

IAS ORIGIN

YOUR PATHWAY TO UPSC SUCCESS

WEEKLY CURRENT AFFAIRS

10TH NOV TO 15TH NOVEMBER



Table of Contents

COP30 – UN Climate Summit 2025.....	4
What is Janjatiya Gaurav Varsh 2025?	14
Odd Radio Circles (ORCs).....	19
Angola.....	21
India’s First MWh-Scale Vanadium Flow Battery at NTPC NETRA.....	30
First Jal Sanchay Jan Bhagidari (JSJB) Awards	36
Oman has been elected to the UNESCO MAB Council (2025–2029)	40
The Rare Earth Hypothesis.....	43
Great Indian Bustard	47
Lab-Grown / Cow-Free Milk	52
Himalayan Black Bear	56
Prime Minister of India visit to Bhutan	61
White Collar Terrorism.....	65
Global TB Report 2025.....	69
Global Cooling Watch 2025 Report.....	73
Operation Bullion Blaze	77
Silver Jubilee of PPV & FRA Act	80
Cabinet Approves New Royalty Rates for 4 Critical Minerals	84
Nyoma Air Base	93
National Database for Emergency Management (NDEM).....	96
ARISE Program.....	102
Export Promotion Mission (EPM)	105
Botswana	109
The India Skills Report 2026	111
Rise in India’s Carbon Emissions	116
Moon’s Sphere of Influence (MSI)	117
Draft Seeds Bill, 2025	120
Hepatitis A.....	124
AI-based Locking Monitoring System called ‘DRISHTI’	127
New Mangalore Port	130

Global Inequality Report 2025	132
National One Health Mission	135
SEBI Warns Against Digital Gold Investments	140
Humboldt Penguin (Spheniscus humboldti)	142
National Biodiversity Authority	144
Issue to produce Indian Nobel laureate	146
Aditya-L1	148
Lake Turkana	151
Rift Valley Fever	154
Mitra Shakti-XI	156
Transplantation of Human Organs and Tissues (Amendment) Rules, 2025	157
Molasses.....	159
Periodic Labour Force Survey (PLFS) Report	160
Ricin	162
World Artificial Intelligence Cooperation Organization (WAICO).....	164
James Watson, Nobel Prize-winning DNA Pioneer Dies	165
V. Rajaraman: Architect of India's Programming Revolution	167
Booker Prize 2025	168
3rd International Conference on Green Hydrogen.....	170
Fungus Infections Rise in India	173
Dumpsite Remediation Accelerator Programme (DRAP).....	174
YBRANT Programme.....	175
Lucifer Bee	176
International Cryosphere Climate Initiative	177
Quantum Diamond Microscope	178
SC Asked HCs to Upload Details of Time Taken by Judges to Deliver Verdicts.....	181

01

COP30 – UN CLIMATE SUMMIT 2025

The 30th Conference of the Parties (COP30) to the UNFCCC began in Belém, Brazil, marking the decade since the Paris Agreement and focusing on translating global climate commitments into concrete implementation.



WHAT IS COP30?

DEFINITION AND CONTEXT

- “COP” stands for *Conference of Parties* the annual meeting of the Parties to the **UN Framework Convention on Climate Change (UNFCCC)**. COP30 is thus the 30th such gathering.
- These COPs are the main multilateral forum for negotiating global responses to climate change: countries come together to assess progress, negotiate agreements, and set future goals.
- The parent treaty is the **UNFCCC**, adopted in 1992, under which the **Paris Agreement (2015)** is a key instrument.

WHEN AND WHERE

- COP30 is scheduled from **10 to 21 November 2025** in **Belém, Brazil**.
- There is also a “Heads of State Summit” portion earlier (6–7 November).
- Belém sits in the Amazon region, which is symbolically and practically significant for forest, biodiversity, and climate discussions.

PRESIDENCY & FRAMEWORK

- Brazil holds the COP30 Presidency, meaning it has influence over key priorities and the framing of the agenda.
- The COP30 structure is not just about formal negotiations (“blue zone”): there is a *Global Climate Action Agenda* that brings in **civil society, businesses, cities, investors, indigenous peoples**, etc.
- According to COP30 Presidency, the *Action Agenda* is structured around **six thematic axes** (or “pillars”):
 - Energy, Industry & Transport Transition
 - Forests, Oceans & Biodiversity
 - Agriculture & Food Systems Transformation
 - Resilience (cities, water, infrastructure)
 - Human & Social Development
 - Enablers: Finance, Technology, Capacity-Building

WHY COP30 IS ESPECIALLY IMPORTANT?

MOMENTUM FROM THE FIRST GLOBAL STOCKTAKE (GST-1)

- The **Global Stocktake (GST)** is a mechanism under the Paris Agreement that periodically assesses collective progress toward climate goals. COP30 is being positioned to *translate the findings* of the first GST into action.
- Thus, COP30 is not just about pledges, but about **implementation**: “from commitments to delivery.”

CLIMATE FINANCE AS A CENTRAL FOCUS

- One of the headline ambitions is mobilizing **US\$ 1.3 trillion annually** by **2035** for climate action, especially for developing countries.
- This finance is expected to come from both public and private sources.
- There’s a roadmap called the “**Baku to Belém Roadmap**”, which is being pushed by Brazil to operationalize this financial ambition.
- Finance isn’t just for mitigation: adaptation finance (supporting countries to cope with climate impacts) is a big concern.
- Civil society (e.g., Amnesty) has pointed out issues with previous pledges: e.g., limited follow-through, slow disbursement, and concerns about debt when finance is not grants.

NATURE-BASED SOLUTIONS & THE AMAZON

- The location in the Amazon gives symbolic weight to **forest protection**, biodiversity, and indigenous rights.
- COP30 is expected to push innovations in forest finance and conservation mechanisms for example, the **Tropical Forest Forever Fund (TFFF)**.
- There is a push to integrate indigenous people more strongly in decision-making and fund governance: their land rights, traditional knowledge, and role in forest stewardship are high on the agenda.

EQUITY, INCLUSION, AND JUSTICE

- COP30 emphasizes *inclusivity*: not only governments but **civil society, cities, youth, indigenous peoples** will be part of “Global Mobilization.”
- The principle of “**common but differentiated responsibilities and respective capabilities (CBDR-RC)**” continues to underpin negotiations.
- Loss and Damage financing (helping countries deal with irreversible climate harms) remains a critical equity issue: many climate-vulnerable nations demand more predictable finance. (Amnesty’s report underscores this gap.)
- Brazil, as host, also wants to highlight socio-bioeconomy in Amazon communities ensuring local and indigenous communities’ benefit, not just external investors.

TECHNOLOGY & CAPACITY BUILDING

- COP30’s Action Agenda also strongly emphasises technology transfer, especially clean energy technologies.
- Capacity building meaning strengthening institutions, local knowledge, and governance structures in vulnerable countries is also a key pillar.
- There’s recognition that to implement NDCs (Nationally Determined Contributions), technical know-how, institutional systems, and cooperation are essential.

JUST TRANSITION & ENERGY TRANSITION

- A just transition away from fossil fuels is expected to be a big theme: making sure that workers, communities, especially in developing countries, are not left behind.
- The summit is also likely to push for sustainable fuels (biofuels, synthetic fuels) some pledges suggest scaling up sustainable fuel use by **4x by 2035** (“Belém 4×” pledge).

- There's also pressure to reform carbon markets or strengthen carbon pricing mechanisms.

DIPLOMATIC SIGNIFICANCE & SYMBOLISM

- Belém (in the Amazon) is symbolically powerful: it draws direct attention to the role of forests and nature in climate mitigation.
- COP30 marks **three decades** of UNFCCC COPs, making it a milestone event.
- It's seen as a "decade of acceleration": the UN Secretary-General has called for COP30 to "ignite a decade of acceleration and delivery" to meet the 1.5 °C target.

KEY CHALLENGES & TENSIONS

1.5 °C TARGET UNDER THREAT

- Despite past COPs, the goal of limiting warming to **1.5°C** remains under significant risk. The UN Secretary-General has warned that the 1.5°C threshold is a "red line" for humanity.
- Some leaders and analysts argue that we are already breaching or close to breaching 1.5°C in terms of temporary overshoots, which raises difficult scientific and political questions.
- There is a **gap between pledges (NDCs)** and what is needed in practice (implementation gap), especially for emissions cuts and finance.

CLIMATE FINANCE CREDIBILITY

- While the \$1.3 trillion-a-year goal is ambitious, **mobilising that much is very challenging**: it requires huge mobilization of both public and private capital.
- There's always a risk that pledges are not met, or that funds are not delivered on time, or that funding is tied to debt (for poor countries) rather than grants. Amnesty's analysis warns that some finance could be debt-creating.
- Ensuring **loss and damage** finance remains predictable and sufficient is politically sensitive: historically, it has been underfunded relative to need.

FOREST PROTECTION CONTROVERSIES

- While the Amazon is central, there's tension over how to pay for forest conservation, and how to ensure **indigenous communities** truly benefit rather than being marginalized.
- Land rights and tenure remain contentious: indigenous peoples often demand stronger legal guarantees for their land to prevent exploitation.

- Mechanisms like the Tropical Forest Forever Fund (TFFF) are ambitious, but governance, accountability, and access (especially for local communities) are complex.

PARTICIPATION & REPRESENTATION

- Translating commitments into action requires more than just national governments: COP30 is pushing for **multi-stakeholder engagement**, but aligning interests among business, cities, civil society, and governments is hard.
- There could be capacity constraints in many developing countries in implementing and scaling climate solutions (technology, institutional capacity, human resources).
- Negotiations remain complex: hundreds of “activation groups” are working on different objectives, but reaching consensus in the formal COP negotiation (blue zone) is historically challenging.



JUST TRANSITION & FOSSIL FUEL PHASE-OUT

- Moving away from fossil fuels is necessary but politically fraught: many economies depend on them, and there’s always tension over how fast and who bears the cost.
- Questions remain about **carbon markets** or offsets: how to structure them fairly, how to prevent greenwashing, how to ensure integrity.
- Scaling up “sustainable fuels” (like biofuels) raises its own issues: land use, food security, lifecycle emissions, and social equity.

LOGISTICAL AND PRACTICAL CHALLENGES

- Hosting such a big COP in Belém (Amazon region) comes with infrastructure, accommodation, and transport challenges.
- There is potential criticism of “climate hypocrisy” delegations emitting carbon to fly in, or the summit’s own carbon footprint.
- Ensuring effective outcome requires not just negotiations but follow-through: monitoring, reporting, and verifying implementation.

WHAT ARE THE EXPECTED OUTCOMES / POTENTIAL WINS?

STRENGTHENED NATIONAL ACTION PLANS (NDCs)

- Countries may come forward with **updated or enhanced NDCs**, reflecting more ambition or more clarity in how they’ll meet their targets.
- There could be stronger alignment of NDCs with **finance, technology, and capacity-building** needs, especially for developing countries.

CONCRETE MOBILIZATION OF CLIMATE FINANCE

- Progress on the **US\$ 1.3 trillion roadmap**: possibly new pledges, mechanisms, or structures to channel public and private funds.
- Potential establishment or expansion of funds for **adaptation and loss & damage**, making them more accessible and predictable.
- Reforms or new approaches in multilateral development banks (MDBs) to scale concessional finance, per the Baku-to-Belém roadmap.

BOOST FOR NATURE-BASED SOLUTIONS

- Launch or scaling up of global funds for forest conservation (e.g., TFFF) with strong governance and participation of indigenous peoples.
- Recognition and better integration of **indigenous land rights and traditional ecological knowledge** into climate finance and implementation strategies.
- New or strengthened mechanisms for REDD+ (or forest conservation) financing.

MULTI-STAKEHOLDER ACTION

- Through the Global Climate Action Agenda, many non-state actors (cities, businesses, civil society) may commit to **measurable deliverables** aligned with the six thematic pillars.
- Development of a “Granary of Solutions”: a repository of proven climate solutions that can be scaled up globally.

- Activation groups working on 30 key objectives could produce roadmaps, indicators, and implementation plans.

STRENGTHENED JUST TRANSITION FRAMEWORK

- Agreements or pledges related to **sustainable fuels (Belém 4*)** could give a major boost to biofuels, synthetic fuels, and other clean energy alternatives.
- Possible progress on international carbon market mechanisms to be more robust, inclusive, and fair.
- Enhanced support for communities (workers, regions) dependent on fossil economies, making the energy transition more equitable.



GOVERNANCE GAINS

- Institutional mechanisms to ensure **accountability, transparency, and implementation** of COP decisions.
- Strengthened linkages between the UNFCCC process and other global environmental processes (e.g., biodiversity conventions) — especially through nature-based action.
- Stronger role for **indigenous peoples** and local communities in global climate governance.

RISKS AND WHY COP30 COULD FALL SHORT

- **Over-ambition vs. Implementation Risk:** There's a risk that COP30 announces big targets and pledges, but many may not be backed by realistic implementation or financing plans.
- **Finance Gap Remains:** Even if \$1.3 trillion is mobilized in rhetoric, the quality (public vs private), accessibility, and conditionality of funds matter a lot.

- **Governance & Equity Challenges:** Without robust safeguards, funds like forest conservation could bypass local communities, or suffer from elite capture.
- **Negotiation Fatigue / Division:** Countries have diverging priorities (developed vs developing, forest countries vs industrial ones), which could dilute outcomes.
- **Greenwashing Risk:** Non-state actors (businesses, cities) may make pledges in COP but not deliver; carbon markets or offset schemes might be misused.
- **Climate Realities Outpace Diplomacy:** Physical climate impacts (extreme weather, tipping points) may accelerate faster than the political will or capacity to act.

IMPLICATIONS FOR INDIA (AND DEVELOPING COUNTRIES)

CLIMATE FINANCE DEMAND

- India, like other major developing economies, will likely push for more predictable **adaptation finance**, **technology transfer**, and capacity-building support.
- The \$1.3 trillion roadmap is particularly relevant: India could argue for more concessional finance, not just private capital.

FORESTS & NATURE-BASED SOLUTIONS

- While COP30 is in Brazil, the lessons from Amazon conservation (e.g., forest-based financing) can be applicable to India's own forest-rich regions (Western Ghats, Himalayas, etc.).
- India could push for global nature-based funds where local and indigenous communities are partners, not just beneficiaries.

ENERGY TRANSITION

- For India's energy policy, COP30 could strengthen arguments for biofuels, green hydrogen, and other sustainable fuels (especially in transport and hard-to-decarbonize sectors).
- It could also help mobilize technology transfer for clean energy, storage, and grid infrastructure.

JUST TRANSITION & SOCIAL EQUITY

- India needs to ensure that climate transition does not disproportionately hurt vulnerable communities (e.g., coal-dependent regions, rural workers).
- At COP30, India could advocate for "just transition mechanisms" (training, social protection, financing) to support affected communities.

GLOBAL LEADERSHIP

- India's active role (as a major emitter, developing economy, and technology user) positions it to be a bridge between developed and developing nations in climate diplomacy.
- India could leverage COP30 to deepen South-South cooperation — e.g., on finance, adaptation, and technology, especially with other Global South countries.



BROADER STRATEGIC & GEOPOLITICAL SIGNIFICANCE

- **Climate Diplomacy Reset:** COP30 could act as a reset point — post-Paris, and after the first GST to reengage global ambition and trust, especially if parties feel the 1.5 °C goal is slipping.
- **Green Economy Push:** The summit could catalyze a wave of investment in green infrastructure, sustainable fuels, forest economies, and nature-based solutions.
- **South-South Finance:** If successful, the Baku-to-Belém roadmap might reshape how developing countries access climate finance, reducing dependency on traditional North-dominated financial institutions.
- **Global Justice:** COP30 is a platform to spotlight climate justice, especially for Indigenous communities, vulnerable countries, and those bearing the brunt of climate change.
- **Institutional Strengthening:** Over time, the mechanisms and action agenda from COP30 could strengthen the architecture of global climate governance, making commitments more enforceable and implementation more robust.

CRITICISMS & CONCERNS RAISED

- **Moral Failure:** The UN Secretary-General has called the world's inability to meet the 1.5 °C target a "moral failure" and "deadly negligence."
- **Protectionism Risk:** India has criticized the EU's *Carbon Border Adjustment Mechanism (CBAM)* at COP30, calling it "protectionist" and not in the spirit of UNFCCC cooperation.
- **EU's Internal Weakening:** There are reports that EU climate ministers weakened their 2040 emissions reduction target at the last minute before COP30, allowing up to 5% flexibility through carbon credits.
- **Participation & Protests:** Indigenous protests have broken out during COP30, demanding more meaningful recognition of land rights and stronger action on deforestation.
- **Logistical Hypocrisy:** There's criticism about the carbon footprint of COP30 itself (flights, accommodation), and whether the event's infrastructure aligns with its climate goals.
- **Janjatiya Gaurav Varsh 2025:** Nationwide celebrations under Janjatiya Gaurav Varsh 2025 are underway to mark the 150th birth anniversary of Bhagwan Birsa Munda and 150 years of "Vande Mataram".

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02

WHAT IS JANJATIYA GAURAV VARSH 2025?

Janjatiya Gaurav Varsh (Tribal Pride Year) 2025 is a year-long nationwide celebration announced by the **Government of India** to honour India's tribal communities, their history, freedom struggle, culture, and contemporary contributions.

It builds upon earlier initiatives like **Janjatiya Gaurav Divas (15 November)**, but expands it into a **full-year observance**.

2025 marks key anniversaries connected to tribal resistance movements, making it strategically chosen.



MAJOR OBJECTIVES OF JANJATIYA GAURAV VARSH 2025

CELEBRATE TRIBAL FREEDOM FIGHTERS

To highlight forgotten tribal warriors such as:

- **Birsa Munda** (Ulgulan)
- **Sidho-Kanho Murmu** (Santhal Hul)
- **Alluri Sitarama Raju** (Rampa Revolt)
- **Tantya Bhil, Govind Guru, Veer Narayan Singh, etc.**

PROMOTE TRIBAL CULTURE & HERITAGE

- Showcasing music, dance, painting, textiles (Gond, Warli, Saora art)
- Preservation of oral traditions, festivals, languages

Please contact IAS Origin Team at 7880009099

STRENGTHEN TRIBAL WELFARE PROGRAMS

Focus areas:

- Education and scholarships
- Health and nutrition
- PVTG upliftment
- Livelihood and economic empowerment
- Access to government schemes

INTEGRATE TRIBAL KNOWLEDGE INTO NATIONAL DEVELOPMENT

- Forest management
- Climate change resilience
- Traditional medicine
- Handicrafts & rural enterprise models

CREATE NATIONAL AWARENESS

- School curriculum additions
- Museum activities
- Tribal research and documentation
- Civil society involvement

ORGANISATIONS INVOLVED:

- Ministry of Tribal Affairs (MoTA) is the nodal agency.
- Supported by Tribal Research Institutes (TRIs), State Governments, Eklavya Model Residential Schools (EMRS), and cultural bodies.

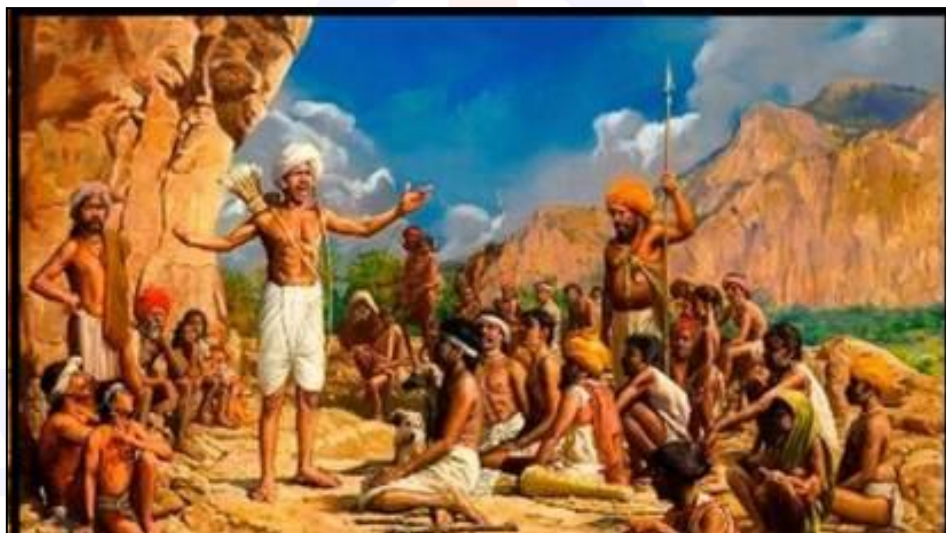
KEY FEATURES:

- **Cultural Commemoration:** Mass events, exhibitions, and Janjati Gaurav Yatras showcasing tribal heroes and their contributions to India's freedom struggle.
- **Educational Outreach:** Competitions, literacy workshops, and museum visits to promote awareness of tribal history among students.
- **Community Empowerment:** Activities like digital and financial literacy programmes in EMRS schools to enhance tribal socio-economic inclusion.
- **National Integration:** Mass singing of Vande Mataram, sports meets, and art exhibitions across States to foster unity and pride.

- **Inclusive Development Focus:** Events across states such as **Jharkhand, Odisha, Gujarat, Nagaland, and Ladakh**, blending traditional culture with modern aspirations.
- **Major Highlight:** The Janjati Gaurav Yatra (Tribal Pride March) from Ambaji and Umargam to the Statue of Unity (Ektanagar), symbolising national unity through tribal heritage.

BIRSA MUNDA

- Birsa Munda (1875–1900) was a **tribal freedom fighter, religious reformer, and leader of the Ulgulan (Great Tumult)** against British colonial rule and exploitative zamindari systems in the Chota Nagpur region (present-day **Jharkhand**).
- He is regarded as the **“Dharti Aaba” (Father of the Earth)** by the Munda community.



EARLY LIFE

- Born on **15 November 1875** in **Ulihatu village**, Ranchi.
- Belonged to the **Munda tribe**, an Austro-Asiatic ethnic group.
- Spent childhood in Chalkad village; exposed to **missionary schools**, learned English, Hindi, and became aware of the political-religious dynamics of the region.
- Witnessed exploitation:
 - loss of tribal lands due to **dikus** (outsiders),
 - **beth begari** (forced labour),
 - missionary pressures,

- forest laws restricting traditional agriculture (**khuntkatti system**).

SOCIO-RELIGIOUS REFORMER

Birsa emerged as a **religious leader** before becoming a political icon.

HIS REFORMS:

Started the **Birsait faith**, a movement based on:

- Monotheism
- Anti-superstition
- Moral discipline
- Social unity
- Rejection of alcohol
- Opposition to Christian missionary dominance

IMPACT:

- Unified various tribal communities (Munda–Oraon) under one cultural identity.
- Became a **messiah figure** with a spiritual-political message.



CAUSES BEHIND BIRSA MUNDA'S MOVEMENT

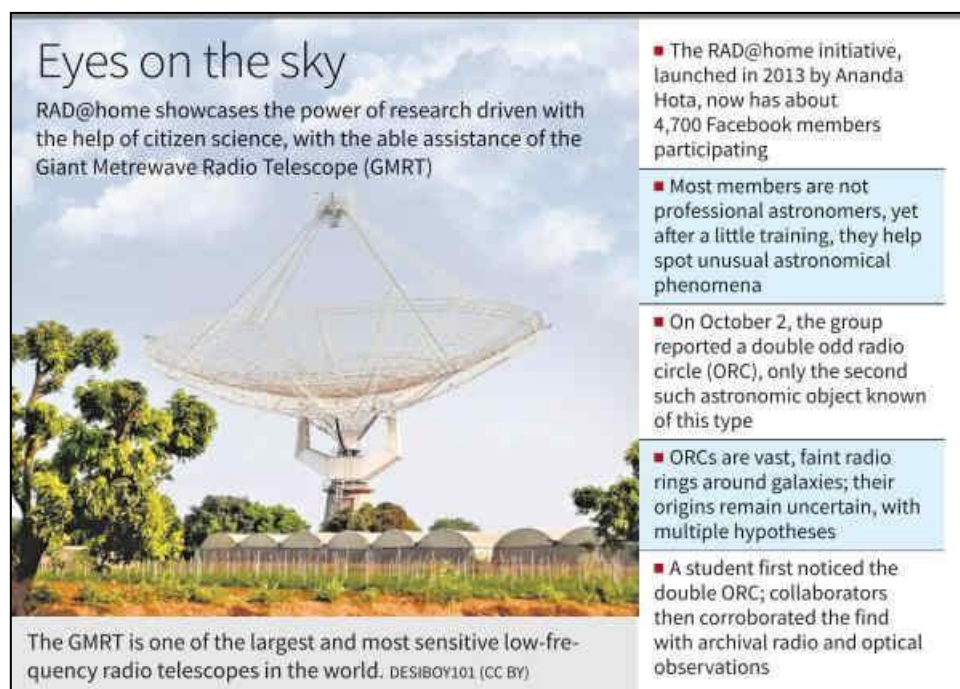
- **Land Alienation:** Traditional **Khuntkatti** land system allowed collective land ownership.
- **British introduced:**
 - Zamindari system,

- Forest Acts,
- evictions of tribal cultivators.
- Outsiders (Sadan, moneylenders, zamindars) gained control of tribal land.
- **Exploitation**
 - Forced labour (**beth begari**)
 - Heavy rents and taxes
 - Bonded labour due to indebtedness
 - Police–zamindar nexus harassment
- **Cultural Suppression**
 - Missionary schools attempted religious conversion.
 - Tribal customs were labelled as “primitive”.
- **Economic Crisis**
 - Crop failures + indebtedness → rise in resentment.

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03**ODD RADIO CIRCLES (ORCS)**

Citizen scientists from India's RAD@home astronomy group, led by Prof. Ananda Hota of the University of Mumbai, have discovered a rare twin "Odd Radio Circle" (double ORC) using LOFAR telescope data — only the second such known instance globally.

**WHAT ARE ORCS?****DEFINITION**

- ORCs (Odd Radio Circles) are *very large, faint, circular radio-emission structures* seen in the sky.
- They are primarily visible **only at radio wavelengths**. In many cases, they have *no counterparts* in optical, infrared (IR), or X-ray observations.
- They typically have **edge-brightened rings** or "shells" — meaning the edges are brighter than the interior.
- Their angular size is often about **1 arcminute** in diameter.

DISCOVERY

- First discovered in data from the **Australian Square Kilometre Array Pathfinder (ASKAP)** telescope, using the *Evolutionary Map of the Universe (EMU)* pilot survey.
- Since then, more ORCs have been identified with other radio telescopes like **GMRT** (Giant Metrewave Radio Telescope) and **MeerKAT**.

- As of recent studies, at least **8 confirmed ORCs** are known, with more candidates being added.

SCALE & PHYSICAL SIZE

- Some ORCs are *extragalactic*, i.e., they are associated with galaxies at **moderate to high redshifts**.
- If you interpret their redshifts correctly, the physical size of an ORC can be *hundreds of kiloparsecs* (kpc), which is enormous (much larger than a typical galaxy).
- Example: A recently discovered ORC (RAD J131346.9+500320) is extremely distant (~7.7 billion light years) and has two interlocked rings ~300,000 light-years across, embedded in a very large radio cloud.

CHARACTERISTICS:

- **Radio-only visibility:** Detected exclusively in radio frequencies—no visible, X-ray, or infrared emission observed.
- **Circular morphology:** Appear as **faint, ring-like or bubble-like structures**, often bright along their edges.
- **Immense scale:** Among the **largest cosmic structures**, extending millions of light-years across.
- **Central galaxy presence:** Some ORCs surround a galaxy, while others exist in isolation, deepening their mystery.
- **Twin ORCs:** The newly discovered “double ORC” shows **two giant plasma rings expanding in opposite directions**, possibly from a central galactic outburst or collision event.

SIGNIFICANCE:

- **Scientific importance:** Offers rare insights into galactic evolution, black hole activity, and intergalactic shockwave dynamics.
- **Technological collaboration:** Demonstrates the synergy between citizen science and advanced observatories like LOFAR and GMRT.
- **Indian contribution:** Highlights India’s growing role in radio astronomy and public-led scientific discovery through initiatives like RAD@home, bridging education and research.

04**ANGOLA**

President of India is on a State Visit to Angola, marking the first-ever visit by an Indian President, to strengthen bilateral cooperation in energy, trade, and technology under the India–Africa Forum Summit framework.

Angola is a **resource-rich nation in southwestern Africa**, known for its vast oil reserves, diamonds, and diverse landscapes ranging from tropical coasts to rugged highlands.

It gained independence from Portugal in 1975 after a long anti-colonial struggle.

Capital: Luanda.

Neighbouring Nations: Republic of the Congo, Democratic Republic of the Congo, Zambia, Namibia, and Atlantic Ocean.

**GEOLOGICAL & PHYSICAL FEATURES:**

- **Topography:** Angola is roughly square-shaped, rising from a narrow coastal plain to a **central plateau** averaging 1,000–2,000 metres in elevation.
- **Highest Point:** **Mount Moco** (2,620 m), near Huambo.
- **Major Rivers:** The **Cuanza**, **Cunene**, and **Cuango** rivers form key drainage basins; some southeastern rivers flow into the **Zambezi** and **Okavango** systems.
- **Soils & Minerals:** Rich in **oil-bearing formations**, **diamonds**, and **metal ores**; features **lateritic soils** and eroded escarpments.
- **Ecosystems:** Hosts semi-desert coasts, rainforests, highlands, and savannahs, making it one of Africa's most **biodiverse** regions.

WHAT IS THE INDIA–AFRICA FORUM SUMMIT (IAFS)?

IAFS is the highest-level official platform for structured cooperation between India and the African continent.

It is India's flagship diplomatic engagement with Africa, equivalent to:

- **FOCAC** (China–Africa Cooperation Forum)
- **TICAD** (Japan–Africa)
- **US–Africa Leaders' Summit**
- It brings together:
 - India's Prime Minister
 - Heads of State/Government of African countries
 - African Union (AU)
 - Regional Economic Communities (RECs)

First held in **2008**, the Summit occurs **periodically** (not annual), depending on diplomatic convenience.



EVOLUTION OF IAFS – THREE SUMMITS TILL DATE

IAFS-I (2008) – NEW DELHI

- **Theme:** *"Partners in Progress: Towards a Shared Future"*
- **Participation:** 14 African nations (based on Banjul Formula: AU selects participants).

KEY FEATURES:

- India positioned itself as a **developmental partner**, not a donor.
- Launched:
 - **Pan-Africa e-Network** (tele-education + telemedicine)
 - **Duty-Free Tariff Preference Scheme (DFTPS)** for Least Developed Countries (LDCs)
 - Capacity building → ITEC scholarships, training programs

SIGNIFICANCE:

Marked India's *institutional entry* into Africa diplomacy.



IAFS-II (2011) – ADDIS ABABA

- **Theme:** “*Enhancing the Partnership: Shared Vision*”
- **Participation:** 15 African countries selected by AU.

KEY OUTCOMES:

- India committed **US\$ 5.7 billion** in Lines of Credit (LoCs).
- **Focus on:**
 - Agriculture
 - Food processing
 - SMEs

- Infrastructure
- Education & skill development
- Establishment of **India–Africa Virtual University**.

SIGNIFICANCE:

Expanded India's development financing and capacity-building footprint.

IAFS–III (2015) – NEW DELHI

- **Theme:** *"Partners in Progress: Towards a Sustainable Future"*
- **Participation:** **ALL 54 African nations**, 41 heads of state/government → unprecedented diplomatic event.

