

P L RAJ UPSC MONTHLY MAGAZINE – COMPILATION

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YOJANA

1. Freedom to Innovate

This chapter explores the theme of innovation as a new dimension of freedom in India, tracing its historical roots, constitutional basis, recent policy boosts, and measurable global impact.

I. India's Historical & Constitutional Ethos of Innovation

Ancient Roots: India has a long civilisational history of innovation.

Scholars: Figures like Pingala, Brahmagupta, Aryabhata, and Bhaskara made significant advances in mathematics and astronomy.

Learning Hubs: Ancient universities like Nalanda, Vikram Shila, and Vallabha were interdisciplinary centres that nurtured fields like metallurgy, medicine, and architecture.

Resilience: This spirit of innovation endured through invasions and colonial rule, showing deep foundational strength.

Innovation as Modern Freedom: The vision of Viksit Bharat 2047 redefines freedom as the capacity to create, solve problems, and shape society.

Constitutional Links: This "freedom to innovate" is implicitly supported by fundamental rights and duties, including Article 14 (Equality), Article 21 (Life and Dignity), Article 21A (Education), and Article 51A (Duty to develop scientific temper).

Decentralisation: Innovation is spreading from metro cities to rural areas and from tech unicorns to self-help groups.

II. Strategic Policy Framework & Institutional Support

Union Budget 2025-26:

1. A dedicated ₹20,000 crore corpus was announced for R&D in strategic and emerging technologies like AI, quantum computing, biotechnology, and clean energy.
2. This budget supports the freedom to experiment, fail, and commercialise innovations.

Deep-Tech Financing:

1. The budget complements the ₹10,000 crore Deep-tech Fund of Funds (FoF) under SIDBI, with the government acting as an early-stage backer for high-risk, long-gestation projects.

Anusandhan National Research Foundation (ANRF):

1. Established by Parliament in 2023, the ANRF replaces SERB with a wider mandate.
2. It has a funding target of ₹50,000 crore for 2023-28, with ₹14,000 crore from the Central Government and the rest from PSUs, the private sector, and international bodies.

Research Development and Innovation (RDI) Scheme:

1. Approved on July 1, 2025, with a ₹1 lakh crore corpus.

2. It offers long-term financing at low or nil interest rates to encourage private sector investment in R&D, with strategic direction from ANRF.

III. Grassroots Innovation & Digital Platforms

National Innovation Foundation (NIF): An autonomous institute under the DST, NIF scouts and supports grassroots innovators from ~600 districts. It has filed over 1,400 patents and facilitated 120+ technology transfers.

Unnat Bharat Abhiyan: This Ministry of Education initiative connects academic institutions with rural India to develop contextual solutions.

Digital Public Infrastructure (DPI): Platforms like Aadhaar, UPI, and ONDC act as building blocks for innovation.

1. As of March 2025, ONDC had onboarded over 7 lakh sellers (mostly MSMEs) and recorded 20.4 crore transactions.

India Energy Stack (IES): This is a UPI-like digital infrastructure for the energy sector, designed to integrate renewables, improve DISCOM efficiency, and support Net Zero goals.

IV. Sectoral Deepening & Measurable Impact

Healthcare:

1. The Ayushman Bharat Digital Mission (ABDM) has registered over 5.23 lakh professionals and 3.49 lakh facilities, with over 20 crore ABHA accounts created.
2. The Pharmaceutical Research Incentive Program (PRIP) has a corpus of ₹25,000 crore to make India a global pharma R&D hub.

Agriculture (Agriculture 4.0): This sector, which employs ~42% of the workforce, is adopting drones, AI, and IoT for precision farming. Initiatives include

Drone Didi, Agri-India Hackathon, and Agri-Tech Innovation Hubs.

Incubation & Frontier Tech:

1. **Atal Tinkering Labs (ATLs)** provide science equipment to thousands of schools.
2. **Atal Incubation Centres (AICs)** are being established in Tier-II and Tier-III areas. These align with missions like the National Quantum Mission (NQM).

Global Rankings:

Global Innovation Index 2024: India ranked 39th.

WIPO IP Filings Report 2023: India ranked 6th globally in patent filings.

Startup Ecosystem: India has over 1.57 lakh recognized startups and 100+ unicorns, with ~51% participation from Tier-II and Tier-III cities

2. People's Padma

This chapter celebrates grassroots cultural icons recognized with the Padma Shri, highlighting their contributions to preserving India's intangible heritage.

