

XPoSat

- Launched on **1 January 2024**, XPoSat strengthened India's capacity in X-ray astronomy.
- Both operate as proposal-driven observatories serving the global scientific community.

Why is SPADEX a Major Technological Breakthrough?

The **Space Docking Experiment**, or SPADEX, demonstrated autonomous docking and undocking in January 2025.

India became the fourth country after the:

- United States
- Russia
- China

ISRO also demonstrated:

- Power transfer between docked satellites
- Robotic-arm operations in microgravity
- Indigenous Bharatiya Docking System

Docking technology is essential for:

- Chandrayaan-4, Gaganyaan, Bharatiya Antariksh Station, Complex future orbital missions

What is India's Venus Mission?

The **Venus Orbiter Mission**, targeted for March 2028, will study:

- Surface geology, Atmospheric composition, Ionosphere, Resurfacing processes, Impact of solar activity

It will also test advanced technologies such as:

- Aerobraking, High-performance thermal management

These capabilities will strengthen India's deep-space expertise.

What is Gaganyaan?

Approved in January 2019, **Gaganyaan** is India's first indigenous human-spaceflight programme.

It aims to:

- Send up to three astronauts, Place them in a 400-km orbit, Keep them in space for up to three days, Return them safely to Earth

The programme includes:

- Two uncrewed missions
- One crewed mission

It entered its final phase in 2025 and is strengthening Indian industry, life-support technology, crew safety and human-spaceflight capability.

How Did the Axiom-4 Mission Support Gaganyaan?

As part of India's human-spaceflight preparations, Group Captain **Shubhanshu Shukla** participated in the ISRO-NASA-supported Axiom-4 mission to the International Space Station in 2025.

He conducted seven Indian microgravity experiments covering:

- Muscle regeneration, Algal growth, Crop viability, Microbial survivability, Cognitive performance, Cyanobacterial behaviour



The mission provided India operational experience in astronaut training, space research and international human-spaceflight procedures.

What is the Bharatiya Antariksh Station?

- The **Bharatiya Antariksh Station**, or BAS, is India's proposed space station and a major component of Space Vision 2047.

It will be:

- A five-module station
- Located in Low Earth Orbit
- Designed for long-duration missions
- Used for microgravity research

The Union Cabinet approved the development of the first module, **BAS-01**, for launch by **2028**.

Research areas will include:

- Life sciences
- Medicine
- Emerging technologies
- Future human exploration

Private Participation and Commercialisation

How Has India Opened the Space Sector?

The sector was opened to private players in **2020**, followed by the **Indian Space Policy 2023**.

Major support measures include:

- IN-SPACe Seed Fund Scheme
- Pre-incubation Entrepreneurship Programme
- ₹1,000-crore Venture Capital Fund
- ₹500-crore Technology Adoption Fund
- Liberalised FDI rules
- Clear authorisation norms under NGP 2024

What are the Liberalised FDI Rules?

The government liberalised FDI in the space sector in February 2024.

- Up to **74% automatic-route FDI** for satellite manufacturing, operations, data products and ground-user services
- Up to **49% automatic-route FDI** for launch vehicles, related systems and spaceports
- **100% automatic-route FDI** for satellite and ground-segment components and subsystems

These reforms seek to attract investment, technology and manufacturing capacity.

How Fast Has the Space Start-Up Ecosystem Grown?

- India had only **one registered space start-up in 2014**.
- By February 2026, the number had crossed **400**.
- Investment in Indian space start-ups exceeded **\$500 million**, including nearly **\$150 million in 2025**.

Major private companies include:

- Pixxel, Dhruva Space, Skyroot Aerospace, Agnikul Cosmos, Bellatrix Aerospace

What is the Role of NSIL and IN-SPACe?

NewSpace India Limited

Established in 2019, NSIL commercialises:

- ISRO technologies, Launch services, Satellite services

Its revenue rose from **₹321.77 crore in 2021-22** to **₹3,246.09 crore in 2024-25**.

IN-SPACe

It acts as a single-window institution to:

- Facilitate private participation, Authorise private space activities, Support technology transfer, Improve regulatory predictability

By January 2026, it had facilitated **71 ISRO technology transfers**.

How Large is India's Space Economy?

- India's space economy is valued at approximately **\$8 billion**, accounting for about **2-3% of the global space economy**.
- It is projected to reach **\$40-45 billion** over the next decade, with a targeted global share of **8% by 2030**.

Launch Vehicles and Indigenous Technology

How Self-Reliant is India in Space Transportation?

India operates:

- PSLV, GSLV, LVM3

Together, these can place:

- Up to 10 tonnes in Low Earth Orbit
- Up to 4.2 tonnes in Geosynchronous Transfer Orbit

They provide independent access for communication, navigation, Earth observation and exploration missions.

What is the Next Generation Launch Vehicle?

The approved **Next Generation Launch Vehicle** will carry up to:

- 30 tonnes to Low Earth Orbit

A partially reusable variant is planned with a payload capacity of:

- 14 tonnes to Low Earth Orbit

Reusable technologies are being developed to reduce launch costs.

How is India Expanding Launch Infrastructure?

Kulasekarapattinam Spaceport

- India's second spaceport is being developed in Tamil Nadu to support small-satellite

launches.

SSLV Complex

- The complex is designed to support **20-25 orbital launches annually**, with its first launch targeted for 2026-27.

Third Launch Pad

A third launch pad at Sriharikota was approved in January 2025 at a cost of **₹3,984.86 crore**.

It will support:

- Next-generation launch vehicles
- Human-spaceflight missions
- Future lunar exploration

What Advances Have Been Made in Propulsion?

India is developing:

- Electric propulsion systems
- Advanced cryogenic engines
- Semi-cryogenic engines
- Reusable rocket technologies
- Multiple-restart capability

The first operational satellite using electric propulsion is targeted for 2026-27.

The upgraded SSLV upper stage has improved payload capacity by nearly **90 kg**.

What is the RLV-TD Programme?

The **Reusable Launch Vehicle-Technology Demonstrator** programme develops technologies for low-cost reusable access to space.

It has tested:

- Hypersonic flight, Autonomous navigation, Runway landing, Thermal protection, Re-entry management

India has completed three successful autonomous runway-landing experiments.



What Indigenous Electronics Has India Developed?

ISRO and the Semiconductor Laboratory developed:

- **VIKRAM3201:** India's first fully indigenous 32-bit space microprocessor
- **KALPANA32:** A processor for high-reliability space missions

These systems reduce dependence on imported components and strengthen mission security.

India's Global Space Partnerships

How Has India's Global Space Role Expanded?

- ISRO launched only **35 foreign satellites** between the 1990s and 2014.
- After 2014 and up to March 2026, India launched **399 foreign satellites**.

India has signed more than:

- 300 cooperation agreements
- With 61 countries
- And five multilateral organisations

What is India's Major Space Partnerships?

- **Russia:** Supports astronaut training, life-support systems, crew safety and Gaganyaan; cooperation dates from **Aryabhata (1975)** and **Rakesh Sharma's spaceflight (1984)**.
- **United States:** The **NASA-ISRO NISAR mission** monitors land, forests, glaciers, oceans, climate change and natural disasters.
- **France:** The **TRISHNA mission** will study crop-water stress, irrigation needs, glaciers, urban ecosystems and climate change.
- **Japan:** The **LUPEX mission** will explore lunar water and ice near the Moon's polar

region.

- **European Space Agency:** Cooperation covers human spaceflight, astronaut training, Low Earth Orbit operations, Moon missions and the **Bharatiya Antariksh Station**.
- **Germany:** Focus areas include satellite and optical communication, human spaceflight, microgravity research, Earth observation and drone technologies.
- **Italy:** Cooperation covers Earth observation, heliophysics, lunar science, sustainable space use and commercial activities.
- **Saudi Arabia:** Partnership includes satellite development, space science, research, innovation and capacity building.
- **Mauritius and Bhutan:** India supports satellite development, ground stations, Earth observation, communication and peaceful space applications.

What is NavIC?

- **NavIC** is India's indigenous regional satellite navigation system.
- It provides positioning, navigation and timing services across India and up to **1,500 km beyond its borders**.

Applications include:

- Train tracking, Vehicle monitoring, Power-grid synchronisation, Geo-fencing Vessel monitoring, Aadhaar device geo-tagging, Public-safety alerts

India has also worked with industry to integrate NavIC into mobile chipsets.

How Does Space Technology Support Agriculture and Water Security?

Satellite applications assist in:

- Crop-acreage mapping, Production

forecasting, Drought assessment, Crop-yield estimation, Agricultural insurance, Irrigation planning, Water-resource management

India-WRIS and the National Hydrology Project use space-based information to improve water governance.

How Does Space Technology Strengthen Disaster Management?

Satellites monitor:

- Cyclones, Floods, Landslides, Forest fires, Other natural hazards
- The **National Database for Emergency Management 5.0** provides real-time geospatial decision support.
- The **Satellite Aided Search and Rescue programme** supports distress alerts and emergency response.

What is the Role of Satellites in Health and Education?

Telemedicine

- Around **179 telemedicine nodes** operate in remote and strategic areas, including nearly 80 in high-altitude regions.

Education

- Under PM e-VIDYA, **370 educational television channels** are delivered through GSAT-15 and GSAT-9.

These services support:

- Digital education, Teacher training, Remote learning, educational outreach

Significance of India's Space Transformation

- **Strategic Autonomy:** Indigenous launch systems, navigation and electronics reduce external dependence.

- **Scientific Leadership:** Lunar, solar, planetary and astronomical missions advance global knowledge.
- **Economic Growth:** Start-ups, FDI and commercial launches are expanding the space economy.
- **Developmental Governance:** Space technology supports agriculture, health, education and disaster management.
- **International Credibility:** Joint missions demonstrate India's reliability as a global partner.
- **National Security:** Navigation, communication and Earth observation strengthen strategic capacity.
- **Inclusive Development:** Space applications increasingly benefit ordinary citizens.
- **Future Readiness:** Gaganyaan, BAS and NGLV prepare India for long-term human exploration.

Way Forward

- **Strengthen Research:** Increase investment in propulsion, reusable systems, robotics and human-spaceflight technology.
- **Expand Private Participation:** Provide stable authorisation, finance and technology-transfer mechanisms.
- **Build Space Infrastructure:** Complete new spaceports, launch pads and testing facilities.
- **Promote Indigenous Manufacturing:** Reduce dependence on imported electronics and critical components.
- **Develop Human Capital:** Expand education, skilling and research in space sciences.
- **Improve Citizen Applications:** Integrate satellite information more deeply into

public administration.

- **Promote Space Sustainability:** Support responsible operations and peaceful use of outer space.
- **Strengthen Global Cooperation:** Continue joint missions, data sharing and capacity building.

Conclusion

India's space programme has evolved from a scientific initiative into a powerful instrument of **strategic autonomy, economic growth, global cooperation and public welfare**. Missions such as

Chandrayaan-3, Aditya-L1 and SPADEX demonstrate technological maturity, while Gaganyaan and the Bharatiya Antariksh Station represent the next phase of human-spaceflight ambition. At the same time, NavIC, disaster-warning systems, telemedicine, educational satellites and agricultural applications show that India's space journey is not only about reaching distant frontiers. It is equally about using science to improve lives and build a self-reliant, responsible and globally respected space power.

Why Does Artificial Intelligence Need Global Regulation?

Source: [The Indian Express](#)

Relevance: UPSC GS Paper III: Science & Technology, Artificial Intelligence, Emerging Technologies, Cybersecurity and Innovation.

Important Key Words

Prelims Keywords

- Global Dialogue on AI, International Scientific Panel on AI, Trusted AI Commons, Data Sovereignty, IndiaAI Mission

Mains Keywords

- Responsible AI, Global AI Governance, Digital Colonialism, Regulatory Fragmentation, Equitable Technology Access

Why in News?

Professor **B. Ravindran**, head of the Centre for Responsible AI at IIT Madras, has been appointed as the **lone Indian among 40 members** of the **Independent International Scientific Panel on AI** for a three-year term.

- The Panel will periodically assess scientific

developments in artificial intelligence and provide evidence-based inputs to the **Global Dialogue on AI**, a United Nations-backed platform in which every country has been invited to participate.

What is the Independent International Scientific Panel on AI?

The Independent International Scientific Panel on AI is the **first global scientific body established specifically to assess developments in artificial intelligence**.

Major Functions

- Periodically review the state of AI science.
- Assess emerging capabilities and risks.
- Prepare reports on the scientific aspects of AI.
- Provide scientific inputs to the Global Dialogue on AI.
- Support evidence-based international discussions.

The Panel will not directly decide political or regulatory questions. Its role is limited to scientific assessment, while governments participating in the



Global Dialogue will address policy and governance issues.

What is the Global Dialogue on AI?

The **United Nations General Assembly** established the Global Dialogue on AI as an inclusive international platform for discussing the development, deployment and governance of artificial intelligence.

It seeks to:

- Include all countries in AI-governance discussions.
- Connect scientific assessments with policymaking.
- Protect the interests of developing countries.
- Encourage international cooperation.
- Ensure that AI benefits humanity as a whole.

The Scientific Panel and Global Dialogue together represent an emerging two-level governance framework: **scientific assessment by experts and policy deliberation by governments.**

Why is Global AI Governance Necessary?

Artificial intelligence is a transformative general-purpose technology capable of reshaping economies, industries, labour markets, governance and everyday life.

- Its impact has been compared to that of the **steam engine**. Therefore, fragmented national approaches alone may be insufficient to govern a technology whose development and deployment cross national borders.

A global framework can help establish minimum standards relating to:

- Safety
- Accountability
- Transparency
- Responsible deployment

- Data protection
- Risk assessment
- Equitable access

How Can Regulatory Fragmentation Affect Innovation?

At present, countries are developing different regulatory frameworks for artificial intelligence.

If each country adopts widely differing standards, AI companies may have to modify their systems separately for every jurisdiction.

Possible Consequences

- **Higher Compliance Costs:** Companies must satisfy multiple regulatory requirements.
- **Fragmented Development:** AI systems may be designed differently for separate markets.
- **Slower Innovation:** Resources may shift from research to regulatory compliance.
- **Unequal Deployment:** Companies may introduce advanced services only in countries with favourable regulations.
- **Regulatory Arbitrage:** Firms may relocate activities to jurisdictions with weaker safeguards.

Internationally agreed minimum regulations can reduce such fragmentation while allowing countries to adopt additional protections suited to their circumstances.

What are the Concerns Around Data Sovereignty?

Data sovereignty refers to the principle that data generated within a country should remain subject to that country's laws and control.

It can help protect:

- National security
- Citizens' privacy

- Domestic data resources
- Strategic economic interests

However, excessive localisation requirements may create difficulties if every country insists that:

- All data must remain within national borders.
- AI infrastructure must be domestically located.
- AI development must occur entirely within the country.
- Cross-border data access must be severely restricted.

Many countries lack the computing power, financial resources and technical expertise needed to build an independent AI ecosystem. Strict national boundaries may therefore increase dependence on the few countries that already control advanced infrastructure.

What is Digital Colonialism?

Digital colonialism refers to a situation in which technologically weaker countries become dependent on foreign platforms, AI models, data infrastructure and technical standards controlled by powerful countries or corporations.