MAJOR ANNOUNCEMENTS:

- **US\$ 10 billion** Line of Credit for 5 years.
- **US\$ 600 million** in grant assistance, including:
 - India-Africa Food Processing Cluster
 - India-Africa Institute of Agriculture
 - India-Africa Centre for Medium-Range Weather Forecasting
 - India-Africa Institutes in health & education
 - Doubling scholarships & training under ITEC.
 - Cooperation on **solar energy under ISA (International Solar Alliance)**.

SIGNIFICANCE:

- Biggest diplomatic gathering in India's history.
- Showcased India as a global leader of the **Global South**.
- India became a strong competitor to China's presence in Africa.

WHY IAFS MATTERS? – STRATEGIC SIGNIFICANCE FOR INDIA

ENERGY & MINERAL SECURITY

- Africa = major supplier of:
 - Uranium (Namibia)
 - Oil & gas (Nigeria, Angola, Mozambique)
 - Rare earths & strategic minerals (DRC, Zambia)

- India needs these for **energy transition, manufacturing, defence, and electronics.**

COUNTERING CHINA'S INFLUENCE

- China's FOCAC + Belt and Road Initiative (BRI) has massive influence.
- India offers **non-predatory, demand-driven, capacity-building** alternatives.
- India is preferred for:
 - Low-cost technology
 - Human resource training
 - Democratic, transparent development approach

MARITIME SECURITY IN INDIAN OCEAN

- 35+ African countries have Indian Ocean coastlines.
- Crucial for:
 - Anti-piracy (Somalia, Gulf of Aden)
 - Secure slocs (Sea Lanes)
 - Indo-Pacific strategy

GLOBAL GOVERNANCE & GLOBAL SOUTH SOLIDARITY

- Africa (54 nations) + India's leadership = strong coalition in:
 - UN reform
 - WTO reform
 - Climate justice (CBDR)
 - Counter-terrorism

AFRICA AS A GROWTH PARTNER

- Africa has the world's **youngest population.**
- Major opportunities in:
 - Healthcare
 - Education
 - ICT
 - Solar energy
 - Agriculture

- Startups & fintech

PRIORITY AREAS OF COOPERATION UNDER IAFS

TRADE & INVESTMENT

- Duty Free Tariff Preference Scheme for African LDCs.
- India among top 5 trading partners for many African nations.

DEVELOPMENT PARTNERSHIP

- LoCs for railways, power, agriculture, water supply, IT parks, etc.

CAPACITY BUILDING

- ITEC training: 40,000+ Africans trained.
- E-VidyaBharati & E-ArogyaBharati e-network.

DEFENCE & SECURITY

- Training African military officers in India.
- Naval patrols and anti-piracy operations.



HEALTHCARE

- Pan-Africa telemedicine
- Pharma exports (“Pharmacy of the Global South”)
- Vaccine supply (COVID, polio, malaria)

CLIMATE & RENEWABLE ENERGY

- ISA membership of 40+ African countries.
- Solar parks, mini-grids, clean cooking solutions.

CHALLENGES FACING IAFS/INDIA–AFRICA PARTNERSHIP

SLOW LOC PROJECT IMPLEMENTATION

- Bureaucratic delays, security issues in Africa, weak local institutions.

COMPETITION FROM CHINA & GULF

- China has deeper pockets (US\$ 60 bn commitments under FOCAC).

POLITICAL INSTABILITY IN AFRICA

- Coups in Sahel region affect economic and security cooperation.

LIMITED PRIVATE INVESTMENT

- Indian businesses face:
 - High risk
 - Lack of connectivity
 - Unclear regulatory frameworks

NEED FOR MORE FREQUENT SUMMITS

- Last IAFS took place in **2015** → long gap.
- Summit delay reduces momentum.

EXPECTED THEMES OF NEXT IAFS (LIKELY 2025–26)

(Based on India's foreign policy trends and Africa's development goals)

DIGITAL PUBLIC INFRASTRUCTURE (DPI) DIPLOMACY

- India's UPI, CoWIN, Digital ID systems → to be shared with Africa.

CLIMATE FINANCE + SOLAR ENERGY

- Expansion of ISA projects across Africa.

DEFENCE & MARITIME COOPERATION

- Anti-piracy
- Africa–India maritime security corridor
- Defence equipment exports

HEALTHCARE MANUFACTURING

- Africa-based vaccine and pharma production hubs.

AGRICULTURE & FOOD SECURITY

Indian expertise for:

- Millets
- Irrigation
- Cold chain

- Farm technology

STARTUPS & SKILL DEVELOPMENT

- India–Africa Startup Bridge
- AI, cybersecurity, coding, innovation hubs.

BLUE ECONOMY COLLABORATION

- Fisheries
- Coastal infrastructure
- Marine conservation

WHY AFRICA VALUES INDIA (UNIQUE ADVANTAGES)

- **Low-cost appropriate technology:** Solar pumps, low-cost pharma, digital payments = perfect for African development.
- **Capacity building focus:** Indian model develops human capital, unlike China's infrastructure-heavy approach.
- **Cultural connections:** Indian diaspora, trade links, and shared colonial history.
- **South–South development model:** No conditions, no political interference, no debt trap diplomacy.



UPSC MAINS ANSWER POINTERS (READY-TO-USE)

INTRO (30 WORDS):

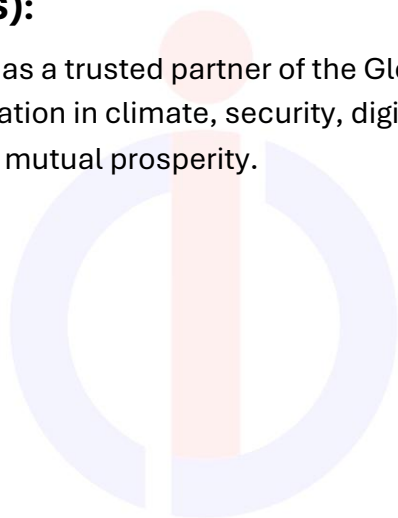
The India–Africa Forum Summit (IAFS) is India's premier platform for structured engagement with the African continent, focusing on development partnership, capacity building, strategic cooperation, and Global South solidarity.

BODY:

- **History:** 2008, 2011, 2015
- **Key themes:** trade, LoCs, ITEC, energy, maritime security, climate, DPI
- **Strategic importance:** minerals, energy, Indo-Pacific, countering China
- **Soft power:** education, health, digital public goods
- **Challenges:** delays, instability, China
- **Future:** climate diplomacy, digital cooperation, defence, agriculture, startups

CONCLUSION (30 WORDS):

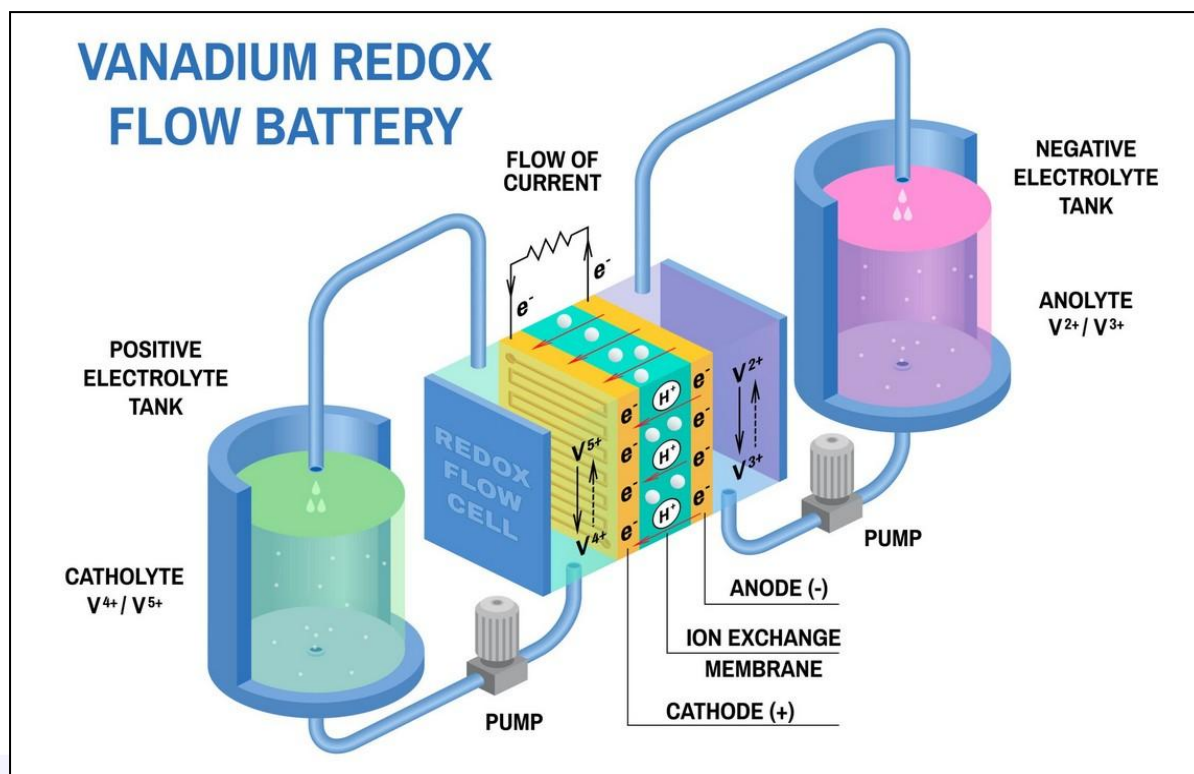
IAFS strengthens India's role as a trusted partner of the Global South. A renewed Summit will enhance cooperation in climate, security, digital transformation, and sustainable development for mutual prosperity.



IAS ORIGIN
HERE IT BEGINS

05**INDIA'S FIRST MWH-SCALE VANADIUM FLOW BATTERY AT NTPC NETRA**

India inaugurated its first MWh-scale Vanadium Redox Flow Battery (VRFB) system of 3 MWh capacity at NTPC NETRA, Greater Noida, marking a breakthrough in long-duration energy storage (LDES) and renewable energy integration.

**WHAT IS VANADIUM?**

- **Vanadium (V)** is a **transition metal** (Atomic number: 23).
- It is **hard, silvery-grey, corrosion-resistant**, and forms stable compounds.
- It naturally occurs in minerals and ores but **rarely exists as a pure metal**.

KEY CHEMICAL & PHYSICAL PROPERTIES

- **Symbol:** V
- **Atomic Number:** 23
- **Type:** Transition metal
- **Common Oxidation States:** +2, +3, +4, +5
- **Highly corrosion-resistant** due to stable oxide layer
- **Forms colorful ions**, crucial for VRFB technology

- Its wide oxidation states allow electrons to move freely → **ideal for redox batteries.**

WHERE IS VANADIUM FOUND?

GLOBAL DISTRIBUTION

Major producers:

- **China** (~60–70% of global production)
- **Russia**
- **South Africa**
- **Brazil**
- **India's vanadium resources**
- India has **very low domestic reserves.**
- Trace amounts found in:
 - **Arunachal Pradesh**
 - **Odisha**
 - **Karnataka**
 - **Jharkhand**

India is **highly dependent on imports**, mostly from **China & South Africa.**

MAJOR USES OF VANADIUM

STEEL INDUSTRY (PRIMARY USE)

- About **90% of vanadium** is used for **steel strengthening.**
- Produces **vanadium steel**, which is:
 - Strong
 - Shock-resistant
 - Wear-resistant
- **Used in:**
 - Aerospace components
 - Tools
 - Armour plates
 - Nuclear reactors

- Automobile parts

HIGH-STRENGTH ALLOYS

- Titanium–vanadium–aluminum alloys for:
- Jet engines
- Spacecraft
- Aerospace frames

CHEMICAL CATALYSTS

- Vanadium pentoxide (V_2O_5) used in:
- Sulphuric acid production
- Ceramics and glass coatings

BATTERIES (EMERGING USE)

- **Vanadium Redox Flow Batteries (VRFBs)**
- The biggest future growth area globally
- Enables **large-scale energy storage**

WHAT IS THIS PROJECT?

INAUGURATION & KEY FIGURES

- The Power Minister (Manohar Lal) inaugurated **India's first MWh-scale vanadium flow battery** at **NTPC NETRA** (NTPC's R&D centre).
- The system has a capacity of **3 MWh**.
- The project is part of NETRA's long-duration energy storage (LDES) strategy to strengthen grid resilience.

WHO BUILT IT / HOW IT WAS AWARDED

- **Delectrik Systems Pvt Ltd** won the tender from NTPC NETRA for this 3 MWh VRFB system.
- The project is being delivered in collaboration with **Rays Power Infra**, a leading EPC (Engineering, Procurement, Construction) company.
- The installation is slated to happen at NETRA campus in **Greater Noida** in first half of 2025.

RELEVANT NTPC PLAN / REPORTING

According to NTPC's corporate report, the VRFB system is for "3 MWh / 600 kW" capacity.

It is part of NETRA's broader energy storage and innovation efforts (including green hydrogen, carbon capture, etc.) as per NTPC's R&D disclosures.

WHAT IS VANADIUM REDOX FLOW BATTERY (VRFB) TECHNOLOGY?

- **Basic Principle:** VRFBs use vanadium ions in different oxidation states (in liquid electrolytes) to store and release energy. Unlike solid-state batteries (like Li-ion), the energy/power components are largely decoupled: you can scale energy by adding more electrolyte tanks.
- **Long-Duration Storage (LDES):** Ideal for large-scale grid applications because they can store energy for many hours without rapid degradation.
- **Durability:** Flow batteries generally have long cycle lives and less degradation over time compared to conventional lithium-ion batteries. (General advantage of flow battery tech.)
- **Safety & Sustainability:** Less risk of thermal runaway. Also, because of their chemistry, they can offer a more diversified battery chemistry portfolio beyond lithium.

WHY THIS PROJECT IS IMPORTANT (SIGNIFICANCE)

ENERGY TRANSITION & GRID STABILITY

As India adds more **renewable energy (solar, wind)**, variability increases. A 3 MWh LDES system helps in **storing excess renewable power** and supplying it when needed.

It helps NETRA's microgrid become self-reliant ("full one-day autonomy" is a stated goal).

PIONEERING LONG-DURATION STORAGE

This is India's first *MWh-scale* vanadium flow battery — a key milestone for LDES in the country.

It signals NTPC's commitment to **R&D and innovation** in advanced energy storage systems, not just traditional batteries.

DIVERSIFICATION OF BATTERY TECHNOLOGY

Reduces India's over-reliance on lithium-ion batteries. Flow batteries provide an alternate chemistry, helping in strategic security of battery supply chains.

As vanadium is a different resource, this could lead to development of new manufacturing and raw-material ecosystems in India.

POLICY & CLEAN ENERGY ALIGNMENT

It aligns with India's push for *long-duration energy storage* (LDES) to support 24×7 renewable energy.

Supports India's climate and energy goals by integrating more renewables while ensuring grid reliability.

SCALABILITY & FUTURE APPLICATIONS

Once proven, such systems can be **scaled up** (larger capacities) or replicated at other NTPC sites or utility-scale plants.

Could support **hybrid microgrids**, remote areas, or even be coupled with green hydrogen / carbon capture setups.

CHALLENGES & RISKS

COST

- Initial CAPEX for flow battery systems is high (electrolyte, tanks, pumps). Whether the economics become competitive vs Li-ion is a challenge.
- Operation & maintenance (pumps, membranes) can add cost.

VANADIUM SUPPLY & PRICE RISK

- Vanadium is not as abundant or cheap as some other materials. Supply constraints or price volatility could be a bottleneck.

TECHNOLOGY RISK

- Although flow batteries are proven, scaling up to multi-MWh grid applications in India is still relatively new.
- Long-term reliability, especially in Indian climatic and operational conditions, needs validation.

SPACE REQUIREMENT

- Flow battery systems require space for large electrolyte tanks which may pose deployment constraints in dense or built-up sites.

REGULATORY & MARKET UNCERTAINTIES

- Lack of mature markets or business models for long-duration storage.

- Unclear frameworks for revenue stacking (how LDES will be compensated in the market) in India.

STRATEGIC IMPLICATIONS FOR INDIA

- **Boost to R&D:** NTPC NETRA's success can trigger more innovation and investments in advanced storage.
- **New Industry Ecosystem:** Slowly build a domestic flow-battery manufacturing ecosystem (electrolyte, membranes, tanks).
- **Green Energy Push:** Enhances India's ability to absorb more renewable energy and manage intermittency.
- **Energy Security:** Diversification from lithium reduces dependencies and supply chain risks.
- **Climate Goals:** Strengthens India's climate action by enabling more renewables + less curtailment.

**IAS ORIGIN**
HERE IT BEGINS

06

FIRST JAL SANCHAY JAN BHAGIDARI (JSJB) AWARDS

The Hon'ble President of India, will confer the First Jal Sanchay Jan Bhagidari (JSJB) Awards and the 6th National Water Awards 2025 on 18th November 2025 at Vigyan Bhawan.



WHAT IS JSJB?

- JSJB stands for **Jal Sanchay Jan Bhagidari** ("Water Conservation Public Participation").
- It is a **community-driven initiative** under the **Jal Shakti Abhiyan: Catch the Rain (JSA: CTR)** campaign.
- It was **launched on 6 September 2024** in Surat, Gujarat.
- **Aim:** To promote **community participation**, awareness, and innovation in water resource management, aligning with the vision of "*Jal Samridh Bharat.*"

FEATURES:

- Awards across **10 categories**, including Best State, District, Village Panchayat, Industry, NGO, and Institution.
- Evaluation based on **field verification** by **CWC** and **CGWB**.
- **46 winners** selected out of **751 applications** received via the Rashtriya Puraskar Portal.

WHY JSJB WAS CREATED / ITS AIMS

- Promote **grassroots water stewardship**: focus on participatory water management through construction and maintenance of water recharge & storage structures.
- Encourage **public participation (Jan Bhagidari)** + CSR + cost sharing. It works on the “3Cs” mantra: **Community, CSR, and Cost**.
- Strengthen **long-term water security & resilience**, especially groundwater recharge.

SCALE & TARGETS

Under this initiative, states/UTs were grouped into zones; each district was tasked to construct a **minimum number of artificial recharge/storage structures**: e.g., 10,000 per zone; hilly/NE districts had a target of 3,000 per district.

- **Urban Local Bodies (ULBs)**: under collaboration with the Ministry of Housing & Urban Affairs, a target was set for ULBs to build recharge structures.
- **Reported achievement: 27.6 lakh structures** completed (vs original target of 10 lakh) according to the JSJB portal.

AWARDS & RECOGNITION UNDER JSJB

- **100 awards** to be given in JSJB 1.0.
- **Categories of awardees:**
 - States (top-performing states)
 - Districts (67)
 - Municipal Corporations (6)
 - Urban Local Body (1)
 - Partner Ministries / Departments (2)
 - Industries (2)
 - NGOs (3)
 - Philanthropists (2)
 - Nodal Officers (14)
- **Financial incentives:**
 - Top districts (Category 1) get ₹ 2 crore
 - Category 2: ₹ 1 crore

- Category 3: ₹ 25 lakh
- Citation for all winners (signed by Secretary of DoWR, RD & GR).

THE 6TH NATIONAL WATER AWARDS (NWA) 2025

WHAT ARE THE NATIONAL WATER AWARDS?

- A flagship initiative by the **Department of Water Resources, River Development & Ganga Rejuvenation**, under the **Ministry of Jal Shakti**.
- Started to **recognize excellence in water conservation, management, and innovation**.
- The 2025 awards correspond to the **6th edition**, recognizing winners for 2024.



KEY FACTS / FIGURES (6TH AWARDS)

- Number of applications: **751** (via Rashtriya Puraskar Portal)
- Number of winners: **46** (including joint winners) across **10 categories**.
- Categories include: Best State, Best District, Best Village Panchayat, Best Urban Local Body, Best School / College, Best Industry, Best Water User Association, Best Institution (other than school/college), Best Civil Society, Best Individual.
- Evaluation Method: Field verification by **Central Water Commission (CWC)** and **Central Ground Water Board (CGWB)**.

TOP WINNERS (6TH EDITION)

- **Best State:** Maharashtra (1st), Gujarat (2nd), Haryana (3rd)
- **Best Districts** (zone-wise):

- East: Rajnandgaon (Chhattisgarh)
- West: Khargone (Madhya Pradesh)
- South: Tirunelveli (Tamil Nadu)
- North: Mirzapur (Uttar Pradesh)
- North-East: Sepahijala (Tripura)
- **Best Urban Local Body:** Navi Mumbai (Maharashtra)

Institution Award Example: IUST (Islamic University of Science & Technology) is recognized for water-conservation model involving recharge pits, rooftop harvesting, and reuse of treated wastewater.

SIGNIFICANCE

- Encourages **innovative water management** and conservation across states, institutions, communities.
- Supports **Sustainable Development Goal (SDG) 6: Clean Water and Sanitation**.
- Promotes **best practices** which can be replicated (e.g., IUST model, municipal initiatives).
- Strengthens **decentralised water governance** and incentivizes local bodies, industries, NGOs to take responsibility.
- Acts as a tool for **policy benchmarking** across states: comparing performance, rewarding good work, encouraging competition.
- Enhances **public awareness** and citizen involvement in water issues.

07**OMAN HAS BEEN ELECTED TO THE UNESCO MAB COUNCIL (2025–2029)**

Oman has been elected as a member of the UNESCO Man and the Biosphere (MAB) Council for the 2025–2029 term during the 43rd UNESCO General Conference in Samarkand.



Oman is a monarchy located on the southeastern coast of the Arabian Peninsula, known for its balance of traditional culture and rapid modernization under Sultan Haitham bin Tariq Al Said.

Capital: Muscat

Neighboring Countries: Bordered by United Arab Emirates (northwest), Saudi Arabia (west), and Yemen (southwest).

Maritime boundaries with the Arabian Sea and Gulf of Oman.

GEOGRAPHICAL FEATURES:

- The **Al-Hajar Mountains** dominate the north, with **Mount Shams (2,980 m)** as the highest peak.
- The vast **Rub' al-Khali (Empty Quarter)** desert covers much of its interior, while fertile coastal plains like **Al-Batinah** and **Dhofar** support agriculture.
- Oman's coastlines, monsoon-fed Dhofar region, and ancient **falaj (irrigation)** systems sustain its oasis-based settlements.

WHAT IS THE MAB PROGRAMME / COUNCIL?

- **MAB (Man and the Biosphere) Programme** is a UNESCO intergovernmental scientific initiative launched in **1971**.
- **Objective:** Promote a sustainable balance between humans and nature. It encourages *biodiversity conservation, sustainable use of ecosystems, research, and education*.
- **World Network of Biosphere Reserves (WNBR):** Under MAB, biosphere reserves are designated globally as “living laboratories” to model sustainable development.
- **Governance:** The MAB programme is governed by an **International Coordinating Council (ICC)** — also called MAB-ICC or MAB Council — which has ~34 member states elected by UNESCO’s General Conference.

WHAT EXACTLY HAPPENED?

- During the **43rd UNESCO General Conference in Samarkand (Uzbekistan)**, Oman was **elected to the MAB Council (ICC)** for the term **2025–2029**.
- The Omani delegation was represented by the **Environment Authority**.
- This election is seen as **recognition of Oman’s environmental leadership and commitment to biodiversity conservation**.

WHY OMAN’S ELECTION IS SIGNIFICANT

A. STRENGTHENING GLOBAL ENVIRONMENTAL ROLE

Oman’s membership gives it a seat at a **key global environmental platform**, enabling it to shape international policies on conservation, sustainability, and climate-nature balance.

Enhances Oman’s diplomatic leverage in **environmental governance**: it will participate in decisions on biosphere reserve designation, research priorities, and global cooperation.

B. ALIGNMENT WITH NATIONAL VISION & SDGS

This step is aligned with **Oman Vision 2040**, which emphasizes environmental sustainability alongside development.

It also aligns with the **UN Sustainable Development Goals (SDGs)**, especially **SDG 15 (Life on Land)** and **SDG 13 (Climate Action)**.

C. BIOSPHERE RESERVES & CONSERVATION CONTRIBUTION

Oman already has **two BIOSPHERE Reserves** in UNESCO's World Network:

- **Jabal Akhdar (Al Jabal Al Akhdar)** Scenic Reserve
- **Al Sareen (Al Sireen) Nature Reserve:** These reserves serve as *models of sustainable development and human-nature harmony* (core + buffer + transition zones) — exactly the purpose of MAB biosphere reserves.

D. RESEARCH & KNOWLEDGE EXCHANGE

As a Council member, Oman can help steer **scientific cooperation**, research funding, and capacity building among MAB member states.

It can push for **innovative sustainable practices** and **policy experiments** in biosphere reserves, contributing to global learning.

E. REGIONAL LEADERSHIP

Oman's election elevates its status among **Arab / Gulf States** in environmental conservation.

Can foster *South-South cooperation* by sharing its experience in managing arid ecosystems, mountain ecosystems (Jabal Akhdar), and engaging local communities in conservation.

CHALLENGES AND CONSTRAINTS

- **Resource Commitment:** Participation in the MAB Council requires sustained investment — for research, management of reserves, and capacity building.
- **Balancing Development:** Oman faces to continue balancing its economic growth (e.g., oil revenues) with environmental protection — especially in fragile mountain and desert ecosystems.
- **Implementation:** Translating decisions at the MAB-ICC level to concrete projects on the ground (in its biosphere reserves) requires strong institutions.
- **Global Expectations:** As a Council member, Oman will be expected to contribute actively to global MAB initiatives, including aligning with the **MAB Roadmap 2025–2035** (new roadmap adopted at 5th World Congress).

08**THE RARE EARTH HYPOTHESIS**

Recent data from NASA's Kepler and James Webb Space Telescopes (JWST) suggest that while Earth-sized planets in habitable zones are common, the specific conditions required for complex life remain extremely rare, reviving interest in the Rare Earth Hypothesis.



The Rare Earth Hypothesis posits that while microbial life might be widespread across the universe, complex, multicellular life is exceptionally uncommon due to the need for a unique and finely tuned set of planetary, stellar, and cosmic conditions.

PROPOUNDED BY:

Proposed by **Peter Ward (palaeontologist)** and **Donald Brownlee (astronomer)** in their 2000 book "Rare Earth: Why Complex Life is Uncommon in the Universe."

AIM:

To explain why Earth-like complex ecosystems may be an extraordinary rarity in the cosmos despite the abundance of stars and planets.

KEY FEATURES:

- **Multiple Conditions Required:** Complex life depends on a rare combination of factors — stable climate, plate tectonics, magnetic field, atmospheric regulation, and a protective gas giant (like Jupiter).
- **Habitable Zone Constraint:** Not enough to be in a "habitable zone"; the planet's composition, orbit, and atmosphere must also remain stable over billions of years.

- **Planetary System Architecture:** Giant planets can either shield inner planets from impacts or destabilize them depending on mass and orbit.
- **Climate Stability:** Long-term carbon-silicate cycling and plate tectonics are vital to maintain a life-supporting atmosphere.
- **Atmospheric Retention:** Only few planets, particularly around Sun-like stars, can sustain thick atmospheres against stellar radiation.

SIGNIFICANCE:

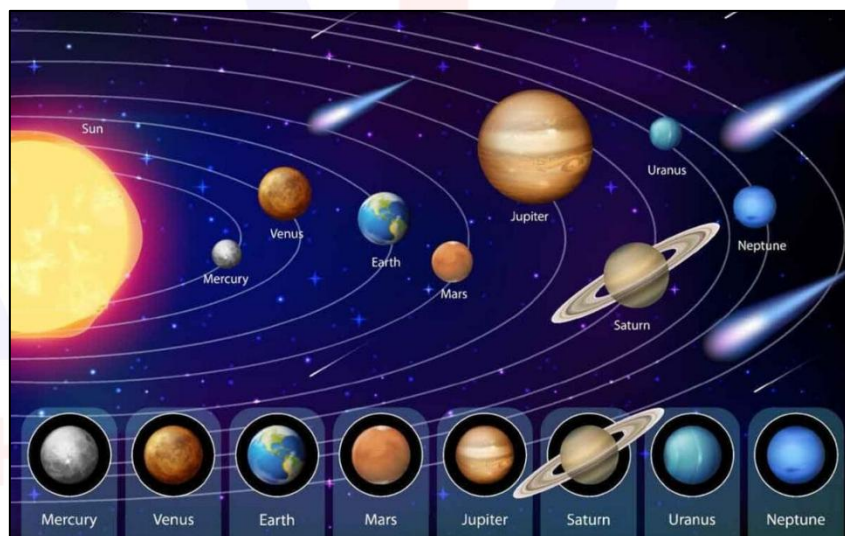
Challenges the Copernican Principle (that Earth is not special) by suggesting Earth's conditions are uniquely fine-tuned for complex life.

Guides astrobiology and exoplanet research, focusing on planetary systems with Earth-like stability.

ESSENTIAL CONDITIONS FOR COMPLEX LIFE

(AS PER RARE EARTH HYPOTHESIS)

These are grouped into **astronomical**, **geological**, and **biological** conditions.



ASTRONOMICAL CONDITIONS

- **Right type of star (G-type main-sequence star)**
 - Sun is stable for billions of years
 - Not too massive → short lifespan
 - Not too small → tidal locking, radiation bursts
- **Location in the Galactic Habitable Zone (GHZ)** Earth is located:
 - Far from the galactic center (low radiation)

- Close to heavy elements for planet formation
- Safe distance from supernovas
- **Right planetary position (Goldilocks Zone)** Earth is:
 - At the perfect distance for liquid water
 - Stable temperature variations
- **Jupiter-like gas giant in outer orbit**
 - Jupiter acts as a cosmic shield against comet impacts.
 - Without Jupiter → frequent asteroid impacts → life can't evolve.

GEOLOGICAL CONDITIONS

- **Plate Tectonics:** Unique to Earth among solar system bodies. They enable:
 - Carbon-silicate cycle
 - Stabilization of atmospheric CO₂
 - Magnetic dynamo support
- **Strong magnetic field** Protects from:
 - Solar wind
 - Radiation
 - Atmospheric stripping
 - Example: Mars lost its atmosphere due to weak magnetic field.
- **Long-term climate stability**
 - Climate remained stable enough for complex life to evolve.

PLANETARY CONDITIONS

- **Liquid water for billions of years**
 - Earth has had stable oceans for ~4.3 billion years.
 - Essential for chemical reactions and proteins.
- **Large Moon**
 - Stabilizes Earth's axial tilt
 - Controls tides
 - Supports evolution of marine organisms
 - No other inner planet has a moon as large relative to its size.

- **Biological Conditions**
 - Rare emergence of complex multicellularity
 - Life arose ~4.0 billion years ago, but complex life only ~600 million years ago (Ediacaran).
 - Took billions of years → Suggests rarity.
- **Cambrian explosion**
 - Sudden diversification of complex life was a rare evolutionary event.
- **Evidence Supporting the Rare Earth Hypothesis:** No evidence of intelligent aliens yet. Despite:
 - 60 years of SETI
 - Thousands of exoplanets discovered
 - No signs of communication
- **All discovered exoplanets lack Earth's unique combination.** Example:
 - Super-Earths too massive
 - Earth-size planets lack tectonics
 - No detected Earth-Moon like pair
 - Very few have Earth-like orbits
- **Other planets in our own solar system are lifeless**
 - Even with water traces (Mars, Europa), no complex life.

CRITICISMS OF THE RARE EARTH HYPOTHESIS

- **It underestimates biological adaptability:** Life survives in extreme environments (extremophiles).
- **Limited sample size:** Only **one known example** of complex life → Earth.
- **Technological life could evolve differently:** Not all life must follow Earth-like conditions.
- **Exoplanet data still incomplete:** We cannot yet detect tectonics, oceans, moons clearly.