Shri Pandi Ram Mandavi – Tribal Instrument Maker:

From: Narayanpur, Chhattisgarh (Bastar region).

Art: Specializes in Gond wood crafts and making bamboo musical instruments, most iconically the 'Sulur' or 'Bastar flute'.

Legacy: Born into a family of woodworkers, he learned the craft from his father. He has mentored young artisans, formed a community to share skills, and acted as a guardian of Muria tribal heritage.

Dr. Venkappa Ambaji Sugatekar – Gondhal Folk Singer:

From: Bagalkot, Karnataka.

Art: A master of the Gondhal folk music tradition of Karnataka.

Legacy: Began training at age 10 and has mastered thousands of folk compositions by memory, including over 1,000 songs and 150 long-form mythological stories. He has trained over 1,000 students free of cost and, at age 82, remains an active cultural ambassador praised by the Prime Minister as a "Cultural Torch Bearer".

Significance of the 'People's Padma':

1. This recognition celebrates grassroots icons often overlooked by mainstream media.
2. It highlights the national importance of preserving intangible cultural heritage like music and crafts.

3. India's War Against Terrorism

This chapter analyses India's evolved counter-terrorism strategy, triggered by a recent attack, detailing its military, institutional, and diplomatic dimensions.

I. Context and Policy Shift

Trigger: The Pahalgam Attack in Jammu & Kashmir on April 22, 2025, was a heinous attack on civilians that reinforced the persistent threat of cross-border terrorism.

Shift in Approach:

Past: India traditionally preferred dialogue and restraint with Pakistan.

Present: Due to Pakistan's continued use of terrorism as state policy, India has shifted to a proactive and pre-emptive counter-terrorism strategy.

New Policy: India now makes no distinction between terrorists and their supporters, treats any attack as an act of war, and no longer accepts Pakistan's "plausible deniability".

II. Military and Institutional Response

Military Operations:

Operation Sindoor: A swift, precise military operation targeting terrorist infrastructure of groups like LeT, JeM, and Hizbul Mujahideen in Pakistan and PoJK. It was the deepest military operation inside Pakistan since the 1971 War.

Historical Precedents: This follows a pattern of increasingly intense strikes, including the 2019 Balakot Airstrike, 2016 Surgical Strikes, and 2015 Operation Hot Pursuit in Myanmar.

Institutional Strengthening (Post-2008 Mumbai Attacks):

NIA: The National Investigation Agency was established in 2009 as the main counter-terror agency. The NIA Act was amended in 2019 to grant it jurisdiction outside India.

Intelligence Sharing: The Multi-Agency Centre (MAC) and National Intelligence Grid (NATGRID) were created to enable real-time intelligence and data sharing.

Countering Terror Financing: The Prevention of Money Laundering Act (PMLA) was strengthened in 2009 and 2023, lowering the beneficial ownership threshold to 10% and bringing crypto transactions under regulation.

III. Disrupting Insurgency and Diplomacy

Jammu & Kashmir: The focus is on halting local recruitment, disrupting the ecosystem of "hybrid" cadres, and tackling narco-terrorism, which funds terror groups. A 3-tiered counter-infiltration grid has significantly reduced violence.

Countering Radicalisation: Government actions include NIA arrests and continuous monitoring of online extremist content to counter drivers like propaganda and victimhood narratives.

Diplomatic Collaboration:

1. India uses multilateral platforms like the G20 and FATF to build consensus. In 2022, it hosted the UNSC Counter-Terrorism Committee and the INTERPOL General Assembly.
2. Bilateral cooperation has led to the successful extradition of 26/11 suspect Tahawwur Rana from the USA.

Way Forward: India must maintain military, intelligence, and diplomatic pressure to counter Pakistan's doctrine of "bleeding India with a thousand cuts" and adapt to evolving threats.

4. Sanskrit in Contemporary Times & NEP 2020

These chapters discuss the revival of Sanskrit, its relevance in the modern world, the challenges it faces, and the transformative role envisioned for it in the National Education Policy 2020.

I. Sanskrit's Relevance and Global Presence

Modern Revival: Despite being over 3,000 years old, Sanskrit is attracting growing interest in the digital age. It is not a "dead language" but a living intellectual force.

Grammar and Technology: The highly precise, algorithmic grammar of Panini's Aṣṭādhyāyī makes Sanskrit uniquely suitable for modern applications in Artificial Intelligence (AI) and Natural Language Processing (NLP).