Developing countries may become digital colonies when they:

- Provide data without receiving proportional economic benefits.
- Depend on foreign AI systems for essential services.
- Lack influence over global technical standards.
- Remain passive consumers rather than technology developers.
- Cannot effectively regulate harmful AI applications.
- Lose control over strategic digital infrastructure.

Many countries in Asia and Africa may lack the institutional capacity required to frame robust AI regulations. Global minimum standards can help protect them from exploitation and technological dependence.

Can Global Regulation Control AI-Related Risks?

Artificial intelligence can support beneficial applications in healthcare, agriculture, education and governance. However, advanced AI tools may also be misused.

Potential risks include assistance in developing:

- Biological weapons
- Chemical weapons
- Advanced cyberattacks
- Disinformation systems
- Harmful autonomous applications

International treaties already regulate biological and chemical weapons. Similar global arrangements may be required to control high-risk AI models and tools that could enable the development of such weapons.

The challenge is to regulate dangerous applications without restricting beneficial innovation.

What is the Risk of an AI Non-Proliferation Regime?

AI governance could adopt language similar to nuclear non-proliferation.

- Some technologically advanced countries or companies may claim that only they possess the capacity to develop safe and responsible AI. They may then seek unrestricted development rights for themselves while limiting access for others.

Such a regime could:

- Concentrate technological power.
- Permanently exclude developing countries.

- Restrict access to advanced models and computing resources.
- Create dependence on a few AI-producing nations.
- Reproduce inequalities associated with the global nuclear order.

Therefore, international regulation must prevent dangerous uses without becoming a mechanism for preserving technological monopolies.

Why Does AI Governance Matter for Developing Countries?

Equitable Access

- Developing countries should be able to use AI in agriculture, healthcare, education, disaster management and public administration.

Protection from Harm

- Common safeguards can protect citizens from unsafe, discriminatory or unaccountable AI systems.

Participation in Rule-Making

- Countries that are not major AI developers should still participate in determining global standards.

Capacity Building

- International cooperation can help countries develop scientific, regulatory and institutional expertise.

Prevention of Digital Dependence

- Inclusive governance can reduce excessive dependence on foreign technologies and corporations.

Developmental Opportunity

- Countries should not be denied AI-driven growth merely because they lack the resources to create large AI models or

computing infrastructure.

What are the Trusted AI Commons?

The **Trusted AI Commons** is a proposed open repository containing tools and resources required to develop and deploy artificial intelligence safely and responsibly.

- It was one of the major outcomes of the **New Delhi AI Impact Summit held in February 2026**.
- The platform will initially be hosted and managed by India. The **IndiaAI Mission** will identify an appropriate institutional mechanism for its operation.

What Will the Trusted AI Commons Contain?

The platform is expected to provide:

- Safety-testing tools
- Evaluation benchmarks
- Datasets
- Deployment protocols
- Responsible-AI frameworks
- Model-assessment resources
- Testing methodologies

For example, an organisation developing an agricultural AI system could use the Commons to identify:

- Relevant datasets
- Suitable evaluation tools
- Safety benchmarks
- Testing procedures
- Deployment protocols

It would function as a **one-stop platform for responsible AI resources**.

Why is it Called a "Commons"?

It is called a Commons because its resources are intended to be:

- Openly available
- Commonly accessible
- Shared across institutions and countries
- Offered under liberal licensing conditions
- Usable by governments, researchers, start-ups and civil society

The Commons will not immediately commission the development of every tool. It will initially bring together existing resources created by organisations such as the **Centre for Responsible AI at IIT Madras** and technology companies such as Google.

How Can the Trusted AI Commons Help?

Lowering Entry Barriers

- Small countries, start-ups and research institutions may not have the resources to build independent AI-safety infrastructure.

Common Evaluation Standards

- Shared benchmarks can make AI testing more consistent across countries and sectors.

Responsible Deployment

- Developers can evaluate AI systems before deploying them in sensitive sectors such as healthcare or agriculture.

Inclusive Innovation

- Open resources can allow smaller organisations and developing countries to participate in AI development.

Transparency and Trust

- Common testing tools can improve public confidence in AI systems.

Global Capacity Building

- The platform can strengthen the technical capacity of countries that currently lack advanced AI-governance institutions.

What is India's Significance in Emerging Global AI Governance?

- **Scientific Representation:** Professor B. Ravindran is the lone Indian member of the 40-member international scientific panel.
- **Institutional Leadership:** India will initially host and manage the Trusted AI Commons.
- **Developing-Country Voice:** India can represent countries that use AI extensively but do not dominate AI development.
- **Responsible-AI Expertise:** IIT Madras' Centre for Responsible AI is developing tools for safe and accountable AI systems.
- **Global Standard-Setting:** Participation allows India to influence emerging international norms.
- **Inclusive Technology Diplomacy:** India can promote an AI order that balances innovation, safety and equitable access.

What are the Major Challenges in Global AI Governance?

- Differing national interests and regulatory approaches
- Rapidly changing AI capabilities
- Concentration of computing infrastructure
- Dominance of large technology companies
- Unequal regulatory capacity among countries
- Tension between data sovereignty and data sharing
- Difficulty in defining high-risk AI applications
- Risk of biological, chemical and cyber misuse
- Possibility of exclusionary technology controls
- Lack of common testing and accountability standards

Way Forward

Establish Minimum Global Standards

- Countries should agree on basic principles relating to safety, transparency, accountability and responsible use.

Adopt Risk-Based Regulation

- High-risk applications should face stricter scrutiny, while low-risk innovation should not be unnecessarily restricted.

Ensure Inclusive Representation

- Developing countries must have meaningful participation in global AI institutions.

Build Regulatory Capacity

- Technical and institutional assistance should be provided to countries lacking AI-governance expertise.

Promote Open Resources

- Platforms such as the Trusted AI Commons should provide accessible datasets, benchmarks and safety tools.

Prevent Technology Monopolies

- Global frameworks should not grant a few

countries or corporations permanent control over advanced AI.

Strengthen Independent Scientific Assessment

- Periodic assessments should guide regulation as AI technology evolves.

Balance Sovereignty and Cooperation

- Countries must protect data and national interests without completely fragmenting the global AI ecosystem.

Conclusion

Artificial intelligence is too transformative and globally interconnected to be governed solely through fragmented national regulations. A global framework is necessary to control dangerous uses, reduce regulatory uncertainty and protect countries that lack advanced AI-governance capacity.

However, global regulation must not become an exclusionary non-proliferation regime controlled by a few countries or technology companies. The future AI order should be based on **scientific evidence, minimum global standards, inclusive representation, open resources and equitable access to innovation.**

India's Emerging Technology Ecosystem

Source: [Press Information Bureau \(PIB\)](#)

Relevance:

GS Paper III: Science and Technology, Artificial Intelligence, Semiconductors, Quantum Technology, Supercomputing, Biotechnology, Digital Infrastructure and Cybersecurity

Important Keywords

Prelims Keywords

- Digital India Programme, Digital Public Infrastructure, IndiaAI Mission, India

Semiconductor Mission, Semicon India Programme, National Quantum Mission, National Supercomputing Mission, PARAM Rudra, MeghRaj, National Blockchain Framework

Mains Keywords

- Technological sovereignty, digital transformation, indigenous innovation, mission-mode governance, frontier technologies, responsible artificial intelligence, human-centric technology, research and development ecosystem,

Why in News?

India is increasingly moving from being a large consumer of digital technologies to becoming a global centre for **technology creation, innovation and deployment**.

Mission-mode programmes in **Artificial Intelligence, semiconductors, quantum technologies, supercomputing, cloud computing, blockchain and biotechnology** are strengthening India's technological capability. These initiatives are also supporting the broader vision of **Viksit Bharat 2047**.

What is Driving India's Technology Transformation?

India's emerging technology ecosystem rests on three interconnected pillars:

- **National capacity:** Expansion of digital infrastructure, data centres, cloud systems, research institutions and high-performance computing.
- **Technological capability:** Development of indigenous solutions in AI, chip design, quantum communication, blockchain and biotechnology.
- **Global credibility:** Promotion of trusted Digital Public Infrastructure, responsible technology governance and international partnerships.

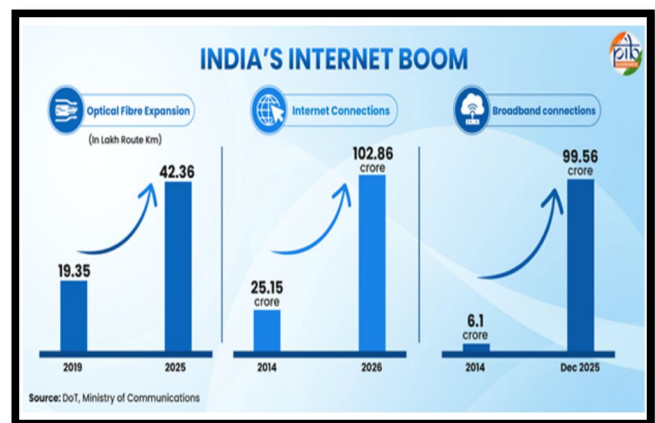
The transformation has been enabled by sustained public investment, startup growth, industry-academia collaboration and large-scale skilling programmes.

Digital India: Foundation of the Technology Ecosystem

The **Digital India Programme**, launched in 2015, created the basic infrastructure required for emerging technologies.

- **Connectivity expansion:** Optical fibre coverage increased from 19.35 lakh route km in 2019 to 42.36 lakh route km in 2025.
- **Internet access:** Connections increased from 25.15 crore in 2014 to 102.86 crore in 2026.
- **Broadband growth:** Broadband connections rose from 6.1 crore to 99.56 crore.
- **5G rollout:** Services reached 99.9% of districts.
- **Affordability:** Average data cost fell from around ₹269 per GB to ₹8-10 per GB.
- **Usage:** Monthly data consumption increased from 61.66 MB to 24.01 GB per user.

Affordable connectivity enabled the growth of **digital payments, cloud services, telemedicine, online education, e-governance and startups**.



Major Emerging Technology Initiatives

1. Artificial Intelligence

The **IndiaAI Mission**, approved in 2024 with an outlay of over ₹10,300 crore, aims to create a nationally accessible AI ecosystem.

Its major components include:

- Indigenous AI computing infrastructure
- Access to advanced GPUs
- AI datasets and models
- Startup support

- Research and innovation
- AI skilling
- Safe and responsible AI

A common computing facility with more than **38,000 GPUs** is being developed. The **AI Kosh** platform hosts 12,115 datasets and 306 AI models across 20 sectors.

Four AI Centres of Excellence focus on:

- Education
- Healthcare
- Sustainable cities
- Agriculture

These centres are developing practical solutions such as disease detection, traffic forecasting, flood prediction and climate-smart farming.

2. Semiconductor Ecosystem

- Semiconductors are essential for electronics, defence, telecommunications, AI, cloud systems and advanced manufacturing.

The **Semicon India Programme**, launched in 2021 with an outlay of ₹76,000 crore, supports:

- Semiconductor fabrication
- Display manufacturing
- Chip design
- Packaging and testing
- Research
- Talent development

As of June 2026, **12 projects worth around ₹1.64 lakh crore** had been approved, including one semiconductor fabrication unit, two compound semiconductor fabs and nine packaging units.

- The **Design Linked Incentive Scheme** supports domestic chip design companies, startups, MSMEs and academic institutions.
- The **India Semiconductor Mission 2.0** focuses on semiconductor equipment, materials, indigenous intellectual property and resilient supply chains.

3. Quantum Technologies

The **National Quantum Mission**, approved in 2023 with an outlay of ₹6,003.65 crore, focuses on:

- Quantum computing
- Quantum communication
- Quantum sensing and metrology
- Quantum materials and devices
- The mission has established four thematic hubs, supported 17 startups and engaged more than 152 researchers across 43 organisations.
- India also demonstrated a **1,000-km secure quantum communication network**.
- The foundation stone for India's first **Quantum Valley** was laid in Amaravati in February 2026.
- Quantum technologies have applications in national security, finance, healthcare, logistics and climate modelling.

4. Supercomputing

- The **National Supercomputing Mission**, launched in 2015 with an outlay of ₹4,500 crore, aims to strengthen India's high-performance computing capacity.

India has deployed:

- 38 supercomputers
- Combined computing power of 47 petaflops
- Indigenous PARAM Rudra systems

Supercomputers support weather forecasting, climate research, AI, drug discovery and advanced scientific modelling.

5. Cloud Computing

- The government cloud platform **MeghRaj**, launched in 2014, provides secure and scalable computing infrastructure for public institutions.

MeghRaj 2.0 strengthened:

- Hybrid cloud architecture
- Cybersecurity
- Data control
- Service scalability



- Its adoption increased from 342 government departments in 2015-16 to 2,323 departments by June 2026.
- It supports major platforms such as DigiLocker, MyGov and the National Scholarship Portal.

6. Blockchain

- The **National Blockchain Framework**, initiated in 2021, seeks to create a secure and interoperable blockchain ecosystem for governance.

Important platforms include:

- Vishvasya Blockchain Stack
- NBFLite Sandbox
- Praamaanik
- National Blockchain Portal

Blockchain is being used for:

- Property records
- Document verification
- Medicine supply chains
- Judicial records
- Audit trails
- Spam control

More than 3 crore property documents had been verified through blockchain platforms by October 2025.

7. Data Centres

- Data centres are the physical backbone of AI, cloud computing, blockchain and digital governance.
- India's data centre capacity increased from around:
 - 375 MW in 2020
 - Nearly 1,500 MW in 2025
- Major hubs include Mumbai, Navi Mumbai, Hyderabad, Bengaluru, Noida and Jamnagar.
- Large hyperscale and AI-focused projects

are also being developed in Andhra Pradesh, Gujarat, Maharashtra and Uttar Pradesh.

Data centres support:

- Data sovereignty
- High-performance computing
- Digital public services
- Cloud adoption
- Skilled employment
- Investment

8. Biotechnology

- Biotechnology is emerging as a major driver of healthcare, food security and industrial innovation.

Important initiatives include:

- National Biopharma Mission
- BioE3 Policy
- BioNEST incubators
- i4 innovation programme
- PACE programme
- India's biotechnology sector grew from over USD 150 billion in 2023 to around USD 190 billion by June 2026.
- DBT-BIRAC established 94 bio-incubators across 25 States and Union Territories.

Building Research and Innovation Capacity

The **Anusandhan National Research Foundation** became operational in 2024.

It promotes collaboration among:

- Universities
- Research institutions
- Industry
- Startups
- Government

Its programmes focus on high-impact research,



translational innovation and industry-academia partnerships.

- The **Research Development and Innovation Scheme**, approved in 2025 with a corpus of ₹1 lakh crore, supports long-term private-sector research in AI, advanced manufacturing, deep technology and strategic sectors.
- These initiatives aim to bridge the gap between laboratory research and commercial applications.

Skilling for Emerging Technologies

India's technology ambitions require a future-ready workforce.

FutureSkills PRIME

Launched in 2018 by MeitY and NASSCOM, it provides training in:

- AI, Big Data, IoT, Cybersecurity, Blockchain and VR

More than 27.53 lakh candidates registered, while around 80% of learners came from Tier-II and Tier-III cities.