09

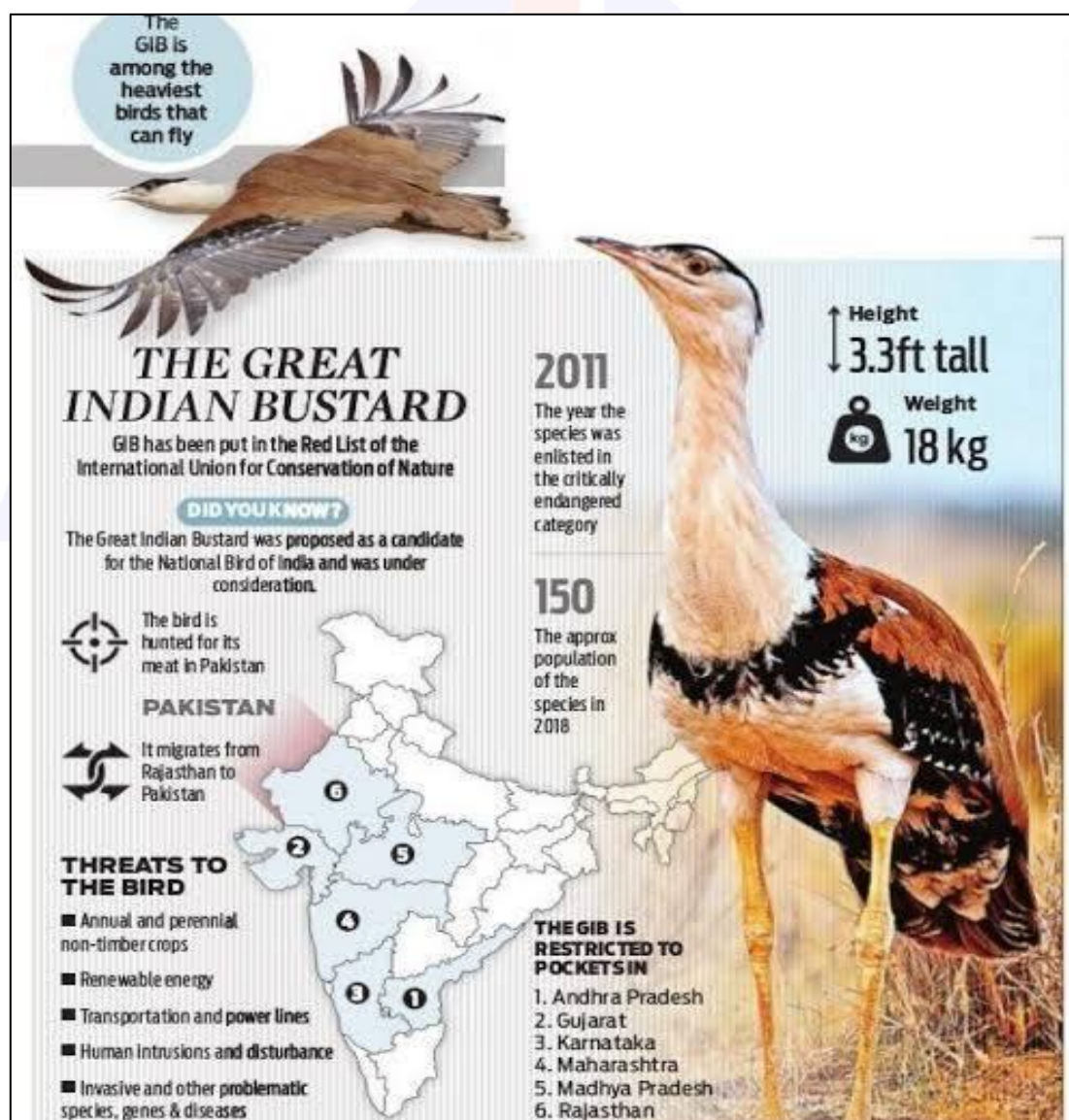
GREAT INDIAN BUSTARD

The Great Indian Bustard (GIB) returned to spotlight after Supreme Court Justice P.S. Narasimha observed that Western-origin environmental doctrines like “inter-generational equity” are inadequate to save critically endangered species.

GREAT INDIAN BUSTARD (GIB)

Great Indian Bustard (*Ardeotis nigriceps*) is one of the **heaviest flying birds in the world** and among the **most critically endangered species globally**.

- **Nickname:** “Godawan” (Rajasthan)
- **Status:** Critically Endangered – IUCN Red List
- **Population:** Around 120–150 individuals left, nearly 90% in Rajasthan’s Desert National Park (DNP).



KEY BIOLOGICAL FEATURES

- **Scientific Name:** *Ardeotis nigriceps*
- **Family:** Otididae
- **Weight:** 15–18 kg (males heavier)
- **Height:** Up to 1 metre
- **Lifespan:** 12–15 years

BREEDING:

- Extremely **low reproductive rate**
- Females lay **only 1 egg/yr**
- High chick mortality → key cause of decline

DIET:

- Insects
- Grass seeds
- Small reptiles
- Berries
- Rodents
- **Omnivorous** + preference for **open grasslands**.



HABITAT & DISTRIBUTION

HABITAT:

- Arid and Semi-arid grasslands
- Thorn scrub
- Dryland ecosystems
- These are **not forests** but **open natural grasslands**

HISTORICAL DISTRIBUTION:

- Rajasthan
- Gujarat
- Maharashtra
- Karnataka
- Andhra Pradesh
- Madhya Pradesh

CURRENT DISTRIBUTION (HIGHLY FRAGMENTED):

- Rajasthan (main stronghold)
- Gujarat (Kachchh)
 - Very small pockets in:
 - Maharashtra
 - Karnataka
 - Andhra Pradesh

WHY IS THE GIB CRITICALLY ENDANGERED? (UPSC HIGH PROBABILITY)

COLLISION WITH OVERHEAD POWER LINES (BIGGEST CURRENT THREAT)

- GIB has **poor frontal vision** → tends to fly low → collides with electric lines.
- Supreme Court (2021): Ordered **undergrounding of power lines in critical habitats** in Rajasthan & Gujarat.

LOSS OF GRASSLAND HABITAT

Grasslands have been incorrectly classified as “**wastelands**” in India leading to:

- Infrastructure
- Renewable energy parks

- Agriculture expansion
- Irrigation projects
- Industrial use

PREDATION OF EGGS BY FERAL DOGS & FOXES

- **Low breeding rate**
- Only **1 egg/year**, high natural losses.

HUNTING IN EARLIER DECADES

- India (pre-1972) & Pakistan (still legally allows Arab falconry hunts).

PROTECTION STATUS

Protection Mechanism	Status
IUCN Red List	<i>Critically Endangered</i>
Wildlife Protection Act, 1972	Schedule I
CMS (Convention on Migratory Species)	Appendix I
CITES	Appendix I
Project Godawan	Rajasthan Govt
Centrally Sponsored Scheme	Integrated Development of Wildlife Habitats (IDWH)

CONSERVATION STATUS:

- **IUCN Red List:** Critically Endangered
- **Wildlife (Protection) Act, 1972:** Schedule I
- **CITES:** Appendix I
- **CMS Convention:** Appendix I
- Part of the **Integrated Development of Wildlife Habitats (IDWH)** species recovery programme

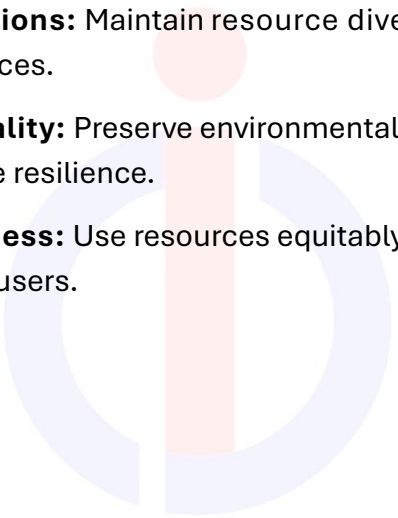
INTERGENERATIONAL EQUITY:

The principle of intergenerational equity holds that each generation acts as a trustee of the Earth, enjoying its resources while ensuring they are passed on to future generations in no worse condition.

It forms the ethical and legal foundation of sustainable development.

CORE PRINCIPLES:

- **Trusteeship:** Every generation must protect and preserve the planet as a shared trust.
- **Conservation of Options:** Maintain resource diversity so future generations have comparable choices.
- **Conservation of Quality:** Preserve environmental quality—air, water, soil, biodiversity—for future resilience.
- **Conservation of Access:** Use resources equitably today without denying fair access to tomorrow's users.


IAS ORIGIN
HERE IT BEGINS

10

LAB-GROWN / COW-FREE MILK

Israel-based startup Remilk has announced the commercial launch of its lab-grown “cow-free” milk from January 2026, marking one of the world’s first large-scale rollouts of animal-free dairy.



WHAT IS LAB-GROWN / COW-FREE MILK?

- Milk produced **without cows**, using **precision fermentation**.
- Microorganisms (usually yeast) are genetically programmed to produce **whey proteins identical to cow’s milk proteins**.
- **No animals involved**, no lactose, no hormones, no antibiotics.

WHAT HAS HAPPENED?

Israel-based startup Remilk **announced the** commercial launch of lab-grown cow-free milk from January 2026.

- Among the **world’s first large-scale, commercial rollouts** of animal-free dairy.
- Signifies a major shift in **food technology, synthetic biology & climate-positive agriculture**.

HOW IS COW-FREE MILK MADE?

1. PRECISION FERMENTATION

- Programmable microbes (like yeast) are given **synthetic DNA blueprints** for milk proteins.

- They ferment sugar → produce *identical* milk proteins (e.g., Whey Protein “Beta-Lactoglobulin”).

2. FILTRATION + FORMULATION

- Proteins filtered → mixed with plant-based fats, vitamins & minerals → **milk identical to cow’s milk**.

WHY IS IT IMPORTANT?

1. CLIMATE IMPACT

- Dairy sector = **3–4% of global greenhouse gas emissions** (CO₂ + methane).
- Lab-grown dairy reduces:
 - **Methane emissions**
 - **Land use** (no grazing land)
 - **Water use** (up to 98% lower)
 - **Biodiversity loss**

2. ETHICAL & ANIMAL WELFARE

- Zero animal exploitation.
- Meets rising demand for **animal-free food**.

3. FOOD SECURITY

- Helps nations with:
 - Low arable land
 - Water scarcity
 - High dependence on dairy imports

4. PUBLIC HEALTH

- No **antibiotics, lactose-free, cholesterol-free, consistent quality**.

INDIA-SPECIFIC

- India is the **world’s largest milk producer** (24% of global output).
- Precision fermented milk could:
 - Compete with Indian dairy cooperatives,
 - Affect rural livelihoods,

- Require updated **FSSAI regulations**,
- Open export opportunities in **value-added bio-foods**.

REGULATORY ANGLE:

- FSSAI has not yet approved large-scale sale of **synthetic/fermented dairy proteins**.
- Need for new categories: “**bioidentical dairy proteins**”, “precision-fermented foods.”

CHALLENGES & CONCERNS

- High production cost (though rapidly decreasing).
- Public acceptance & labelling (milk vs. bio-milk?).
- Safety standards & long-term health considerations.
- Impact on farmers & the livestock economy.



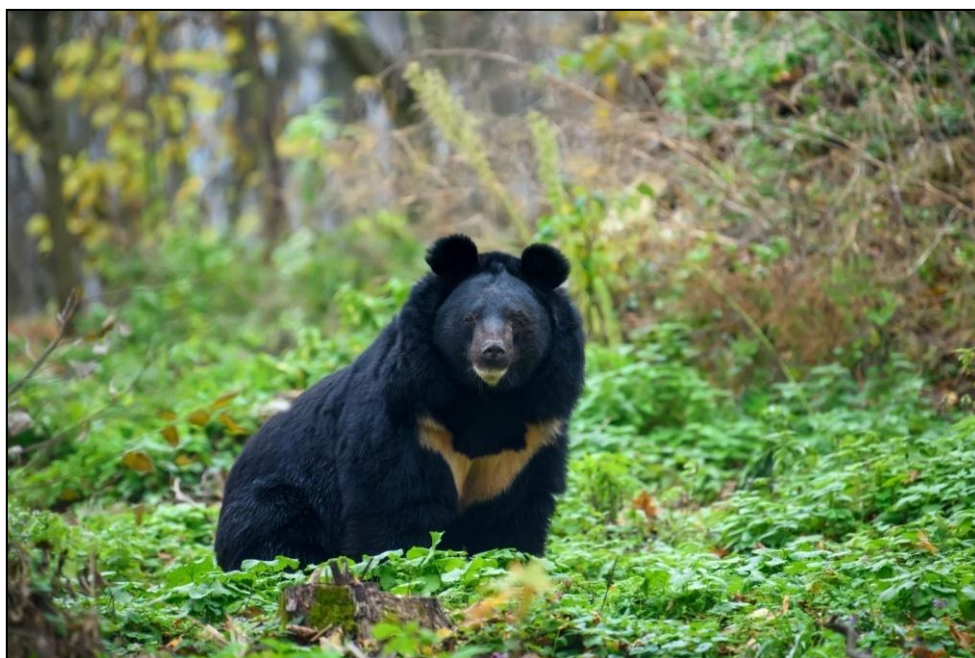
INDIAN STARTUPS IN LAB-GROWN / PRECISION-FERMENTED DAIRY

- **Zero Cow Factory**
 - Based in **Surat**.
 - Uses **precision fermentation** to produce animal-free A2 milk proteins (casein + whey) by genetically programming microbes.
 - Raised **US\$ 4 million** in seed funding to scale R&D, pilot facility, and regulatory approvals.

- Claims environmental benefits: **up to 99% less land, 98% less water**, plus reduced CO₂ vs conventional dairy.
- Their special focus: **A2 beta-casein**, which is considered more digestible / better tolerated in some populations.
- **Phyx44**
 - Based in **Bengaluru**.
 - A *full-stack precision fermentation* startup: produces **whey and casein proteins + fats** identical to cow's milk, but without animals.
 - Raised **US\$ 1.2 million** in a seed round to scale R&D and formulation.
 - Their goal: serve dairy-products market (ice cream, cheese, yogurt) with sustainable, lactose-free, animal-free versions.
- **Aamikza Biotechnology**
 - Focuses on **fermented milk cultures** (starter cultures) rather than full animal-free milk.
 - They engineer bacterial strains (e.g., Lactobacillus) to produce specific dairy characteristics (taste, texture) helping innovate in traditional Indian dairy (curd, lassi, paneer) sustainably.
 - While not “cow-free milk” in the Remilk sense, they contribute to **biotech in the dairy sector**, which is relevant for the broad “future of dairy” discussion.

11**HIMALAYAN BLACK BEAR**

Himalayan black bears in Uttarakhand are turning unusually aggressive as erratic weather and delayed winter, linked to climate change, have disrupted their natural hibernation cycle—leading to a spike in human-wildlife conflict incidents.

**SCIENTIFIC & TAXONOMIC DETAILS**

- **Common Name:** Himalayan Black Bear / Asiatic Black Bear
- **Scientific Name:** *Ursus thibetanus laniger* (Himalayan subspecies)
- **Family:** Ursidae
- **IUCN Status (Asiatic Black Bear):** Vulnerable
- **CITES:** Appendix I
- **Indian Wildlife Protection Act, 1972:** Schedule II

KEY FEATURES

- Medium-sized bear with a **distinct white V-shaped chest patch**.
- Thick black fur adapted to cold mountainous climates.
- Excellent climbers and swimmers.
- **Omnivorous:**
 - Fruits, nuts, acorns
 - Insects, honey

- Occasionally small mammals and carrion
- **Hibernation:** Partial; many individuals come out during warmer winter days.

DISTRIBUTION IN INDIA

HIMALAYAN RANGE – FROM WEST TO EAST:

- Jammu & Kashmir
- Ladakh
- Himachal Pradesh
- Uttarakhand
- Sikkim
- Arunachal Pradesh

ALTITUDE RANGE:

- 1,200 – 4,300 metres
- Found in **temperate, mixed, alpine forests, and rhododendron zones.**

NOT FOUND IN:

- Peninsular India
- Andaman & Nicobar
- Western Ghats (those have Sloth Bears only)

HABITAT

Prefers:

- **Temperate broadleaf forests**
- **Coniferous forests**
- **Mixed deciduous–conifer landscapes**
- Area's rich in oak, walnuts, and fruit trees

BEHAVIOUR & ECOLOGY

- **Nocturnal / crepuscular** (active at dusk/dawn).
- Often involved in **human–bear conflict** in Himalayan states due to:
 - Crop raiding
 - Livestock depredation

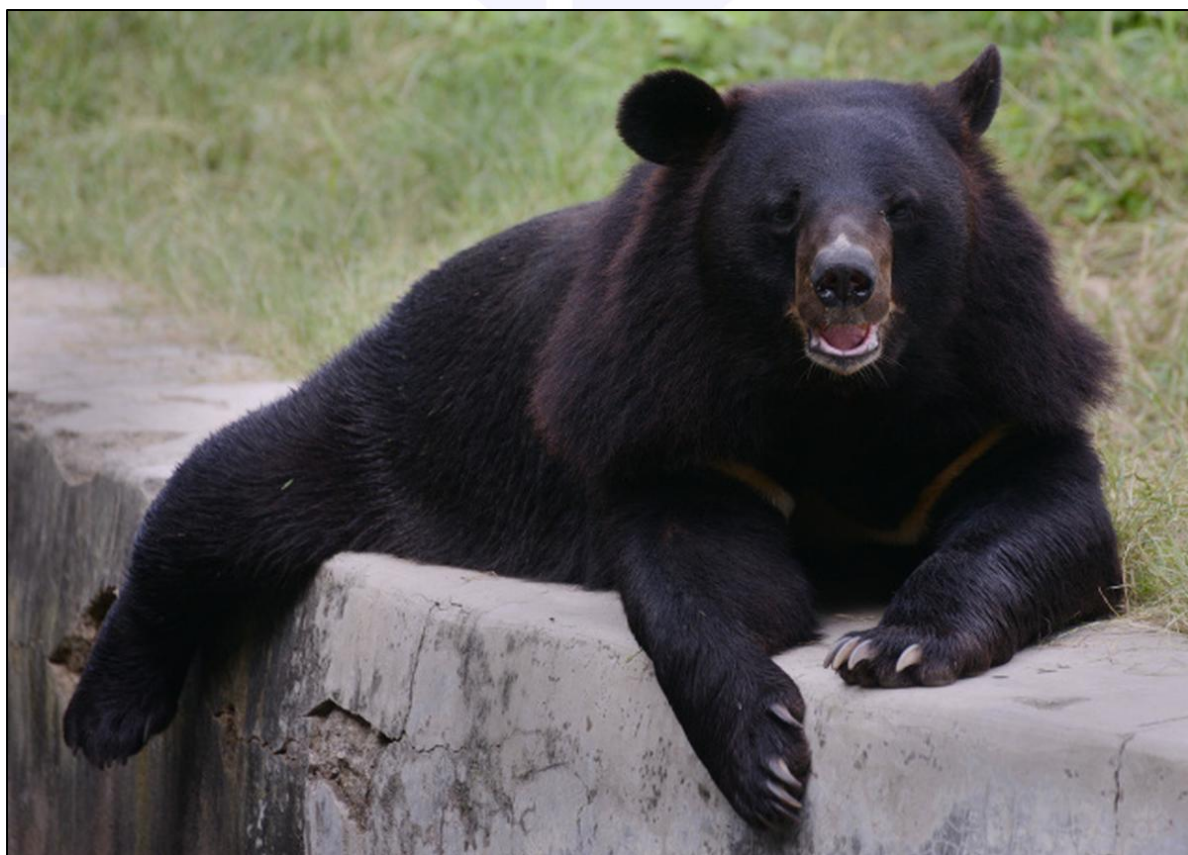
- Increasing overlap with human settlements
- They attack defensively when surprised → leading to injuries/fatalities.

DISTINCTIVE CHARACTERISTICS:

- Glossy black coat, tan-brown muzzle, and **powder-puff ears**.
- Males weigh up to **180–250 kg**, females **35–170 kg**.
- **Arboreal and nocturnal**, skilled climbers and swimmers.
- Enters **winter torpor/hibernation** in colder months — now disrupted due to climate change.

POPULATION STATUS

- Declining in most Himalayan states.
- Major reasons:
 - Habitat loss
 - Fragmentation of forests
 - Poaching (especially for gall bladder → used in traditional medicine)
 - Climate change altering vegetation patterns



THREATS

HABITAT LOSS & FRAGMENTATION

- Expansion of roads, hydropower, tourism, apple orchards
- Leads to loss of natural food → conflict with humans

POACHING

- For gall bladder and paws (high demand in illegal medicinal markets)

CLIMATE CHANGE

- Warmer winters → disturbance of hibernation
- Upward shift of vegetation zones
- Reduction in nut-bearing trees (acorns, walnuts)

HUMAN–BEAR CONFLICT

- Especially high in **J&K, Himachal and Uttarakhand**
- Bears raid orchards and stored grains
- Retaliatory killing occurs

CONSERVATION MEASURES

WILDLIFE PROTECTION ACT (SCHEDULE II)

- Strict protection with penalties for hunting/trade.

INCLUSION UNDER CITES APPENDIX I

- International trade completely restricted.

NATIONAL BEAR CONSERVATION AND WELFARE PLAN

- Prepared by MoEFCC & Wildlife Institute of India
- Focus on conflict mitigation, rescue, and rehabilitation

HUMAN–WILDLIFE CONFLICT MITIGATION MEASURES

- Solar fencing
- Compensation schemes
- Awareness programs
- Bear-proof grain storage units

PROTECTED AREAS WERE FOUND

- Dachigam NP (J&K)
- Great Himalayan NP (HP)
- Kedarnath WLS, Nanda Devi BR (Uttarakhand)
- Khangchendzonga NP (Sikkim)
- Namdapha NP (Arunachal Pradesh)

RESCUE & REHABILITATION CENTERS

- Srinagar
- Shimla
- Uttarkashi

DIFFERENCE BETWEEN HIMALAYAN BLACK BEAR & BROWN BEAR

Feature	Himalayan Black Bear	Himalayan Brown Bear
Chest Mark	White V-shape	No chest mark
Altitude	1,200–4,300 m	3,300–5,500 m
IUCN Status	Vulnerable	Endangered
Behaviour	More arboreal	Ground-dwelling
Conflict	High	Low

12

PRIME MINISTER OF INDIA VISIT TO BHUTAN

Prime Minister of India visit to Bhutan strengthened India–Bhutan ties through the launch of key hydroelectric projects, new MoUs in health and renewable energy, and a ₹4,000 crore Line of Credit, reinforcing India’s “Neighbourhood First” policy.



CONTEXT & SIGNIFICANCE

- Bhutan is India’s **closest strategic partner** in the Himalayas.
- India remains Bhutan’s **largest development partner**, primary trade partner, and the main investor in hydropower.
- The visit was aimed at:
 - Strengthening economic relations
 - Expanding hydropower cooperation,
 - Securing regional connectivity routes,
 - Supporting bhutan’s modernization vision

KEY OUTCOMES OF THE VISIT

HYDROPOWER COOPERATION (CORE PILLAR OF INDIA–BHUTAN RELATIONS)

INAUGURATION OF HYDROELECTRIC PROJECTS

- India and Bhutan jointly inaugurated major hydropower infrastructure.
- Bhutan’s hydropower projects export surplus electricity to India, providing:

- **revenue to Bhutan** (largest share of foreign exchange)
- **clean energy to India**
- Hydropower accounts for **~30% of Bhutan's GDP**.

PUNATSANGCHHU-II HYDROELECTRIC PROJECT

- A major highlight of the visit was progress on **Punatsangchhu-II (P-II)**.
- Built in collaboration with India.
- Expected to **generate around 1000+ MW** of clean energy.
- Entire power output to be purchased by India.

PUSH FOR NEW JOINT PROJECTS

- Both sides agreed to explore:
 - Pumped-storage hydropower
 - Small hydro projects
 - Joint ventures for export-oriented clean energy

KEY OUTCOMES:

- **Inauguration:** 1020 MW **Punatsangchhu-II Hydroelectric Project**, a flagship symbol of Indo–Bhutan hydropower cooperation.
- **Resumption of Punatsangchhu-I Project:** Understanding to restart work on the 1200 MW dam, enhancing regional energy integration.
- **Cultural Diplomacy:** Allocation of land in **Varanasi** for a Bhutanese monastery and guest house to strengthen spiritual and cultural ties.
- **Connectivity & Trade:** Decision to establish an **Immigration Check Post at Hatisar–Gelephu**, improving people-to-people and trade linkages.
- **Financial Cooperation:** Announcement of a new **₹4,000 crore Line of Credit** to support Bhutan's development priorities.

MOUS SIGNED

MOU IN HEALTH SECTOR

- Focus on:
 - Digital health
 - Telemedicine
 - India's vaccine supply & health capacity-building
 - Bhutan–India medical education cooperation

MOU IN RENEWABLE ENERGY

- Solar energy
- Battery storage
- Green mobility
- Grid modernization
- Transfer of Indian expertise under ISA (International Solar Alliance)

₹4,000 CRORE LINE OF CREDIT (MAJOR HIGHLIGHT)

- India extended a **₹4,000 crore concessional line of credit** to Bhutan.
- Will support:
 - infrastructure
 - digital public services
 - tourism
 - sustainable urban development
 - hydropower-linked infrastructure

This is crucial for Bhutan's post-COVID economic recovery and modernization.

INDIA'S "NEIGHBOURHOOD FIRST" POLICY — HOW THIS VISIT FITS IN

The visit strengthens:

- **Strategic trust**
- **Economic interdependence**
- **Connectivity & security in the Eastern Himalayas**

India ensures that its neighbors:

- Remain stable,
- Prosperous,
- And strategically aligned against external influence (especially china).

BHUTAN'S INTERESTS & GAINS

- India is Bhutan's **largest development aid partner** (since 1961).
- ~70% of Bhutan's hydropower is jointly developed with India.
- Bhutan's economy depends on electricity export to India.

- India supports Bhutan's transition from LDC → middle-income nation.
- India assists Bhutan's youth digital-skilling, education, and cybersecurity.

GEOSTRATEGIC IMPORTANCE (FOR UPSC MAINS)

- Bhutan lies at a **critical tri-junction** between India, China, and Nepal.
- Doklam plateau issue makes India–Bhutan cooperation vital for:
 - security of the Siliguri Corridor
 - stability of India's Northeast
- Hydropower helps Bhutan stay economically resilient, reducing Chinese influence.

CONNECTIVITY AGREEMENTS

India supports Bhutan on:

- **Rail link:** Kokrajhar (Assam) – Gelephu (Bhutan)
- **Gelephu Mindfulness City:** A new Indo-Bhutan economic corridor.
- **Digital Public Infrastructure:** India to help Bhutan adopt UPI-like systems.
- Deeper linkage with India's "Act East" through Assam and Arunachal Pradesh.

INDIA–BHUTAN TRADE FACTS

- Trade with India = **82% of Bhutan's total trade.**
- India is the **largest source of FDI** in Bhutan.
- Major exports: electricity, ferrosilicon, chemicals.
- Major imports: food grains, fuel, machinery.

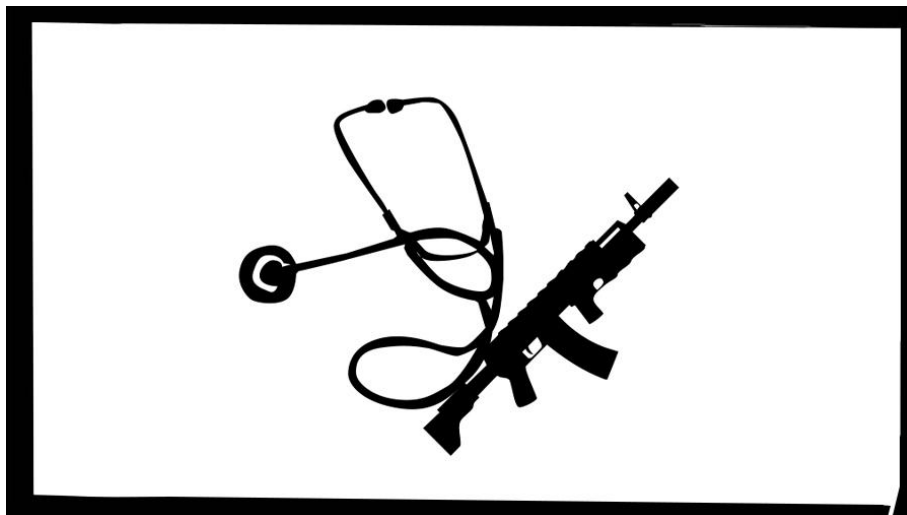
INDIA'S DEVELOPMENT ASSISTANCE TO BHUTAN

Union Budget 2024–25 allocated:

- **₹2,440 crore** — highest for any country.
- Funds used for:
 - Schools, hospitals, roads, ICT projects
 - Hydropower
 - Digital Bhutan initiative

13**WHITE COLLAR TERRORISM**

The Faridabad terror module bust involving the arrest of doctors and engineers with 3,000 kg of explosives has exposed a new wave of “white-collar terrorism.”

**MEANING**

White Collar Terrorism refers to: **Deliberate, coordinated non-violent acts involving financial fraud, cyber manipulation, institutional sabotage, or misuse of official power with the intent to destabilize the state, economy, democratic institutions, or social harmony.**

It is:

- **Non-violent**
- **Knowledge-driven**
- **High-technology-based**
- **Carried out by educated professionals**
- **Often transnational**

HOW IT DIFFERS FROM TRADITIONAL TERRORISM

Feature	Traditional Terrorism	White Collar Terrorism
Nature	Violent (bombs, attacks)	Non-violent, systemic
Actors	Extremist groups	Professionals: bankers, bureaucrats, tech experts

Targets	People, buildings	Economy, governance systems
Tools	Guns, explosives	Finance, digital systems, propaganda
Visibility	High	Low, invisible
Impact	Immediate	Slow but catastrophic

METHODS OF WHITE-COLLAR TERRORISM

A. FINANCIAL TERRORISM

- Laundering money for extremist groups
- Pump-and-dump stock manipulation
- Hawala networks financing insurgency
- Using shell companies for illicit flows

B. CYBER TERRORISM (NON-VIOLENT DIGITAL DISRUPTION)

- Hacking critical infrastructure (power grids, banking systems)
- Stealing military data
- Deploying ransomware to cripple services

C. INFORMATION & PSYCHOLOGICAL MANIPULATION

- Coordinated misinformation campaigns
- Deepfake political propaganda
- Social media radicalization

D. INSTITUTIONAL/ADMINISTRATIVE SABOTAGE

- Corrupt officials helping extremist networks
- Misuse of regulatory powers to destabilize sectors
- Leaking confidential security information

E. CORPORATE/SUPPLY CHAIN INFILTRATION

- Foreign hostile investment in strategic sectors

- Counterfeit pharmaceuticals, defence equipment

WHY IT IS DANGEROUS FOR INDIA

FUELS EXTREMISM & INSURGENCY

- Hawala routes used to fund **Kashmir militancy**
- Fake currency networks earlier linked to ISI

DESTABILISES THE INDIAN ECONOMY

- Cyberattacks on RBI-linked systems
- Stock market manipulation (e.g., pump-and-dump scams)

THREAT TO NATIONAL SECURITY

- Targeting power grids, railways, satellite systems

WEAKENS PUBLIC TRUST IN INSTITUTIONS

- Corruption linked to extremist financing
- Data theft from government databases

CROSS-BORDER HYBRID WARFARE

- Part of China–Pakistan’s **hybrid war strategy** (disinformation + cyber + economic sabotage).