Secular Knowledge: Beyond religious texts, Sanskrit is the language of seminal secular works in fields like planetary motion (Surya Siddhanta), medicine (Ayurveda), and statecraft (Artha sastra).

Global Academia: Sanskrit is taught at top universities like Harvard, Oxford, and Kyoto as a key to understanding philosophy and ancient science. Digital humanities projects like the Sanskrit WordNet are making its texts globally accessible.

Grassroots Movement: Organizations like Sanskrit Bharati lead a global movement to promote spoken Sanskrit through workshops and media, showing it is a vibrant, living language.

II. NEP 2020 and the Integration of Sanskrit

Policy Vision: The National Education Policy (NEP) 2020 formally acknowledges Sanskrit's significance and aims to fully integrate it into the modern education system. It positions Sanskrit as a bridge between ancient Indian knowledge systems and contemporary education.

School Education:

1. Sanskrit will be offered as a mainstream option under the three-language formula.
2. The pedagogy will shift from rote memorisation to immersive methods like Simple Standard Sanskrit (SSS) and Sanskrit Through Sanskrit (STS).

Higher Education: Sanskrit departments are envisioned as interdisciplinary hubs linked with modern disciplines like AI, cognitive science, and ecology.

Value-Based Education: Sanskrit texts like the Panchatantra and Hitopadesh will be used as ethical resources to teach values like Seva, Ahimsa, and Satya through storytelling.

Challenges: Key hurdles to this revival include a perception of elitism, a shortage of trained teachers, and a lack of standardised curricula. The NEP's approach is structural, aiming to overcome these barriers through comprehensive reforms.

5. Freedom of Good Health

This chapter details the Ayushman Bharat mission, a comprehensive initiative to provide accessible, affordable, and equitable healthcare to all citizens.

Concept: True freedom of health means access to medical care without financial, social, or institutional exclusion.

Four Pillars of Ayushman Bharat: The mission is built on four integrated pillars:

Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB PM-JAY): Provides financial protection.

Ayushman Arogya Mandir (AAM): Strengthens community-level primary healthcare.

Ayushman Bharat Digital Mission (ABDM): Creates a secure, portable digital health data ecosystem.

Pradhan Mantri Ayushman Bharat Health Infrastructure Mission (PM-ABHIM): Strengthens health infrastructure at all levels.

AB PM-JAY (Financial Protection):

Launched in 2018, it's the world's largest public health assurance scheme.

1. It provides a ₹5 lakh annual health cover per family for secondary and tertiary care.
2. Impact (as of June 2025): Over 9 crore hospital admissions worth more than ₹1 lakh crore have been authorized. It covers over 32,000 hospitals, and women constitute ~50% of admissions. The transgender community was included in 2023.

PM-ABHIM (Infrastructure):

Launched in October 2021 with a corpus of ₹64,000 crore to boost primary and critical care infrastructure and prepare for future pandemics.

ABDM (Digital Empowerment):

ABHA ID: A unique 14-digit health ID to link and access medical records nationwide. As of mid-2025, over 79 crore ABHA IDs have been created.

Innovations: The "Scan & Share" feature allows for QR code-based OPD registration in under 5 minutes, having already saved an estimated 6 crore man-hours.

6. Empowering the Farmers

This chapter outlines the strategic shift in India's agricultural policy towards ensuring farmers' income security and empowering them as Agri-entrepreneurs.

Importance of Agriculture: The sector contributes ~18% to India's GVA and employs 46% of the workforce.

Shift in Policy Focus: The central goal has shifted from just production to ensuring income security for farmers.

Multi-pronged Strategy:

Reducing Cultivation Costs:

1. The Kisan Credit Card (KCC) Scheme provides short-term concessional credit at a 4% interest rate. Agri credit via KCC reached ₹10.20 lakh crore by March 2025.
2. Fertiliser subsidies on Urea and DAP shield farmers from price inflation.

Ensuring Remunerative Prices:

3. The Minimum Support Price (MSP) policy covers 22 crops and is fixed at 1.5 times the cost of production.

Post-Harvest Infrastructure:

4. The Agriculture Infrastructure Fund (part of Atmanirbhar Bharat) provides loans with 3% interest subvention to create infrastructure like cold storages and pack houses.

Farmer Producer Organisations (FPOs): Over 10,000 FPOs have been established to help farmers with fragmented holdings achieve economies of scale and better bargaining power.