NIELIT

NIELIT provides training through:

- 56 centres
- 750 affiliated institutes
- More than 9,000 facilitation centres

It offers courses in AI, cybersecurity, cloud computing, electronics and blockchain.

SOAR Programme

The **Skilling for AI Readiness programme**, launched in 2025, introduces AI literacy for school students from Classes 6 to 12.

Chips to Start-up Programme

Launched in 2022, it aims to create 85,000 industry-ready professionals in:

- VLSI
- ASICs
- System-on-Chip design
- Embedded systems
- Semiconductor research

India's Growing Global Technology Credibility

Digital Public Infrastructure

India's DPI ecosystem includes:

- Aadhaar
- UPI
- DigiLocker
- CoWIN
- UMANG
- Government e-Marketplace

India has signed agreements with 23 countries for cooperation on DPI.

UPI is operational in countries such as Singapore, UAE, France, Nepal and Sri Lanka.

Global Innovation Index

India's rank improved from **81st in 2015** to **38th in 2025**.

Global Capability Centres

India hosts over:

- 2,100 GCCs
- 3,728 units
- 2.36 million professionals

GCCs have evolved from back-office centres into hubs for AI, research, cybersecurity and digital innovation.

Bharat 6G Alliance

The **Bharat 6G Alliance**, formed in 2023, supports indigenous 6G research, standards and advanced communications.



Technology Diplomacy

- The **NEST Division** under the Ministry of External Affairs handles the international dimensions of AI, 5G, 6G, semiconductors, biotechnology and clean technologies.
- This reflects the growing role of technology in India's foreign policy.

Significance of India's Emerging Technology Ecosystem

- **Technological sovereignty:** Domestic capability in AI, semiconductors, quantum systems and cloud infrastructure reduces external dependence.
- **Economic growth:** Emerging technologies improve productivity, manufacturing, innovation and employment.
- **Better governance:** DPI and digital

platforms make public service delivery faster, transparent and inclusive.

- **National security:** Quantum communication, cybersecurity, semiconductors and supercomputing have strategic applications.
- **Inclusive development:** Affordable internet expands access to finance, education, healthcare and government services.
- **Global influence:** India is increasingly shaping international debates on trusted, inclusive and human-centric technology.

Key Challenges

- **Import dependence:** Advanced semiconductor equipment, critical minerals and specialised hardware are still largely imported.



- **R&D gap:** India needs higher public and private investment in frontier research.
- **Skill shortage:** Deep-tech sectors require advanced and interdisciplinary expertise.
- **Digital divide:** Unequal access to devices, connectivity and digital literacy persists.
- **Cybersecurity:** Greater digitalisation increases risks of cyberattacks and data breaches.
- **Ethical concerns:** AI and biotechnology require transparent and responsible regulation.
- **Commercialisation gap:** Research often fails to move effectively from laboratories to industry.

Way Forward

- Increase investment in frontier research and deep technology.
- Strengthen industry-academia partnerships.
- Expand advanced skilling in AI, quantum technology, semiconductors and biotechnology.
- Promote indigenous manufacturing of critical components.
- Develop strong frameworks for data protection, ethical AI and cybersecurity.

- Improve access to technology in rural and underserved areas.
- Encourage startup-led innovation and research commercialisation.
- Build international partnerships without compromising technological sovereignty.

Conclusion

India's emerging technology ecosystem marks a shift from **technology consumption to technology creation**. Mission-mode programmes, Digital Public Infrastructure, research institutions, startups and skilling initiatives are creating a strong foundation for technological leadership. To sustain this momentum, India must combine innovation with inclusion, self-reliance with global cooperation, and technological growth with ethical governance. This will be central to achieving **Viksit Bharat 2047**.

Public Health

Union Health Ministry Releases National Family Health Survey – 6

Source: [PIB](#)

Relevance: GS Paper II: Social Justice, Health, Government Policies, Women and Child Development

Important Key Words

For Prelims

- NFHS-6, MoHFW, IIPS Mumbai, ANC, Institutional Delivery, Full Immunisation, Rotavirus Vaccine, Stunting, Wasting, PM-JAY, POSHAN 2.0, U-WIN

For Mains

- Maternal health, child nutrition, financial protection, universal health coverage, public health system, women empowerment, last-mile delivery, SDG achievement

Why in News?

- The Union Health Ministry released the National Family Health Survey-6.
- NFHS-6 shows India's progress in **maternal health, child healthcare, nutrition, immunisation, financial protection and women empowerment**.
- The survey highlights improvement in institutional deliveries, antenatal care, child vaccination, reduction in stunting and expansion of health insurance coverage.

About NFHS-6

The **National Family Health Survey** is a large-scale survey that provides data on health, nutrition, population and family welfare.

NFHS-6 was conducted during **2023-24** by the Ministry of Health and Family Welfare. The **International Institute for Population Sciences, Mumbai** acted as the nodal agency.

The survey covered nearly **6.79 lakh households** across **715 districts**.

It supports evidence-based planning and helps governments design policies up to the district level.

Key Findings of NFHS-6

1. Maternal and Child Healthcare

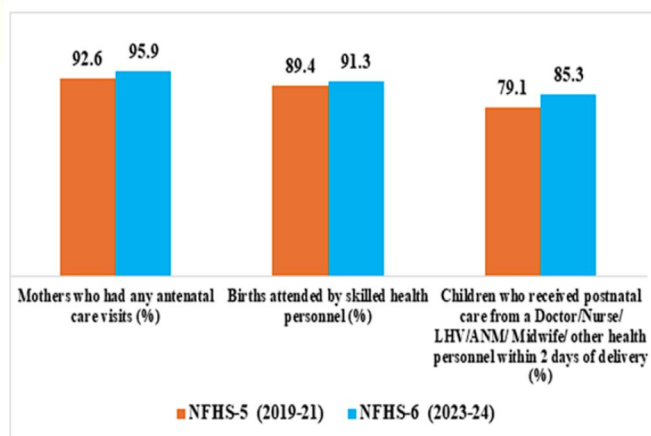
- NFHS-6 shows strong improvement in maternal and child healthcare services.

Important findings include:

- Antenatal care coverage** increased from **92.6% to 95.9%**.
- Mothers receiving ANC in the **first trimester** increased from **70.0% to 76.2%**.
- Mothers receiving at least **four ANC visits** increased from **58.5% to 65.2%**.
- Institutional deliveries** increased from **88.6% to 90.6%**.
- Births attended by skilled health personnel increased from **89.4% to 91.3%**.
- Postnatal care for newborns within two

days improved from **79.1% to 85.3%**.

This shows better access to healthcare during pregnancy, childbirth and postnatal period.



2. Maternal Nutrition

Maternal nutrition also improved.

- Mothers consuming **iron folic acid tablets for 100 days or more** increased from **44.1% to 54.9%**.
- Mothers consuming iron folic acid tablets for **180 days or more** increased from **26.0% to 37.8%**.

This is important for reducing anaemia and improving maternal and child health outcomes.

3. Family Planning

- India's **Total Fertility Rate** remains at **2.0**.
- The **Contraceptive Prevalence Rate** increased from **66.7% to 69.1%**.
- This shows improved access to family planning services and greater awareness among couples.

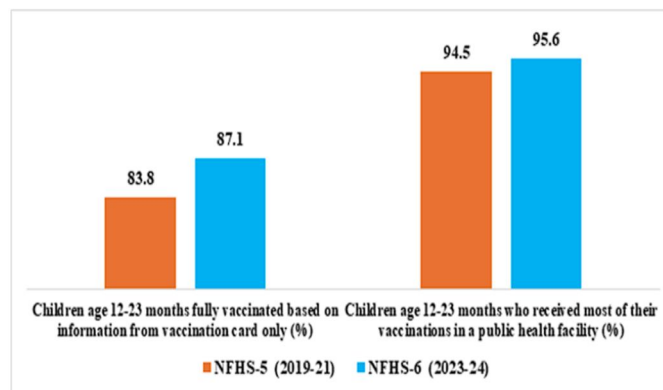
4. Child Immunisation

NFHS-6 shows continued progress towards universal immunisation.

- Full vaccination coverage among children aged **12-23 months** increased from **83.8% to 87.1%**.
- Any vaccine received by children aged **12-23 months** remained above **96%**.

- 95.6% of children** received most vaccinations through public health facilities.
- Rotavirus vaccination coverage increased sharply from **36.4% to 85.4%**.
- Second dose of measles-containing vaccine increased from **58.6% to 71.8%**.

This reflects stronger last-mile delivery, better cold chain systems and public trust in government health facilities.



5. Child Health Indicators

NFHS-6 also shows improvement in child health.

- Symptoms of **acute respiratory infection** among children declined from **2.8% to 1.9%**.
- Severe diarrhoea declined to **0.5%**.

These improvements indicate better child healthcare, sanitation awareness and early treatment access.

6. Child Nutrition

NFHS-6 indicates encouraging progress in child nutrition.

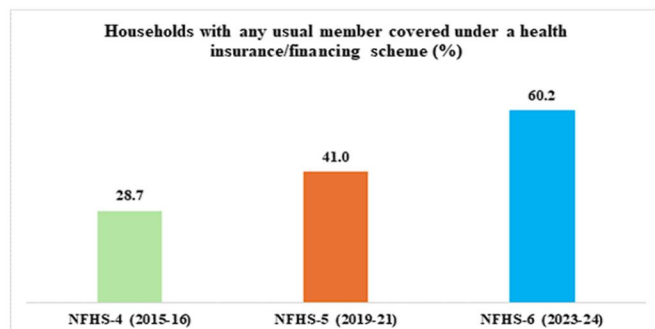
- 95.6% of children under six months** were breastfed during the survey period.
- Children breastfed within one hour of birth increased from **41.8% to 50.1%**.
- Stunting** among children under five declined from **35.5% to 29.3%**.
- Severe wasting** declined from **7.7% to 5.2%**.
- Underweight prevalence declined marginally from **32.1% to 31.8%**.
- Children aged **6-8 months** receiving solid or

semi-solid food along with breastmilk increased from **45.9% to 59.5%**.

This shows improvement in long-term nutrition outcomes, but undernutrition remains a concern.

7. Health Protection and Insurance

- Health insurance or financing scheme coverage increased from **41.0% to 60.2%** at the household level.
- This reflects the impact of **Ayushman Bharat - Pradhan Mantri Jan Arogya Yojana** and other health protection initiatives.
- It is an important step towards **Universal Health Coverage**.



8. Women's Empowerment and Financial Inclusion

NFHS-6 also records progress in women's empowerment.

- Women who had ever used the internet nearly doubled from **33.3% to 64.3%**.
- Women having a bank or savings account that they themselves use increased from **78.6% to 89.0%**.
- Women having a mobile phone that they themselves use increased from **53.9% to 63.6%**.
- Use of hygienic methods of menstrual protection among women aged **15-24 years** increased from **77.6% to 79.2%**.

These indicators show improvement in digital access, financial inclusion and health awareness among women.

Major Schemes Behind Progress

1. Janani Suraksha Yojana

- It promotes institutional deliveries by providing financial assistance to pregnant women, especially from poor households.

2. Janani Shishu Suraksha Karyakram

- It provides free services to pregnant women and sick newborns in public health institutions.

3. Pradhan Mantri Surakshit Matritva Abhiyan

- It provides assured antenatal care services to pregnant women.

4. SUMAN

- **Surakshit Matritva Aashwasan** aims to provide assured, respectful and quality maternal and newborn healthcare.

5. PM Matru Vandana Yojana

- It provides maternity benefit support to pregnant and lactating women.

6. Universal Immunisation Programme

- It provides vaccines to protect children against vaccine-preventable diseases.

7. POSHAN Abhiyaan and POSHAN 2.0

- These schemes aim to reduce malnutrition among children, adolescent girls, pregnant women and lactating mothers.

8. Ayushman Bharat PM-JAY

- It provides health insurance coverage to vulnerable families and reduces out-of-pocket expenditure.

9. Mission Parivar Vikas

- It focuses on improving access to family planning services.

10. U-WIN

- It supports digital tracking of immunisation services.

NFHS-6 RELATED SCHEMES

Important Health, Nutrition and Family Welfare Schemes — Brief Points with Launch Years

1 Janani Suraksha Yojana (JSY) 2005



- Ministry: Ministry of Health and Family Welfare
- Safe motherhood scheme
- Focus: Institutional deliveries
- Cash assistance to pregnant women
- Targets poor pregnant women, especially in rural and low-performing states
- Implemented under National Health Mission

2 Janani Shishu Suraksha Karyakram (JSSK) 2011



- Ministry: Ministry of Health and Family Welfare
- Focus: Free maternal and newborn healthcare
- Covers pregnant women and sick infants
- Free drugs, diagnostics, diet, blood, transport and treatment
- Reduces out-of-pocket expenditure

3 Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA) 2016



- Ministry: Ministry of Health and Family Welfare
- Focus: Quality antenatal care
- Service day: 9th day of every month
- Targets pregnant women in the 2nd and 3rd trimester
- Detects high-risk pregnancies and improves maternal health

4 SUMAN Surakshit Matritva Aashwasan 2019



- Ministry: Ministry of Health and Family Welfare
- Focus: Respectful and quality maternal and newborn care
- Covers pregnant women, mothers up to 6 months after delivery and newborns
- Objective: Zero preventable maternal and newborn deaths

5 Pradhan Mantri Matru Vandana Yojana (PMMVY) 2017



- Ministry: Ministry of Women and Child Development
- Maternity benefit scheme
- Focus: Nutrition and wage compensation
- Cash incentive through Direct Benefit Transfer
- For pregnant and lactating women
- Additional benefit for the second child if the child is a girl

6 Universal Immunisation Programme (UIP) 1985



- Ministry: Ministry of Health and Family Welfare
- Vaccination for children and pregnant women
- Protects against vaccine-preventable diseases
- Includes BCG, OPV, DPT, Hepatitis B, Measles-Rubella, Rotavirus and others
- Objective: Reduce child mortality and morbidity

7 POSHAN Abhiyaan 2018



- Ministry: Ministry of Women and Child Development
- Focus: Reduction of malnutrition
- Targets children, adolescent girls, pregnant women and lactating mothers
- Aims to reduce stunting, wasting, anaemia and low birth weight

8 POSHAN 2.0 2021



- Ministry: Ministry of Women and Child Development
- Focus: Integrated nutrition support
- Includes Anganwadi Services, POSHAN Abhiyaan and related nutrition schemes
- Strengthens nutrition delivery and monitoring

9 Ayushman Bharat PM-JAY 2018



- Full form: Pradhan Mantri Jan Arogya Yojana
- Ministry: Ministry of Health and Family Welfare
- Health assurance scheme
- Coverage: ₹5 lakh per family per year
- Targets poor and vulnerable families
- Reduces catastrophic health expenditure

10 Mission Parivar Vikas and U-WIN 2016



- Ministry: Ministry of Health and Family Welfare
- Focus: Family planning
- Targets high fertility districts
- Improves access to contraceptives and reproductive health services
- Aims to reduce Total Fertility Rate in high-focus areas



U-WIN 2023 (pilot)

- Ministry: Ministry of Health and Family Welfare
- Focus: Digital immunisation tracking
- Model: Similar to Co-WIN
- Covers pregnant women and children
- Tracks vaccination records and reduces dropouts



QUICK REVISION

- JSY, JSSK, PMSMA and SUMAN improve maternal and newborn care
- PMMVY supports maternity benefits
- UIP and U-WIN strengthen immunisation
- POSHAN schemes address malnutrition
- PM-JAY and Mission Parivar Vikas support health protection and family planning



Useful for UPSC / APPSC / TGPSC | NFHS-6 linked schemes



Significance of NFHS-6 Findings

1. Shows Progress in Public Health

- NFHS-6 shows that India has improved in maternal healthcare, institutional deliveries, child immunisation and nutrition.
- This reflects the impact of sustained public health programmes.