GLOBAL EXAMPLES

- **Stuxnet cyberattack** crippled Iran's nuclear centrifuges (non-violent sabotage).
- **Russia’s misinformation campaigns** in US & Europe.
- **China’s digital espionage networks** targeting defence systems.

INDIAN CONTEXT & RECENT CASES

- **2020 Mumbai Power Grid attack** suspected to be a cyber sabotage attempt.
- **Terror financing cases** involving hawala networks in Kerala, J&K, Delhi.
- **Crypto-based financing** caught in NIA raids (2022–24).
- **Deepfake videos** used during elections to polarize voters.

STEPS TAKEN BY INDIA

LEGISLATIVE MEASURES

- **Unlawful Activities (Prevention) Act (UAPA)** – terror financing
- **PMLA, 2002** – checks money laundering
- **NIA Amendment Act** – includes cyber terrorism

FINANCIAL INTELLIGENCE MEASURES

- **FIU-IND**
- **NIL (National Intelligence Grid – NATGRID)**
- **FATF compliance** (India in the *white list*)

TECHNOLOGICAL MEASURES

- **CERT-In, Cyber Swachhta Kendra**
- **National Cyber Coordination Centre (NCCC)**

INSTITUTIONAL MEASURES

- Dedicated **NIA terror financing units**
- Bilateral cooperation with **Israel, USA, Japan** on cyber defence

CHALLENGES

- Lack of technical expertise in law enforcement
- Encrypted communication (WhatsApp, Telegram)
- Rapid evolution of cyber tools
- Difficulty in detecting cross-border transactions
- Dark-web activity

14**GLOBAL TB REPORT 2025**

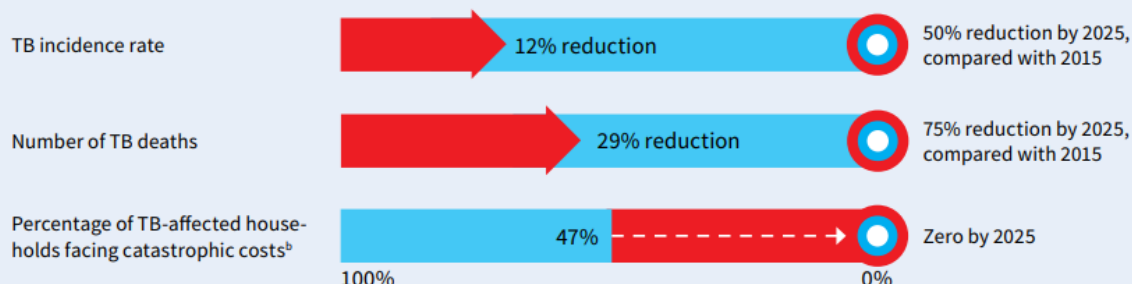
The WHO Global Tuberculosis Report 2025, shows that India remains the country with the highest TB burden (25% of global cases) despite achieving a 21% reduction in incidence since 2015.

WHAT IS THIS REPORT?

- The **WHO Global Tuberculosis Report 2025** is a comprehensive assessment of the global TB epidemic covering incidence, diagnosis, treatment, prevention, and progress toward targets.
- Based on data from **184 countries**, covering > 99% of global population and TB cases.

GLOBAL TB BURDEN (2024 DATA)

- **Incidence:** ~ **10.7 million** people fell ill with TB in 2024 (95% UI: 9.9–11.5 m).
- This corresponds to an incidence rate of **131 cases per 100,000** population.
- **HIV co-infection:** ~ 5.8% of incident cases were among people living with HIV.

End TB Strategy, 2025 milestones**REGIONAL DISTRIBUTION**

- Most TB cases in 2024 were in:
 - **South-East Asia** (34%)
 - **Western Pacific** (27%)
 - **Africa** (25%)
- Smaller shares: Eastern Mediterranean, Americas, Europe.

TREND REVERSAL & PANDEMIC IMPACT

- Between 2020 and 2023, TB incidence increased due to **COVID-19 disruptions**.

- In 2024, **both TB incidence and the estimated number of people ill decreased** for the first time since the pandemic.

TB MORTALITY (2024)

- **Total deaths:** Estimated **1.23 million** in 2024.
 - HIV-negative: ~1.08 million
 - HIV-positive: ~150,000
- Deaths reduced by **3% from 2023 to 2024**.
- Since 2015, **TB deaths declined by ~29%**, but this is **far from the End TB Strategy's 2025 mortality milestone** (75% reduction target).

HIGH-BURDEN COUNTRIES & INDIA'S ROLE

- **Eight countries accounted for ~67%** of global TB cases in 2024.
 - Top: **India (25%)**, followed by Indonesia, Philippines, China, Pakistan, Nigeria, DR Congo, Bangladesh.
- **India:**
 - TB incidence fell **21%** from 2015 to 2024 (from 237 to 187 / lakh).
 - Treatment coverage: **~92% in 2024**, much improved from 53% in 2015.
 - TB mortality in India decreased from **28 / 100,000 (2015)** to **21 / 100,000 (2024)**. Business Standard
 - But India still has **32% of global MDR/RR-TB cases** (multi-drug/rifampicin-resistant).

WHY PROGRESS IS SLOWER THAN NEEDED?

- The **2025 milestone** of the WHO End TB Strategy is **50% reduction in incidence (vs 2015)**. But only ~12% decline has been achieved by 2024.
- **Funding concerns:** Stagnation in global financing could derail progress.
- Gaps remain in case detection, especially in high-burden countries.

INITIATIVES TO REDUCE TB:

GLOBAL LEVEL:

- **End TB Strategy (WHO, 2015–2035):** Global framework to cut TB deaths by 90% and incidence by 80% by 2030.

- **UN High-Level Meetings (2018, 2023):** Renewed global commitments, including targets for funding, vaccine development, and universal access to TB care.
- **Global Fund & Stop TB Partnership:** Strengthen resource mobilization, surveillance, and innovation.
- **New WHO Guidelines (2024–25):** Updated guidance on **diagnosis, MDR-TB treatment, and TB–diabetes comorbidity** management.

INDIA LEVEL:

- **National Strategic Plan for TB Elimination (2017–2025):** Targets an **80% incidence reduction by 2025**, ahead of global goals.
- **Ni-kshay Poshan Yojana:** Nutritional support for TB patients.
- **Pradhan Mantri TB Mukh Bharat Abhiyan:** Community engagement and corporate participation in patient adoption.
- **Expanded Diagnostics:** Rollout of **Truenat and CBNAAT** molecular tests nationwide.

KEY CHALLENGES HIGHLIGHTED IN REPORT

- **Under-reporting / Missed Cases:** Even though many diagnosed, some remain “missing.”
- **Drug-resistant TB:** MDR/RR-TB remains a concern.
- **Health Systems Strain:** Post-pandemic recovery is fragile.
- **Equity Issues:** Vulnerable groups (e.g., HIV-positive) remain disproportionately affected.
- **Sustainable Funding:** Donor fatigue and reduced international assistance.

IMPLICATIONS FOR INDIA

- India’s strong performance shows effective **case-finding**, treatment expansion, and drug-resistance management.
- But **25% global share** means India continues to carry a large share of global TB burden → calls for **continued social, public-health, and financial commitment**.
- Need to accelerate **innovative diagnostics, community engagement**, and **private-public partnership** to close gaps.

- TB elimination aligns with **SDG 3 (Good Health and Well-being)**; deliverables hinge on sustained investment and political will.
- India's experience can inspire **South-South cooperation**, sharing of best practices with other high-burden countries.

RECOMMENDATIONS:

- **Accelerate Vaccine R&D:** Prioritize global and domestic investment in next-generation TB vaccines, fast-tracking trials and equitable access frameworks.
- **Expand Molecular Diagnostics:** Scale up Truenat, CBNAAT, and LAMP-based tests for rapid, accurate detection in high-risk and remote districts.
- **Ensure Sustainable Financing:** Increase domestic TB funding through national health budgets and blended finance models to reduce donor dependency.
- **Strengthen Nutrition & Social Support:** Link TB programs with food security and welfare schemes to address poverty, malnutrition, and stigma barriers.
- **Integrate Digital Surveillance:** Use AI-enabled platforms and real-time data analytics for better case tracking, treatment adherence, and outcome monitoring.

IAS ORIGIN
HERE IT BEGINS

15**GLOBAL COOLING WATCH 2025 REPORT**

The UNEP launched the Global Cooling Watch 2025 report at COP30 in Belém, Brazil, warning that global cooling demand could triple by 2050 under a business-as-usual scenario, potentially doubling emissions and straining power systems.

**WHAT IS THE GLOBAL COOLING WATCH 2025 REPORT?**

- Published by **UNEP** (United Nations Environment Programme) under its **Cool Coalition**.
- Released at **COP30, Belém, Brazil** on 11 November 2025.
- Second edition (first was in 2023).
- Purpose: assess **global cooling demand**, inequalities in access, and outline sustainable pathways for “cooling” (both adaptation and mitigation).

KEY FINDINGS & PROJECTIONS

- **Rapid Growth in Cooling Demand**
 - Under *business-as-usual*, cooling demand could **more than triple by 2050**.
 - Drivers: rising population, increasing income, more extreme heat events, and more low-income households getting access to inefficient cooling.
- **Emissions from Cooling Could Nearly Double**
 - Cooling-related greenhouse gas emissions are projected to reach **7.2 billion tons of CO₂-equivalent by 2050** under current trends.
 - This happens *despite* efficiency efforts and refrigerant phase-down, due to sheer scale of increased cooling demand.

- **Sustainable Cooling Pathway**

- The report proposes a **Sustainable Cooling Pathway**, which could reduce those 2050 emissions by **64%**, to **2.6 billion tons of CO₂e**.
- With simultaneous **rapid decarbonisation of the power sector**, cooling emissions could be brought **down to 97% below business-as-usual**.

- **Massive Energy & Infrastructure Savings**

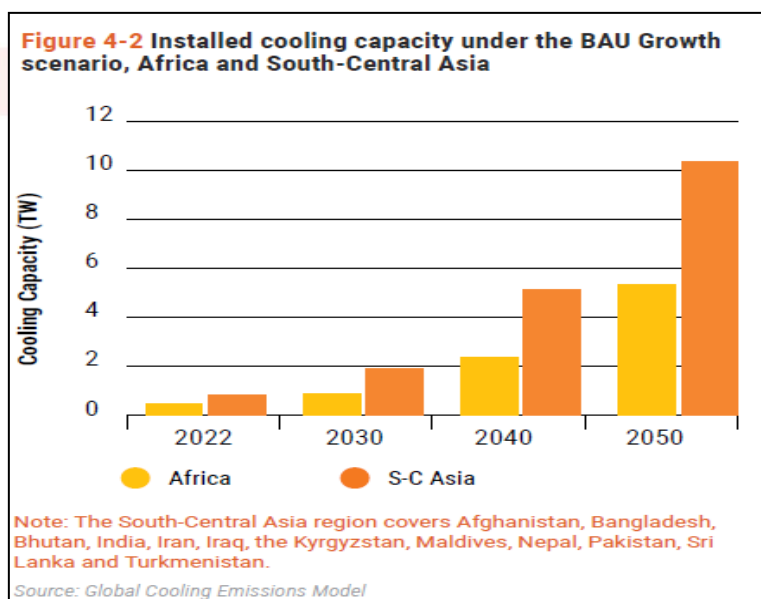
- The pathway could yield **US\$ 17 trillion** in cumulative energy savings by 2050.
- Avoided grid investments up to **US\$ 26 trillion**, by reducing peak electricity demand from cooling.

- **Inequity in Cooling Access**

- Over 1 billion people currently lack adequate access to cooling.
- Without sustainable solutions, vulnerable populations (e.g., in low-income countries) will face rising heat stress, even as they gain access to cooling.

KEY FRAMEWORKS INTRODUCED

- **Sustainable Cooling Hierarchy**: New framework to guide decision-makers on prioritizing cooling solutions (passive, low-energy, high-efficiency, etc.).
- **Tiered Access Framework**: A framework to ensure **equitable access** to cooling, especially for vulnerable populations.
- **Global Cooling Pledge**: The report provides the scientific foundation for this Pledge; a commitment by countries to align with sustainable cooling pathways.



KEY SOLUTIONS & STRATEGIES (POLICY & TECHNOLOGY)

- **Passive Cooling**
 - Urban design: green spaces, shading
 - Building design: better materials, insulation
 - Nature-based solutions for heat mitigation.
- **Low-Energy & Hybrid Cooling Systems**
 - Fans, evaporative coolers, hybrid systems (“fan + AC”) → reduce electricity use.
 - Use of high-efficiency equipment (inverter ACs, variable-speed compressors).
- **Refrigerant Transition**
 - Accelerated phase-down of **hydrofluorocarbons (HFCs)** via Kigali Amendment.
- **Decarbonization of Power Sector**
 - Combine sustainable cooling pathway with clean grid to minimize residual emissions.
- **Nature-based Urban Cooling**
 - Example: Bosco Verticale (Milan): vegetation “filters” sunlight, lowers surface temperature, reduces cooling need.
- **Local Governance & Heat Resilience**
 - Report launches “**Beat the Heat / Mutirão Contra o Calor Extremo**” campaign: local-level action on heat resilience.
 - Treat cooling as *essential infrastructure*, like water and energy.

CHALLENGES & BARRIERS IDENTIFIED

- Many countries **lack comprehensive cooling policies**: only ~54 countries have all three pillars (passive cooling, energy-efficiency standards, refrigerant transition).
- **Financing gap**: Local governments need support to implement cooling solutions and heat resilience projects.
- **Infrastructure constraints**: Peak load from ACs could overwhelm electricity grids if not managed.

- **Equity issues:** Ensuring that lower-income populations benefit from sustainable cooling and do not rely on inefficient and polluting systems.
- **Heat exposure:** Vulnerable populations already face extreme heat; must treat heat protection as a public good.

UNEP RECOMMENDATIONS:

- Adopt a **Sustainable Cooling Pathway** combining passive design, efficient appliances, and rapid clean energy integration.
- **Accelerate refrigerant phase-down** through Kigali Amendment implementation and enforce full lifecycle refrigerant recovery.
- **Mobilize green finance** via concessional lending, PPPs, and climate bonds to expand access to sustainable cooling.
- Mandate **passive cooling standards** in national building and urban planning regulations.
- Ensure **equitable access** by subsidizing efficient cooling for vulnerable communities and heat-stressed regions.

IAS ORIGIN
HERE IT BEGINS

16**OPERATION BULLION BLAZE**

The Directorate of Revenue Intelligence (DRI) launched “Operation Bullion Blaze” in Mumbai, cracking a major gold-smuggling and melting syndicate. It seized 11.88 kg of gold worth ₹15.05 crore and arrested 11 individuals.

**WHAT IS OPERATION BULLION BLAZE?**

- It is a **major gold smuggling bust** carried out by India's **Directorate of Revenue Intelligence (DRI)**.
- Conducted around **10 November 2025**, when DRI raided four locations in **Mumbai**.
- Targets were:
 - **Two illegal gold-melting units** (clandestine furnaces)
 - **Two unregistered shops** in Mumbai used to receive and sell the melted gold.

WHAT WAS SEIZED / RECOVERED?

- **Gold:** 11.88 kg of 24-carat gold was seized.
- **Silver:** 8.72 kg of silver (worth ₹13.17 lakh) was also recovered.
- **Value (Gold):** The gold is valued at around **₹15.05 crore**.
- **Arrests:** 11 people arrested, including the alleged mastermind, his father, a manager, melters, delivery people, and accountant.

- The melting units were fully operational, designed to convert smuggled gold (sometimes concealed in wax or other forms) into pure bars.

MODUS OPERANDI OF THE SMUGGLING NETWORK

- **Smuggling Gold into India:** The gang smuggled gold into India, possibly in disguised or concealed forms (e.g., wax).
- **Melting in Covert Furnaces:** Smuggled gold was melted in secret furnaces — effectively converting it into pure bullion.
- **Selling in Grey Market:** The refined gold bars were then sold in the grey market (i.e., outside formal legal channels) to local buyers via unlicensed shops.
- **Network Structure:** The network included the person who allegedly set up and ran the furnaces (“melters”), financiers / accountant, shop front operators, and delivery people — a full value-chain.

LEGAL BASIS & CHARGES

- The seizure was made under the **Customs Act, 1962**.
- The DRI (customs intelligence agency) carried out the operation, showing this is **not merely a police crime but a smuggling + statutory revenue loss crime**.

WHY THIS OPERATION MATTERS (IMPORTANCE / IMPLICATIONS)

- **Economic & Fiscal Impact**
 - Gold smuggling circumvents import duties → significant government revenue loss.
 - Illegal bullion entering grey / black markets distorts the legitimate bullion trade.
- **Shadow Economy & Money Laundering**
 - Smuggled gold is often part of a hidden / shadow economy, supporting money-laundering and potentially funding other illicit activities.
 - Melting units help convert smuggled gold into pure, untraceable bars — making money laundering easier.
- **Customs Enforcement Strength**
 - Demonstrates DRI’s capability to act on specific intelligence and conduct simultaneous raids.
 - Acts as a deterrent to other smuggling networks, especially those involved in precious metal trafficking.

- **Grey Market Risk**
 - Illicitly refined bullion entering the grey market undermines regulated bullion trade.
 - Increases risk of inflation in gold trading and loss of trust in formal bullion markets.
- **Regulatory & Policy Implications**
 - May prompt tighter regulation on gold import, processing, and sale.
 - Need for stricter monitoring of melting units and end-point bullion distribution.
 - Strengthening of enforcement agencies (DRI) for bullion smuggling.

LINKAGES WITH BROADER ISSUES

Illicit Financial Flows (IFF): **Operation relates to IFF due to cross-border smuggling + conversion of gold.**

- **Black Money:** Smuggled gold can be a way to store black money and launder it.
- **Customs & Revenue:** Highlights the critical role of customs intelligence in protecting national revenue.
- **Economic Security:** Precious metals smuggling threatens economic stability and formal sectors.
- **Governance & Enforcement:** Need for better regulatory frameworks for bullion trade, better cooperation between customs, revenue, tax, and law-enforcement agencies.

17

SILVER JUBILEE OF PPV & FRA ACT

Union Agriculture Minister presented the Plant Genome Saviour Awards in New Delhi to mark the Silver Jubilee of the Protection of Plant Varieties and Farmers' Rights (PPV&FRA) Act, 2001.



WHAT IS THE PPV&FRA ACT?

- **Full Name:** Protection of Plant Varieties and Farmers' Rights Act, 2001 (PPV&FR Act)
- **Purpose:**
 - To provide a system for **protection of plant varieties**
 - To protect the **rights of farmers** and plant breeders
 - To encourage the development of new plant varieties
- **Legislative History:**
 - Enacted: 30 October 2001 (Act No. 53 of 2001)
 - Came into force in parts: key provisions came into effect on different dates (Nov 2005 / Oct 2006)
- **Authority:**
 - **PPV&FRA Authority** established under the Act to administer registrations, benefit-sharing, documentation, etc.
 - Branch offices in Guwahati, Ranchi, Palampur, Pune, Shivamogga

WHY IS THE SILVER JUBILEE (25 YEARS) IMPORTANT?

- Marks **25 years since enactment**, a milestone to assess both outcomes and future direction.
- Symbolic of India's commitment to **both IPR (Intellectual Property Rights) and farmers' rights**: a *sui generis* system balancing breeders' incentives and farmers' customary practices.
- Opportunity to reflect on progress in **biodiversity conservation, seed sector innovation**, and **farmers' benefits**.

KEY ACHIEVEMENTS OVER 25 YEARS

- **Registration of Plant Varieties**
 - Thousands of varieties registered across crop groups: cereals, legumes, vegetables, oilseeds, etc. (PPV&FRA website: 10,018 certificates issued as of 31 October 2025)
 - Enables formal recognition and IPR protection for breeders.
- **Farmers' Rights Recognition**
 - Farmers (including small, marginal, tribal) can register "farmers' varieties" → protect traditional landraces.
 - Exemption from fee for farmers' variety registration/proceedings under the Act.
 - Benefit-sharing mechanism: "Gene Fund" established to give rewards and recognition to farming communities preserving genetic resources.
 - Plant Genome Saviour Community Award, Farmer Reward & Recognition awarded annually for farmers conserving plant genetic resources.
- **Support for Breeders**
 - Breeders (private / public / institutional) granted breeder's rights: produce, sell, license, import/export of registered varieties.
 - Protection incentivizes investment in R&D for new varieties.
- **Regulation & Testing**
 - "DUS" (Distinctness, Uniformity, Stability) test guidelines developed for assessing varieties.
 - Compulsory licensing provision: if a breeder doesn't make registered variety reasonably available, license can be forced.
- **Institution Building**

- National-level PPV&FRA Authority established.
- Documentation, cataloguing of extant and farmers' varieties.
- Transparency via annual reports, public registry of plant varieties.

CHALLENGES & GAPS AFTER 25 YEARS

- **Access vs Commercialization**

- While breeders' rights are strong, ensuring availability of protected varieties to small farmers remains a challenge.
- Compulsory licensing mechanisms not always used, which may limit public-good use.

- **Awareness and Participation**

- Many farmers, especially in remote/rural areas, are unaware of their rights under PPV&FRA.
- Low registration of farmers' varieties in some regions; administrative capacity for documentation may be inadequate.

- **Benefit-Sharing Implementation**

- The "Gene Fund" is underutilized; disbursement and reward mechanisms may not reach all deserving farming communities.
- Ensuring fair compensation when breeders commercialize farmers' genetic resources is complex.

- **Regulatory & Operational Bottlenecks**

- Delay in DUS testing for some species → slows registration.
- Branch offices may have limited capacity.
- Maintaining balance between proliferation of IPR and protection of agrobiodiversity.

- **Link with Seed Policy Reforms**

- Ongoing debates on Seeds Bill / Seed Policy: how to harmonize PPV&FRA protections with seed market liberalization.
- Ensuring synergy with other biodiversity and farmers-rights systems (e.g., Biological Diversity Act, Farmers' Rights under ITPGRFA).

PLANT GENOME SAVIOUR AWARDS:

A national recognition scheme instituted by PPV&FRA to honour farmers and communities preserving traditional and endangered plant varieties.

Origin: Introduced under Section 39(1)(iii) of the PPV&FRA Act to reward grassroots conservationists of genetic resources.

Awarded to: Individual farmers and community seed groups engaged in conserving indigenous landraces and wild relatives of crops.



2025 recipients include **Community Seed Bank (Telangana)**, **Mithilanchal Makhana Producers' Association (Bihar)**, and **CRS-Na Dihing Tenga Unyan Committee (Assam)**, among others.

18**CABINET APPROVES NEW ROYALTY RATES FOR 4 CRITICAL MINERALS**

The Union Cabinet has approved the rationalisation of royalty rates for four critical minerals Graphite, Caesium, Rubidium, and Zirconium to promote domestic production.

**WHAT HAPPENED**

- On **12 November 2025**, the **Union Cabinet** approved the rationalisation of royalty rates for **4 critical minerals: Graphite, Caesium, Rubidium, Zirconium**.
- The move is part of the government's **Critical Minerals Mission** to boost domestic production of key minerals.
- Revision of royalty structure: charged as a percentage of **Average Sale Price (ASP)** for all four minerals.

NEW ROYALTY RATES (KEY DETAILS)

According to the Cabinet decision (via PM's office):

Mineral	Royalty Rate (New)
Graphite	- $\geq 80\%$ fixed carbon $\rightarrow$ 2% of ASP - $< 80\%$ fixed carbon $\rightarrow$ 4% of ASP (ad valorem)
Caesium	2% of ASP (on the caesium metal content in ore)
Rubidium	2% of ASP (on rubidium metal content)
Zirconium	1% of ASP (on zirconium metal content)

For graphite, this replaces the earlier per-tonne royalty (fixed since 2014) with a more market-linked (ad valorem) rate.

The ASP-based system allows royalty to vary with ore grade and market price, making it more dynamic.

WHY THESE MINERALS ARE CRITICAL

- **Graphite:** Crucial for **EV-battery anodes** and high-tech batteries; India currently imports ~60% of its graphite needs.
- **Zirconium:** Used in **nuclear reactors**, aerospace, high-temperature & corrosion-resistant applications.
- **Caesium:** Applications in **atomic clocks**, GPS, and specialized medical equipment.
- **Rubidium:** Used in specialty glass (fibre optics), night-vision devices, telecommunication.

These minerals are also linked with **other critical minerals**: associated mineral blocks may contain lithium, tungsten, rare earth elements, niobium, etc.

SIGNIFICANCE FROM A POLICY AND STRATEGIC PERSPECTIVE

A. GREEN ENERGY TRANSITION

- Promotes **domestic production** of minerals crucial for EVs, nuclear energy, telecommunications, and other green-tech applications.
- Reduces **import dependence**, especially important given **China's dominance** in several critical mineral supplies.

B. RESOURCE SECURITY & STRATEGIC AUTONOMY

- By rationalizing royalty, India hopes to **unlock mineral blocks** that were not auctioned or explored earlier (especially for caesium, rubidium, zirconium).
- Strengthens **Atmanirbhar Bharat** by building domestic capacity for critical minerals.

C. ECONOMIC & INVESTMENT IMPACT

- More investor-friendly royalty rates → encourages **mining investment**.
- Helps bidders in upcoming **mineral auctions** make more “rational” financial offers.
- Generates **employment** in mining, processing, and downstream industries.

D. SUPPLY CHAIN RESILIENCE

- Encouraging domestic mining reduces **geopolitical risk** associated with global supply chain disruptions.
- Supports **critical-mineral mission** which aims to build the full value chain (exploration, mining, processing).

CHALLENGES & RISKS

- **Environmental Concerns**
 - Increasing mining of critical minerals can lead to **ecological damage**, water stress, and land degradation if not managed sustainably.
 - Need strong Environmental Impact Assessment (EIA) and reclamation practices.
- **Price Volatility Risk**
 - While ad valorem royalty better reflects market prices, extreme price swings (boom or bust) can affect revenue and fiscal predictability.
- **Implementation & Monitoring**
 - Ensuring that actual ASP is properly assessed and reported may be challenging.
 - Royalty collection, auditing, and enforcement will need to be robust.
- **Exploration Risk**
 - Exploration of less-known minerals (caesium, rubidium) might require significant capex and specialized technology.
 - Geological risk: not all auctioned blocks may yield economically viable concentration.
- **Community & Social Risk**
 - Mining operations may face resistance from local communities; need for stakeholder engagement, CSR.
 - Benefit sharing, rehabilitation, and local economic development must be addressed.

WHAT ARE CRITICAL MINERALS?

Critical minerals are those minerals that are:

- **Essential** for a country's economic growth, national security, and technological development, **AND**

- Have a **high risk of supply disruption** because they are either rare, geographically concentrated, or controlled by a few countries.
- In short: **High importance + High supply risk = Critical Mineral**

WHY ARE THEY CALLED “CRITICAL”?

A mineral is categorized as *critical* when:

1. IT IS CRUCIAL FOR MODERN TECHNOLOGIES

Used in:

- Electric Vehicle (EV) batteries
- Green hydrogen
- Solar panels
- Wind turbines
- Smartphones & electronics
- Nuclear energy
- Jet engines, defence systems

2. IT HAS LIMITED GLOBAL AVAILABILITY

Many are found in only a few countries.

Example:

- **China controls 60–80%** of Rare Earth Elements processing
- **DR Congo** supplies ~70% of the world’s cobalt
- **Chile** has the largest lithium reserves

3. HIGH IMPORT DEPENDENCE

- India imports many such minerals → supply risk.

WHY ARE CRITICAL MINERALS IMPORTANT FOR INDIA?

ENERGY TRANSITION

India’s goals:

- 500 GW renewable capacity
- 50% non-fossil electricity by 2030
- EV revolution

All require critical minerals.

NATIONAL SECURITY

- Defence, nuclear energy, space technology rely on them.

ATMANIRBHAR BHARAT

Currently India imports:

- 100% of lithium
- 90% of nickel
- 100% of caesium, rubidium
- Large quantities of rare earths

Reducing import dependence strengthens autonomy.

GLOBAL COMPETITION

- USA, EU, Japan, Australia have already declared national critical mineral strategies.

CRITICAL MINERALS IMPORTANT FOR UPSC

India's 2023 "Critical Minerals List" includes **30 minerals**. Some major ones:

BATTERY MINERALS

- Lithium
- Cobalt
- Nickel
- Graphite

TECHNOLOGY & ELECTRONICS MINERALS

- Rare Earth Elements (REEs)
- Gallium
- Germanium
- Silicon (for semiconductors)

STRATEGIC & DEFENCE MINERALS

- Zirconium (nuclear)

- Niobium (missiles, defence)
- Titanium (aerospace)
- Tungsten (hard alloys)

GREEN ENERGY TRANSITION

- Vanadium (flow batteries)
- Manganese

SPACE, TELECOM & HIGH-TECH

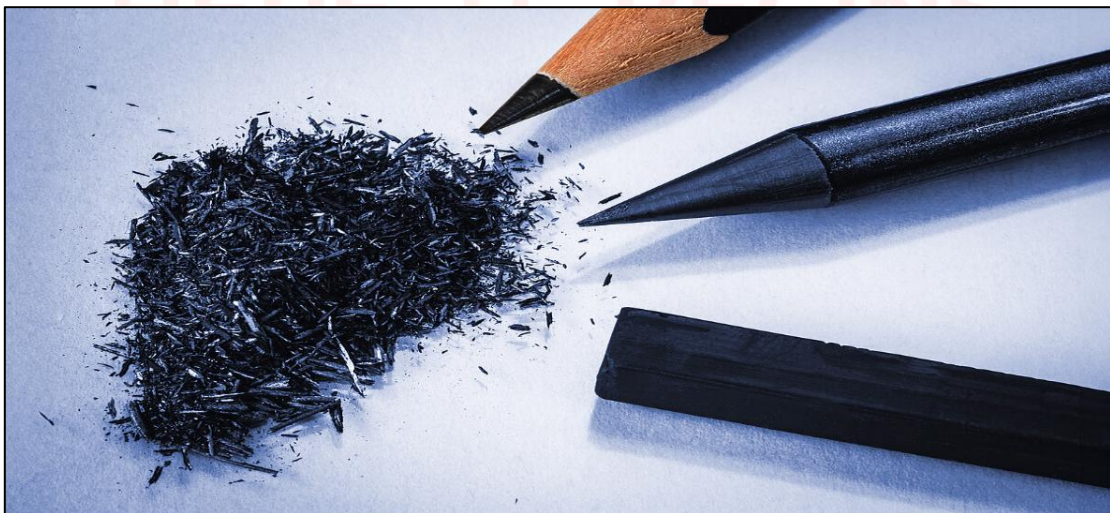
- Caesium
- Rubidium

USES OF THE 4 CRITICAL MINERALS

GRAPHITE – “THE NEW AGE INDUSTRIAL METAL”

KEY USES

- **Battery Manufacturing**
 - Used in **lithium-ion batteries** (anode material).
 - Nearly **50–60% of a Li-ion battery** is graphite.
 - Critical for **EVs, smartphones, energy storage systems**.
- **Refractories & Steel Industry**
 - Used in **foundries, crucibles, furnace linings** due to high heat resistance.
 - Essential in **steel, cement, and metallurgy**.