Digital Agriculture Mission:

Agri Stack: A Digital Public Infrastructure (DPI) is being created with three registries: a geo-referenced plot registry, a farmer registry with a unique Farmer ID linked to Aadhaar, and a digital crop survey.

Benefits: This DPI enables instant KCC loan approvals, direct MSP registration, and precision advisory services.

SATHI Portal: A portal for Seed Authentication, Traceability, and Holistic Inventory to ensure farmers receive quality seeds.

7. Freedom with a Steel Resolve

This chapter traces the history of India's steel industry, from its celebrated pre-colonial past to its current status as a global powerhouse.

Pre-Colonial Fame:

In the 18th century, India was renowned for its high-quality wootz steel, produced using a charcoal-based iron method.

Major steel-making centers included Golconda, Mysore, and Gwalior. Indian swords made from this steel were globally reputed.

Use in Warfare:

1. Tipu Sultan's sword, used against the British in 1799, was made from wootz steel.
2. Tipu Sultan and Hyder Ali also used pioneering iron-cased rockets in the 1780 Anglo-Mysore War, which were superior to British versions.
3. Rani Lakshmibai of Jhansi was a sword-wielding queen who fought in the 1857 Sepoy Mutiny.

Rise of the Modern Industry:

1. The discovery of the Raniganj coalfield in 1815 and rich hematite deposits in Odisha in 1903-04 enabled large-scale, coke-fuelled production.
2. In 1905, the government contracted to buy 20,000 tonnes of steel rails annually from Indian companies.

3. The first modern Indian steel plant, Tata Steel, began construction in Jamshedpur in 1908 and rolled its first ingots in 1912.

Post-Independence Growth:

1. In 1947, India's steel production capacity was around 1 million tonnes.
2. Today, India is the 2nd largest crude steel producer in the world, marking a journey from colonial constraints to global leadership.

KRUKSHETRA

1. Agriculture 4.0 – Towards Agri-Tech Revolution

This chapter provides a comprehensive overview of the state of Indian agriculture, the urgent need for a technological transformation, the key components of digital agriculture, and the path forward.

I. Importance & Challenges of Indian Agriculture

Economic Backbone:

1. Agriculture employs 42.3% of India's workforce.
2. It contributes around 18.2% to the national GDP.

Persistent Challenges:

Low Productivity: Yields are 20–60% lower than global averages.

Climate Dependency: 52% of farming is rain-fed and heavily dependent on the monsoon.

Fragmented Landholdings: 89.4% of farmers are smallholders, owning less than 2 hectares of land.

Post-Harvest Losses: Significant losses ranging from 0.92% to 15.88% occur across various crops.

Livestock Issues: The sector is hampered by a lack of quality fodder, gaps in animal healthcare, and weak supply chains.

II. The Concept of Digital Agriculture (Agriculture 4.0)

The Need: A growing population necessitates a technological transformation to increase farmer incomes, ensure food security, and enhance sustainability.

Two Core Paradigms:

Smart Farm Digitisation (Farm-Level): This involves using technologies like IoT-based sensors, drones for spraying, automated irrigation, and mobile-based farm management platforms to make individual farms more responsive and efficient.

Smart Agri-Sphere Digitisation (Ecosystem-Level): This focuses on strengthening the entire agricultural ecosystem through satellite-based monitoring, blockchain-enabled supply chains, and digital platforms for market access, credit, and insurance.

III. Key Digital Interventions & Rural Readiness

Addressing Farm-Level Challenges:

Pest Control: Technology can help mitigate the 30–35% of crop losses caused by pests.

Water Management: With 70–80% of farmers dependent on groundwater, IoT sensors can cut water usage by approximately 50%.

Labour Shortages: Automation helps alleviate labour shortages, a problem cited by 90% of farmers.

Digital Readiness: Rural India is increasingly ready for this transition.

1. 85.5% of households have smartphones.
2. 86.3% have internet access at home.
3. 95.5% of rural youth (15–29) own smartphones.

IV. Agri Stack India: A Comprehensive Digital Backbone

Purpose: The Agri Stack, or Comprehensive Agriculture Management System (CAMS), is a digital public infrastructure designed for policy planning, monitoring, and real-time decision-making.

Key Components: It integrates multiple databases, including:

1. An Aadhaar-linked Farmer Database with information on FPO membership and landless workers.
2. Geo-tagged Land & Asset Records with soil health and ownership status.
3. Real-time data from satellites and weather alerts.