2. Strengthens Evidence-Based Policymaking

- NFHS data helps governments plan policies based on facts.
- District-level data can guide targeted interventions.

3. Supports SDG Achievement

- Progress in health, nutrition, women empowerment and financial protection supports India's progress towards Sustainable Development Goals.

4. Shows Public Trust in Government Health Facilities

- The fact that **95.6% of children received most vaccinations through public health facilities** shows community trust in the public health system.

5. Improves Financial Protection

- Expansion of health insurance coverage reduces the burden of health expenditure on poor and vulnerable households.

6. Promotes Women Empowerment

- Improvement in women's bank account ownership, mobile phone use and internet access reflects rising social and economic empowerment.

Challenges

1. Persistent Undernutrition

- Stunting and underweight levels have declined, but they remain significant public

health concerns.

2. Dual Burden of Malnutrition

- India faces both undernutrition and rising overweight or obesity among adults.

This creates a complex nutrition challenge.

3. Non-Communicable Diseases

- Rising lifestyle-related risks and non-communicable diseases require greater focus on preventive healthcare.

4. Regional Inequality

- National improvement may hide gaps between states, districts, rural areas and urban areas.

5. Quality of Healthcare

- Higher institutional delivery is important, but quality of care during pregnancy, childbirth and postnatal period also needs attention.

6. Behavioural Change

- Improvements in nutrition, hygiene, breastfeeding and family planning require continuous awareness and community participation.

Way Forward

- India should strengthen primary healthcare through Health and Wellness Centres and better frontline health worker support.
- Nutrition programmes must focus on the first **1,000 days** of a child's life, from pregnancy to two years of age.
- The government should improve dietary diversity, breastfeeding practices and complementary feeding.
- Digital platforms such as **U-WIN** should be used to track immunisation and reduce dropouts.



- There is a need to strengthen preventive healthcare to control non-communicable diseases and lifestyle risks.
- Health insurance coverage should be expanded along with quality and affordability of healthcare services.
- Women's digital and financial inclusion should be linked with health awareness, nutrition education and welfare delivery.

Conclusion

NFHS-6 reflects India's steady progress in maternal

and child health, immunisation, nutrition, financial protection and women empowerment.

The findings show that flagship schemes and stronger primary healthcare delivery have improved several key indicators.

However, challenges such as undernutrition, non-communicable diseases, obesity and regional inequalities remain. India must now focus on quality healthcare, preventive health, balanced nutrition and last-mile delivery to achieve inclusive and sustainable health outcomes.

Pradhan Mantri Surakshit Matritva Abhiyaan: A Decade of Inclusive Maternal Healthcare

Source: [PIB](#)

Relevance: UPSC GS Paper II: Social Justice, Health, Welfare Schemes, Issues Relating to Women, Government Policies and Social Sector Services.

Important Key Words

For Prelims:

- Pradhan Mantri Surakshit Matritva Abhiyaan, e-PMSMA, Antenatal Care, Maternal Mortality Ratio, Reproductive, Maternal, Newborn, Child and Adolescent Health, Mother and Child Protection Card, Accredited Social Health Activist

For Mains:

- Maternal Healthcare, High-Risk Pregnancy, Early Risk Detection, Continuum of Care, Public-Private Partnership, Last-Mile Delivery, Maternal Mortality Reduction, Inclusive Healthcare.

Why in News?

The Pradhan Mantri Surakshit Matritva Abhiyaan completed ten years of implementation. More than 7.50 crore pregnant women have received antenatal

services under the programme, in addition to routine antenatal care.

- The initiative provides free and comprehensive antenatal care at designated government health facilities on the 9th of every month.

Why Maternal Health Matters

Maternal health is an important indicator of the accessibility and quality of a country's healthcare system.

- Pregnancy-related complications can threaten the lives of both the mother and the child if risks such as severe anaemia, hypertension and gestational diabetes are not detected and treated early.

India's Maternal Mortality Ratio declined from:

- 556 deaths per lakh live births in 1990
- 130 during 2014-16
- 87 during 2022-24
- India aims to achieve the Sustainable Development Goal of reducing MMR to below 70 per lakh live births by 2030.



Pradhan Mantri Surakshit Matritva Abhiyaan (PMSMA)



10 Years of Safe Motherhood Support

1 Why in News?



Completed 10 years of implementation



More than **7.50 crore** pregnant women received antenatal services



Free antenatal care on the **9th** of every month

2 What is PMSMA?



Launched in 2016 by Ministry of Health and Family Welfare



Free, comprehensive antenatal care at government facilities



Focus on women in 2nd and 3rd trimesters

3 Why Maternal Health Matters

556

(1990)

130

(2014–16)

87

(2022–24)



SDG target:
below 70 by 2030

4 Key Services



Clinical examination



Blood and urine tests



Ultrasonography



IFA and calcium supplements



Counselling on nutrition and safe pregnancy



Birth planning and complication readiness

5 High-Risk Pregnancy (HRP)



Early detection of high-risk pregnancies



Linked to nearest First Referral Unit (FRU)



Green sticker: no risk detected



Red sticker: high-risk pregnancy

6 e-PMSMA



Launched in 2022



Name-based HRP tracking



Follow-up till 45th day after delivery



SMS alerts to beneficiary and ASHA



Extra follow-up visits for HRP cases

7 Incentives

For ASHA



- ₹100 per HRP follow-up visit (up to 3)
- ₹500 on healthy outcome verification

For Beneficiary



- ₹100 per visit for follow-up transport (up to 3)

8 Supporting Schemes



JSY



JSSK



SUMAN



POSHAN Abhiyaan



PMMVY



LaQshya

9 Key Takeaway



Safer pregnancy



Early risk detection



Better maternal and newborn health



PMSMA – Strengthening safe motherhood in India through free antenatal care, early risk identification and follow-up support.



What is Maternal Mortality Ratio?

The **Maternal Mortality Ratio** is the number of maternal deaths per **one lakh live births** during a given period.

- A maternal death refers to the death of a woman during pregnancy or within **42 days of the termination of pregnancy** due to causes related to or aggravated by pregnancy or its management. Accidental and incidental causes are excluded.

What is Pradhan Mantri Surakshit Matritva Abhiyaan (PMSMA)?

The **Pradhan Mantri Surakshit Matritva Abhiyaan** was launched by the **Ministry of Health and Family Welfare** in 2016.

It provides:

- Free antenatal care
- Comprehensive medical examinations
- Diagnostic services
- Medicines
- Counselling
- Identification and follow-up of high-risk pregnancies

The programme primarily serves pregnant women in their:

- **Second trimester:** 13–27 weeks
- **Third trimester:** 28 weeks until delivery

Services are provided at designated public health facilities in rural and urban areas on the **9th of every month**.

Goal of PMSMA

PMSMA seeks to improve the quality and coverage of antenatal care, diagnostics and counselling under the **Reproductive, Maternal, Newborn, Child and Adolescent Health strategy**.

It is based on the principle that every pregnant

woman should receive at least one comprehensive examination by a physician or specialist during the second or third trimester.

Major Objectives

- Ensure at least one specialist antenatal examination for every pregnant woman.
- Improve the quality of antenatal services.
- Provide applicable diagnostic tests and medicines.
- Detect and manage existing medical and obstetric conditions.
- Identify and line-list high-risk pregnancies.
- Prepare individual birth and complication-readiness plans.
- Reach women who missed or discontinued routine antenatal care.
- Address malnutrition during pregnancy.
- Provide special attention to adolescent, early and high-risk pregnancies.
- Link high-risk cases with appropriate referral facilities.

Services Provided

The minimum service package includes:

- Clinical examination
- Blood and urine tests
- Ultrasonography
- Screening for high-risk factors
- Iron and folic acid supplements
- Calcium supplements
- Treatment of identified conditions
- Nutrition counselling
- Birth planning
- Complication-readiness counselling
- Safe-pregnancy guidance
- Mother and Child Protection Card
- Safe motherhood booklet

The programme follows a **single-window approach** so that pregnant women can receive essential investigations, medicines and counselling at one facility.

High-Risk Pregnancy Identification

PMSMA screens pregnant women for **25 high-risk factors**, including:

- HIV and syphilis
- Severe anaemia
- Pregnancy-induced hypertension
- Gestational diabetes
- Hypothyroidism
- Tuberculosis and malaria
- Previous caesarean section
- Multiple pregnancy
- Hepatitis B
- Abnormal fetal heart rate
- Teenage pregnancy
- High fever
- Reproductive tract and sexually transmitted infections
- Previous stillbirth
- Congenital malformation
- Negative blood group
- Early or elderly first pregnancy
- Grand multiparity
- Short stature
- Other medical or obstetric complications

Women identified as high-risk are linked to the nearest **First Referral Unit** for appropriate management and safe delivery.

Colour-Coded Risk Identification

A sticker is placed on the Mother and Child Protection Card:

- **Green sticker:** No risk factor detected
- **Red sticker:** High-risk pregnancy identified

This enables health workers to identify cases requiring priority care and follow-up.

Sticker Color	Condition
Green Sticker	Women with no risk factor detected
Red Sticker	Women with high risk pregnancy

Extended PMSMA

The **Extended PMSMA**, or **e-PMSMA**, was introduced in 2022 to strengthen the management of high-risk pregnancies.

Key Features

- Name-based line-listing of high-risk pregnancies
- Up to four additional PMSMA sessions in a month
- Individual tracking until a healthy outcome
- Follow-up until the **45th day after delivery**
- SMS alerts to the beneficiary and ASHA worker
- Additional check-ups and continuous monitoring
- Financial support for follow-up visits

The initiative ensures that high-risk identification is followed by sustained care rather than remaining a one-time diagnosis.

Financial Incentives under e-PMSMA

Incentives for ASHA Workers

- **₹100 per high-risk pregnancy** for mobilisation for each of up to three follow-up visits
- **₹500 per high-risk pregnancy** after a healthy outcome for both mother and child is verified on the 45th day after delivery

Assistance to Beneficiaries

A woman identified with a high-risk pregnancy

may receive:

- ₹100 per follow-up visit
- Support for a maximum of three visits
- Assistance towards transportation to the PMSMA clinic or nearest appropriate facility

Private-Sector Participation

PMSMA systematically involves private medical practitioners.

Private-sector:

- Obstetricians and gynaecologists
- Radiologists
- Physicians

are encouraged to volunteer at government facilities where public-sector specialists are unavailable or inadequate.

Doctors were encouraged to contribute **one day every month**, amounting to 12 days annually.

The national PMSMA portal and mobile application facilitate private and voluntary-sector participation.

The **IPledgeFor9 Achievers Awards** recognise individuals and teams contributing voluntarily to the programme.

Who Can Access PMSMA?

PMSMA services are available to:

- Pregnant women in their second or third trimester
- Indian citizens residing in India
- Women attending designated facilities on the 9th of every month
- Women who missed or dropped out of routine antenatal care
- Women identified with high-risk pregnancies

High-risk and missed-ANC cases receive special attention.

Major Achievements

- More than **7.50 crore** pregnant women received antenatal services.
- India's MMR declined by **43 points**, from 130 to 87 per lakh live births between 2014–16 and 2022–24.
- High-risk pregnancy screening and specialist care became more systematic.
- e-PMSMA strengthened individual tracking and follow-up.
- Private doctors were mobilised to supplement government health services.
- Antenatal services became more accessible at designated facilities across the country.

The decline in MMR cannot be attributed to one scheme alone, but PMSMA forms an important part of India's broader maternal-health framework.

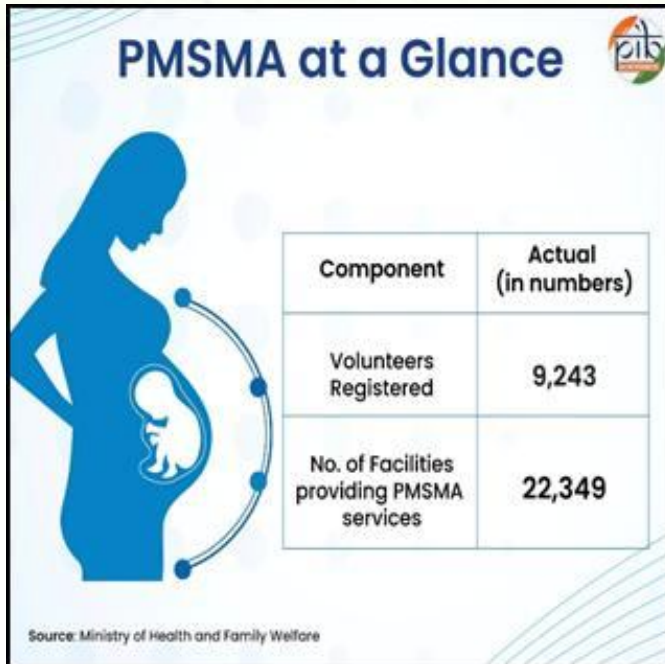


PMSMA and Other Maternal-Health Initiatives

Janani Suraksha Yojana

Promotes institutional deliveries.

- More than **11.96 crore** women benefited since 2014–15.



Janani Shishu Suraksha Karyakram

Provides free healthcare services to pregnant women and newborns.

- More than 18.05 crore beneficiaries received support.

SUMAN

The **Surakshit Matritva Aashwasan** initiative strengthens respectful and quality maternal healthcare through more than **99,290 facilities**.