- **Lubricants**
 - Used as **dry lubricant** due to layered crystal structure.
- **Nuclear Industry**
 - Acts as a **neutron moderator** in some nuclear reactors.
- **Electronics**
 - Used in **graphene production**—superconductor, high conductivity material.

CAESIUM – “STRATEGIC METAL FOR ATOMIC PRECISION”

KEY USES

- **Atomic Clocks**
 - Basis of the world’s most accurate clocks: **Caesium atomic clocks define the SI second.**
 - Critical for **GPS, telecom networks, satellite navigation.**
- **Oil & Gas Drilling**
 - Caesium formate brine used for **high-pressure, high-temperature drilling fluids.**
- **Pharma & Chemical Research**
 - Used in **catalysts and spectroscopy.**
- **Space & Defence**
 - Ion propulsion systems use **caesium plasma.**
 - Used in **infrared detectors.**



RUBIDIUM – “HIGH-TECH NICHE METAL”

KEY USES

- **Electronics & Signal Processing**
 - Used in **rubidium atomic clocks**, slightly less accurate than caesium but cheaper.
 - Important for **telecommunications and computing**.
- **Medical Imaging**
 - **Rubidium-82** used in **PET scans** to detect heart diseases.
- **Specialty Glass**
 - Used in **optical and fiber optics glass**.
- **Research**
 - Used in **quantum computing experiments**, laser cooling projects.



ZIRCONIUM – “NUCLEAR-GRADE INDUSTRIAL MINERAL”

KEY USES

- **Nuclear Reactors**
 - Used in **fuel cladding** of nuclear reactors because of:
 - very **low neutron absorption**,
 - high **corrosion resistance**.
 - Essential for **Pressurised Heavy Water Reactors (PHWRs)** used in India.
- **Ceramics and Tiles**
 - Used in **glazes, refractories, and abrasives**.

- **Aerospace & Defence**
 - High-temperature resistance makes it suitable for **jet engines, heat shields, missiles**.
- **Chemical Industry**
 - Used in **pumps, valves, and reactors** that handle corrosive chemicals.
- **Medical**
 - Used in **surgical instruments and dental implants** due to biocompatibility.



WHY THESE MINERALS MATTER FOR INDIA?

- All four are **Critical Minerals** under the Government of India's list.
- India **imports heavily**, especially graphite and zirconium.
- Needed for:
 - **Electronics manufacturing**
 - **EV sector**
 - **Defence & nuclear technology**
 - **Space sector**
 - **Renewable energy**

19**NYOMA AIR BASE**

The Indian Air Force (IAF) has operationalized the Nyoma Air Base in Eastern Ladakh, with Air Chief Marshal A.P. Singh making the inaugural landing on a C-130J aircraft.

**WHAT HAPPENED?**

- The Indian Air Force has operationalised the Nyoma Air Base in Eastern Ladakh.
- Air Chief Marshal A.P. Singh made the inaugural landing on a C-130J Super Hercules transport aircraft.
- This marks a major boost to India's forward air mobility near the Line of Actual Control (LAC) with China.

WHERE IS NYOMA?

- Located at 13,700 feet altitude in Eastern Ladakh, near the LAC in the Chushul sector.
- Part of the Kangri-Nyoma sub-sector, a sensitive area close to Demchok, Chumar, DBO (Daulat Beg Oldie).

WHY NYOMA AIR BASE IS IMPORTANT?

STRATEGIC LOCATION NEAR LAC

- Nyoma is only **~50 km from the LAC**, giving India a **forward airfield** in a high-tension zone.
- Helps counter China's infrastructure buildup on its side (e.g., **Ngari Gunsa airbase** in Tibet).

BOOST TO IAF'S AIRLIFT CAPABILITY

- Nyoma can now support:
 - **C-130J Super Hercules**
 - **Chinook heavy-lift helicopters**
 - **Apache attack helicopters**
 - **UAVs like Heron and Rustom**
- This enables:
 - Rapid troop deployment
 - Supply of ammunition & logistics
 - Quick casualty evacuation
 - High-altitude operations

ALL-WEATHER, ALL-YEAR OPERATIONS

Unlike earlier Advanced Landing Grounds (ALGs) which had limited operations, Nyoma now has:

- Paved runway
- Aircraft shelters
- Night landing capability
- Modern navigation systems

COMPLEMENTS OTHER FORWARD BASES

Nyoma strengthens the network of existing forward bases:

- **Daulat Beg Oldie (DBO)**
- **Fukche**
- **Thoise**
- **Leh Air Base**

Together, they create a **high-altitude air power corridor**.

INFRASTRUCTURE PUSH IN EASTERN LADAKH

The airbase complements:

- **DSDBO Road,**
- **Chushul–Demchok connectivity,**
- **BRO’s Darbuk–Shyok–DBO projects,**
- **New tunnels & bridges.**

This enhances **logistics resilience** against China.

SUPPORTS INDIA’S OFFENSIVE & DEFENSIVE CAPABILITY

- Enhances **air dominance** over the region.
- Strengthens India’s ability to:
 - Monitor PLA troop buildup
 - Move troops for quick reaction
 - Conduct high-altitude operations

A critical requirement posts the **2020 Galwan Valley clashes**.

BOOST TO CIVIL–MILITARY INTEGRATION

Nyoma could potentially support civilian flights under UDAN 4.2 / UDAN for Hill Areas, improving:

- Tourism (Pangong Lake region)
- Connectivity for border villages
- Development of remote areas

20

NATIONAL DATABASE FOR EMERGENCY MANAGEMENT (NDEM)

The Ministry of Road Transport and Highways (MoRTH) has made it mandatory for all highway Detailed Project Reports (DPRs) to include analysis using ISRO's National Database for Emergency Management (NDEM).

WHAT IS NDEM?

The **National Database for Emergency Management (NDEM)** is a **geospatial, satellite-based, real-time information system** created by the **National Remote Sensing Centre (NRSC)**, **ISRO** under the **National Disaster Management Authority (NDMA)**.

It is India's **central Digital Disaster Management Platform** that integrates:

- Satellite images
- GIS maps
- Crowd-sourced data
- Early warning systems
- Real-time alerts from IMD, CWC, INCOIS, Forest Survey of India, etc.

Used by: **NDMA, NDRF, State Disaster Management Authorities (SDMAs), Ministries, Armed Forces, CAPFs, Home Ministry.**

VISION OF NDEM

"To provide a single, accurate, real-time geospatial platform for disaster preparedness, mitigation, relief, and recovery."

It supports all phases of Disaster Management:

- Preparedness
- Mitigation
- Response
- Relief
- Recovery
- Reconstruction



WHO DEVELOPED IT?

- **National Remote Sensing Centre (NRSC)**, Hyderabad (ISRO)
- Under guidance of **NDMA** and **Ministry of Home Affairs (MHA)**
- As part of the **National Spatial Data Infrastructure (NSDI)**.

WHY NDEM WAS CREATED?

India faces:

- 58.6% land vulnerable to earthquakes
- 12% land vulnerable to floods
- 68% area drought-prone
- 5,700 km coastline prone to cyclones
- Increasing urban disasters (heatwaves, industrial fires, accidents)

India needed a **centralised, real-time disaster monitoring system** → NDEM.

KEY FEATURES OF NDEM

CENTRALIZED GEOSPATIAL DATABASE

- **NDEM houses more than:**
 - 4,000+ GIS layers
 - 1,500+ hazard datasets
 - High-resolution satellite imagery
- **Examples:**
 - Flood hazard zonation
 - Cyclone track prediction
 - Forest fire locations
 - River basin maps
 - Landslide-prone areas
 - Seismic zones

REAL-TIME DISASTER MONITORING

- NDEM receives live feeds from:
 - IMD → cyclone alerts, rainfall forecast
 - CWC → river flood levels

- INCOIS → tsunami warnings
- Forest Survey of India (FSI) → forest fire alerts
- ISRO satellites → flood mapping, burned area mapping
- GSI → landslide hazard maps

EARLY WARNING DISSEMINATION

Real-time alerts sent to:

- District administrations
- SDMAs
- NDRF teams
- Meteorological centres
- Public alert systems

DECISION SUPPORT SYSTEM (DSS)

NDEM performs:

- Flood inundation simulation
- Cyclone landfall prediction
- Tsunami impact modeling
- Evacuation route planning
- Resource allocation optimisation

MOBILE APPLICATIONS

Apps for field teams:

- Geotagging affected areas
- Reporting damaged roads, bridges
- Uploading photos of real-time situations
- Marking safe shelters

3D VISUALIZATION

Used to assess:

- Urban flooding
- Building collapse risk
- Infrastructure vulnerability

- Landslide susceptibility

INTEGRATED COMMAND AND CONTROL

Used by:

- NDRF
- Indian Army, Navy, Air Force
- Indian Coast Guard
- State Police
- Disaster Response Forces

TECHNOLOGY BEHIND NDEM

- Bhuvan Platform (ISRO)
- Cartosat satellites (cartographic mapping)
- RISAT (radar imaging for cloud-penetrating flood data)
- Oceansat (cyclones, coastal monitoring)
- GeoNode-based GIS architecture
- AI/ML-based risk prediction

DATA TYPES STORED IN NDEM

- **Hazard Data**
 - Earthquakes
 - Cyclones
 - Floods
 - Tsunamis
 - Drought
 - Heatwaves
 - Landslides
 - Forest fires
- **Infrastructure Data**
 - Roads, bridges
 - Railways
 - Airports

- Power lines
- Dams & reservoirs
- Hospitals
- Schools
- Relief shelters
- **Demographic Data**
 - Population
 - Age groups
 - Vulnerable communities
- **Administrative Boundaries**
 - State, district, taluk, village
 - Disaster-prone zones

HOW NDEM WORKS DURING DISASTERS (EXAMPLE-WISE)

- **Cyclones**
 - IMD cyclone track + Oceansat wind speed + storm surge model → Creates impact maps + evacuation alerts.
- **Floods**
 - RISAT radar images penetrate clouds → Real-time flood inundation maps delivered within 45 minutes.
- **Forest Fires**
 - FSI + ISRO thermal anomalies → Sends immediate alerts to forest staff & local authorities.
- **Landslides**
 - GSI hazard zonation + rainfall forecast → Predicts possible landslide slopes.
- **Industrial Disasters**
 - GIS layers of industries
 - Chemical storage maps → Used during gas leaks, industrial incidents.

IMPORTANCE OF NDEM FOR INDIA

- **Strengthens NDMA's mandate under DMA 2005**

- Moves India toward data-driven disaster governance.
- **Enhances India's Global Ranking in Sendai Framework**
 - Improves risk reduction systems.
- **Critical for National Security:** Used for military and dual-use emergencies:
 - Border floods
 - Earthquakes in border areas
 - Flash floods in Ladakh/Arunachal
- **Supports Smart Cities**
 - Urban flood prediction
 - Heatwave monitoring
- **Climate Change Adaptation**
 - Extreme weather prediction
 - Glacier lake outburst flood (GLOF) monitoring
 - Sea level rise maps

CHALLENGES FOR NDEM

DATA VACUUM IN REMOTE DISTRICTS

- Low capacity in SDMA/District teams to use GIS
- Dependence on satellite cloud-free windows
- Limited integration with real-time sensors
- Digital divide at local levels
- Need for cross-ministry coordination
- Cybersecurity risks

RECENT UPDATES (IMPORTANT FOR PRELIMS 2024–25)

- NDEM upgraded under National Geospatial Policy 2022
- Uses ISRO's Bhuvan 3.0
- Integrated with NDMA's CAP (Common Alerting Protocol)
- Linked with C-DAC's early warning tools
- Supports heatwave early warning (2024 onwards)
- New GLOF module for Himalayas launched in 2025

21**ARISE PROGRAM**

At the COP30 Climate Summit in Belém, Brazil, the Climate Investment Funds (CIF) launched a new program — ARISE (Accelerating Resilience Investments and Innovations for Sustainable Economies) — with initial funding of million from Germany and Spain.

WHAT IS ARISE?

- **ARISE** stands for **Accelerating Resilience Investments and Innovations for Sustainable Economies**.
- It is a **new climate-resilience investment programme** under the **Climate Investment Funds (CIF)**.
- Officially announced at **COP30, Belém, Brazil**, on 10 Nov 2025.
- Initial funding: **US\$ 100 million** pledged by **Germany (USD 63.25 m)** and **Spain (USD 36.8 m)**.

**WHAT IS THE CLIMATE INVESTMENT FUNDS (CIF)?**

- A **multilateral climate finance institution**, established in **2008**, hosted within the **World Bank**.
- Works via **six Multilateral Development Banks (MDBs)** (e.g., ADB, AfDB) to deploy concessional finance.
- Its mission: catalyse **transformational low-carbon and climate-resilient investments** in developing countries.

WHY WAS ARISE LAUNCHED? (RATIONALE)

- **Adaptation Gap:** Many developing countries lack the financial and institutional capacity to adapt to climate shocks (floods, droughts, storms). ARISE aims to close this gap.

- **Opportunity Mindset:** Rather than seeing climate risk only as a cost, ARISE tries to “turn climate risk into opportunity”—by building resilience in economic systems.
- **Multilateral Strategy:** Works through MDBs to bring in co-financing and develop large, systemic resilience investments.
- **COP30 Agenda Alignment:** COP30 in Belém emphasized resilience. Multilateral banks used the opportunity to present ARISE as a flagship adaptation finance instrument.

KEY FOCUS AREAS OF ARISE

According to CIF / reporting:

- **Sectors:** Agriculture, water, energy, transport, industry
- **Approach:** Systems-based resilience planning (not piecemeal projects)
- **Target countries:** Vulnerable developing economies — especially **Least Developed Countries (LDCs)** and **Small Island Developing States (SIDS)**.
- **Finance Model:** Blended finance concessional CIF funds + co-financing by MDBs + private sector.
- **Innovation & Institutions:** Support for resilience innovations + strengthening national institutions to integrate resilience into economic planning.

SIGNIFICANCE FROM UPSC PERSPECTIVE

(A) CLIMATE FINANCE & ADAPTATION

- ARISE is a **significant step in scaling climate adaptation finance**.
- Shows how **multilateral development banks (MDBs)** are pivoting to resilience.
- Strengthens the global adaptation finance architecture.

(B) GLOBAL EQUITY / JUSTICE

- Prioritizes **vulnerable economies** (LDCs, SIDS), addressing **climate equity**.
- Sends a signal that rich countries (Germany, Spain) are contributing to **resilience, not just mitigation**.

(C) MULTILATERALISM & COOPERATION

- ARISE reflects **multilateral cooperation**: CIF + MDBs + national governments.
- Enhances trust in **global climate finance mechanisms**, especially at COP-level.

(D) ECONOMIC RESILIENCE

- By integrating resilience into planning, ARISE promotes **climate-resilient economies**, not just disaster response.
- Encourages **longer-term sustainable development**.

(E) IMPLEMENTATION FOCUS

- COP30 has been called a “COP of implementation.” ARISE is a practical, finance-backed tool rather than a mere declaration.

CHALLENGES & RISKS

- **Scale:** \$100 million is relatively modest compared to adaptation needs (billions needed).
- **Co-financing Risk:** Need to mobilize large MDB / private investment — risk of insufficient follow-up.
- **Institutional Capacity:** Many developing countries may lack the institutional frameworks to absorb and effectively deploy ARISE funds.
- **Monitoring & Results:** Measuring resilience outcomes is complex (how to track “innovations,” “resilience capacity”?).
- **Sustainability:** Ensuring that investments are not only short-term but build **long-term resilience infrastructure**.

UPSC RELEVANCE: MAINS, PRELIMS, ESSAY

- **Prelims:** Know COP30 key announcements, adaptation finance, CIF, climate funds.
- **GS Paper 3:** Disaster Management / Climate Change / Finance — ARISE as a tool for adaptation finance, resilience.
- **GS Paper 2:** Multilateral cooperation, climate equity, global governance.
- **Essay:** “Resilience as the new frontier in climate finance: Role of multilateral funds” or “Adaptation finance and global equity”.

22

EXPORT PROMOTION MISSION (EPM)

The Union Cabinet chaired by Prime Minister of India has approved the Export Promotion Mission (EPM) with an outlay of ₹25,060 crore (2025–26 to 2030–31) to strengthen India's export competitiveness.



WHAT IS THE EXPORT PROMOTION MISSION (EPM)?

- The **Union Cabinet**, chaired by the Prime Minister, has approved the **Export Promotion Mission (EPM)** with an outlay of ₹ 25,060 crore for the period FY 2025–26 to FY 2030–31.
- The mission was first announced in the **Union Budget 2025-26**.
- Aim: **Strengthen India's export ecosystem**, especially targeting **MSMEs, first-time exporters**, and **labour-intensive sectors** (like textiles, leather, gems & jewellery, etc.).
- It replaces a fragmented set of export-support schemes with a **single, outcome-based, digitally driven** mechanism.

INSTITUTIONAL STRUCTURE & IMPLEMENTATION

- **Implementing Agency:** Directorate General of Foreign Trade (DGFT), under the Department of Commerce.
- **Collaborative Framework:** Involves multiple agencies and stakeholders:
 - Department of Commerce
 - Ministry of MSME
 - Ministry of Finance

- Financial Institutions
- Export Promotion Councils, Commodity Boards, Industry Associations
- State Governments
- A **dedicated digital platform** will handle applications, approvals, and fund disbursement.

COMPONENTS — TWO SUB-SCHEMES OF EPM

EPM is structured into **two integrated sub-schemes**:

- **Niryat Protsahan (“Export Encouragement”)**
 - Focus: **Financial support** for exporters, especially MSMEs.
 - Instruments:
 - Interest subvention
 - Export factoring (i.e., financing receivables)
 - Collateral guarantees
 - Credit cards for e-commerce exporters
 - Credit enhancement to diversify into new markets
- **Niryat Disha (“Export Direction”)**
 - Focus: **Non-financial enablers** to boost export capacity.
 - Components:
 - Quality/compliance certification
 - International branding & packaging support
 - Participation in trade fairs
 - Export warehousing & logistics
 - Inland transport reimbursements
 - Trade intelligence, capacity building of exporters

KEY FEATURES & STRATEGIC SHIFTS

- **Consolidation:** EPM merges existing schemes like:
 - Interest Equalisation Scheme (IES)
 - Market Access Initiative (MAI)This rationalisation helps reduce duplication and simplifies the support architecture.

- **Digital-First:** Entire application-to-disbursal process via DGFT-run digital platform.
- **Outcome-Based:** Performance and results (export growth, diversification) will guide disbursement rather than just budgetary allocation.
- **Sectoral Priorities:** EPM will prioritize sectors hit by recent global tariff escalations:
 - Textiles
 - Leather
 - Gems & Jewellery
 - Engineering goods
 - Marine products
- **Inclusivity:** Focus on MSMEs and first-time exporters to ensure broad-based benefit.
- **Geographic Reach:** Aims to boost exports from non-traditional districts (interior, low export-intensity regions).

WHY IS EPM IMPORTANT FOR INDIA?

- **Export Competitiveness & Economic Growth**
 - Exports are a key driver of GDP growth, especially in labour-intensive sectors.
 - Strengthening exports helps in job creation, particularly in MSMEs.
- **Countering External Risks / Tariff Pressures**
 - With rising global trade tensions (e.g., tariffs from the US), EPM gives Indian exporters a cushion and capability to diversify.
- **Financial Inclusion**
 - By focusing on affordable trade finance (via Niryat Protsahan), the mission assists small and first-time exporters who typically face credit constraints.
- **Trade Infrastructure & Brand Building**
 - Non-financial support helps Indian goods meet global standards (quality, compliance), thereby increasing global market access.
- **Employment & Regional Development**
 - By targeting non-export-intensive regions, the mission can generate employment in interior districts and promote inclusive growth.

- **Strategic Export Policy Shift**

- Moving from fragmented, scheme-based support to a unified, flexible, digital mission aligns with India's broader push for economic modernization (Viksit Bharat) and competitive global trade.

CHALLENGES & RISKS

- **Implementation Risk:** Ensuring effective digital architecture (DGFT platform) works seamlessly.
- **Absorption Risk:** MSMEs may struggle to use the financial tools (factoring, credit) effectively.
- **Corruption / Leakages:** Risk of misuse of funds if not well monitored.
- **Costs vs Returns:** ₹ 25,060 crore is a large outlay — need to ensure exports grow proportionately to justify.
- **Sustainability:** Export push should not just rely on subsidies; long-term competitiveness must come through value addition.
- **Market Risk:** Even with support, exporters are exposed to volatile global demand, geopolitical risks, and currency fluctuations.

IAS ORIGIN
HERE IT BEGINS

23

BOTSWANA

During President of India state visit to Botswana, the country announced the donation of eight cheetahs to India under Project Cheetah.



BOTSWANA:

WHAT IT IS?

- Botswana is a **landlocked country in Southern Africa**, renowned for its democratic stability, wildlife diversity, and conservation-led development model.
- It gained independence from Britain in **1966** and has since become one of Africa's most peaceful and prosperous nations.
- **Located in:** The centre of Southern Africa, roughly triangular in shape, covering about 600 miles north–south and east–west.
- **Neighbouring Border Nations:** Namibia (Caprivi Strip), Zambia, Zimbabwe and South Africa.

GEOLOGICAL & PHYSICAL FEATURES:

- Lies on a **high inland plateau (~1,000 m elevation)** dominated by the **Kalahari Desert sands**.
- Divided into three main regions:
 - **Hardveld** (rocky hills and shallow soils in the east)
 - **Sandveld** (deep Kalahari sands covering most of the country)
 - **Ancient lakebeds and wetlands** in the north (Okavango Delta, Makgadikgadi Pans).
 - Major rivers include the **Okavango, Chobe, and Limpopo**; rainfall is sparse and seasonal.
 - **Climate:** Semi-arid, with hot summers (up to 34°C) and dry winters; cyclic droughts are frequent.

CHEETAH DISTRIBUTION WORLDWIDE:

- **Global Range:** Once widespread across Africa, the Middle East, and India, cheetahs now occupy only ~9–10% of their historical range.
- **Current Population:** Around 7,100 adult and adolescent cheetahs remain globally.
- **African Distribution:**
 - **Southern Africa** (Namibia, Botswana, Angola, South Africa, Mozambique, Zambia) holds the largest population, retaining about **22% of the species' former range**.
 - **Eastern Africa** (Kenya, Tanzania) retains about **6%**.

24**THE INDIA SKILLS REPORT 2026**

The India Skills Report 2026 shows India's employability rate rising to 56.35% (from 54.81%), signalling a rapid improvement in how "job-ready" the youth are.

WHAT IS THE INDIA SKILLS REPORT (ISR)?

- An annual report assessing **employability** of Indian youth, skill readiness, and future trends.
- Prepared by **ETS (Educational Testing Service)** in collaboration with **CII, AICTE, AIU, and Taggd**.
- Uses data from:
 - *Global Employability Test (GET)* — more than **100,000 candidates**.
 - Employer surveys across **seven major industry sectors**.
- The 2026 edition is the **13th edition** of the report.

AIM:

- To measure **employability** and skill gaps across education streams, sectors and regions.
- To map **emerging trends** in AI, gig work, digital fluency and hiring patterns.
- To help **policymakers, academia and industry** align curricula, training and recruitment with the demands of the future of work.

KEY FINDINGS OF ISR 2026

- **Employability Rate**
 - India's overall employability rose to **56.35%** in 2026, up from **54.81%** in 2025.
 - This reflects a continuing upward trend (2022: ~46.2% → 2026: ~56.3%).
- **Women Surpass Men**
 - For the **first time**, women's job-readiness (employability) has surpassed men's.
 - Reported rates: Women ~54%, Men ~51.5%.
 - This shift is attributed to **hybrid work, online learning**, and better **digital upskilling**.
- **AI & Technology Penetration**

- India now accounts for **16% of global AI talent**.
- Expected to reach **1.25 million AI specialists by 2027**.
- Over **90% of Indian employees** report using **generative AI tools** at work.
- **Future of Work – Gig & Freelance Workforce**
 - Projection: India's gig / freelance workforce could reach **23.5 million by 2030**.
 - Project-based hiring saw a **38% year-on-year increase**.
- **Sectoral Demand & Skills**
 - High-demand sectors: **Technology (IT), BFSI, Manufacturing, Renewable Energy, Healthcare**.
 - Top skills: **AI, Data Analytics, Cloud Computing, Cybersecurity**.
 - Vocational / technical streams:
 - Commerce graduates: ~62.81% employability.
 - Science graduates: ~61%
 - Arts graduates: ~55.55%
 - ITI graduates: ~45.95%, Polytechnics: ~32.92%
- **Internship & Practical Exposure**
 - ~92.8% of students expressed the need for **industry internships or hands-on exposure**.
 - There is a growing trend toward *micro-credentials* and **stackable certificates**, rather than relying solely on traditional degrees.
- **State-level Employability**
 - The top three states in employability: **Uttar Pradesh, Maharashtra, Karnataka**.
 - Emerging **tier-2 / tier-3 talent hubs** are gaining importance in skill ecosystems. (E.g., insights from report narrative)

WHY THESE FINDINGS MATTER?

A. POLICY IMPLICATIONS

- Emphasis on **skill-first economy**: The shift from degree-based hiring to skill-based hiring can influence **education policy, vocational training, and higher education reforms**.

- **Gender inclusion:** With women surpassing men in employability, policies for **female skill development, digital access, and work-from-home models** become more critical.
- **AI & Future Work:** Strong AI penetration signals need for **AI skilling, reskilling, technology-focused curriculum, and creating a future-ready workforce.**

B. ECONOMIC DEVELOPMENT AND LABOR MARKET

- Gig economy growth suggests a shift in **employment models** — more flexible, project-based work.
- Demand in sectors like renewable energy and healthcare aligns with India's **long-term economic and strategic priorities.**
- Rise in **micro-credentials** / stackable certifications offers an alternative path for youth to upskill without full-time degree programs.

C. SOCIAL EQUITY

- Greater participation of **women** in the skilled workforce is a big social plus.
- Tier-2 / tier-3 city talent rise signals **decentralization of opportunities**, reducing urban-rural divide.

D. GLOBAL COMPETITIVENESS

- With 16% of global AI talent, India can position itself as a **global talent hub**. This has implications for outsourcing, foreign investment, and India's role in the global digital economy.
- Modular skilling and recognized micro-credentials can help Indian talent connect with **global job markets.**

CHALLENGES HIGHLIGHTED / IMPLIED BY THE REPORT

- **Quality vs Quantity:** Rising employability is good, but ensuring **deep, job-relevant skills** (not just test-readiness) remains a challenge.
- **Sustainability of Gig Work:** Gig jobs offer flexibility but may lack **social security**, career progression, and benefits.
- **Access to Training:** Not all youth may access modular certificates or internships, especially in remote / underdeveloped regions.
- **AI Divide:** While AI uptake is high, not all sectors or workers may benefit equally → risk of **skill polarization.**

- **Credential Recognition:** Micro-credentials / online certificates must be **recognized by industry and education institutions** to be truly valuable.

OPPORTUNITIES FOR INDIA IN THE SKILLS LANDSCAPE:

- **Becoming a Global Talent Powerhouse:** Large, young population + rising employability + English & digital fluency position India as a **primary supplier of skilled talent** to the world.
- **Leadership in AI & Emerging Tech:** Strong base in **computer science, IT, data, cloud and AI** opens space for India to build **indigenous AI products** and capture high-value global technology work.
- **Demographic Dividend with Skills, Not Just Numbers:** With a large share of youth, a skills-first orientation can convert demographic size into **productivity, innovation and entrepreneurship**.
- **Tier-2 & Tier-3 Cities as New Skill Hubs:** Growing employability and women's participation in smaller cities can **decongest metros**, spread growth and create **regional innovation clusters**.
- **Rise of Flexible Work Models:** Gig work, remote work and freelancing enable Indians to **work globally while staying local**, earning in diverse markets and time zones.
- **Deepening Industry–Academia Linkages:** Micro-credentials, internships and industry projects create **continuous pipelines** from campus to corporate, reducing onboarding costs and mismatch.

CHALLENGES HIGHLIGHTED IN THE REPORT:

- **Access & Equity Gaps:** Advanced skills in AI, data, automation remain more accessible in metros and elite institutions; rural and Tier-3 learners still face infrastructure, cost and exposure barriers.
- **Soft Skills & Critical Thinking Deficits:** Persistent concerns around communication skills, problem-solving, teamwork and critical thinking despite technical competence, especially for first-gen learners.
- **Industry–Curriculum Mismatch:** Many curricula lag behind rapidly changing tech (AI, green energy, quantum, biotech), leading to time-lag between learning and market demand.
- **Digital Divide & Cost of New Tech:** Devices, high-speed internet and access to advanced labs or tools are still unevenly distributed, making high-end skilling expensive or inaccessible for many.

- **Over-reliance on Foreign Tech & Platforms:** Heavy dependence on non-Indian AI tools and platforms risks value capture going abroad, while India mostly supplies labour instead of owning IP.
- **Gig Work Without Safety Nets:** Gig and freelance roles can mean income volatility, lack of social security and weak bargaining power, especially for youth with little financial literacy.

WAY AHEAD:

- **Curriculum Reform:** Skills-First & Interdisciplinary: Embed AI, data, digital skills, climate & sustainability across disciplines, with majors + minors and flexibility to mix tech and non-tech domains.
- **Strengthen Vocational & Community-Based Skilling:** Scale ITI, polytechnic and NSDC-led programs, link them to local industry clusters, and build affordable, modular courses in emerging sectors.
- **Democratise Access to Digital & AI Learning:** Expand online platforms, SWAYAM-type courses, blended learning, and subsidizes access to devices and connectivity, particularly in rural and Tier-3 areas.
- **Boost Industry–Academia Collaboration:** Make internships, apprenticeships, live projects and credit-based industry training mandatory and mainstream, not optional add-ons.
- **Invest in Faculty Upskilling:** Continuous faculty development in AI, data science, green tech, biotech, and pedagogy so that teachers can translate new technologies into classroom and lab practice.
- **Focus on Soft Skills & Holistic Development:** Integrate communication, critical thinking, ethics, teamwork and leadership into all programmes through clubs, projects, debates, community work.
- **Promote Indigenous Tech & Multilingual Tools:** Incentivize creation of Indian AI platforms, low-cost EdTech, and multilingual content, ensuring that India is not just a user but also a creator of technology.

25

RISE IN INDIA'S CARBON EMISSIONS

The Global Carbon Project's 2025 assessment shows that India's carbon emissions rose by only 1.4%, a sharp slowdown compared to 4% in 2024.



RISE IN INDIA'S CARBON EMISSIONS:

India's annual carbon emissions arise mainly from fossil fuel use especially coal making it the third-largest global emitter after China and the U.S.

MAJOR TRENDS HIGHLIGHTED IN THE REPORT:

- **Slower Emission Growth in India:** India's carbon emissions rose only **1.4% in 2025**, a sharp drop from **4% in 2024**, driven by good monsoon conditions and faster renewable energy uptake.
- **Global Emissions Still Rising:** Worldwide fossil CO₂ emissions are projected to grow **1.1%**, reaching **38 billion tonnes** pushing the remaining carbon budget for 1.5°C dangerously close to exhaustion.
- **China Shows Moderation:** China's emissions grew only **0.4%**, supported by an unprecedented expansion of renewable energy capacity.
- **Coal Dominance Continues:** India's emissions remain coal-heavy, while global emissions from coal (+0.8%), oil (+1%), and gas (+1.3%) continue to rise.
- **Carbon Budget Nearly Exhausted:** Only **170 billion tonnes** of CO₂ remain for a 1.5°C pathway equivalent to **four years** at current emission rates—making the target almost unattainable.