4. Linkages to credit and insurance like Kisan Credit Cards and PMFBY.
5. Integration with government schemes like
6. PM-KISAN for targeted delivery and grievance redressal.

V. Government Schemes & The Way Forward

Dhan-Dhaanya Krishi Yojana: A new scheme approved for a 6-year period starting in 2025-26, it will cover 100 districts selected for low productivity, low cropping intensity, and low credit disbursement. It will be implemented by converging 36 existing schemes across 11 departments.

The Path to Agriculture 4.0:

Infrastructure: Improve high-speed rural internet and ensure reliable power through renewable energy.

Capacity Building: Strengthen agricultural extension services and provide skill development in digital tools for farmers.

Institutional Support: Leverage the network of 113 ICAR institutes, 74 Agricultural Universities, 731 KVKs, and over 1 lakh PACS to drive adoption.

2. Conservation Agriculture: Practices and Perspectives

This chapter details the shift towards Conservation Agriculture (CA) as a sustainable alternative to the intensive farming practices of the Green Revolution.

I. Background and Core Principles

Legacy of the Green Revolution: While it achieved food self-sufficiency, it led to negative consequences like soil health degradation, water stress, and air quality deterioration. This prompted the search for more sustainable practices.

Three Core Principles of CA: Defined by the FAO, this system is built on three interconnected principles applied simultaneously:

1. Minimum Soil Disturbance: Using Zero Tillage (ZT) and direct seeding to prevent erosion and preserve soil organic matter.
2. Permanent Soil Cover: Using organic mulch or crop residue to shield the soil, conserve moisture, and boost biodiversity.
3. Crop Diversification: Employing crop rotation and intercropping to improve soil structure and fertility while breaking pest cycles.

II. Benefits of Conservation Agriculture

Yield and Cost:

1. In the Indo-Gangetic Plains, Zero Tillage has resulted in 10-17% higher yields for rice and wheat.
2. It leads to an average cost reduction of 15-16% per hectare, with savings of ₹5,760 per hectare in the Indo-Gangetic Plains.

Climate and Environment:

1. ZT can sequester up to 3,667 kgs of CO₂ per hectare per year.
2. It saves about 60 litres of fuel per hectare, reducing CO₂ emissions by 156 kgs per hectare annually.
3. It also leads to a 25-35% saving in water.

Human and Social:

1. Reduces the drudgery for women farmers by cutting down on nursery and tillage work.
2. Improves public health by lowering air pollution from residue burning and reducing groundwater contamination.

III. Adoption and Way Forward

Current Scale: CA is currently practiced on 25-30 million hectares by over 7 lakh farmers in India, concentrated in the rice-wheat belt of Punjab and Haryana but expanding to other states.

Success Story: In Rajanpur village, Bihar, there has been 100% adoption of Zero-Tillage for wheat, supported by CSISA and ICAR, leading to significant yield increases.

Challenges: Key barriers include the high cost of ZT machinery, knowledge gaps among farmers, competing uses for crop residue (fodder), and cultural resistance to new practices.

The Path Forward: The focus must be on establishing CA mechanisation hubs, developing sustainable business models, strengthening subsidy schemes, and scaling up farmer training through participatory extension models.

3. Gene Editing Technology – Transforming Agriculture

This chapter explores the revolutionary impact of gene editing, particularly CRISPR–Cas9, on creating climate-resilient, nutritious, and high-yielding crops.

I. Introduction to Gene Editing

A Revolutionary Tool: Genome editing helps in precisely tailoring crops with desirable traits like increased productivity, pest resistance, and climate resilience.

CRISPR–Cas9: Derived from a bacterial immune system, the CRISPR–Cas9 "genetic scissors" were developed by Jennifer Doudna and Emmanuelle Charpentier, who were awarded the Nobel Prize in Chemistry in 2020.

Advantages: It is more precise than older GM methods and has faster development cycles than traditional breeding.

II. Applications in Crop Improvement

Yield Enhancement: In rice, editing genes like OsAPL and OsSXX1 has led to higher yields. Over 55 rice genes have been edited for various improvements.

Nutritional Improvements (Biofortification):

1. Golden Rice with beta-carotene for Vitamin A.
2. Zinc-enriched rice and wheat.
3. Wheat with reduced gliadin for celiac patients.
4. Soybean with reduced phytic acid for better iron and zinc absorption.