Other Supporting Programmes

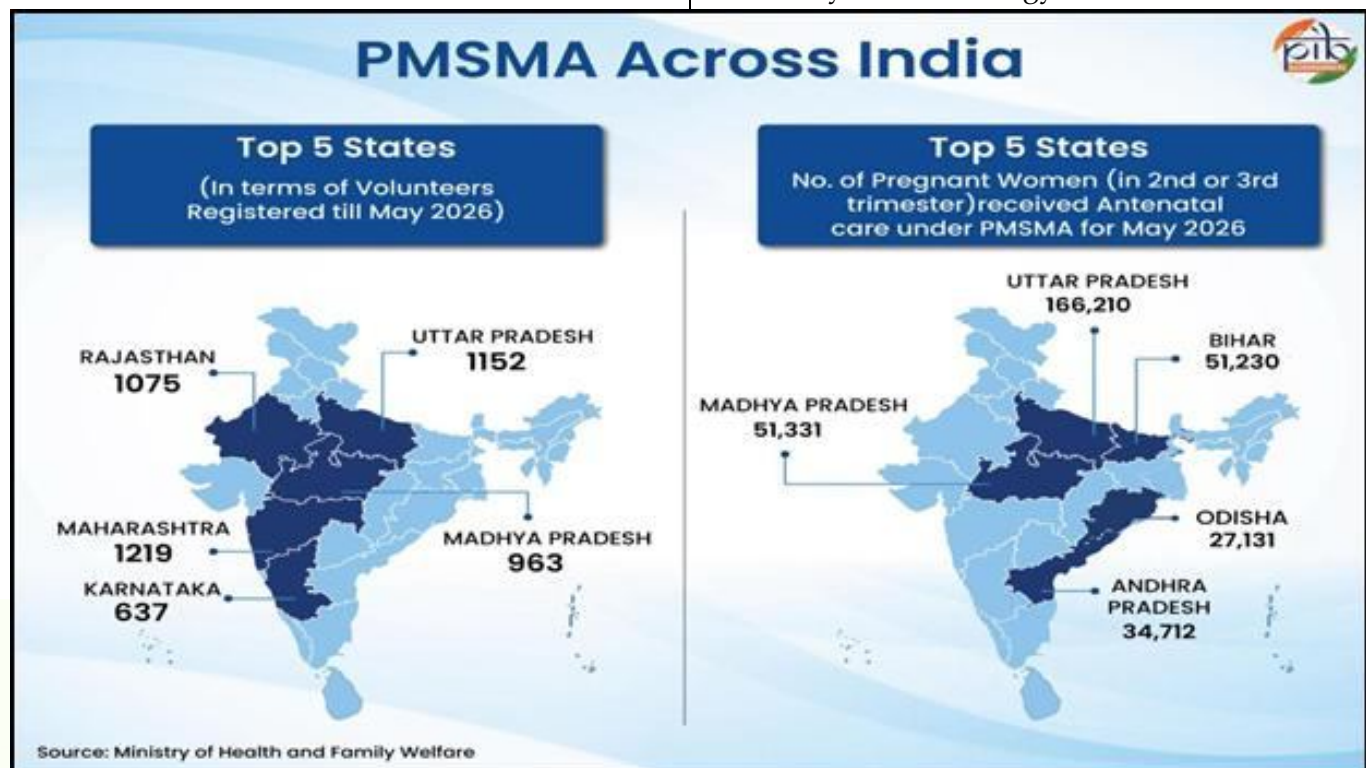
- POSHAN Abhiyaan: Maternal and child nutrition
- PM Matru Vandana Yojana: Maternity benefits
- LaQshya: Quality improvement in labour rooms
- National Health Mission: Financial and institutional support
- Ayushman Arogya Mandirs: Primary healthcare and antenatal services

Together, these initiatives create an integrated maternal and newborn healthcare ecosystem.

Commemoration of Ten Years

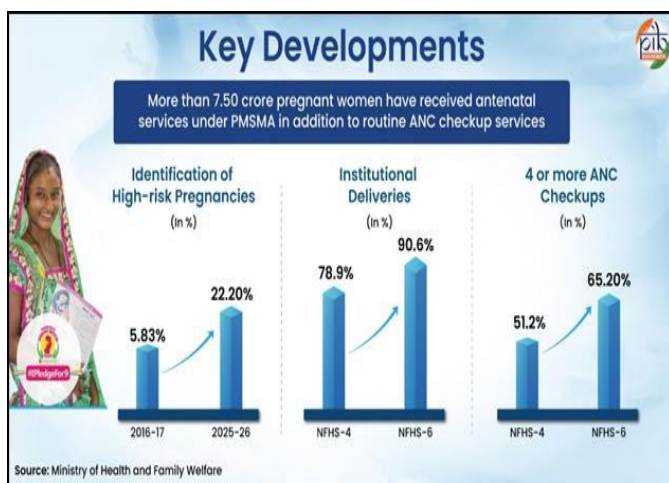
The ten-year milestone is being observed through:

- Ayushman Arogya Shivirs at 1.8 lakh



Ayushman Arogya Mandirs

- Special PMSMA sessions at district hospitals, sub-district hospitals and First Referral Units
- Community awareness programmes through:
 - Village Health, Sanitation and Nutrition Days
 - Jan Arogya Samitis
 - Self-Help Groups



Significance

1. Early Risk Detection

- Screening identifies high-risk conditions before they become life-threatening.

2. Universal and Free Care

- The programme provides quality antenatal services irrespective of income or location.

3. Specialist Access

- Pregnant women receive at least one examination by a physician or trained specialist.

4. Reduction in Maternal and Neonatal Risks

- Timely treatment of anaemia, hypertension, diabetes and other conditions improves pregnancy outcomes.

5. Continuity of Care

- e-PMSMA tracks high-risk pregnancies until after delivery.

6. Public-Private Partnership

- Volunteer doctors supplement specialist shortages in government facilities.

7. Last-Mile Inclusion

- Special efforts target women who missed or dropped out of routine antenatal care.

Challenges

- Shortage of obstetricians, radiologists and trained doctors
- Uneven quality of services across districts
- Limited access in remote and difficult areas
- Delays in diagnostic reports and referrals
- Weak follow-up of high-risk pregnancies
- Inadequate awareness among vulnerable women
- Transportation barriers
- Digital and documentation gaps
- Need for stronger coordination between facilities, ASHAs and referral units

Way Forward

- Ensure specialist availability at every designated PMSMA facility.
- Strengthen referral transport and First Referral Units.
- Improve the tracking of high-risk pregnancies through e-PMSMA.
- Expand ultrasound and diagnostic facilities in underserved areas.
- Increase awareness through ASHAs, SHGs and community institutions.
- Improve coordination between antenatal, delivery and postnatal services.



- Conduct regular audits of maternal deaths and near-miss cases.
- Strengthen nutrition, anaemia and adolescent-pregnancy interventions.
- Encourage greater private-sector volunteering.
- Monitor outcomes rather than only the number of check-ups conducted.

Conclusion

PMSMA has institutionalised free, specialist antenatal care on a fixed day every month and

strengthened the early detection of high-risk pregnancies.

- Its integration with e-PMSMA, referral services, ASHA follow-up and other maternal-health programmes has contributed to a more systematic and inclusive healthcare framework. Continued investment in specialists, diagnostics, transport and post-diagnosis follow-up is essential to ensure that **no woman loses her life while giving life.**

Why Does Kerala Face Recurrent Nipah Spillovers?

Source: [The Hindu](#)

Relevance: UPSC GS Paper II: Public Health, Health-System Preparedness and Government Response.

Important Key Words

Prelims:

- Nipah Virus, Pteropus medius, Natural Reservoir, Nosocomial Transmission, Bangladesh Strain

Mains :

- One Health Approach, Human-Wildlife Interface, Zoonotic Spillover, Health-System Resilience, Pandemic Preparedness

Why in News?

Nipah Resurgence: Nipah virus has resurfaced in Kozhikode, where a **43-year-old patient** who tested positive is battling for life at Government Medical College Hospital.

- The latest case has renewed attention on Kerala's recurring Nipah risk, ecological vulnerability, zoonotic-disease profile and public-health preparedness.

What Has Been Kerala's Nipah Outbreak History?

- **2018 Outbreak:** Kerala's first Nipah outbreak identified **23 cases**, including 18 laboratory-confirmed cases. The case-fatality rate was **91%**, with only two survivors.
- **2019 Spillover:** A single case was detected in Ernakulam, and the patient survived.
- **2021 Case:** A 12-year-old boy was diagnosed with Nipah in Malappuram.
- **2023 Cluster:** Kozhikode reported a cluster of six Nipah cases.
- **2024 Spillovers:** Two isolated cases were reported from separate spillover events in Malappuram during July and September.
- **2025 Independent Events:** Four cases were recorded in Malappuram and Palakkad. Epidemiological investigations found no links between them, suggesting independent spillovers from the natural reservoir.
- **2026 Resurgence:** Nipah has again surfaced in Kozhikode, reinforcing the pattern of

recurrent spillovers.

Why is Nipah Recurring in Kerala?

- **Natural Reservoir:** The **Indian flying fox bat, *Pteropus medius***, has been consistently identified as the natural reservoir of Nipah virus in Kerala. Serological studies and viral detection show that the virus circulates among bat colonies, particularly in northern districts.
- **Evidence from Bat Samples:** During the 2018 outbreak, nearly **25% of sampled bats** tested positive for Nipah viral RNA. Subsequent spillover investigations also detected the virus in bat samples.
- **Roosts Near Settlements:** Pteropus bats are distributed across Kerala and often roost close to human habitation. A Kerala Forest Research Institute mapping study found that almost all identified roosting sites were near human settlements.
- **Persistent Environmental Presence:** Repeated spillovers suggest that the virus has established itself within Kerala's ecological environment. The perennial natural reservoir makes complete prevention of future spillovers difficult.

Why is Spillover Risk Highest Between April and September?

- **Seasonal Fruit Availability:** Fruit-laden trees become abundant during this period, increasing bat-foraging activity near farms and human settlements.
- **Bat Breeding Cycle:** Bat breeding and associated behavioural changes coincide with this period, increasing movement and interaction with food sources.
- **Viral-Shedding Dynamics:** Seasonal changes in viral shedding by bats may raise

the chances of environmental contamination and human exposure.

- **Recurring Seasonal Pattern:** The April-September risk window has remained consistent since Kerala's first Nipah outbreak in 2018.

What Makes Kerala Vulnerable to Zoonotic Diseases?

- **Biodiversity Hotspot:** The Western Ghats along Kerala's eastern flank is one of the world's richest biodiversity regions. Its tropical rainforest climate supports hundreds of species of birds, reptiles and mammals.
- **Limited Protected Area:** Only about **1,60,000 sq. km** of this rich biosphere is formally protected, leaving extensive zones where human activity and wildlife habitats overlap.
- **High Population Density:** Dense human settlements, plantations and agricultural lands are located close to forest fringes, increasing human-wildlife interaction.
- **Habitat Disturbance:** Deforestation, habitat fragmentation, urbanisation and agricultural intensification force wildlife closer to settlements and cultivated food sources.
- **Climate-Related Disruption:** Climate-driven ecological changes may alter animal behaviour, food availability and disease dynamics, increasing future spillover risk.
- **Intensified Human-Wildlife Interface:** Kerala's ecological richness, dense settlement pattern and land-use changes create frequent opportunities for exposure to novel pathogens.



VIRUSES & ZOOONOTIC DISEASES

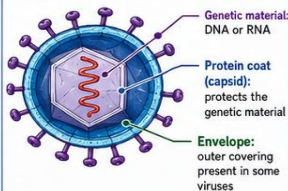
Understanding viruses, Nipah virus, and animal-to-human disease transmission



1 WHAT IS A VIRUS?

- A virus is a very small infectious particle that can cause disease in living organisms.
- Viruses are much smaller than bacteria and cannot be seen with a normal microscope.
- They can infect humans, animals, plants, and even bacteria.

2 STRUCTURE OF A VIRUS



4 WHAT ARE ZOOONOTIC DISEASES?

Zoonotic diseases are diseases that spread from animals to humans.

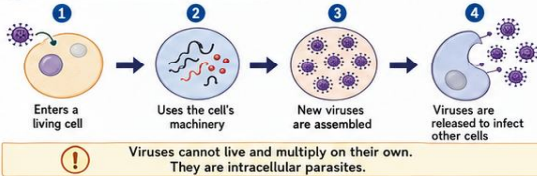


5 ABOUT NIPAH VIRUS (NiV)

About	Nipah virus is a zoonotic virus that spreads from animals to humans, through contaminated food, or by direct human-to-human transmission.
Causative agent	An RNA virus of the family <i>Paramyxoviridae</i> , genus <i>Henipavirus</i> ; closely related to Hendra virus.
Host / reservoir	First identified in domestic animals such as pigs, dogs, cats, goats, horses, and sheep. Main natural reservoir is fruit bats of the genus <i>Pteropus</i> ; virus is present in urine, feces, saliva, and birthing fluids.
Symptoms	Encephalitic syndrome with fever, headache, drowsiness, confusion, and coma; often fatal.
Fatality rate	40% to 75%
Diagnosis	Real-time polymerase chain reaction (RT-PCR) from body fluids.
Vaccine status	No vaccines exist for humans or animals.
WHO stand	WHO has designated Nipah as a priority disease.



3 HOW VIRUSES MULTIPLY

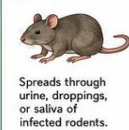


6 EXAMPLES OF ZOOONOTIC DISEASES

1 RABIES



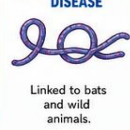
2 HANTAVIRUS



3 NIPAH VIRUS INFECTION



4 EBOLA VIRUS DISEASE



5 AVIAN INFLUENZA



6 SWINE FLU



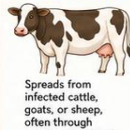
7 PLAGUE



8 LEPTOSPIROSIS



9 BRUCELLOSIS



PUBLIC HEALTH MESSAGE



Avoid contact with sick or wild animals.



Wash hands regularly.



Eat safe, well-washed food.



Seek medical help early if symptoms appear.

How Do Ecological and Human Factors Intersect?

- Shared Landscapes:** Bat roosts, fruit trees, plantations and human settlements often occupy the same geographical space. This proximity increases the probability of contaminated fruit, surfaces or other indirect exposure.
- Habitat Fragmentation:** Disturbed habitats push bats and other wildlife towards cultivated areas and settlements in search of food and shelter.
- Agricultural Intensification:** Expansion of farms and plantations near forest margins increases contact between wildlife, domestic environments and humans.
- Urbanisation Pressure:** Rapid settlement

expansion reduces ecological buffers and increases overlap between natural reservoirs and human activity.

- Seasonal Exposure:** Bat foraging, fruit availability, breeding and viral shedding come together during the high-risk months, creating favourable conditions for spillover.

Why is Nipah Considered a High-Threat Pathogen?

- High Mortality:** Nipah has a severe mortality profile, as demonstrated by Kerala's 2018 case-fatality rate of 91%.
- Unpredictable Spillovers:** Cases may arise independently from the natural reservoir, making outbreaks difficult to predict.
- Human Transmission Risk:** The virus can spread between humans, particularly in healthcare settings without adequate



infection control.

- **Pandemic Potential:** The World Health Organization classifies Nipah as a priority pathogen because of its lethality, unpredictability and potential to cause large outbreaks or a future pandemic.
- **Kerala's High-Threat Profile:** WHO has advised Kerala to remain vigilant regarding Nipah, Avian Influenza H5N1 and Kyasanur Forest Disease, all of which have high mortality, transmissibility or pandemic potential.

What Other Zoonotic Diseases Affect Kerala?

Kerala's broader zoonotic-risk profile includes:

- **Kyasanur Forest Disease, Leptospirosis, Scrub typhus, Japanese encephalitis, West Nile fever, Rabies, Avian influenza**

Nipah is therefore part of a wider landscape of animal-origin diseases linked to Kerala's ecology and human-wildlife interface.

What Did Kerala Learn from the 2018 Outbreak?