26**MOON'S SPHERE OF INFLUENCE (MSI)**

ISRO confirmed that the Chandrayaan-3 Propulsion Module (PM) re-entered the Moon's Sphere of Influence (MSI) during its high-altitude Earth-bound orbit, undergoing two lunar flybys.

**WHAT IS THE SPHERE OF INFLUENCE (SOI)?**

In celestial mechanics, the **Sphere of Influence (SOI)** is the region around a celestial body where **its gravitational pull dominates** over all other bodies.

It is used to determine:

- Which body mainly governs an object's orbit
- When spacecraft navigation switches from one celestial reference body to another

WHAT IS THE MOON'S SPHERE OF INFLUENCE (MSI)?**DEFINITION**

The Moon's Sphere of Influence (MSI) is the region around the Moon within which **Moon's gravity becomes stronger than Earth's gravity** for orbital calculations.

VALUE

MSI radius $\approx$ 66,000 km (approx. 66,100 km)

This radius is derived using the Laplace Sphere of Influence formula:

$$r_{SOI} = a * \left(\frac{m}{M}\right)^{\frac{2}{5}}$$

where:

- aaa = average distance between Earth & Moon
- mmm = mass of Moon
- MMM = mass of Earth

WHY IS MSI IMPORTANT FOR LUNAR MISSIONS?

WHEN A SPACECRAFT ENTERS MSI:

- It shifts from **Earth-centered orbit calculations** to **Moon-centered orbit calculations**
- Mission navigation switches reference frame
- Lunar capture maneuver becomes possible

FOR CHANDRAYAAN MISSIONS:

- Entering MSI is the **final step before lunar orbit insertion**
- Spacecraft trajectory changes are controlled by Moon's gravity

FEATURES OF THE SPHERE OF INFLUENCE:

- **Dominant gravitational region:** Moon's gravity governs trajectory integration more strongly than Earth's.
- **Not a physical boundary:** It is a mathematical convenience, not a sharp gravitational cutoff.
- **Both Earth & Moon still influence motion:** Earth still perturbs the orbit inside MSI; Moon still perturbs outside it.
- **Useful for "patched conic" method:** Helps switch from one two-body solution (Earth–craft) to another (Moon–craft).
- **Shape is not perfectly spherical:** It is closer to an **oblate spheroid**, influenced by orbital eccentricity and the Sun.

SIGNIFICANCE:

- **Trajectory Planning:** Determines when spacecraft navigation should shift from Earth-centric to Moon-centric calculations.
- **Critical for Lunar Flybys & Insertions:** Ensures optimal timing for orbit circularisation, braking, or slingshot manoeuvres.
- **Avoids Orbital Uncertainty:** Helps predict perturbations from Earth, Sun, and other lunar orbiters.

CHANDRAYAAN-3 PROPULSION MODULE RE-ENTERING MSI —

WHAT DOES IT MEAN?

ISRO confirmed: “The Chandrayaan-3 Propulsion Module re-entered the Moon’s Sphere of Influence during its high Earth-bound orbit and performed two lunar flybys.”

WHAT THIS INDICATES:

A. HIGH EARTH ORBIT → MOON GRAVITY CAPTURE

The PM was placed in a high elliptical orbit where the **apogee intersected MSI**, enabling:

- Gravitational pull of Moon to influence trajectory
- Natural drift toward lunar region
- Minimal fuel use

B. TWO LUNAR FLYBYS

Flybys allow:

- Trajectory correction
- Orbital energy exchange
- Testing long-duration spacecraft stability
- Extended scientific observations (Spectro-polarimetry of Earth Clouds – SHAPE)

C. FUEL EFFICIENCY

By taking advantage of MSI entry:

- ISRO saved fuel
- Prolonged PM life
- Enabled possible return trajectory experiments

This was similar to gravity assist maneuvers used by NASA, JAXA, ESA missions.

27**DRAFT SEEDS BILL, 2025**

The Government of India has released the Draft Seeds Bill, 2025 for public consultation to overhaul India's seed regulation framework. It aims to **replace the Seeds Act, 1966 and Seeds (Control) Order, 1983** with a modern, farmer-centric and innovation-driven system.

**CONTEXT & WHY THE BILL IS PROPOSED**

- The **Ministry of Agriculture & Farmers Welfare** released the draft Seeds Bill, 2025, to **replace**:
 - The *Seeds Act, 1966*
 - *Seeds (Control) Order, 1983*.
- Goal: Modernize seed regulation for today's **technology-driven agriculture**, large private-sector seed market, and global seed trade.
- The public consultation period for the draft is **open until 11 December 2025**.

MAJOR PROVISIONS & FEATURES**MANDATORY REGISTRATION**

- **Every** seed variety (except some limited exceptions) must be registered before sale or distribution.
- Existing varieties (notified under 1966 Act) are given "deemed registration" for a transitional period.
- Entities required to register: seed producers, seed dealers, processors, nurseries, and certification agencies.

QUALITY REGULATION & TRACEABILITY

- Specifies **minimum seed standards**: germination, genetic purity, health, traits.
- Mandatory **labelling** of seed packets; use of QR codes for traceability (contains variety, origin, quality metrics).
- Establishment or notification of **state and central seed testing laboratories** for scientific assessment.

FARMERS' RIGHTS

- Farmers retain the right to **save, use, exchange, sow, and re-sow** seeds from their harvests (i.e., farm-saved seed).
- However, **selling under a brand name** requires registration.
- Provision for **compensation**: If a registered seed underperforms (i.e., does not deliver claimed performance), farmers can claim compensation under specified conditions.



IMPORT OF SEEDS

- Imports are allowed but regulated: The bill envisions **quarantine standards** and **seed certification norms** for imported seeds.
- Unregistered varieties can be imported for **research/trials** (subject to conditions).

GOVERNANCE & INSTITUTIONAL MECHANISM

- **Central Seed Committee**: To advise the government on policy, regulation, and quality.

- **Registration Sub-Committee** and possibly technical sub-committees for certification and biosafety.

PENALTY & OFFENCE STRUCTURE

- Offences classified into **three categories**: trivial, minor, and major.
 - **Trivial**: e.g., not displaying registration certificate, labeling error → warning then ₹50,000 for repeat.
 - **Minor**: misbranding, over-charging → first-time ₹1 lakh, repeat ₹2 lakh.
 - **Major**: spurious seeds, non-registered variety, running without registration → ₹10 lakh (1st), ₹20 lakhs (2nd in 5 years), **₹30 lakh + cancellation + imprisonment** (repeat) up to 3 years.
- Decriminalization: For small/minor lapses to ease compliance for small seed players.

PRICE REGULATION

- The Bill empowers the **Central Government** to fix prices in “emergent situations” (e.g., seed scarcity or exploitative pricing) to protect farmers.

DISPUTE RESOLUTION & ACCOUNTABILITY

- Designed a mechanism for speedy resolution of seed-related disputes.
- Certification agencies and seed companies are made accountable for meeting promised performance metrics.
- Inspectors will have powers of sample collection, search, seizure, testing.

POTENTIAL BENEFITS / MERITS

- **Improved Seed Quality**: Mitigates the problem of fake, sub-standard seeds affecting farmers.
- **Increased Farmer Protection**: Compensation rights if seeds underperform boost accountability.
- **Enhanced Traceability**: Digital traceability via QR codes helps in tracking seed origin and quality.
- **Innovation Encouragement**: Regulated imports + registered variety mechanism can encourage R&D in new seed varieties.
- **Ease of Doing Business**: Decriminalizing minor offences reduces regulatory burden and helps small seed enterprises.

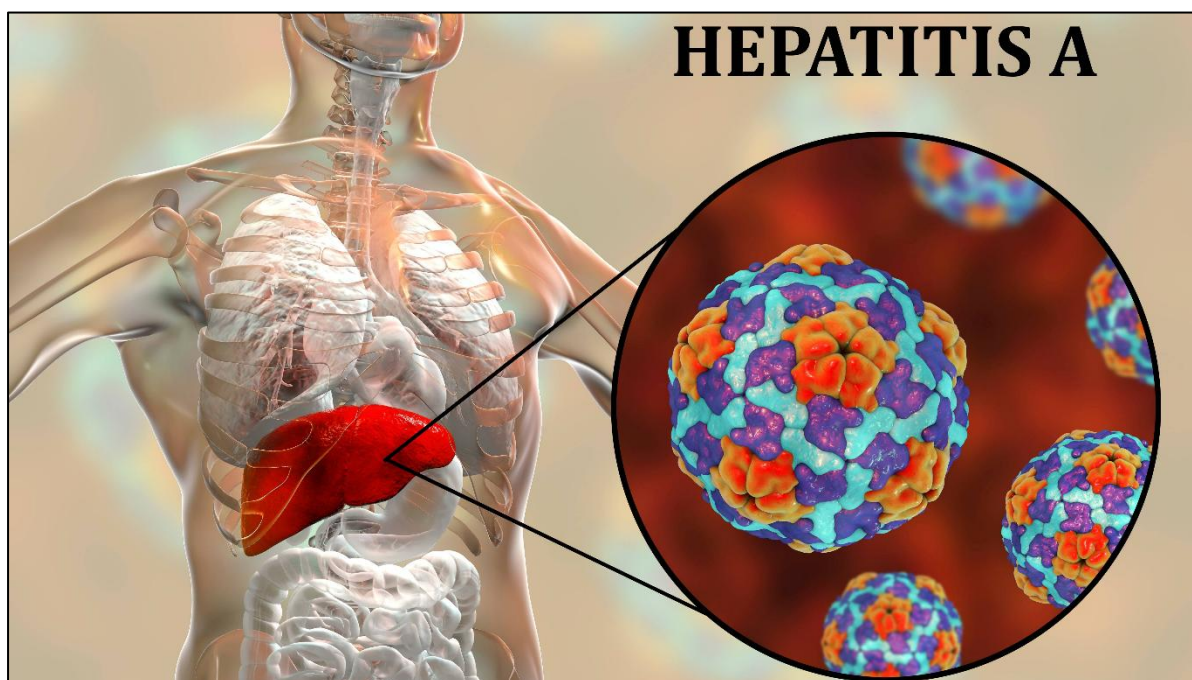
CRITICISMS / RISKS / CHALLENGES

- **Compensation Clause Weak:** Critics say compensation mechanism is not strong enough; may have restrictive conditions.
- **Centralization:** Strong central control (registration, price regulation) could reduce states' flexibility and neglect regional agro-climatic needs.
- **Compliance Burden:** Small and marginal seed producers may struggle to meet registration and testing requirements.
- **Biosafety Concerns:** The Bill's mechanism for GM seed regulation may not be robust enough for environmental safety, some experts warn.
- **Seed Industry Risk:** Heavy penalties for major offences may disincentivize smaller players; risk of over-regulation.
- **Farmer Rights Tension:** While farm-saved seed rights are protected, selling under a brand name requires registration → potential tension between farmer freedom and formal seed markets.

IAS ORIGIN
HERE IT BEGINS

28**HEPATITIS A**

Public health experts are urging that Hepatitis A vaccination be included in India's Universal Immunization Programme (UIP) due to rising outbreaks and declining natural immunity among adolescents and young adults.

**HEPATITIS A:**

Hepatitis A is an **acute viral infection** caused by the Hepatitis A Virus (HAV), leading to inflammation of the liver.

It does **not cause chronic liver disease**, but can result in **severe hepatitis or acute liver failure**, especially in adults.

GEOGRAPHICAL DISTRIBUTION:

- Occurs **worldwide**, with **cyclic outbreaks** and both sporadic and epidemic patterns.
- Highly prevalent in **low- and middle-income regions** with poor sanitation—most children get infected early in life.
- Low prevalence in high-income countries, but outbreaks occur in specific risk groups (MSM, PWID, travellers, homeless communities).

MODE OF TRANSMISSION (VECTOR/ROUTE):

- (Hepatitis A has **no vector**; transmission is faeco-oral.)

- Ingestion of **contaminated food or water**.
- Direct contact with an infected person, including **poor hygiene**, dirty hands, or **oral-anal sexual contact**.
- Household transmission common when infected individuals handle food.
- Waterborne outbreaks linked to **sewage contamination**.
- **Symptoms:** Fever, malaise, loss of appetite, Nausea, diarrhoea, abdominal discomfort, Dark urine and jaundice.

TREATMENT:

- **No specific antiviral treatment** exists.
- Hospitalisation only for **severe disease or acute liver failure**.

UNIVERSAL IMMUNISATION PROGRAMME (UIP):

India's largest public-health vaccination programme providing **free immunisation** to all children and pregnant women against major **vaccine-preventable diseases**. It is one of the **largest immunisation programmes globally**.

LAUNCHED IN:

- **1978** – as **Expanded Programme on Immunization (EPI)**
- **1985** – renamed & expanded as **Universal Immunization Programme (UIP)**
- Nationwide coverage achieved by **1989–90**

The infographic is titled "Discover the power of the Universal Immunization Programme (UIP)!" and is set against a dark red background. At the top, it features the Government of India emblem and the text "Ministry of Health and Family Welfare, Government of India". To the right, a cartoon character is being vaccinated by a large syringe. The text "Get vaccinated against 12 vaccine-preventable diseases at no cost." is displayed. Below this, two columns list available vaccines. The left column, titled "Vaccines available nationally against these 11 diseases", lists: Diphtheria, Pertussis, Tetanus, Polio, Measles, Rubella, Rotavirus diarrhea, Hepatitis B, Meningitis, Severe form of childhood Tuberculosis, and Pneumonia caused by Hemophilus Influenza type B and Pneumococcal Pneumonia. The right column, titled "Vaccine available sub-nationally against 1 disease", lists: Japanese Encephalitis, JE vaccine is provided only in endemic districts. At the bottom right, there is an illustration of a shield with a cross and a syringe.

Ministry of Health and Family Welfare
Government of India

Discover the power of the Universal Immunization Programme (UIP)!

Get vaccinated against **12** vaccine-preventable diseases at no cost.

Vaccines available nationally against these 11 diseases

- Diphtheria
- Pertussis
- Tetanus
- Polio
- Measles
- Rubella
- Rotavirus diarrhea
- Hepatitis B
- Meningitis
- Severe form of childhood Tuberculosis
- Pneumonia caused by Hemophilus Influenza type B and Pneumococcal Pneumonia

Vaccine available sub-nationally against 1 disease

- Japanese Encephalitis, JE vaccine is provided only in endemic districts

KEY COMPONENTS OF UIP:

- **Strategy & Policy:**
 - Guided by National Health Policy, National Vaccine Policy & NTAGI recommendations.
- **Cold Chain, Vaccines & Logistics:**
 - ~30,000 Cold Chain Points; ILRs, Deep Freezers, WIC/WIFs, vaccine vans.
 - Uses eVIN for real-time stock & temperature monitoring.
 - Injection Safety & Waste Disposal: AD syringes, hub-cutters, CPCB-compliant biomedical waste disposal.
- **AEFI Surveillance System:**
 - Structured multi-level reporting since 1988.
 - SAFEVAC portal for real-time AEFI reporting.
- **Training:**
 - Standardized training for MOs, health workers, cold-chain technicians (NCCTC Pune, NCCVMRC Delhi).

IAS ORIGIN
HERE IT BEGINS

29

AI-BASED LOCKING MONITORING SYSTEM CALLED 'DRISHTI'

Indian Railways is set to install an AI-based Locking Monitoring System called 'DRISHTI' to enhance freight train security by detecting tampered or unlocked wagon doors in real time.



WHAT IS DRISHTI?

- **DRISHTI** is an **AI-based surveillance and locking-condition monitoring system** developed for **Indian Railways' freight wagons**.
- Developed by a collaboration between:
 - **Northeast Frontier Railway (NFR)**
 - **IIT Guwahati Technology Innovation & Development Foundation (IITG-TIDF)**
- **Purpose:** Real-time detection of unlocked, tampered, or improperly locked doors of freight wagons during transit, without needing to stop the train.

WHY IS DRISHTI NEEDED?

- Freight wagons travel for long distances, often through remote or difficult terrain. Manual checks of door locks are:
 - Time-consuming
 - Labor-intensive
 - Risky / not reliable under movement conditions
- Tampered or unlocked doors on wagons pose:

- Security risk: pilferage, theft
- Safety risk: cargo loss, accidents
- Operational inefficiencies: manual checking leads to slowdowns and human error
- Thus, a automated, AI-driven solution like DRISHTI can drastically improve security, reliability, and efficiency.

HOW DOES DRISHTI WORK? (TECHNOLOGY DETAILS)

- **Cameras & Sensors:** AI-powered cameras (high-speed imaging) and sensors are mounted strategically on wagons to monitor door-lock mechanisms.
- **Computer Vision + Machine Learning:** Video feed is continuously analysed using computer vision + ML to check:
 - Door position (open / closed)
 - Locking status (locked, partially locked, tampered)
 - Any anomaly (sudden unlock, tampering)
- **Real-Time Alerts:** When the system detects abnormal behavior (e.g., tampering), it generates automated alerts to a control center without disrupting the movement of the train.
- **Data Analytics & Logging:** All events are logged, giving a data trail for audit, investigation, and accountability. It also helps in predictive maintenance or identifying recurring security risks.
- **On-Train Integration:** The design ensures the system works **while the train is in motion**, not only at static checkpoints.
- **Prototype Trial:** The system has been under a trial for **around 10 months** on selected wagons; early results show good accuracy.

KEY FEATURES & ADVANTAGES

- **Real-Time Monitoring:** Constant tracking of locking conditions → immediate detection of issues.
- **Reduced Human Intervention:** Less reliance on manual inspections → frees up manpower.
- **Enhanced Security:** Helps prevent theft, tampering, and pilferage by ensuring wagon doors remain properly locked.
- **Operational Efficiency:** Since the system works in motion, there's no need for frequent halts just to check doors.

- **Transparency:** Data-driven system adds accountability; every anomaly is tracked and logged.
- **Scalability:** Designed to be scalable across the NFR network, and potentially other freight corridors.
- **Indigenous Innovation:** Developed by Indian Railways and IIT Guwahati — strengthens Make-in-India push in transport technology.

CHALLENGES / RISKS / CONSIDERATIONS

- **Cost of Deployment:** Installing AI-powered cameras & sensors on large numbers of wagons might be expensive.
- **Data Infrastructure:** Need reliable data communication infrastructure to transmit real-time data from moving wagons to control centers.
- **False Alarms:** AI-based anomaly detection may generate false positives → must fine-tune model to minimize false alerts.
- **Maintenance:** Hardware (cameras/sensors) needs regular maintenance and calibration.
- **Privacy & Security:** Data generated needs secure storage and proper access controls.
- **Scalability:** While prototype is successful, large-scale roll-out requires logistics, training, and integration with existing railway systems.
- **Integration with Legacy Systems:** Needs to be smoothly integrated with Indian Railways' current control and monitoring systems.

STRATEGIC & POLICY IMPLICATIONS

- **Freight Security:** Enhances security of goods trains reduces risk of pilferage, strengthening India's supply chain.
- **Rail Modernization:** Fits into broader push by Indian Railways toward digitization, automation, and AI-enabled operations.
- **Public-Private / Academia Cooperation:** Example of **industry-academia partnership** (NFR + IIT Guwahati).
- **Safety Assurance:** Can become part of safety protocols, particularly in sensitive or high-value freight corridors.
- **Smart Infrastructure:** Reinforces the concept of "Smart Railways" as part of India's infrastructure development strategy.
- **Economic Loss Reduction:** Preventing cargo theft / damage → reduces economic loss and improves freight reliability → benefits trade and economy.

30**NEW MANGALORE PORT**

The Government of India has launched ₹1,500 crore worth of modernisation projects at the New Mangalore Port as part of its Golden Jubilee (50 years) celebrations in 2025.

**NEW MANGALORE PORT (NMP):**

New Mangalore Port is an **all-weather, deep inner-harbour major port** on India's west coast, and the **only major port in Karnataka**. It is among India's **top 10 major ports** and a key gateway for petroleum, coal, container, and agricultural cargo.

LOCATION:

- Situated at **Panambur, Mangaluru**, on the **Arabian Sea** coast.
- Lies north of the **Gurupur (Phalguni) River** estuary.
- 170 nautical miles south of Mormugao Port (Goa) and 191 nautical miles north of Kochi Port.

ESTABLISHED IN:

- **1962** – Mangalore Harbour Project initiated
- **1968** – Maritime works commenced
- **4 May 1974** – Declared India's 9th Major Port
- **11 January 1975** – Formally inaugurated by PM Indira Gandhi
- **1 April 1980** – Came under Major Port Trust Act, 1963
- **3 November 2021** – Renamed as New Mangalore Port Authority (NMPA) under the Major Port Authorities Act, 2021

HISTORY:

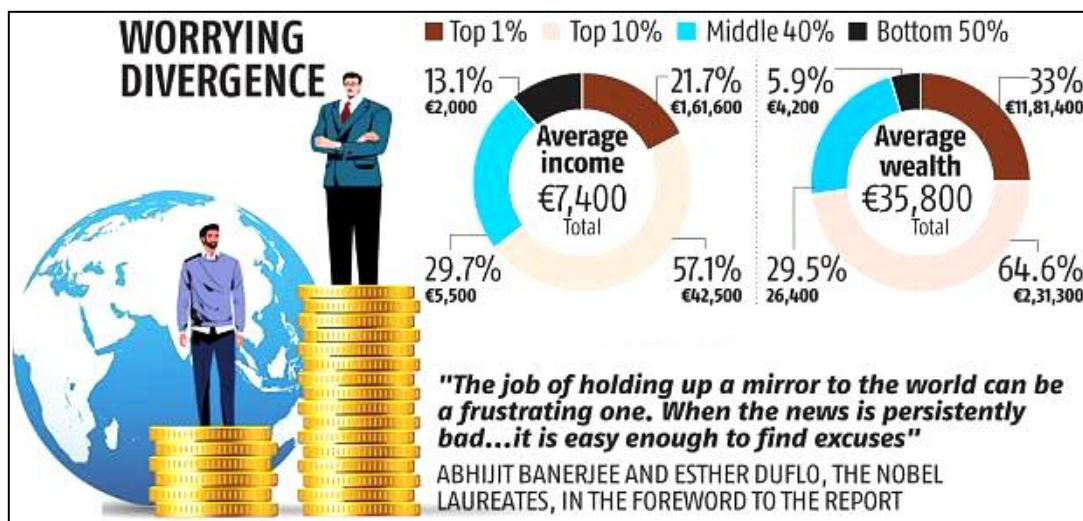
- Ancient port city referenced in **Roman, Greek, and Ptolemaic** records; known as **Mangala** in classical geography.
- Arab traders used the port for spice and silk trade during the **Vijayanagara Empire**.
- Old Mangalore Port (Bunder) became inadequate for rising trade needs, leading to the creation of a new deep-water port at Panambur.
- Grew from handling <1 lakh tonnes to **46 million tonnes (2024–25)**.

KEY FEATURES:

- Deepest inner harbour on India's west coast.
- **Total area:** ~480 hectares (1,200 acres).
- **Handles major export cargo:** POL products, iron ore pellets, container cargo.
- **Handles major import cargo:** crude oil (for MRPL), coal, fertilizer, edible oil, liquid chemicals, containers.
- Excellent connectivity via **NH-66, Konkan Railway (Surathkal station)** and **Mangaluru International Airport**.
- Plays a vital role in **export-led growth**, reducing logistics costs, and supporting Karnataka's industrial hinterland.

31**GLOBAL INEQUALITY REPORT 2025**

The **Global Inequality Report 2025** was recently commissioned by the **South African Presidency of the G20**. It was prepared by the **G20 Extraordinary Committee of Independent Experts on Global Inequality**, led by Nobel laureate **Joseph E. Stiglitz**.

**WHAT IS THE "GLOBAL INEQUALITY REPORT 2025"?**

- It is a major report on global income and wealth inequality commissioned by the **South African Presidency of the G20**.
- Prepared by a **G20 Extraordinary Committee of Independent Experts on Global Inequality**, chaired by Nobel laureate **Joseph E. Stiglitz**.
- Released ahead of the **G20 Summit**, highlighting inequality as a systemic risk to economic, social, and political stability.

KEY FINDINGS OF THE REPORT

- **Wealth Concentration at the Top**
 - Globally, the **richest 1% captured 41% of all newly generated wealth** between 2000 and 2024.
 - By contrast, the **bottom 50% of the world's population got only about 1% of that new wealth**.
 - This indicates an extreme skew in wealth creation and accumulation.
- **Income Inequality Is High in Most Countries**
 - Around **83% of countries**, accounting for nearly **90% of the world population**, have **Gini coefficients above 0.40**, indicating high income inequality.

- Despite some convergence (e.g., developing economies catching up), **within-country inequality** remains very serious.
- **Food Insecurity and Social Risk**
 - Approximately **2.3 billion people** (1 in 4 globally) now suffer moderate or severe **food insecurity**.
 - Since 2019, about **335 million more people** have become food insecure.
 - High inequality contributes to fragility, social unrest, and democratic erosion.
- **Intergenerational & Inherited Inequality**
 - A large portion of wealth is being passed down: the report projects around **US\$ 70 trillion inheritance** in the next decade, potentially exacerbating inequality across generations.
 - This inheritance dynamic reinforces **intergenerational concentration of wealth**.
- **Capital vs Labour Share**
 - In many countries (56% of them, per one analysis), the income share of **capital (returns on investment)** is rising, while the **labor share (wages)** is declining.
 - This trend favors the wealthy, who own more capital, over workers whose income depends on labor.



- **Perceptions of Inequality**

- According to global surveys (e.g., Pew Research), a **majority in many countries** see inequality as a “very big problem.”
- Many point to **wealthy people having too much political influence** as a key driver.

- **Social Crisis Warning**

- The UN’s *World Social Report 2025* warns of a **global social crisis** driven by inequality, economic insecurity, and erosion of trust.
- More than **2.8 billion people** live on daily incomes of **US\$ 2.15–6.85**, making even moderate inequality a huge risk.

KEY DRIVERS OF THE INEQUALITY

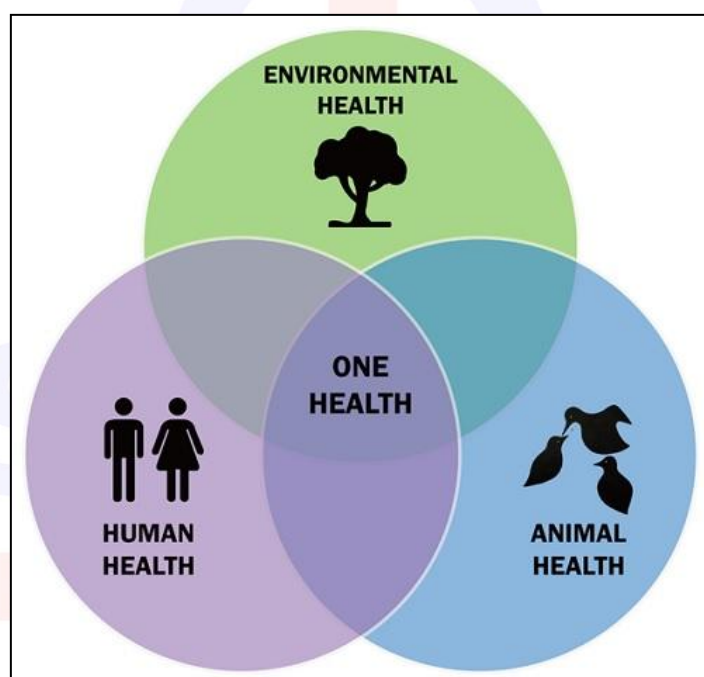
- **Capital Dominance:** Since 1990, **56% of countries** have seen a rise in income **share for capital**, while the overall labour share has declined globally.
- **Concentrated Ownership:** Nearly **85%** of the population **derives no income from capital**, highlighting the extreme concentration in capital ownership.
- **Wage Disparity:** Between 2019 and 2024, the average CEO pay increased by 50%, while the average **worker’s income** rose by **less than 1%**.
- **Public Wealth Erosion:** Rapid **private wealth growth** outpaced **public asset expansion**, leading to governments with high net debt and limited investment capacity.

32**NATIONAL ONE HEALTH MISSION**

The government will soon launch the National One Health Mission with a budget of ₹383 crore to unify the **human, animal, and environmental health sectors**.

WHAT IS THE NATIONAL ONE HEALTH MISSION?

- The **National One Health Mission (NOHM)** is a **cross-ministerial initiative** in India that integrates **human, animal, and environmental health**.
- It was approved by the **Prime Minister's Science, Technology, and Innovation Advisory Council (PM-STIAC)**.
- Implementing agency: **Indian Council of Medical Research (ICMR)** is a key stakeholder.
- The **National Institute of One Health (NIOH)**, Nagpur, has been approved by the Cabinet, and its director will also serve as mission head.

**WHY WAS THE MISSION LAUNCHED?**

- India faces a **high risk of zoonotic disease spillover** due to:
 - Dense human population
 - Large livestock population
 - Rich biodiversity / wildlife interfaces.
- Past and potential future pandemics: COVID-19, bird flu, Nipah, etc. show need for **integrated surveillance**.

- Antimicrobial resistance (AMR) is a growing threat, arising from overuse of antibiotics in **both humans and animals**.
- Interconnected environmental factors (water, climate, wildlife) underline that health cannot be siloed — “One Health” approach needed.

VISION & OBJECTIVES

According to the mission’s own description:

- Achieve **integrated disease surveillance** (human-animal-environment) to detect endemic, epidemic and pandemic threats.
- Build **early warning systems** and real-time data platforms for zoonoses.
- Strengthen **R&D** for vaccines, diagnostics, and therapeutics across sectors.
- Enhance **laboratory and biosafety capacity**, including BSL-3 / BSL-4 labs.
- Promote **capacity building**: train public health staff, veterinarians, researchers.
- Institutionalize governance and coordination across ministries, states, and scientific agencies.
- Involve community participation and integrate environmental health (water, wildlife, ecosystem) in surveillance.

GOVERNANCE & INSTITUTIONAL MECHANISM

- **Executive Committee:**
 - Chaired by the Minister of Health & Family Welfare, with the **Principal Scientific Adviser (PSA)** as vice-chair.
 - Includes secretaries from various ministries & two states (on a rotating basis).
- **Scientific Steering Committee:**
 - Chaired by the **PSA**.
 - Includes heads / secretaries of stakeholder ministries and state representation.
- **Cross-Ministerial Framework:**
 - Involves 13+ ministries / departments (Human Health, Animal Husbandry, Environment, Agriculture, etc.).
- **Funding:**
 - Government has approved ₹ **386.86 crore** until 2027-28 for One Health coordination & R&D under **PM Ayushman Bharat Health Infrastructure Mission**.

KEY COMPONENTS / INITIATIVES

- **Integrated Surveillance**

- Combine data from human health systems, animal health, wildlife, environment.
- Use sentinel-based systems (e.g., at bird sanctuaries, markets, water bodies) for early detection.



- **Laboratory Network**

- Build / use BSL-3 / BSL-4 labs to test high-risk and emerging pathogens.

- **Research & Innovation**

- Develop new vaccines, diagnostics, therapeutics; streamline regulatory approvals.
- Use modeling, AI / ML, data analytics for disease prediction and decision support.

- **Rapid Response Mechanism**

- Create **Rapid Response Teams (RRTs)** for outbreak investigation and containment.
- Real-time integrated outbreak response across sectors.