Managing Stress:

Abiotic Stress: Genes have been edited in maize and wheat for drought tolerance and in other crops for flood and salinity tolerance.

Biotic Stress: Knocking out "susceptibility (S) genes" has led to resistance against blast disease in rice and citrus canker in citrus fruits.

III. India's Progress and Regulatory Framework

Breakthroughs in Rice: In 2025, ICAR developed the world's first two genome-edited rice varieties:

1. DRR Rice 100 (Kamla): Offers a 20% higher yield and matures 20 days earlier, saving water and reducing methane emissions.
2. Pusa DST Rice 1: Tolerant to saline and alkaline soils.

Other Achievements:

1. Development of mustard with reduced glucosinolate at Delhi University.
2. Creation of the first gene-edited sheep with 30% higher muscle mass by ICAR in Kashmir.
3. Ongoing research in 24 field crops and 15 horticultural crops.

Regulatory Framework:

1. Unlike GM crops, gene editing does not involve inserting foreign DNA.
2. In 2022, India issued guidelines exempting genome-edited crops developed using SDN1 and SDN2 techniques from the stringent biosafety rules that apply to GM crops.
3. However, challenges like off-target effects, gene flow to wild relatives, and ethical debates must be carefully managed.

4. Carbon Farming for Climate-Smart Agriculture

This chapter explains the concept of carbon farming, detailing how sustainable agricultural practices can turn farms into carbon sinks, providing both climate and economic benefits.

I. Agriculture's Dual Role in Climate Change

As a Source: Agriculture contributes nearly 20% of global GHG emissions through sources like livestock, chemical fertilisers, and paddy cultivation.

As a Sink: Through sustainable practices known as carbon farming, agriculture can capture and store atmospheric CO₂, transforming from a net emitter to a net absorber of GHGs.

II. Core Carbon Farming Practices

This approach involves a suite of practices designed to increase carbon in soil and vegetation:

Agroforestry: Combining trees with crops to sequester CO₂.

Reduced Tillage: Minimizing soil disturbance to keep carbon locked in the soil.

Cover Cropping: Planting crops like clover or vetch to cover bare soil, preventing carbon loss and improving fertility.

Biochar Application: Adding a special charcoal made from biomass to soil, where it stores carbon for centuries.

4Rs Nutrient Management: Applying the Right Source, Right Rate, Right Time, and Right Place for fertilisers to reduce emissions.

III. Carbon Markets and the Way Forward

Economic Incentive: Carbon farming allows farmers to earn a new revenue stream by selling carbon credits (where 1 credit equals 1 tonne of CO₂ removed).

India's Potential:

1. India has the potential to generate \$63 billion in carbon revenue across 170 million hectares.
2. India was an early adopter of carbon trading and has the second-highest number of Clean Development Mechanism (CDM) projects globally, after China. The Indian Carbon Market was legalized via the Energy Conservation Amendment Act, 2022.

Challenges: Hurdles include the high cost of climate-smart technologies, lack of farmer awareness, and poor rural infrastructure.

The Path Forward: This requires a National Carbon Farming Mission, standardization of carbon measurement protocols, development of credible MRV (Measuring, Reporting, Verification) systems, and mobilizing KVKs for farmer training.

5. Ploughs to Precision

This chapter details the ongoing transformation of Indian agriculture from traditional, labour-intensive methods to modern, data-driven precision farming.

I. The Transition to Precision Agriculture

Economic Context: Agriculture provided livelihoods to over 46% of the population and contributed nearly 18% of GVA in 2023-24.

From Tradition to Technology: The sector is shifting from being dependent on manual labour and simple tools to adopting Precision Agriculture, which uses digital technologies for real-time, data-driven decision-making.

II. Key Digital Interventions

Artificial Intelligence (AI): AI is used to analyze big data from satellites and soil sensors for pest detection, yield prediction, and irrigation scheduling. Microsoft's

AI Farm Vibes in Baramati showed a 40% yield increase and 50% water savings.

Satellite and Remote Sensing: The government's FASAL programme with ISRO has improved crop forecasting and drought warnings.

Digital Marketplaces:

e-NAM (National Agriculture Market) has integrated 1,522 mandis and linked over 18 million farmers with buyers, promoting fair pricing.

Mobile Solutions: The Kisan Suvidha app provides real-time info, while the m-Kisan SMS service reaches 8.93 crore families in local languages.