- **Nosocomial Transmission Risk:** Of the 23 cases identified in 2018, only the index patient contracted the infection in the community. All other cases resulted from **nosocomial transmission** across three hospitals.
- **Need for Clinical Suspicion:** The outbreak demonstrated that clinicians must maintain a high index of suspicion when encountering unusual cases of acute encephalitis syndrome or clusters of severe illness.
- **Infection-Control Priority:** Kerala strengthened standard infection-prevention and control procedures in hospitals to

reduce healthcare-associated transmission.

- **Clinical Algorithms:** The State developed clinical algorithms for emerging viral infections at tertiary-care institutions.
- **Diagnostic Strengthening:** The experience led to improved diagnostic, laboratory and research capacity for rapid pathogen detection.

What Makes Kerala's Nipah Response Effective?

- **Rapid Index-Case Identification:** Kerala's public-health system has repeatedly demonstrated the ability to identify the first case quickly and initiate containment.
- **Coordinated Surveillance:** Disease surveillance, clinical monitoring, laboratory diagnosis and public-health action operate in close coordination.
- **Early Laboratory Confirmation:** Expanded **Virus Research and Diagnostic Laboratory networks** enable faster confirmation and identification of pathogens.
- **Monitoring Encephalitis Cases:** The State closely monitors acute encephalitis cases of unknown cause and screens severe respiratory infections.
- **Hospital Infection Control:** Stronger infection-control practices have reduced human-to-human transmission after the major 2018 outbreak.
- **Limited Secondary Spread:** Following the initial outbreak, human-to-human transmission has occurred only once, during the 2023 cluster.
- **Emergency Management:** Intensive health-emergency management allows isolation, contact tracing and containment to begin rapidly.

How is Kerala Strengthening Long-Term Preparedness?

- **Community Awareness:** The Health Department focuses on reducing bat-human interaction by educating communities about the perennial spillover risk.
- **One Health Strategy:** Kerala combines human, animal and environmental surveillance to detect zoonotic threats at an early stage.
- **Grassroots Surveillance:** More than 2.5 lakh trained volunteers track unusual disease patterns and report unusual animal or bird deaths.
- **Early Warning Network:** Community reporting supports early detection of zoonotic outbreaks such as Nipah and Mpox.
- **Nipah Research Centre:** Kerala established the One Health Centre for Nipah Research and Resilience in Kozhikode in 2023.
- **Resilience Building:** The Centre focuses on community awareness, capacity building,

spillover reduction and rapid-response preparedness.

- **Outbreak Documentation:** Every Nipah outbreak in Kerala has been documented to improve future surveillance and response.
- **Research Priorities:** The State is focusing on epidemiology, sero-surveillance and research into host factors.

Conclusion

Kerala's Nipah risk arises from the intersection of a permanent bat reservoir, dense human settlement, rich biodiversity, habitat disturbance and seasonal ecological conditions. Complete prevention of spillovers may not be possible, but Kerala has significantly strengthened its ability to detect cases early, prevent hospital transmission and contain outbreaks.

Its experience shows that **One Health surveillance, community participation, rapid laboratory diagnosis, infection control and sustained research** are central to managing recurrent zoonotic threats.

Revisiting India's Ultrasound Laws: Balancing Sex-Selection Prevention with Cancer Diagnosis

Source: [The Hindu](#)

Relevance: UPSC GS Paper II: Public Health, Government Policies, Gender Justice and Healthcare Access.

Important Keywords

Prelims Keywords

- PCPNDT Act, Ultrasonography, High-Frequency Linear Probe, Portable Ultrasound, Sex Determination

Mains Keywords

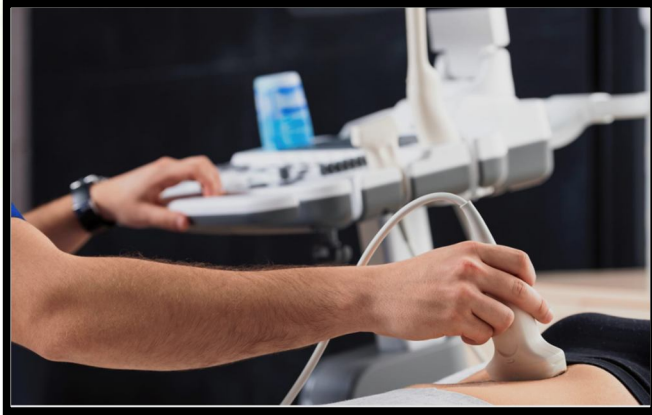
- Gender Justice, Community-Based Diagnosis, Regulatory Reform,

Technology-Neutral
Equitable Healthcare

Regulation,

Why in News?

Advances in **portable ultrasound and AI** have renewed debate over the **PCPNDT Act**. While the law restricts ultrasound use to prevent prenatal sex determination, it also limits community-based cancer diagnosis in rural areas. The key issue is whether regulation should distinguish foetal-imaging devices from high-frequency probes used for superficial conditions such as breast lumps.



Why Was the PCPNDT Act Enacted?

- The PCPNDT Act was introduced in **1994** amid a sharp decline in India's child sex ratio.
- The growing availability of ultrasonography from the 1980s enabled prenatal sex determination, which was followed in some cases by sex-selective abortion of female foetuses.

The legislation sought to:

- Prevent misuse of diagnostic technology
- Prohibit prenatal sex determination
- Stop disclosure of the sex of the foetus
- Address gender discrimination and son preference
- Regulate genetic clinics, laboratories and ultrasound centres

Thus, the law combines medical regulation with the wider objective of protecting the girl child.

What are its Major Provisions?

Mandatory Registration

- All genetic clinics, ultrasound centres and laboratories must be registered with the district authorities.

Regulation of Machines

- A clinic must obtain registration before purchasing an ultrasound machine.

Manufacturers and dealers must:

- Verify the buyer's registration
- Obtain an undertaking against sex determination
- Match invoices with the registered centre
- Report the transaction to authorities

Location Restriction

- Once installed, the machine must remain at the approved location. Moving it outside the registered facility can attract serious legal penalties.

Record-Keeping

- Registered centres must maintain detailed records for every ultrasound examination.

Prohibition on Sex Disclosure

- Communication or disclosure of the sex of the foetus is strictly prohibited.

What Has Been the Impact of the Law?

Improvement in Sex Ratio

- India's sex ratio at birth has gradually improved after the law's introduction. However, this improvement cannot be conclusively attributed to the PCPNDT Act alone.

Continuing Illegal Practices

Sex-selective practices have not disappeared. Illegal networks continue to operate outside formal healthcare systems using:

- Portable ultrasound devices
- Informal providers
- Covert arrangements
- Unregistered locations

The discovery of an illegal prenatal sex-determination network in Karnataka in 2025 highlighted the persistence of such practices.



Pre-conception and Prenatal Diagnostic Techniques (Prohibition of Sex Selection) Act, 1994 (PCPNDT)

Key features, offences, legal provisions and ethical issues



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1 ABOUT THE ACT  - Enacted to prevent female foeticide and address the declining sex ratio in India. - Under this Act, prenatal sex determination was banned.	2 OBJECTIVES  - To ban the use of sex-selection techniques either before or after conception. - To prevent misuse of prenatal diagnostic techniques for sex-selective abortion.	3 OFFENCES UNDER THE ACT  - Conducting or aiding prenatal diagnostic techniques in unregistered facilities. - Sale, distribution, supply, renting or related dealing in any ultrasound machine that can detect the sex of the foetus.	4 POWER OF INVESTIGATION & ARREST  - Appropriate Authority has the power to investigate. - Appropriate Authority does not have the power to arrest under this Act. - Police have the authority to make an arrest under this Act.
5 PROVISIONS REFERRED UNDER THE PRESENT CASE			
A MEANING OF FOETUS [SECTION 2(BC)]  "Foetus" means a human organism during the period of development beginning on the fifty-seventh day following fertilization or creation (excluding any time in which its development has been suspended) and ending at birth.	B MEANING OF PRE-NATAL DIAGNOSTIC PROCEDURES [SECTION 2(O)]  Includes gynaecological, obstetrical or medical procedures such as ultrasonography, foetoscopy, and taking/removing samples of amniotic fluid, chorionic villi, blood or any other tissue/fluid of a man or woman for analysis in a Genetic Laboratory or Genetic Clinic for conducting analysis or pre-natal diagnostic tests for selection of sex before or after conception.	C COGNIZANCE OF OFFENCES [SECTION 28]  - Court takes cognizance on a complaint made by: (a) the Appropriate Authority concerned, or any officer authorised by the Central Government, State Government or the Appropriate Authority; (b) any person who has given at least 15 days' notice, in the prescribed manner, to the Appropriate Authority about the alleged offence and intention to complain to the court. - Cases are triable by a Metropolitan Magistrate or a Judicial Magistrate of the First Class. - On demand by parties under clause (b), the court may direct the Appropriate Authority to make relevant records available.	
6 PRE-NATAL TECHNIQUES AND ETHICAL ISSUES			
 Violation of Rights and Human Dignity: Sex-selective abortion is a form of gender discrimination and violence against women; it violates the right to life, dignity and equality.	 Undermines Dignity: It undermines the value and dignity of human life and the diversity of human society.	 Adds to Social Problems: Leads to skewed sex ratio, increased trafficking and violence against women, and reduced marriage prospects for men.	 Responsibility towards Unborn Child: Raises moral questions about prenatal diagnosis for non-medical purposes and the responsibility of parents and healthcare providers towards the unborn child.  Access to Healthcare: Can worsen health disparities and inequalities, especially for marginalised communities with limited access to healthcare and information.
 QUICK TAKEAWAY The PCPNDT Act seeks to curb sex selection, prevent misuse of prenatal diagnostic techniques, and protect gender equality and human dignity. 			

Unintended Social Consequences

- Evidence cited in the article suggests that restricting prenatal sex selection did not automatically remove son preference.

Some families with a firstborn girl:

- Had additional children in the hope of having a son
- Reduced investment in girls' health and education
- Experienced higher mortality among

firstborn girls

- Faced greater dilution of household resources

These effects were reportedly stronger among poorer rural households unable to access illegal sex-selection services.

- The experience shows that legal prohibition alone cannot eliminate deeply rooted gender discrimination.



Why is the Existing Framework Being Questioned?

Uniform Treatment of Different Technologies

- The law regulates ultrasound machines largely as a single category, even though modern probes have different technical capabilities and medical uses.

Restrictions on Portability

- Portable devices cannot ordinarily be taken into communities because ultrasound machines must remain at their registered locations.

Chilling Effect on Healthcare

- Fear of prosecution and extensive compliance requirements may discourage doctors and institutions from offering ultrasound-based services in underserved areas.

Technological Change

- The law was framed when ultrasound machines were large, facility-based systems. Today, handheld devices can connect to smartphones or tablets and be used close to a patient's home.
- The regulatory framework has not fully adapted to this technological shift.

How Can Portable Ultrasound Improve Cancer Care?

Patients in rural areas often face:

- Long travel distances
- Limited access to specialists
- High travel costs
- Lack of family support
- Delayed diagnosis and treatment

Portable ultrasound can bring services such as:

- Breast imaging
- Assessment of superficial lumps
- Ultrasound-guided biopsies
- Early referral of suspicious cases

closer to the community.

- This is particularly relevant in India, where nearly **70% of the population lives in rural areas** and specialist radiologists and imaging facilities are unevenly distributed.
- Early diagnosis can prevent patients with treatable breast lumps from reaching hospitals only after the disease has advanced.

Why are High-Frequency Linear Probes Important?

High-frequency linear probes are commonly used to examine superficial body structures such as:

- Breast tissue
- Thyroid
- Muscles
- Tendons
- Soft-tissue swellings

The article argues that such probes cannot be used for foetal sex determination but remain subject to the same restrictions as conventional ultrasound equipment.

- Allowing their controlled community use could therefore improve cancer diagnosis without undermining the central objective of the PCPNDT Act.

What Role Can Artificial Intelligence Play?

AI-enabled ultrasound systems can assist with:

- Image acquisition
- Identification of suspicious lesions
- Pattern recognition

- Automated interpretation
- Generation of preliminary reports
- Referral decisions

A pilot study cited in the article combined portable ultrasound scans performed by minimally trained individuals with AI analysis. The system reportedly identified suspicious breast lesions with high accuracy and flagged all confirmed cancer cases.

Potential Role of Frontline Workers

With suitable training and safeguards, frontline health workers could:

- Scan patients presenting with breast lumps
- Identify cases requiring urgent referral
- Reassure patients with apparently benign findings
- Reduce delays in reaching specialist facilities

AI can help address shortages of trained radiologists, but it should assist rather than replace qualified medical decision-making.

What Reforms Have Been Suggested?

Distinguish Between Use Cases

The law should differentiate between:

- Obstetric ultrasound capable of foetal imaging
- Superficial diagnostic ultrasound used for cancer and other conditions

Permit Community-Based Screening

- Community use of approved **high-frequency linear probes** could be legalised under controlled conditions.

Regulate by Capability

- Regulation should be based on what a device can technically do rather than treating every ultrasound machine dentially.

Recognise AI-Enabled Systems

The Act should address emerging systems that:

- Restrict foetal imaging
- Prevent sex determination or disclosure
- Generate purpose-specific reports
- Maintain secure digital audit trails

Create Purpose-Specific Registration

- Separate registration may be introduced for devices used exclusively for community-based cancer diagnosis.

What Safeguards are Necessary?

Reform should not weaken protection against sex-selective practices.

Necessary safeguards include:

- Certification of approved probes and devices
- Geofencing of portable equipment
- Secure digital registration of every scan
- Restricted software configurations
- Prohibition of obstetric imaging in community devices
- Regular audits and inspections
- Operator training and accreditation
- Data privacy protections
- Clear referral protocols
- Strict penalties for unauthorised use

Technology can also enable automatic logging of the operator, location, time and purpose of every scan.

Way Forward

Adopt Risk-Based Regulation

- Restrictions should correspond to the actual risk of misuse associated with each device and clinical purpose.

Pilot Community Programmes

- Controlled pilots can assess the safety and effectiveness of portable ultrasound for breast-cancer diagnosis.

Strengthen Gender Interventions

Legal regulation must be supported by:

- Girls' education
- Social-security measures
- Gender-sensitisation campaigns
- Action against dowry and discrimination
- Improved investment in girls' health

Ensure Human Oversight

- AI-generated findings should be reviewed through an appropriate medical referral system.

Consult Stakeholders

- Reform should involve radiologists, oncologists, public-health specialists, women's groups, engineers and legal experts.

Conclusion

The PCPNDT Act remains essential for preventing the misuse of medical technology for prenatal sex determination. However, a law designed around older ultrasound systems should not unintentionally restrict technologies that can improve early cancer diagnosis.

A carefully designed amendment can permit community-based use of high-frequency probes and safeguarded AI systems while retaining strict controls against sex selection. The objective should be to protect both **the girl child and women's access to timely healthcare.**

Geography

Western Ghats ESA Plan: Conservation Imperative and State-Level Resistance

Source: [The Indian Express](#)

Relevance: UPSC GS Paper I: Geography, Physical Geography of India, Western Ghats and Monsoon System.