- **Data Integration & Sharing**

- Federated data systems to connect human, animal, environmental health databases.
- Unified dashboard (“One Health Dashboard”) launched to improve data visibility and coordination.

- **Community Engagement & Youth Involvement**
 - Engaging youth via dedicated youth engagement programs.
 - Training / capacity building in local communities, health workers, veterinarians.
- **AMR Focus**
 - Rational antibiotic use in humans and animals to address antimicrobial resistance.

SIGNIFICANCE & STRATEGIC IMPORTANCE

- **Pandemic Preparedness:** Institutionalizes a **proactive, multi-sector response** to zoonotic and emerging disease threats, not just reactive.
- **Public Health Security:** Strengthens national capacity to detect and control zoonoses (e.g., Nipah, bird flu) early.
- **Sustainable Development:** One Health aligns with SDG goals (health, environment, biodiversity).
- **AMR Control:** By integrating animal and human health, the mission helps tackle antimicrobial resistance, a major global threat.
- **Resource Efficiency:** Prevents duplication of surveillance systems; optimizes use of labs, data, manpower.
- **Inter-Ministerial Cooperation:** Promotes coordination across many departments – health, agriculture, environment – optimizing governance.
- **Economic Resilience:** Reduces risk from disease outbreaks that can hurt livestock, wildlife economies, and human health together.



CHALLENGES / RISKS

- **Coordination Challenge:** Managing 13+ ministries / departments; needs strong institutional mechanism.
- **Data Sharing Risks:** Integration of diverse data sources (human, animal, environment) raises concerns of privacy, interoperability.
- **Infrastructure Gaps:** Not all regions may have BSL-3 labs, diagnostic capacity, data infrastructure.
- **Sustained Funding:** Initial funds approved, but long-term budget commitment will be key.
- **Field Capacity:** Training of veterinarians, wildlife health workers, environmental scientists is needed.
- **Community Participation:** Engaging remote / rural communities in surveillance and reporting is difficult.
- **Regulatory Bottlenecks:** Approvals for trials, research across sectors may be slow; need streamlined regulatory frameworks.

ABOUT THE ONE HEALTH APPROACH

- It is a **collaborative, multisectoral, and transdisciplinary strategy** to sustainably balance and optimise human, animal, and environmental health.
- The One Health approach recognizes that nearly **75%** of new human diseases **originate from animals**, requiring a coordinated effort to tackle emerging threats.
- **Key Integration:** It unites **zoonotic surveillance, AMR regulation, food-safety controls, and ecological protection** to reduce cross-species transmission.
- **Global Collaboration:** The WHO, FAO, WOAH, and UNEP formally endorse the framework.

33

SEBI WARNS AGAINST DIGITAL GOLD INVESTMENTS

Securities and Exchange Board of India (SEBI) has issued a **public advisory** cautioning investors against **investing in digital gold** and **e-gold products**.

WHAT IS DIGITAL GOLD?

- Digital gold refers to the **online purchase of gold** without physically possessing it.
- The **value of digital gold is linked to the price of physical gold**, and it is often created and traded using blockchain technology.
- It allows investors to **buy, sell, and store gold electronically** and even **convert holdings** into physical gold, such as coins, bars, or jewelry.
- **Advantages:** Eliminates **storage and security concerns**, enables investment in **small denominations** and **offers quick liquidity** during emergencies.

WHY DID SEBI ISSUE A WARNING?

- SEBI noted that several digital platforms are **marketing digital gold** as an investment alternative to physical gold, **without regulatory oversight**.
- Such products are **neither classified as securities** nor **regulated as commodity derivatives**, meaning they operate **outside SEBI's jurisdiction**.

WHAT DOES SEBI SUGGEST AS SAFER ALTERNATIVES?

In its advisory, SEBI recommends investors consider **regulated gold investment products** instead of unregulated digital gold:

- **Gold ETFs** (Exchange-Traded Funds) offered by mutual funds regulated by SEBI.
- **Electronic Gold Receipts (EGRs)** traded on stock exchanges with regulatory oversight.
- **Exchange-traded commodity derivative contracts** on gold.

These instruments come with **better transparency, regulatory oversight, and investor protection**.

RISKS ASSOCIATED WITH DIGITAL GOLD

- **Lack of Regulation:** Operates **outside SEBI's framework**, making **redressal difficult** in case of disputes or fraud.

- **Counterparty Risk:** Since digital gold is **not traded on exchanges**, investors **depend entirely** on the **platform's reliability**. A default or insolvency can lead to a total loss.
- **Operational Risk:** Issues such as mismanagement, technical glitches, or fraudulent storage claims pose additional threats.
- **No Transparency:** Absence of standardised pricing and storage audits increases investor vulnerability.
- **Market Influence:** Aggressive marketing & social media promotions often obscure the associated risks.

SEBI-APPROVED AVENUES FOR SAFE GOLD INVESTMENT

SEBI recommends **investors opt** for regulated gold investment products such as:

- **Gold Exchange-Traded Funds (ETFs):** Traded on stock exchanges, backed by physical gold holdings, and governed by SEBI norms.
- **Sovereign Gold Bonds (SGBs):** Issued by the RBI on behalf of the government, offering fixed interest and capital appreciation.
- **Electronic Gold Receipts (EGRs):** Tradeable instruments on exchanges representing actual gold holdings.
- **Commodity Derivatives (MCX/NSE):** Offer exposure to gold prices with risk management, mark-to-market settlements, and clearing corporation guarantees, reducing default risks.

34**HUMBOLDT PENGUIN (SPHENISCUS HUMBOLDTI)**

Chile's Ministry of the Environment has reclassified the Humboldt penguin as 'endangered' within the country, due to a decline of over 50% in its population since the late 1990s.

**TAXONOMY**

- **Scientific name:** *Spheniscus humboldti*
- **Family:** Spheniscidae
- **Genus:** *Spheniscus* (Band penguins)
- Related to **Magellanic**, **African**, and **Galápagos** penguins.

GEOGRAPHIC RANGE

- Native to the **western coast of South America**.
- Found in **Peru and northern Chile** (Pacific coastline).
- Named after the **Humboldt Current** — a cold, nutrient-rich current that supports vast marine life.

HABITAT

- Coastal deserts, rocky shores, islands with caves, crevices, guano deposits (used for nesting).
- Dependent on nutrient-rich waters from **upwelling zones** of the Humboldt Current.

PHYSICAL FEATURES

- Medium-sized: **65–70 cm tall**, weight **4–5.5 kg**.
- Black head with a white border running from behind the eye, around the black ear-coverts, and chin.
- A pink fleshy patch on the face helps thermoregulation.

CONSERVATION STATUS

- **IUCN:** *Vulnerable (VU)*
- **CITES:** Appendix I
- **CMS:** Appendix I
- **Peru & Chile:** Protected species
- **WAZA (zoos):** Part of breeding programmes.

THREATS

- **El Niño events:** Reduce fish availability → starvation & breeding failure.
- **Overfishing** (anchovies, sardines) → reduces primary food supply.
- **Habitat loss**, especially due to **guano mining**.
- **Bycatch** in gillnets.
- **Pollution:** Oil spills, plastic ingestion.
- **Climate change**, warming oceans → disrupts cold current & fish patterns.

DIET

- Primarily **anchovies**, **sardines**, and small fish.
- Also, squid and crustaceans.

REPRODUCTION

- Breeds throughout the year depending on food availability.
- Usually lays **two eggs** in burrows or guano nests.
- Both parents take turns incubating.

35

NATIONAL BIODIVERSITY AUTHORITY

The **National Biodiversity Authority (NBA)** released ₹43.22 lakh in patent-linked **Access and Benefit Sharing (ABS) funds** to reward biodiversity contributors.



NATIONAL BIODIVERSITY AUTHORITY (NBA)

INTRODUCTION

- **Established:** 2003
- **Legal Basis:** Biological Diversity Act, 2002 (India)
- **Purpose:** To implement **provisions of the BD Act** and promote **conservation, sustainable use, and equitable sharing of benefits arising from biological resources and traditional knowledge.**

OBJECTIVES

- **Regulate access to biological resources** by Indian citizens, companies, and foreign entities.
- **Ensure fair and equitable benefit sharing** from the use of biological resources and traditional knowledge.
- Advise **Central Government** on biodiversity conservation and sustainable use policies.
- Support **State Biodiversity Boards (SBBs)** and **Biodiversity Management Committees (BMCs).**

FUNCTIONS

- **Grant approvals** for access to Indian biological resources and associated knowledge by Indian and foreign entities.
- **Regulate commercial utilization** of bio-resources.
- **Facilitate benefit sharing** with local communities/traditional knowledge holders.
- **Documentation** of traditional knowledge through **People's Biodiversity Registers (PBRs)**.
- **Policy and research support:** Advises government on conservation, sustainable use, and ABS (Access and Benefit Sharing) matters.

STRUCTURE

- **Chairperson:** Appointed by Central Government
- **Members:** Experts in biodiversity, law, environment, and industry
- **Secretariat:** Supports day-to-day functioning
- **State Level:** State Biodiversity Boards (SBBs)
- **Local Level:** Biodiversity Management Committees (BMCs)

POWERS

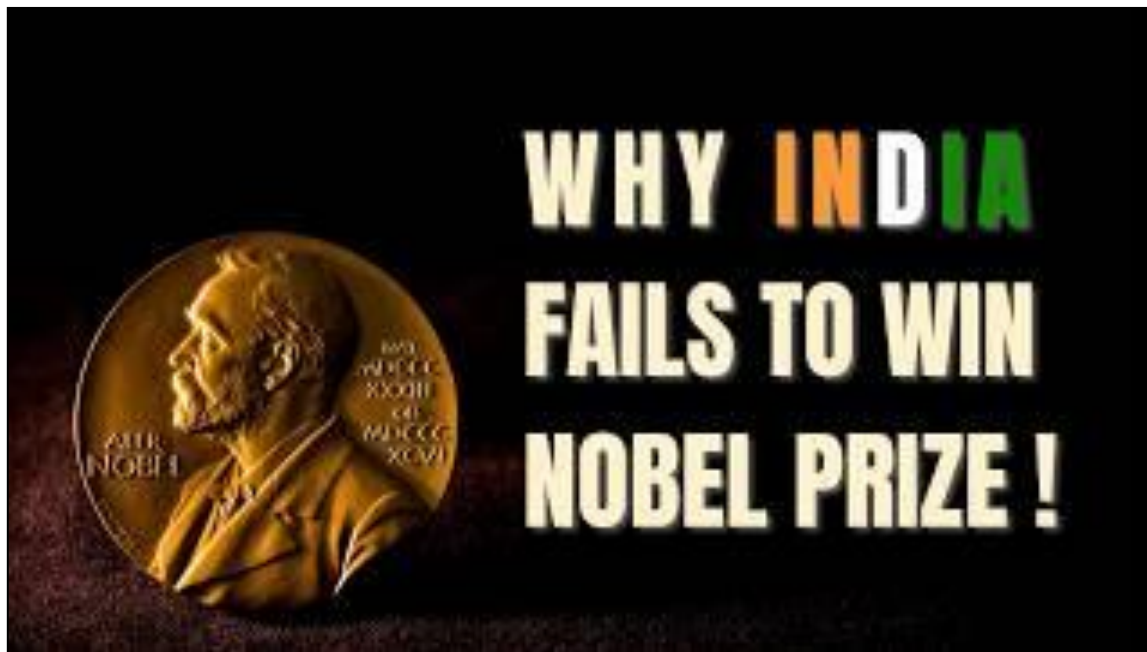
- Authority to **take action against violation** of the Biological Diversity Act.
- **Penalties:** Can impose fines and prosecute entities misusing biological resources.
- **Guidelines:** Issues ABS guidelines and monitors implementation.

RELEVANCE TO INDIA

- India is **one of the 17 megadiverse countries**.
- NBA ensures **biological resources are protected** while **benefits reach local communities**.
- Example: Turmeric patent case → NBA successfully **revoked foreign patent claims** based on Indian traditional knowledge.

36**ISSUE TO PRODUCE INDIAN NOBEL LAUREATE**

India has not produced a Nobel laureate in science in nearly a century, despite a vast scientific talent base and expanding research network.

**CURRENT STATUS OF INDIAN SCIENCE AND R&D**

- **Low Research Investment:** India's R&D expenditure remains at **0.7% of GDP**, far below **China (2.4%)**, **Japan (3.3%)**, and **South Korea (4.9%)** (UNESCO, 2023).
- **Public-Dominated Research:** Over **80% of total R&D** spending comes from government sources, while the private sector's share remains **under 15%** (DST, 2024).
- **Talent Drain:** India contributes **nearly 10% of global STEM graduates**, yet loses thousands of researchers annually to advanced ecosystems abroad.
- **Publication-Innovation Gap:** India ranks **3rd globally** in research output but **only 36th in citation impact** (Scopus, 2024), reflecting a focus on volume, not value.
- **Fragmented Institutions:** The country hosts over **1,400 R&D institutions**, but many operate in silos with limited inter-agency collaboration

BARRIERS TO SCIENTIFIC EXCELLENCE IN INDIA

- **Opaque Recruitment:** Hiring in major research institutions lacks transparency, with reports of regional bias and patronage overshadowing merit-based selection (CAG, 2022).

- **Weak Research Infrastructure:** Equipment shortages and maintenance delays, especially in universities, result in under-utilisation of up to **40% of laboratory capacity (NITI Aayog, 2023)**.
- **Leadership Deficit:** Top posts in bodies like the Council of Scientific and Industrial Research and Department of Biotechnology (DBT) often remain vacant for long periods (Parliamentary Committee, 2020).
- **Overlapping Governance:** The **2021 NITI Aayog Science and Technology Index** found overlapping mandates among agencies, causing duplication and underutilisation of research grants.

WAY FORWARD

- **Younger Leadership:** Reserve half of top posts – **Directors, Vice-Chancellors, and Secretaries of DST/DBT/CSIR** – for mid-career scientists (40–50 years), replicating the **reformist model** once led by **Homi Bhabha and Vikram Sarabhai**.
- **Higher R&D Spending:** Raise research outlay to **3% of GDP** as envisaged in **STIP-2020**, with separate funds for basic sciences, clean energy, and space technology to build global-scale labs.
- **Industry Collaboration:** Provide tax credits and grants for companies partnering with public labs – similar to the **ISRO-L&T** and **DRDO-Tata Advanced Systems** models to scale applied research.
- **Outcome-based evaluation:** Under the **National Research Foundation (NRF)**, rank institutions by patents, technology transfers, and societal impact instead of publication count.

37**ADITYA-L1**

The VELC onboard Aditya-L1 has enabled the first spectroscopic observation of a coronal mass ejection (CME) in the visible wavelength range.

**BACKGROUND**

- **Aditya-L1:** India's first **solar observation mission** by ISRO, launched in **2023**.
- **Objective:** Study **Sun's outermost layer (corona)**, solar emissions, and their impact on space weather.
- **Orbit:** Positioned at **L1 Lagrangian Point (~1.5 million km from Earth)** → continuous, uninterrupted solar observation.

WHAT IS VELC?

- **Full form:** **Visible Emission Line Coronagraph**
- **Type:** Coronagraph (instrument to block Sun's bright disk and study faint corona)
- **Function:**
 - Observes **solar corona in visible wavelengths** (mainly green line at 530.3 nm, corresponding to Fe XIV emission).
 - Measures **velocity, temperature, density** of coronal plasma.
 - Detects **Coronal Mass Ejections (CMEs)** — massive eruptions of plasma and magnetic field.

WHAT IS A CORONAL MASS EJECTION (CME)?

- **Definition:** A **large-scale eruption** of magnetized plasma from the Sun's corona into space.
- **Characteristics:**
 - Travels at **400–3000 km/s**.
 - Can reach **Earth in 1–4 days**, causing geomagnetic storms.
- **Impact on Earth:**
 - Disturbs **satellite operations, power grids, and communication systems**.
 - Triggers **auroras** in polar regions.

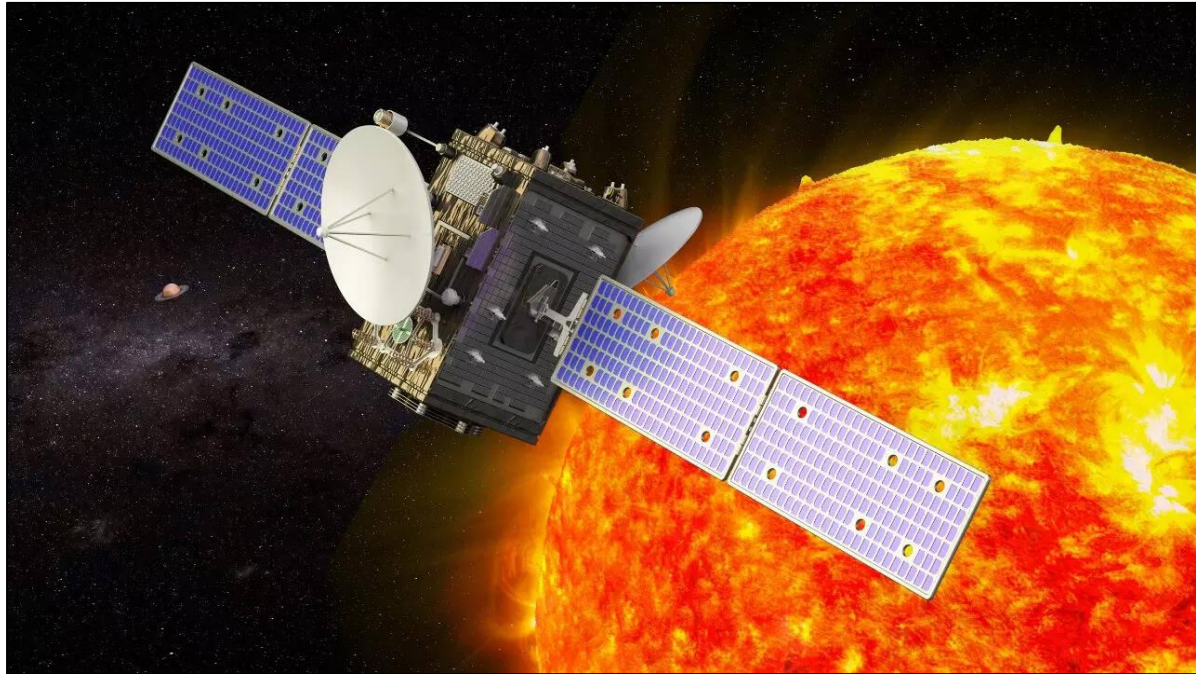
WHY IS THIS OBSERVATION SIGNIFICANT?

- **First Spectroscopic Observation in Visible Wavelength**
 - Earlier CME studies mostly used **X-ray, UV, or radio wavelengths**.
 - Visible light spectroscopy provides **direct measurement of plasma velocity and temperature**.
- **Indian Achievement**
 - Confirms India's capability in **advanced solar physics and space weather research**.
- **Scientific Applications**
 - Better **prediction of space weather events** → protection of satellites, communication, and power grids.
 - Provides data for **solar corona heating studies**, a major unsolved problem in astrophysics.

INSTRUMENT CAPABILITIES

Feature	VELC (Aditya-L1)
Wavelength	500–550 nm (visible green line, Fe XIV)
Function	Imaging + spectroscopy of corona
CME Detection	First-ever spectroscopic measurements in visible light

Velocity Measurement	Doppler shift of emission lines
Temperature & Density	Derived from line intensity ratios



KEY FINDINGS AND PARAMETERS

- **Electron Density:** The CME contained about **370 million electrons** per cubic centimeter much higher than the 10–100 million in the normal corona.
- **Energy:** Its energy was estimated at **9.4×10^{21} joules**, which significantly exceeds the energy of WWII atomic bombs.
- **Mass and Speed:** The CME had a mass of about **270 million tonnes** and an initial velocity of **264 km/sec**, with plasma **temperatures** reaching nearly **1.8 million Kelvin**.

38**LAKE TURKANA**

A recent study found that changes in Lake Turkana's water levels affected fault movement and magma generation, showing a direct link between climate change and tectonic processes.

**LAKE TURKANA****LOCATION**

- **Region:** Northern Kenya, extends slightly into Ethiopia (Omo River inflow).
- **Coordinates:** ~3°N, 36°E
- **Type:** Endorheic lake (no outflow, saline)

PHYSICAL FEATURES

- **Area:** ~6,405 km² (largest desert lake in the world)
- **Length:** ~290 km
- **Width:** 32–32 km (varies)
- **Depth:** Average 30 m, max 109 m

- **Salinity:** Slightly saline, high evaporation rate due to arid climate
- **Elevation:** ~360 m above sea level

HYDROLOGY

- **Inflow:** Primarily **Omo River** from Ethiopia (~90% of water input)
- **Outflow:** None; **endorheic basin** → water lost through evaporation
- **Water level fluctuations:** Highly dependent on **seasonal rainfall** and **Omo River inflow**

GEOLOGY & PALEONTOLOGY

- Region called the “**Cradle of Humankind**”
- Numerous **hominid fossils** found → Australopithecus, Homo habilis, Homo erectus
- Important for understanding **human evolution and prehistoric archaeology**

BIODIVERSITY

- **Flora:** Desert-adapted shrubs, reeds along the shore
- **Fauna:**
 - Fish: Nile tilapia, catfish (important for local fisheries)
 - Birds: Flamingos, pelicans, herons
 - Crocodiles along the shore

SOCIO-ECONOMIC IMPORTANCE

- **Fisheries:** Lake Turkana supports **livelihoods of local communities** (Turkana people)
- **Hydropower potential:** Ethiopia’s **Gibe III Dam** on Omo River → affects water inflow
- **Tourism:** Known for **archaeological sites, flamingo colonies, and desert landscapes**

THREATS

- **Climate change:** Increasing temperatures → higher evaporation → falling water levels
- **Dam projects:** Gibe III Dam reduces water inflow → threatening biodiversity and fisheries

- **Overfishing:** Unsustainable extraction of fish resources
- **Desertification:** Arid conditions limit ecosystem resilience

LAKE TURKANA

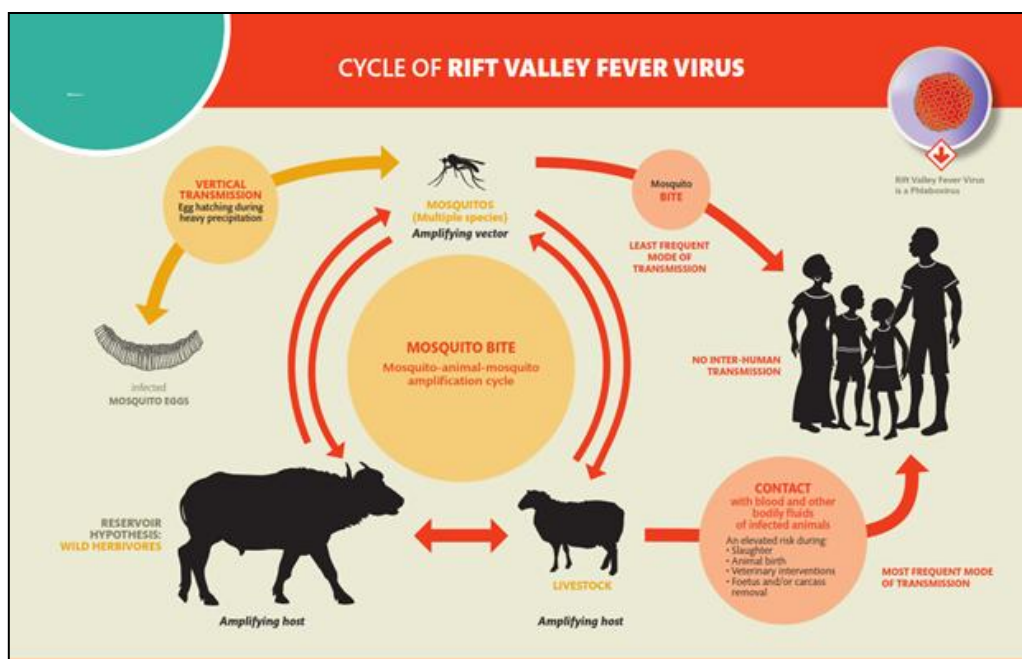
- Lake Turkana is the world's **largest permanent desert lake** and the **largest alkaline lake**, mainly situated in **Kenya's Great Rift Valley**. Its northern end extends into **Ethiopia**.
- **World Heritage Site:** Known as the "**Jade Sea**" for its turquoise colour, its basin was declared a UNESCO World Heritage Site in 1997
- **Hominin Site:** The Turkana Basin is a significant **paleoanthropological site**, often referred to as the "**Cradle of Humankind**" due to numerous hominin fossil discoveries.
- **River Flow:** Three rivers, **Omo**, **Turkwel**, and **Kerio**, feed the lake, with the Omo River contributing nearly 90% of the total inflow.
- **Nile Crocodile:** It has the **world's largest breeding colony** of Nile crocodiles, concentrated on its Central and South Islands.

IAS ORIGIN
HERE IT BEGINS

39

RIFT VALLEY FEVER

WHO has confirmed a **Rift Valley Fever** outbreak in **Mauritania & Senegal**, West Africa.



RIFT VALLEY FEVER (RVF)

INTRODUCTION

- **Definition:** RVF is a **viral zoonotic disease** caused by **Rift Valley fever virus (RVFV)**.
- **First identified:** 1931, in **Kenya's Rift Valley region**.
- **Virus Family:** *Phenuiviridae* (genus *Phlebovirus*).

HOSTS AND TRANSMISSION

- **Primary hosts:** Domestic livestock — **sheep, goats, cattle, camels**.
- **Secondary hosts:** Humans (zoonotic infection).
- **Transmission:**
 - **Mosquito-borne:** Mainly **Aedes, Culex species**.
 - **Direct contact:** Handling infected animal tissues or blood.
- **Not transmitted human-to-human.**

SYMPTOMS

- **In Animals:**

- High mortality in young animals
- Abortion in pregnant animals (hence called “abortion storm”)
- Fever, weakness, hepatic lesions
- **In Humans:**
 - Mild: Fever, headache, muscle pain, photophobia
 - Severe: Hemorrhagic fever, encephalitis, retinitis (rare)
 - Mortality: ~1% (but can be higher in outbreaks)

GEOGRAPHIC DISTRIBUTION

- **Endemic Region:** Africa, mainly **Eastern and Southern Africa**.
- **Outbreaks reported:**
 - Kenya, South Africa, Egypt, Mauritania, Senegal, Sudan, Saudi Arabia, Yemen.
- **Spread:** Usually associated with **heavy rainfall** → **mosquito population boom**.

DIAGNOSIS

- **Laboratory tests:**
 - RT-PCR for virus detection
 - ELISA for IgM/IgG antibodies
- **Field indicators:** Sudden abortions in livestock → early warning for outbreak.

PREVENTION & CONTROL

- **In Animals:**
 - Vaccination (live attenuated vaccines: Smithburn vaccine)
 - Vector control (mosquito control, draining stagnant water)
- **In Humans:**
 - Avoid contact with infected animals or blood
 - Protective clothing and gloves
 - Early diagnosis and supportive treatment

ECONOMIC & PUBLIC HEALTH SIGNIFICANCE

- **Livestock losses:** Massive abortions and deaths → affects rural economy.
- **Public health:** Zoonotic spillover → risk to humans in contact with livestock.
- **Global concern:** Potential for **spread beyond Africa** → monitored by WHO and OIE.

40

MITRA SHAKTI-XI

The 11th edition of the India–Sri Lanka Joint Military Exercise, “Mitra Shakti-XI – 2025”, has begun at the Foreign Training Node in Karnataka, India.



OBJECTIVE:

To improve **coordination** and strengthen **joint sub-conventional operations** under the United Nations mandate.

REPRESENTATION:

The exercise involves Indian troops from the **RAJPUT Regiment** and Sri Lankan troops from the **GAJABA Regiment**, along with **Air Force personnel** from both countries.

FOCUS AREAS:

Includes **counter-terrorism operations**, heliborne raids, drone deployment, counter-unmanned aerial systems (C-UAS) operations, **Army Martial Arts Routine (AMAR)**, and yoga.

SIGNIFICANCE:

The exercise enhances India–Sri Lanka **defence cooperation**, deepens **bilateral relations**, and promotes **regional peace** and stability.

41**TRANSPLANTATION OF HUMAN ORGANS AND
TISSUES (AMENDMENT) RULES, 2025**

Union Ministry of Health and Family Welfare has amended the Transplantation of **Human Organs and Tissues (Amendment) Rules, 2025** under the **Transplantation of Human Organs and Tissues Act, 1994**.

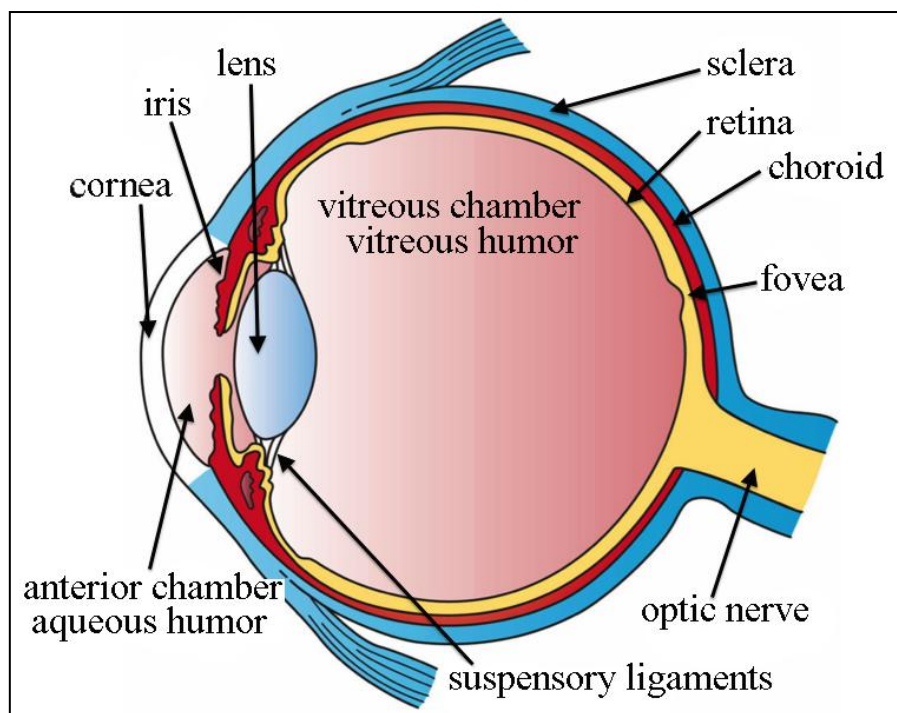
**KEY HIGHLIGHTS**

- The amendment strengthens the **National Organ Transplant Programme (NOTP)** and streamlines functioning of corneal transplantation centres, while facilitating wider **accessibility to eye donation and transplantation services across the country**.
- The amendment removes the mandatory requirement of **Clinical Specular Microscope equipment** in corneal transplantation centers, which was used earlier to assess corneal endothelial cell health.

ABOUT THE CORNEA

- The cornea is the **transparent, dome-shaped outermost layer of the eye** that acts like a window, allowing light to pass and focus on the retina for clear vision.
- It serves as a protective barrier against dust, microbes, and physical injury and maintains the eye's shape and fluid balance.
- The **cornea comprises six layers** — Epithelium, Bowman's Layer, Stroma, Pre-Descemet's (Dua's) Layer, Descemet's Layer, and Endothelium — each essential for transparency and refraction.
- It is **highly sensitive with 300–600 times** more pain receptors than skin, ensuring rapid reflex protection.

- While minor injuries heal quickly, deeper damage or scarring can cause opacity and vision loss, often requiring a corneal transplant (keratoplasty) or artificial cornea (keratoprosthesis) to restore vision.



SIGNIFICANCE

- Corneal blindness has been the **second-leading cause of blindness** in the over-50 age group in India
 - India has an estimated 1.2 million corneal blind persons, to which 25 000–30 000 people are added every year.
- The amendment aims to **boost cornea donation and transplantation services by streamlining the functioning of corneal transplantation centers** and improving coordination among hospitals, tissue banks, and regulatory authorities.
- It aligns with the government's vision of equitable healthcare access and is expected to strengthen India's cornea donation and transplantation ecosystem in the long term.
- The overarching objective is to reduce the burden of corneal blindness, which is the second-leading cause of blindness among Indians over 50 years old.

42**MOLASSES**

The Central government is looking to permit around **1.5 million tonnes of sugar exports in 2025–26** and abolish the **50% export tax on molasses** to improve realisations and help farmers receive faster payments.

**ABOUT**

- The export decision was communicated to the chief minister while listing out the **steps taken by the central government to protect the interest of sugarcane farmers in the country.**
- **Gross sugar production** stood at 29.1 million tonnes in the 2024–25 and is estimated to rise 16% to 34.35 million tonnes in the current 2025–26.
- It is projected that 3.4 million tonnes of sugar will be diverted to ethanol production in 2025–26, compared to 3.5 million tonnes in the preceding year.

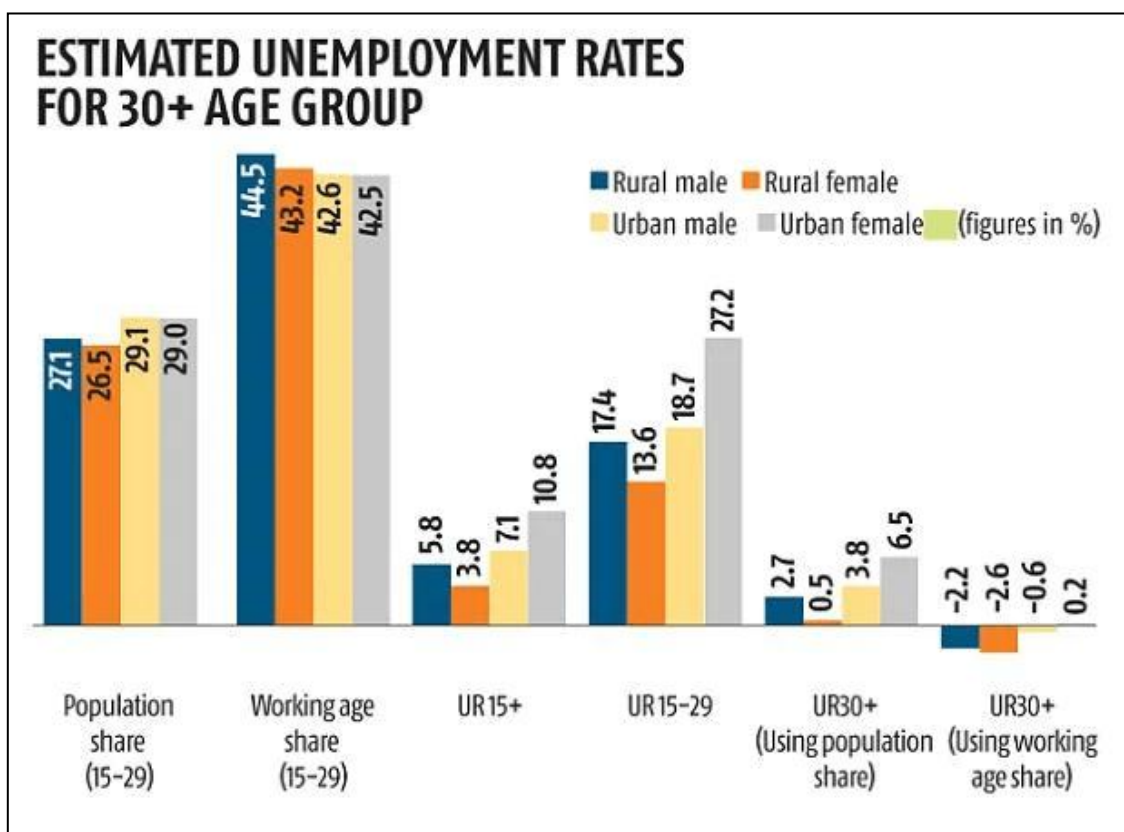
MOLASSES

- Molasses is a thick, dark brown syrup obtained as a byproduct during the process of **refining sugarcane or sugar beet into sugar.**
- **Uses**
 - **Food industry:** Used in baking (e.g., gingerbread), rum production, and animal feed.
 - **Industrial use:** In ethanol, citric acid, and yeast production.
 - **Agriculture:** As a component in cattle feed and for soil conditioning.
- It is a key raw material for **ethanol production under India's ethanol blending programme** to reduce crude oil imports.

43

PERIODIC LABOUR FORCE SURVEY (PLFS) REPORT

The Periodic Labour Force Survey (PLFS) was conducted by the Labour Bureau for the July-September 2025 quarter.



ABOUT

- Unemployment Rate:** Overall, it dropped to 5.2% in July-September, 2025 from 5.4% in the previous quarter.
 - Rural:** It declined to 4.4% during the period from 4.8%.
 - Urban:** Increased from 6.1% to 6.2% for males, and from 8.9% to 9.0% for females.
- Employment Pattern:**
 - Rural areas:** Dominated by self-employment – increased to 62.8% (from 60.7%). Majority engaged in the agriculture sector – 57.7% (up from 53.5%), due to seasonal operations.
 - Urban areas:** Regular wage/salaried employment rose slightly to 49.8% (from 49.4%). The workforce was concentrated in the tertiary sector – 62.0% (up from 61.7%).

- **Labour Force Participation Rate (LFPR):**
 - **Overall LFPR:** 55.1% (steady from 55.0% last quarter).
 - **Rural LFPR:** 57.2% (up from 57.1%).
 - **Urban LFPR:** 50.7% (up from 50.6%).
 - **Female LFPR:** Increased to 33.7% (from 33.4%).
 - **Rural female LFPR:** 37.5% (up from 37.0%).
- **Worker Population Ratio (WPR):** For persons of age 15 years and above in the country during the quarter was 52.2%.
 - In rural areas, WPR was 54.7% as compared to WPR of 47.2% recorded in urban areas for the same quarter.

KEY TAKEAWAY

- Rural employment improved, driven by agriculture and self-employment.
- Urban employment remained stable, with a slight rise in salaried jobs.
- Female participation in the labour force showed a gradual rise.
- Overall unemployment declined, reflecting a moderate labour market recovery.

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44

RICIN

The Gujarat Anti-Terrorism Squad (ATS) foiled an alleged terror plot and arrested men with suspected links to terrorism who were reportedly attempting to produce **Ricin chemical**



ABOUT RICIN

- Ricin is a highly toxic protein extracted from the castor bean plant (*Ricinus communis*).
- It blocks protein synthesis in cells, causing multiple organ failure and death within hours of exposure. Even a few milligrams can be fatal.
- It is listed under **Schedule-1 of the Chemical Weapons Convention (CWC)**, supervised by the **Organisation for the Prohibition of Chemical Weapons (OPCW)**, as it has no legitimate civilian use.
- There is **no known antidote for Ricin poisoning**.

CHEMICAL WEAPONS CONVENTION (CWC)

- **Adopted:** 1992 and came into force in 1997.
- **Administered by:** Organisation for the Prohibition of Chemical Weapons (OPCW), headquartered at The Hague, Netherlands.
- **Objective:** To eliminate an entire category of weapons of mass destruction (WMD) by prohibiting the development, production, acquisition, stockpiling, transfer, and use of chemical weapons and by ensuring their destruction.
- **India:** Among the original signatories and one of the first countries to ratify the Convention in 1996.

- **Schedule system:** Chemicals are divided into three schedules based on lethality and civilian use:
 - **Schedule 1:** High toxicity, no legitimate civilian use (e.g. Ricin, Sarin, VX).
 - **Schedule 2:** Can be used as weapon precursors but have limited industrial uses.
 - **Schedule 3:** Used in large-scale industry but can be weapon precursors (e.g. Phosgene, Hydrogen Cyanide).



HERE IT BEGINS

45

WORLD ARTIFICIAL INTELLIGENCE COOPERATION ORGANIZATION (WAICO)

At the APEC Summit in Busan (2025), President Xi Jinping proposed forming the World Artificial Intelligence Cooperation Organization (WAICO).



ABOUT

- It is a new global **AI governance initiative** proposed by Chinese President Xi Jinping, with the headquarters **proposed in Shanghai, China**.
- WAICO intends to address the **current fragmented governance of AI** by fostering international cooperation, aligning AI strategies and technical standards, and promoting inclusive innovation ecosystems, especially for developing countries.

46

JAMES WATSON, NOBEL PRIZE-WINNING DNA PIONEER DIES

James Dewey Watson, the Nobel Prize-winning biologist renowned for co-discovering the **double-helix structure of DNA**, died in New York.

DNA (DEOXYRIBONUCLEIC ACID)

- It is the molecule that stores genetic instructions essential for an organism's growth and function.
- It is a double helix formed by base pairs attached to a sugar-phosphate backbone.
- It consists of two strands twisted into a double helix, with each strand made of a sugar-phosphate backbone and four nitrogen bases — adenine (A), thymine (T), cytosine (C), and guanine (G).
- Most DNA is located in the cell nucleus (where it is called nuclear DNA), but a small amount of DNA can also be found in the mitochondria

DNA PIONEER JAMES WATSON DIES AT 97



MAJOR CONTRIBUTIONS OF JAMES DEWEY WATSON

- Watson's landmark 1953 collaboration with Francis Crick, aided by X-ray data from Rosalind Franklin and Maurice Wilkins, **revolutionized biology by revealing DNA's structure and replication mechanism.**
- He contributed to **cancer research** and played a key role in the **Human Genome Project (1988–1992)**, overseeing the mapping of human genes.

- He also served as a professor at Harvard and transformed Cold Spring Harbor Laboratory into a leading molecular biology center.

DISCOVERY OF DOUBLE-HELIX STRUCTURE OF DNA

- **James Dewey Watson** was globally celebrated for co-discovering the double-helix structure of DNA in **1953** with Francis Crick .
- Their model revealed how genetic information is stored and replicated, explaining heredity and enabling vast advances in biology.
- The discovery built on decades of prior research, including Friedrich Miescher's identification of DNA in 1869 and the realization in the 1940s that DNA, not proteins, carried genetic information.
- It was catalyzed by X-ray crystallography data, especially Photo 51 taken by Rosalind Franklin's team, which revealed the **molecule's double-helical shape**.
 - Their model showed that DNA consists of two strands with complementary base pairs — A with T, and C with G arranged like a twisted ladder, allowing precise replication.

IMPACTS

- The elegant structure explained how traits are inherited and sparked the birth of molecular biology, biotechnology, and genetic engineering.
- It led to transformative tools like CRISPR, revolutionized agriculture and medicine, and enabled genetic analysis in forensics and evolutionary biology.

RECOGNITION

- This breakthrough earned Watson, Crick, and Wilkins the 1962 Nobel Prize and laid the foundation for modern genetics, enabling advances in medicine, forensics, and biotechnology.

47

V. RAJARAMAN: ARCHITECT OF INDIA'S PROGRAMMING REVOLUTION

Prof. Vaidyeswaran Rajaraman, a pioneering engineer and academic who helped establish computer science education in India, passed away.

VAIDYESWARAN RAJARAMAN

- He was Born in Tamil Nadu and he studied physics at St. Stephens College, earned an engineering diploma from IISc Bengaluru, and completed his PhD at the University of Wisconsin-Madison.
- He was a pioneering **computer scientist** and educator, who played a foundational role in **shaping India's software programming** and services sector.

MAJOR CONTRIBUTIONS

- His early work on **analogue computing** at IISc led to advanced training abroad at MIT and Wisconsin, after which he returned to India to build one of the country's **first computer centres around an IBM mainframe**.
- Rajaraman's intensive Fortran courses trained early programmers and forged links with emerging firms like TCS and HCL.
- His students went on to **lead India's software industry**.
- His **1968 Fortran booklet became a bestseller**, prompting a prolific publishing career that made him a household name in programming education.
- He was instrumental in launching **India's first B.Tech in computer science** at **IIT-Kanpur in 1979** and later helped design the **MCA programme to meet industry needs**.
- He advanced India's computing capabilities as head of IISc's Supercomputer Education and Research Centre (1982–1994).

RECOGNITION AND LEGACY

- A Bhatnagar Prize winner, Rajaraman was also honoured with a Padma Bhushan in 1998, besides several other awards.
- He wrote more than 20 textbooks on computer science which are still being taught in colleges and universities across the country.
- His legacy spans analogue machines to supercomputers, and his quiet dedication shaped generations of programmers, educators, and tech leaders.

48

BOOKER PRIZE 2025

David Szalay won this year's Booker Prize for fiction for his novel '**Flesh**,' is the **first Hungarian-British author** to win the Booker Prize.

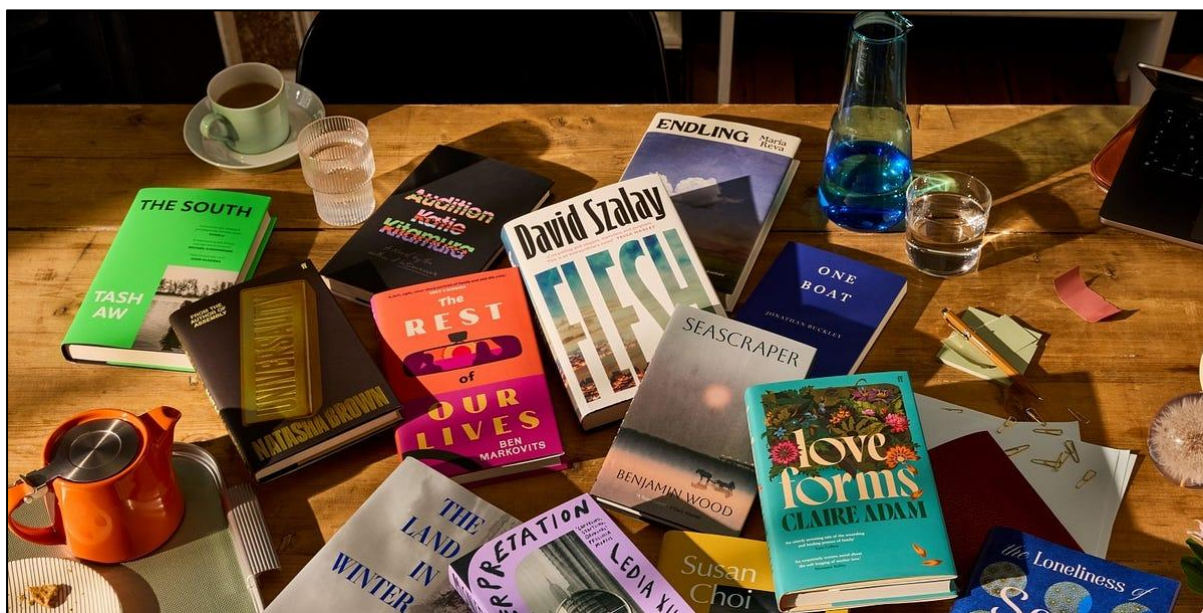


ABOUT

- The Booker Prize, is a **prestigious literary award conferred each year** for the **best single work of sustained fiction** written in the **English language**, which was published in the United Kingdom and/or Ireland.
- **Launch:** It was first awarded in **1969** to promote reading and literature.
 - The inaugural Booker Prize was awarded to **PH Newby** for **Something to Answer For**.
- **The Booker Prize Foundation** has an in-house team who select a multicultural group of creative artistes, experts and critics.
- **Indian Winner:** Several Indian writers as well as writers of Indian-origin have won the Prize.
 - These include VS Naipaul in 1971 for In A Free State, Salman Rushdie for Midnight's Children in 1981, Arundhati Roy for The God of Small Things (1997), Kiran Desai for The Inheritance of Loss (2006), Aravind Adiga for The White Tiger (2008).

INTERNATIONAL BOOKER PRIZE

- This prize is awarded **annually** to the best works of long-form fiction or collections of short stories, translated into English and published in the United Kingdom (UK) or Ireland.
- It was established in **2005**.
- In 2022 Geetanjali Shree for her Hindi novel, **Tomb of Sand** received the prize.
- In 2025, **Banu Mushtaq and Deepa Bhashti** won it for the translated anthology of Mushtaq's short stories from Kannada into English, Heart Lamp.



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49

3RD INTERNATIONAL CONFERENCE ON GREEN HYDROGEN

At the 3rd International Conference on Green Hydrogen, the Union Minister for New & Renewable Energy highlighted the National **Green Hydrogen Mission** (NGHM) as a catalyst for India's clean energy transition, job creation, and global leadership in green hydrogen.



NATIONAL GREEN HYDROGEN MISSION

- It was launched by the Government of India in January 2023 and spearheaded by the Ministry of New and Renewable Energy (MNRE).
- It is a cornerstone of India's strategy to achieve energy independence by 2047 and net-zero emissions by 2070.
- It aims to position India as a global hub for the production, utilization, and export of green hydrogen and its derivatives.



OBJECTIVES

- It aims to reduce dependence on fossil fuels and cut emissions in hard-to-abate sectors like steel, cement, refining, and mobility.
- It aims to create export opportunities for green hydrogen and its derivatives such as ammonia and methanol.
- It aims to generate employment and stimulate economic growth through innovation and infrastructure development.
- It aims to develop green hydrogen hubs and promote public-private partnerships for technology advancement.



CHALLENGES

- **High production costs:** Electrolyser technology and renewable energy inputs remain expensive.
- **Infrastructure gaps:** Limited hydrogen pipelines, refueling stations, and storage facilities.
- **Technology maturity:** Many green hydrogen applications are still in pilot or demonstration stages.
- **Policy coordination:** Cross-sectoral alignment is needed across energy, transport, industry, and finance ministries.
- **Global competition:** Countries like the EU, US, and China are also aggressively pursuing green hydrogen leadership.

WAY AHEAD

- India's National Green Hydrogen Mission is a strategic push to align clean energy with industrial growth and global competitiveness.
- Key priorities include scaling domestic manufacturing, expanding pilot projects, boosting R&D, building hydrogen infrastructure, improving policy coherence, and leveraging renewable energy to produce affordable green hydrogen for domestic and export markets.

IAS ORIGIN
HERE IT BEGINS

50

FUNGUS INFECTIONS RISE IN INDIA

Studies suggest that **fungal infections** would overtake the annual incidence of tuberculosis in India.



ABOUT

- A study in 2022 had estimated that **India has the largest burden of fungal diseases per capita in the world.**
 - This means over 57 million people (4.1% of the population) are affected by serious fungal diseases.
- The report also flagged how **diagnostic limitations** across the country had already inhibited some high-quality epidemiological studies.

FUNGAL INFECTIONS

- **Fungal infections also called mycoses** are diseases caused by **fungi**.
 - Fungi are **eukaryotic organisms (cells with nuclei)** that differ from bacteria and viruses.
 - They thrive in warm, moist environments and can live on skin, mucous membranes, or inside the body.
- **Fungal infections** range from mild to life-threatening.
- **People with weakened immune systems** are at higher risk for most fungal infections.

51

DUMPSITE REMEDIATION ACCELERATOR PROGRAMME (DRAP)

The Dumpsite Remediation Accelerator Programme (DRAP) has been launched by the Ministry of Housing and Urban Affairs (MoHUA).



DUMPSITE REMEDIATION ACCELERATOR PROGRAMME (DRAP)

It is a year-long, mission-mode initiative which aims to fast-track the remediation of remaining dumpsites and reclaim valuable urban land for community and infrastructure development, advancing India's vision of achieving "Lakshya Zero Dumpsites" by September 2026.

The Dumpsite Remediation Action Plan (DRAP) is guided by the 5P framework from the Swachh Bharat Mission, ensuring comprehensive oversight, funding, and community engagement:

- **Political Leadership:** Senior leaders adopt specific dumpsites to drive progress
- **Public Finance:** Additional financial support is provided to cities with significant legacy waste, supplementing existing funds.
- **Partnerships:** Collaborations include corporates/PSUs for funding, PWDs/NHAI for using inert waste in road construction, technical experts for engineering, and NGOs for community outreach.
- **Public Advocacy:** Focus on awareness and health initiatives for affected communities, including SafaiMitras and nearby residents.
- **Project Management:** Site-specific micro-action plans with defined timelines, resource allocation, and monitoring mechanisms ensure effective execution.

52

YBRANT PROGRAMME

The Indian Institute of Corporate Affairs (IICA), in partnership with WNS Global Services, launched the **YBRANT programme**.



YBRANT PROGRAMME

- It is a strategic collaboration between government, industry, and academia.
- It is designed to instill sustainable development values in future CEOs.
- It is a six-month blended learning program that includes 15 modules, 22.5 hours of academic instruction, and 18 hours of fieldwork, delivered via IICA's online platform.

OBJECTIVES AND NEED

- India's CSR spending has grown significantly from ₹10,065.93 crore in FY 2014–15 to ₹34,908.75 crore in FY 2023–24 highlighting the need for professionals who balance profit with responsible conduct.
- Therefore, the YBRANT programme aims to cultivate socially responsible and sustainability-oriented business leaders.

53

LUCIFER BEE

Australian scientists have discovered a **new native bee species named Lucifer**.



ABOUT

- The new species – **dubbed Megachile (Hackeriapis) Lucifer** – was first discovered **in 2019** in the **state of Western Australia**.
 - It's the **first new member** of this bee group to be described in more than 20 years.
 - **Australia** has around 2,000 native bee species, more than 300 of which are yet to be scientifically named and described.
- The **highly distinctive, upward-pointing horns** on the female bee's face inspired its name.
 - Each of the horns on the bee measure about **0.9 millimetres** and scientists note could be used to access flowers, compete for resources, and defend nests.
 - Interestingly, the species' male bees lack the horns.

SIGNIFICANCE

- The discovery will **raise awareness about the number of undiscovered species** that may still exist, especially in areas threatened by mining.
 - Many mining companies still don't survey for native bees, including those that play crucial roles in supporting threatened plants and ecosystems.
- Almost all flowering plants depend on wild pollinators, particularly bees, but **habitat loss and climate change** are driving many vital species to the brink of extinction.

54**INTERNATIONAL CRYOSPHERE CLIMATE
INITIATIVE**

The “**2025 State of the Cryosphere Report**” underscores that Earth’s glaciers and ice sheets are rapidly melting.

KEY HIGHLIGHTS

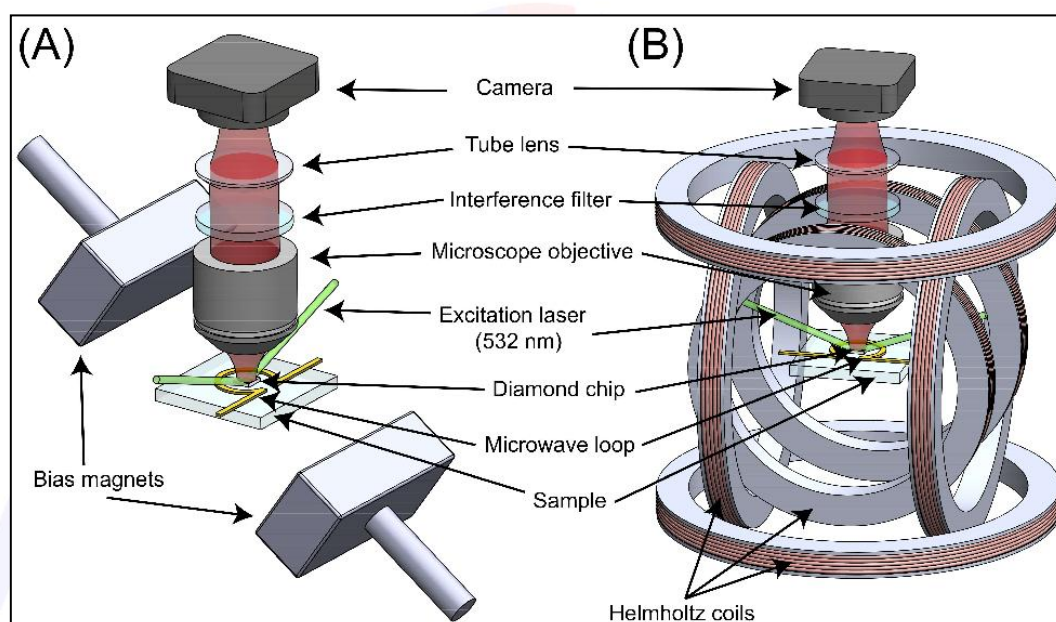
- **Critical Thresholds:** Earth’s cryosphere (glaciers and ice sheets) is nearing critical temperature thresholds, with irreversible melting likely at just 1°C of warming, and many glaciers could melt irreversibly at even lower temperatures.
- **Global Ice Loss:** Rapid melting of polar ice sheets and glaciers, notably in Greenland and Antarctica, is accelerating sea-level rise and causing significant impacts on ocean currents and ecosystems.
- **Sea Ice Decline:** Both Arctic and Antarctic sea ice have hit record lows in 2025, affecting global climate patterns and marine food webs.
- **Sea-Level Rise:** Staying at current warming levels (~1.2°C) could lead to several meters of sea-level rise over centuries, threatening coastal cities and small islands, but limiting warming to 1.5°C or below can slow this process.
- **Impact on Water Resources:** Melting glaciers and ice sheets have already released large volumes of water, roughly 13% of global annual water consumption in 2023, with future reductions threatening water security for billions.
- **Ocean Changes:** Melting polar ice and warmer waters are disrupting ocean currents, slowing the Atlantic Meridional Overturning Circulation, and potentially causing colder temperatures in northern Europe.
- **Increased Risks:** Loss of permafrost, increased ocean acidification, and declining snow cover are further aggravating climate change effects, threatening ecosystems and human livelihoods.

55**QUANTUM DIAMOND MICROSCOPE**

India has developed its first **indigenous Quantum Diamond Microscope (QDM)** for dynamic magnetic field imaging, marking a major milestone in the field of quantum sensing.

QUANTUM DIAMOND MICROSCOPE (QDM)

- The **Quantum Diamond Microscope (QDM)** is a cutting-edge **quantum sensor** that uses **diamonds with nitrogen-vacancy (NV) centers** to detect and image **magnetic fields at extremely high resolution**.
- Developed using principles of **quantum mechanics**, it is one of the most **sensitive magnetic field detectors** available.

**HOW IT WORKS**

- **Nitrogen-vacancy (NV) centers in diamonds:**
 - NV centers are **defects** in the diamond lattice where a nitrogen atom replaces a carbon atom adjacent to a vacancy.
 - These centers have unique **quantum spin properties** that react to magnetic fields.
- **Magnetic field detection:**
 - The NV centers in the diamond interact with external magnetic fields.
 - When illuminated with **laser light**, they emit **fluorescence** that varies depending on the local magnetic environment.

- The emitted light is captured and analyzed to **map the magnetic field** with micron-scale resolution.
- **Data output:**
 - Produces **high-resolution magnetic field images**, revealing internal structures of materials, cells, or devices without physically contacting them.

KEY FEATURES

- **High sensitivity:** Detects very weak magnetic fields (nanoTesla to microTesla range).
- **Non-invasive imaging:** Can image delicate biological samples without damage.
- **High spatial resolution:** Down to **micron or sub-micron scale**.
- **Quantum technology-based:** Relies on **quantum spin states**, not classical sensors.

APPLICATIONS

A. MEDICINE AND BIOLOGY

- Imaging **neural activity in brain tissues** by detecting tiny magnetic signals.
- Mapping **magnetic nanoparticles in cells** for cancer or drug research.

B. MATERIAL SCIENCE

- Detecting defects in **semiconductors and electronic circuits**.
- Studying **magnetic materials** and their behavior at micro scales.

C. QUANTUM RESEARCH

- Testing **quantum devices** and sensors.
- Advancing **quantum computing and precision measurement technologies**.

D. SPACE & ASTRONOMY (POTENTIAL)

- Detecting subtle magnetic fields in planetary materials or extraterrestrial samples.

RELATED TERMS

- **NV Centers:** Nitrogen atoms substituting carbon in diamonds, key to QDM.
- **Quantum Sensor:** Device that exploits quantum properties (superposition, entanglement) for ultra-precise measurement.

- **Magnetic Microscopy:** Imaging method for magnetic fields in materials and biological samples.

ADVANTAGES OVER CONVENTIONAL MICROSCOPES

Feature	Conventional Microscopes	QDM
Magnetic Field Detection	Cannot directly detect weak magnetic fields	Can detect nanoTesla-level magnetic fields
Sample Damage	Some methods invasive	Non-invasive, safe for biological samples
Resolution	Micrometer or limited	Sub-micron with quantum precision
Applications	Limited to optical/chemical	Material, biological, quantum research

IAS ORIGIN
HERE IT BEGINS

56

SC ASKED HCS TO UPLOAD DETAILS OF TIME TAKEN BY JUDGES TO DELIVER VERDICTS

The Supreme Court said all High Courts should put out in the public domain the time taken by their judges to pronounce verdicts in pending cases.



ABOUT

- There are **no specific timelines** within which judges have to deliver judgments.
- The convention is that the judiciary ought to pronounce judgments **within a reasonable time, from two to six months**, of reserving cases.
- However, judges, including in the Supreme Court and the High Courts, have in practice **reserved judgments for well over a year before delivering them**.
 - This may be due to the complexity of the question of law involved or the burden of work.

RECOMMENDATIONS BY SC

- There ought to be a dashboard on High Court websites, exclusively focussing on the **reservation and pronouncement of judgments**.
 - This will show the **transparency and accountability** of the judiciary to the people.
- State High Courts to **file reports on their existing mechanisms** to bring into the **public domain**:

- the dates when pending judgments were reserved,
- the time taken between the reservation of judgments and their pronouncement,
- and when a pronounced judgment is actually uploaded on their official websites.

SIGNIFICANCE

- Promotes judicial transparency and public trust.
- Helps in monitoring judicial efficiency and reducing delays in pronouncing judgments.
- Strengthens accountability mechanisms within the judiciary.

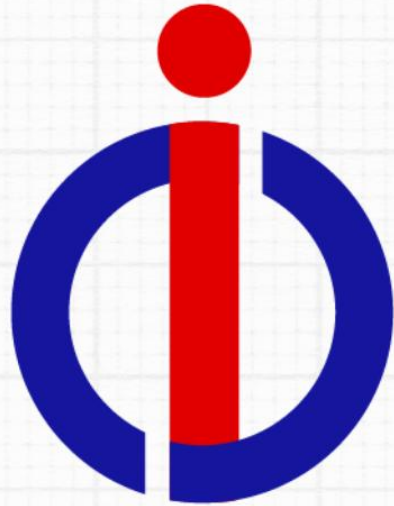
Judiciary in India Supreme Court: The highest court in India, with the authority to interpret the Constitution, adjudicate disputes between states and the center, and oversee the legality of laws and government actions.

High Court: Each state or group of states has a High Court, which handles appeals from lower courts and issues related to state-level legal matters.

District Courts handle civil and criminal cases at the district level, and various specialized courts such as family courts, consumer courts, and labor courts.

Each branch operates independently but is designed to work in harmony with the others, providing a system of **checks and balances** to ensure fair governance and adherence to the Constitution.

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