Important Key Words

Prelims Keywords

- Western Ghats, Ecologically Sensitive Area, Gadgil Committee, Kasturirangan Committee, Environment (Protection) Act, 1986

Mains Keywords

- Conservation-Development Balance, Ecological Federalism, Natural Landscape, Payment for Ecosystem Services, Phased Notification

Why in News?

The Centre is considering a **phased notification of Ecologically Sensitive Areas in the Western Ghats**, beginning with States where agreement on boundaries is close, particularly **Gujarat, Maharashtra and Goa**.

- The latest draft notification proposes to designate **56,825.7 sq. km** across six States as ESA. However, disagreements over village boundaries, agricultural areas, plantations,

industries, mining and development restrictions have prevented final notification for more than a decade.

The six concerned States are:

- Gujarat
- Maharashtra
- Goa
- Karnataka
- Kerala
- Tamil Nadu

What are Ecologically Sensitive Areas?

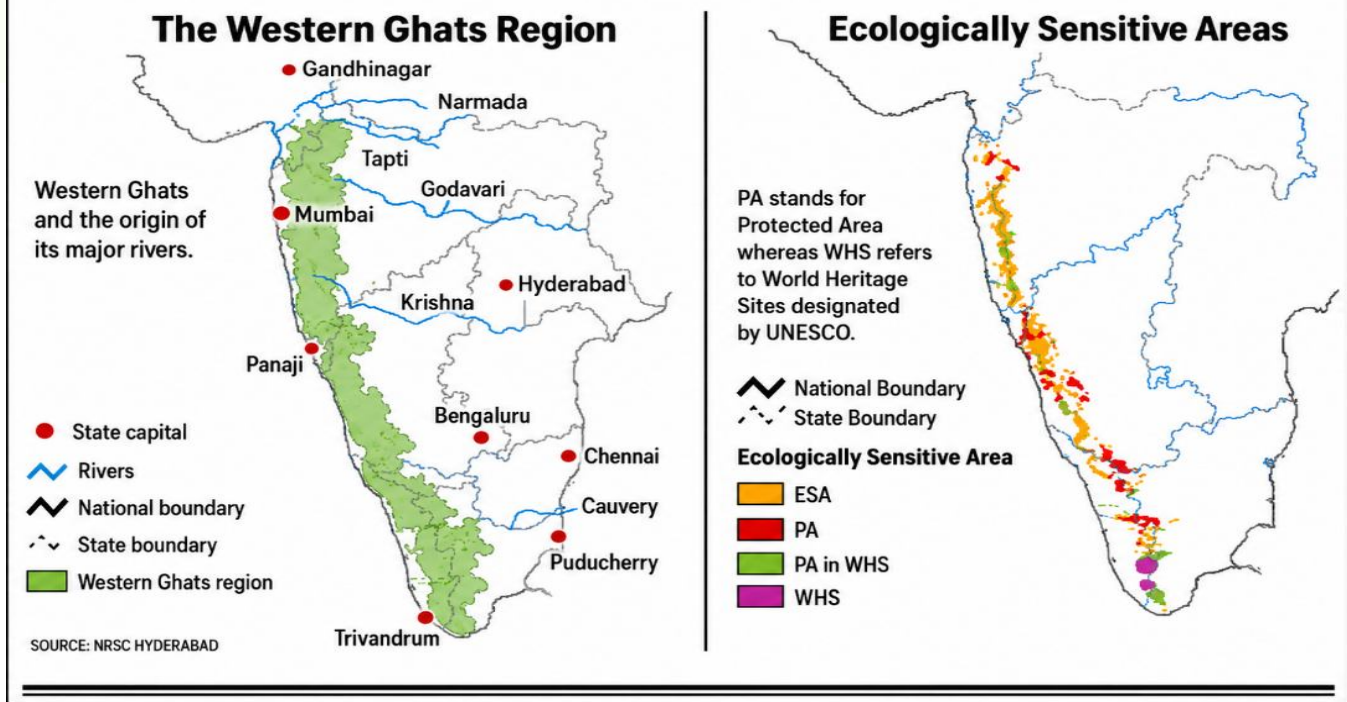
- Ecologically Sensitive Areas** are regions of **high ecological importance and vulnerability** where **environmentally harmful activities** are **regulated or restricted**.

The objective is not necessarily to prohibit all human activity, but to balance:

- Biodiversity conservation
- Existing settlements
- Agriculture and plantations
- Livelihood requirements
- Sustainable development

Once notified under the **Environment (Protection) Act, 1986**, the restrictions acquire legal force.

• THE EXTENT OF DEMARCATION



Earlier ESA-type protections have been applied in areas such as:

- Dahanu
- Mahabaleshwar-Panchgani
- Doon Valley

How Did the Western Ghats ESA Proposal Evolve?

Gadgil Committee

- The **Madhav Gadgil-led Western Ghats Ecology Expert Panel**, constituted in 2010, identified the Western Ghats as covering about **1,29,037 sq. km**.
- It recommended that the entire region be treated as ecologically sensitive, with restrictions based on the degree of ecological fragility.
- The proposal faced strong resistance from States because of concerns over extensive restrictions on economic and developmental

activities.

Kasturirangan Committee

A High-Level Working Group chaired by former ISRO Chairman **K. Kasturirangan** was subsequently constituted.

Its 2013 report identified the geographical extent of the Western Ghats as approximately **1,64,280 sq. km** and divided it into:

- **Cultural Landscape – 60%:** Settlements, agriculture and plantations dominated by human activity.
- **Natural Landscape – 40%:** Regions with high biodiversity, low fragmentation and low population density, including national parks and tiger and elephant habitats.

The Committee proposed that around **60,000 sq. km of natural landscape** be designated as ESA.

WESTERN GHATS & ECOLOGICALLY SENSITIVE AREAS (ESA)

BALANCING CONSERVATION, LIVELIHOODS & SUSTAINABLE DEVELOPMENT

1. THE WESTERN GHATS

- ~1,500 km long mountain chain along India's western coast
- One of the 8 'hottest hotspots' of biodiversity
- Source of major rivers: Godavari, Krishna, Cauvery, Periyar, Mandovi, Sharavathi and others
- Influences monsoon and supports agriculture, livelihoods and economic growth



2. WHAT ARE ECOLOGICALLY SENSITIVE AREAS (ESAs)?

ESAs are regions of high ecological importance and vulnerability where environmentally harmful activities are regulated or restricted.

OBJECTIVE: BALANCE



Once notified under the Environment (Protection) Act, 1986, restrictions acquire legal force.

Earlier ESA-type protections in: Dahanu | Mahabaleshwar-Panchgani | Doon Valley

3. HOW DID THE PROPOSAL EVOLVE?

GADGIL COMMITTEE (2010)

- Identified extent: 1,29,037 sq. km
- Recommended entire region as ESA with graded restrictions
- Faced strong resistance from States

KASTURIRANGAN COMMITTEE (2013)

- Identified extent: 1,64,280 sq. km
- Divided into:
 - Cultural Landscape (60%): Settlements, agriculture, plantations
 - Natural Landscape (40%): High biodiversity, low fragmentation, low density
- Recommended ~60,000 sq. km (natural landscape) as ESA

KEY DIFFERENCE

Gadgil: Broad ecological regulation of entire region



Kasturirangan: Separate cultural & natural landscapes approach



Basis of later negotiations and draft notifications

4. DRAFT NOTIFICATION – KEY MILESTONES

- March 2014**: First draft notification: 56,825.7 sq. km identified as ESA
- Area reduced**: Reduced by >3,000 sq. km after Kerala's ground verification (exclusion of agricultural lands, orchards, plantations, horticulture plots, residential areas)
- Six iterations**: Six versions issued since 2014
- Latest draft**: Issued on 31 July 2024; valid till 1 July 2026
- New provision**: Centre can finalise ESA:
 - State by State in phases, or
 - Through a combined notification

5. ACTIVITIES PROPOSED TO BE RESTRICTED



* Large construction projects exceeding 20,000 sq. metres built-up area.



Existing settlements, agriculture and some development are not uniformly prohibited. Focus is on high-impact activities that damage fragile ecosystems.

6. WHY STATES ARE OPPOSING?

Livelihood & concerns	Economic interests	Boundary & data disputes	Fear of uniform restrictions
Impact on farming, plantations, housing, infrastructure, small businesses and employment	Mining, quarrying, industries, tourism, infrastructure and commercial plantations	Disagreements on village names, revenue boundaries, satellite imagery, land-use, forest classification	Settled and cultivated areas should not be treated like undisturbed forests

7. PRESENT POSITION OF SIX STATES

GUJARAT	MAHARASHTRA	GOA	KARNATAKA	KERALA	TAMIL NADU
Consent for ~446-470 sq. km; across 46 villages; sought protection for projects & timber/mineral extraction	Agreed in principle; seeks exclusion of 378 villages (mainly for industries, mining and distance from ESA).	Seeks exclusion of 121 villages in Sattari taluka from 108 proposed.	Consistently rejects Kasturirangan recommendations; largest share ~20,668 sq. km	Seeks reduction from 9,993.7 sq. km to ~8,805 sq. km; wants exclusion of villages in Idukki, Wayanad, etc.	~6,914 sq. km proposed; no major divergence, final demarcation pending.

8. WHY WESTERN GHATS NEED PROTECTION

- Global biodiversity hotspot; home to endemic flora & fauna
- Influences monsoon; brings abundant rainfall on western coast
- Source of major rivers; critical for water security & livelihoods
- Supports plantations & crops (pepper, cardamom, cinnamon, mango, jackfruit, etc.)
- Unregulated activities cause deforestation, landslides, habitat loss & river stress



9. WAY FORWARD

- Scientific & village-level demarcation; reconcile satellite data with land records
- Graded regulation based on ecological sensitivity
- Protect ecological corridors & connectivity
- State & community participation in decisions
- Financial incentives & Payment for Ecosystem Services for States
- Phased notification where consensus is reached
- Clear regulatory categories: prohibited, regulated, permitted



GOAL: Conserve the Western Ghats while safeguarding livelihoods and enabling sustainable, inclusive growth.



How Did the Gadgil and Kasturirangan Approaches Differ?

Aspect	Gadgil Committee	Kasturirangan Committee
Identified extent	1,29,037 sq. km	1,64,280 sq. km
Proposed coverage	Entire Western Ghats	Mainly natural landscape
Approach	Broad ecological regulation	Separation of cultural and natural landscapes
Approximate ESA	Entire identified region with graded restrictions	Around 60,000 sq. km
State response	Strong resistance	Basis of later negotiations and draft notifications

The Kasturirangan approach attempted to reduce the impact on settlements, plantations and agricultural areas while protecting relatively undisturbed ecosystems.

How Did the Draft Notification Evolve?

The recommendations were accepted in principle, but States were invited to submit their objections before finalising the boundaries.

In **March 2014**, the Centre issued the first draft notification identifying **56,825.7 sq. km** as ESA.

The area was reduced by more than 3,000 sq. km after Kerala conducted a ground-verification exercise and sought the exclusion of:

- Agricultural lands
- Orchards
- Horticultural plots

- Plantations
- Residential areas

Six versions of the draft notification have been issued since 2014. The latest was issued on **July 31, 2024**, and remains valid until late July 2026.

A significant change in the latest draft allows the Centre to finalise the ESA:

- State by State in phases, or
- Through a combined notification covering all six States

What Activities Would be Restricted?

The proposed framework seeks to prohibit or tightly regulate activities with a major ecological impact, including:

- New mining
- Quarrying and sand extraction
- New thermal power plants
- Red-category polluting industries
- Large construction projects
- Large townships

The supplied proposal also refers to restrictions on large construction projects exceeding a built-up area of **20,000 sq. metres**.

- Existing settlements, agriculture and some forms of development are not intended to be uniformly prohibited. The regulatory focus is primarily on high-impact activities that may fragment or damage fragile ecosystems.

Why are States Opposing the Proposal?

Livelihood and Settlement Concerns

- The Western Ghats are densely populated, unlike many remote mountain ecosystems. Numerous villages, farms and plantations fall close to the proposed ESA boundaries.

States fear that restrictions may affect:

- Farming
- Plantation activities
- Housing
- Local infrastructure
- Small businesses
- Employment

Economic Interests

The region supports:

- Mining
- Quarrying
- Industries
- Tourism
- Infrastructure projects
- Commercial plantations

Some States have sought exclusions to preserve space for these activities.

Boundary and Data Disputes

Disagreements remain over:

- Village names
- Revenue boundaries
- Satellite imagery
- Land-use classification
- Forest and non-forest areas
- Differences between official records and ground conditions

Fear of Uniform Restrictions

- States argue that villages with settlements and agricultural activity should not be treated in the same way as undisturbed forests or wildlife habitats.

What is the Present Position of the Six States?

Gujarat

- Gujarat has reportedly given final consent for approximately **449–470 sq. km across 64**

villages. It has sought protection for ongoing projects and limited minor-mineral extraction in non-forest areas.

Maharashtra

- Maharashtra has agreed in principle but has sought the exclusion of **378 villages**, citing industries, mining and the distance of some villages from ecologically sensitive zones.
- The supplied reports give different totals for the number of villages initially identified, but both agree on the demand to exclude 378 villages.

Goa

- Goa has sought the exclusion of **21 villages in Sattari taluka** from the 108 villages proposed under ESA.

Tamil Nadu

- Tamil Nadu has about **6,914 sq. km** proposed under ESA and has not raised major divergences, although final demarcation remains pending.

Karnataka

- Karnataka has the largest proposed ESA share, around **20,668 sq. km**, but has consistently rejected the Kasturirangan recommendations.

Kerala

- Kerala has sought to reduce its proposed ESA from **9,993.7 sq. km** to around **8,805 sq. km**.

It has demanded the exclusion of villages in areas such as:

- Idukki
- Wayanad
- Cardamom Hills

The State argues that these regions contain plantations, agriculture and settlements. The expert

committee has not accepted all the proposed exclusions.

Why Do the Western Ghats Need Protection?

Global Biodiversity Importance

- The Western Ghats are one of the world's recognised biodiversity hotspots and are counted among the **eight hottest hotspots of biological diversity**.
- They support hundreds of plants and animals found nowhere else.

Influence on the Monsoon

- The mountain chain acts as a physical barrier to moisture-bearing winds, producing abundant rainfall on its western coastal side.

Source of Major Rivers

Its forests, springs and rainfall sustain important rivers, including:

- Godavari
- Krishna
- Cauvery
- Periyar
- Mandovi
- Sharavathi

These river systems support water security, agriculture, livelihoods and economic activity across peninsular India.

Ecological Continuity

- Mining, deforestation, habitat loss and unregulated construction can fragment wildlife habitats and disrupt ecological corridors.

Disaster Vulnerability

- Concerns over landslides, deforestation and uncontrolled construction have increased

the demand for stronger environmental regulation.

Livelihood Dependence

The region has historically supported plantations and cultivation of:

- Pepper
- Cardamom
- Cinnamon
- Mango
- Jackfruit

Its conservation is therefore connected not only with wildlife but also with long-term livelihood and water security.

What is the Centre's Phased Plan?

The Centre is considering moving ahead with ESA notifications in States where consensus is close instead of waiting for agreement from all six States.

The first phase may include:

- Gujarat
- Maharashtra
- Goa

This phased approach seeks to prevent disputes in Karnataka and Kerala from indefinitely delaying legal protection in States where boundaries are largely settled.

What is the Role of the 2022 Expert Committee?

The Centre constituted a fresh expert committee in 2022 under **Sanjay Kumar**, former Director General of Forests.

The Committee has:

- Held meetings with State governments
- Conducted field visits in all concerned States except Kerala
- Examined satellite imagery
- Reconciled village-level records

- Reviewed revenue and boundary details
- Considered State objections
- Studied the continuity of ecological corridors

The Committee includes experts associated with institutions such as:

- Indian Institute of Science
- Indian Institute of Remote Sensing
- Geological Survey of India

Its final report will determine whether the additional reductions sought by States should be accepted.

Can Financial Incentives Improve State Cooperation?

The expert committee has considered financial incentives for States that protect the Western Ghats. The Kasturirangan Committee had recommended that the six States negotiate with the Centre for **grant-in-aid** in return for conserving natural resources.

It also suggested arrangements for **Payment for Ecosystem Services**, recognising benefits such as:

- Water security
- Forest conservation
- Biodiversity protection
- Climate regulation
- Ecological services extending beyond State boundaries

Such financial support could help compensate States and local communities for restrictions on revenue-generating activities.

Way Forward

Scientific and Village-Level Demarcation

- Satellite imagery must be reconciled with land records and field verification to prevent settlements and agricultural areas from being wrongly classified.

Graded Regulation

- Restrictions should be based on ecological sensitivity rather than applying identical rules to forests, plantations and densely populated villages.

State and Community Participation

- State governments, local bodies, farmers, plantation workers and civil society should participate in finalising boundaries and regulatory conditions.

Protect Ecological Corridors

- Exclusions should not break the continuity of forests, wildlife habitats and river catchments.

Compensate Conservation

- Grant-in-aid and Payment for Ecosystem Services can reduce the financial burden of protecting ecologically valuable regions.

Adopt Phased Notification

- States where consensus has been achieved should not be forced to wait indefinitely for unresolved disputes elsewhere.

Ensure Regulatory Clarity

- The final notification should clearly distinguish between prohibited activities, regulated activities and activities that may continue.

Conclusion

The Western Ghats ESA debate represents a difficult balance between **ecological security, local livelihoods and State development priorities**. The region's biodiversity, monsoon influence and role in sustaining major rivers make conservation essential, but its dense population and plantation economy require a carefully differentiated approach.

- A scientifically demarcated, consultative and phased framework—supported by financial compensation and graded restrictions—can protect the Western Ghats

without treating conservation and development as mutually exclusive goals.

Europe's 2026 Heatwave: Omega Block, Climate Change and the Adaptation Gap

Source: [The Indian Express](#)

Relevance: UPSC GS Paper I: Geography, Atmospheric Circulation, Jet Streams, Heatwaves and El Niño.

Important Key Words

For Prelims

- Omega Block, Heat Dome, Jet Stream, Urban Heat Island, El Niño

For Mains

- Climate Adaptation Gap, Extreme-Heat Resilience, Climate Whiplash, Public-Health Preparedness, Infrastructure Vulnerability

Why in News?

Western and Central Europe are experiencing a severe heatwave caused by a persistent high-pressure system known as an **Omega Block**.

- France has reported at least **18 direct heat-related deaths** and **40 drownings**, as people entered rivers, lakes and unsupervised coastal areas to escape extreme temperatures.
- Several European countries, including France, the United Kingdom, Spain and Italy, have issued heat alerts, while schools, transport services and power systems have faced disruptions.

What is an Omega Block?

An **Omega Block** is a persistent atmospheric

pattern in which a high-pressure system becomes positioned between two low-pressure systems.

On a weather map, the airflow resembles the Greek letter **Omega (Ω)**.



France has seen 40 drownings in six days as people flee a heat dome pushing 43 degrees Celsius. Here is the atmospheric traffic jam that made it happen, and why climate change turned it lethal.

Role of the Jet Stream

- The **jet stream** is a narrow band of strong winds flowing from west to east in the upper atmosphere. It normally moves weather systems across Europe.

During an Omega Block:

- The jet stream becomes highly curved.
- A high-pressure ridge becomes stationary.
- Low-pressure systems remain on either side.
- Normal movement of weather systems is interrupted.

The result is an atmospheric “traffic jam” in which the same weather conditions remain over a region for several days.

How Does a Heat Dome Develop?

The central high-pressure system draws warm and

WHAT IS AN OMEGA BLOCK?

An Omega Block is a large weather pattern shaped like the Greek letter Ω (omega). It traps hot air over a region, leading to prolonged heatwaves and dry conditions.

WHY IT CAUSES HEATWAVES

- High pressure acts like a lid, trapping warm air near the surface.
- Sinking air prevents cloud formation and rainfall.
- The trapped air heats up further, leading to extreme temperatures.

HOW IT WORKS

- 1** Normally, the jet stream flows from west to east, moving weather systems along.
- 2** Sometimes, the jet stream becomes wavy and develops large bends.
- 3** A high pressure area builds in the middle, rising over the region.
- 4** This blocks the usual flow, trapping warm air beneath it.
- 5** The pattern can persist for days or weeks, intensifying the heat.

IMPACTS OF AN OMEGA BLOCK

- EXTREME HEAT**
Temperatures soar and can break records.
- DRY CONDITIONS**
Lack of rain leads to drought, wildfires, and water stress.
- HEALTH RISKS**
Heat exhaustion, heatstroke and higher risk for vulnerable people.
- IMPACTS ON DAILY LIFE**
Disrupted transport, school closures, strain on power and health systems.



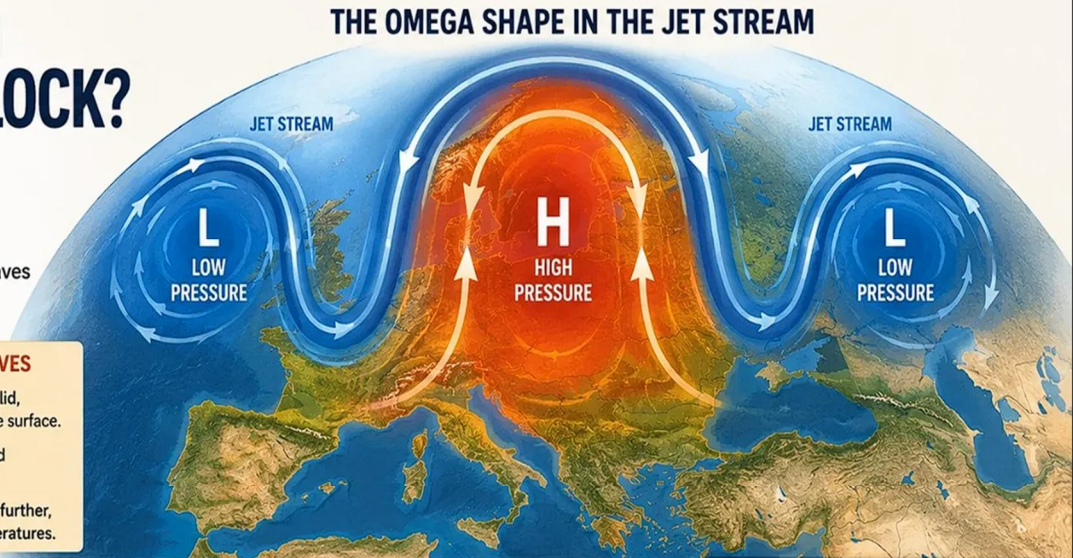
WHY IT'S HAPPENING MORE OFTEN?

Climate change is altering jet stream patterns, making persistent Omega Blocks—and severe heatwaves—more likely.



EXAMPLE: EUROPE 2025

A powerful Omega Block over Europe has led to record-breaking heat, deaths, power cuts, school closures and major disruption.



dry air from North Africa towards Europe.

Under this high pressure:

- Air sinks towards the surface.
- Sinking air is compressed and becomes warmer.
- Cloud formation is suppressed.
- Prolonged sunshine further heats the land.
- Warm surface air cannot rise and disperse.

The trapped mass of hot air acts like a **lid over the atmosphere**. This condition is commonly described as a **heat dome**.

Thus, the Omega Block refers to the broader atmospheric pattern, while the heat dome describes the trapping and intensification of hot air beneath the high-pressure ridge.

Why is Europe Experiencing Extreme Heat?

Saharan Air Intrusion

- The stationary high-pressure system is pulling hot, dry air northward from the Sahara and trapping it over Europe.

Prolonged Sunshine

- Clear skies allow continuous solar heating during the day.

Weak Atmospheric Circulation

- The disrupted jet stream prevents cooler weather systems and Atlantic air from reaching affected regions.



Warm Nights

- Night-time temperatures have remained unusually high. When buildings and the human body cannot cool after sunset, heat stress accumulates over successive days.

Urban Heat Island Effect

- Concrete, asphalt and dense construction absorb heat during the day and release it at night, making cities hotter than surrounding rural areas.

Why Has the Heatwave Become Deadly?

Infrastructure Designed for Cold Weather

- Much of Europe's housing, transport and public infrastructure was developed for historically temperate or cold conditions.

Homes often use:

- Thick stone
- Brick
- Concrete
- Heavy insulation

These materials retain indoor warmth during winter but can trap heat during summer.

Limited Air Conditioning

- Household air conditioning remains uncommon in several European countries because prolonged extreme heat was historically rare.

Long Summer Daylight

- Western Europe experiences long daylight hours during summer, allowing buildings and urban surfaces to absorb heat for extended periods.

Vulnerable Population

- Older persons, children and people with existing health conditions face higher risks from dehydration, heat exhaustion and heatstroke.

Unsafe Search for Relief

- The high number of drownings in France reflects people entering unsupervised water bodies without adequate knowledge of currents, depth or swimming safety.
- The event therefore demonstrates that heat-related mortality includes not only direct heatstroke deaths but also indirect behavioural and infrastructural consequences.

How is Climate Change Intensifying the Event?

Omega Blocks and European heatwaves occurred before modern climate change. However, human-induced warming has increased the temperature upon which such natural weather patterns operate. Europe has been warming at **more than twice the global average rate**, making it the world's fastest-warming continent.

- The current heatwave is estimated to be several degrees hotter than it would have been without human-caused climate change.

Amplification Effect

Climate change does not necessarily create every blocking pattern. Instead, it intensifies its consequences:

- Higher baseline temperatures
- More severe heat peaks
- Longer-lasting heatwaves
- Warmer nights
- Greater wildfire risk
- Increased pressure on health and infrastructure

A weather system that once produced an uncomfortable week can now produce a lethal emergency.

What Role Does the Albedo Effect Play?

Albedo refers to the ability of a surface to reflect sunlight.

- Bright ice reflects a large share of solar energy. However, as Arctic ice melts, darker ocean water is exposed.
- Dark water absorbs more heat than ice, contributing to further warming. Since the Arctic is warming faster than any other region, these changes can influence neighbouring Europe and reinforce regional warming.

What is Climate Whiplash?

Climate whiplash refers to rapid shifts between contrasting extreme weather conditions, such as:

- Hot and cold
- Wet and dry
- Drought and intense rainfall

Europe experienced below-normal temperatures shortly before unusually intense heat developed.

- Such abrupt fluctuations are becoming increasingly common as climate change disrupts established atmospheric and seasonal patterns.

What are the Wider Impacts of the Heatwave?

Public Health

Extreme heat increases the risk of:

- Heat exhaustion
- Heatstroke
- Dehydration
- Cardiovascular stress
- Respiratory problems

Education

- Schools have been closed or forced to

modify schedules because buildings cannot maintain safe indoor temperatures.

Transport

- Rail services may slow down because heat can affect tracks, power systems and other infrastructure.

Electricity

- High electricity demand and power failures can worsen indoor heat exposure, especially where cooling systems are already limited.

Agriculture

- Farmers have shifted harvesting to night-time hours to protect workers and crops from extreme daytime heat.

Wildfires

- Hot, dry and windy conditions increase wildfire risk across Spain, Italy and other affected regions.

Urban Services

- Libraries, museums, cinemas and community buildings have been used as temporary cooling shelters for vulnerable people.

When is Relief Expected?

Forecasts suggested that conditions would begin easing gradually as the Omega Block weakened and the jet stream resumed its normal west-to-east movement.

- However, heat stored in buildings, soil and urban surfaces does not disappear immediately. Even after atmospheric conditions change, temperatures may remain uncomfortable for several days.

Authorities have therefore continued:

- Heat alerts
- Cooling-centre operations



- Public-health advisories
- Warnings against swimming in unsupervised waters

What Does the Emerging El Niño Mean for India?

An **El Niño** phase is developing in the equatorial Pacific Ocean.

- El Niño refers to the unusual warming of surface waters in the central and eastern equatorial Pacific. It can influence weather patterns across the world.

Possible Implications for India

- Increased probability of below-normal monsoon rainfall
- Higher likelihood of prolonged heatwaves
- Greater stress on agriculture and water resources
- Possible weakening of rainfall during the later monsoon months

Historical records show that many El Niño years have been associated with below-normal Indian monsoons.

- However, the relationship is **probabilistic rather than deterministic**. El Niño increases the likelihood of certain outcomes but does not guarantee them.

What Lessons Does the Heatwave Offer?

Adaptation Must Match Changing Climate Risks

- Past weather patterns can no longer be treated as a reliable basis for designing infrastructure.

Heat is a Multi-Sectoral Disaster

- Extreme heat affects health, housing, transport, electricity, education, agriculture and water safety simultaneously.

Night-Time Heat Matters

- Heat action plans should monitor minimum temperatures because hot nights prevent physical and urban recovery.

Local Preparedness Determines Impact

- The same temperature can produce different outcomes depending on housing design, cooling access, public awareness and emergency systems.

Indirect Deaths Must Be Recognised

- Drownings, workplace accidents and power failures may be linked to extreme heat even when heatstroke is not the immediate cause.

Way Forward

Climate-Resilient Buildings

- European cities need ventilation, shading, reflective materials and passive-cooling systems suited to hotter summers.

Urban Cooling

Cities should expand:

- Tree cover
- Green spaces
- Cool roofs
- Shaded public areas
- Water-sensitive urban planning

Stronger Heat Action Plans

- Warnings should be linked with local emergency response, outreach to vulnerable groups and real-time health monitoring.

Public Cooling Infrastructure

- Libraries, schools, museums and community halls can serve as accessible cooling centres.

Water-Safety Measures

- Supervised swimming facilities, trained

lifeguards and clear warnings are essential during heat emergencies.

Infrastructure Upgradation

- Power grids, railways, schools and healthcare facilities must be redesigned for recurring extreme-heat conditions.

Climate Mitigation

- Long-term resilience requires reducing greenhouse-gas emissions alongside immediate adaptation.

Conclusion

Europe's 2026 heatwave illustrates how a natural atmospheric blocking pattern can become far more dangerous in a warming climate. The Omega Block trapped Saharan air over a continent whose buildings, public services and lifestyles were designed for cooler conditions.

- The crisis is therefore not only a weather event but also an **adaptation failure**. As heatwaves become more frequent and intense, countries must redesign infrastructure, strengthen public-health systems and treat extreme heat as a major disaster-management challenge.