Hardware Automation: Drones, automated irrigation systems like Nano Ganesh, and remote-operated transplanters are reducing labour effort and increasing efficiency.

III. Government Initiatives and the Way Forward

Digital Agriculture Mission (2024): Approved with a ₹2,817 crore outlay, this mission aims to build a unified digital ecosystem using AI, IoT, blockchain, and drones.

Agri Stack Project: This project is creating a digital database of over 11 crore farmers linked with Aadhaar, land records, and finances.

Namo Drone Didi (2023): With a funding of ₹1,261 crore, this scheme aims to empower 15,000 Women SHGs by distributing drones for smart spraying by 2026.

Challenges and Path Forward: The main hurdles are the digital divide, high costs of technology, limited digital literacy, and data privacy concerns. The way forward requires investment in digital infrastructure, farmer training in local languages, and a focus on affordable, farmer-centric technologies.

6. Agri Startups in India

This chapter highlights the booming aggrotech startup ecosystem in India, which is leveraging technology and innovation to solve long-standing agricultural challenges.

I. The Agritech Boom

The Problem: 80% of India's farmers are smallholders who face challenges like outdated techniques, lack of access to quality inputs and finance, and dependence on middlemen.

The Solution: Agritech startups are bridging these gaps with technology to improve productivity and streamline supply chains.

Growth & Investment: The sector has attracted \$2.4 billion in funding since 2014, with deal volume up 28% in 2024 compared to 2023. By 2025, India is projected to have over 4,000 agritech startups.

Government Support: The Startup India initiative has recognized 2,800 agritech startups, providing them with tax exemptions and funding support.

II. Key Areas of Impact & Success Stories

Precision Farming: Startups provide AI and IoT tools that can increase yields by up to 30%.

Supply Chain Optimization: Startups like Ninja cart and Cromar connect farmers directly to buyers, reducing post-harvest losses which can be as high as 20-30% in perishables.

Agri-Fintech: Startups like Arya.ag and Jai Kisan are bridging credit gaps for farmers. Arya.ag has facilitated ₹15,000 crore in storage and ₹8,000 crore in financing.

Success Stories:

DeHaat: An end-to-end solutions platform serving over 265,000 farmers in Bihar, UP, and Odisha. It has helped increase farmer incomes by 20% through direct market linkages.

Farm theory: A startup tackling Agri-waste by collecting surplus or imperfect produce and selling it to processors and retailers like Reliance Retail. It helps farmers earn an extra ₹15,000 per season for crops that would otherwise be wasted.

III. Challenges and Conclusion

Hurdles: Startups face challenges of low digital literacy (only 23% of rural India has reliable smartphone + internet), high costs of technology for smallholders, and inconsistent state-level regulations.

Conclusion: With over \$2.4 billion in investment and 4,000+ startups, the sector is poised for massive growth and can lead India into the fourth agricultural revolution by making farming more sustainable and profitable.

7. Cooperative Path to the SDGs

This final chapter underscores the crucial role of cooperatives in India's development, their natural alignment with the Sustainable Development Goals (SDGs), and the need for their modernization.

I. The Cooperative Advantage in India

Scale and Reach: India has a massive cooperative network, with over 8.5 lakh cooperatives and a membership of more than 30 crore people.

Historical Contributions: Cooperatives were central to India's major agricultural transformations:

1. Green Revolution: Enabled by credit and marketing coops like IFFCO and KRIBHCO.
2. White Revolution: Led by AMUL, which transformed India into the world's largest milk producer.

3. Blue Revolution: Strengthened by fishermen's cooperatives.

Alignment with SDGs: Unlike profit-driven corporations, cooperatives are people-centered and prioritize welfare, sustainability, and inclusiveness, making them natural partners for achieving the SDGs.

II. Recent Policy Push and Future Directions

Renewed Focus: The creation of a dedicated Ministry of Cooperation in 2021 and the Prime Minister's motto of "Sahkar Se Samridhi" (Prosperity through Cooperation) have provided renewed momentum.

Reforms: Key reforms include introducing model bye-laws for PACS to make them multipurpose, establishing new multi-state cooperatives for seeds and exports, and creating a National Cooperative Database.

Emerging Cooperatives: While India's focus has been on traditional sectors, there is a need to expand into emerging areas like renewable energy, platform/IT, health and care, and ecotourism cooperatives to address modern challenges.

III. Challenges and Conclusion

Key Issues: Cooperatives in India face significant challenges, including weak management, political interference, lack of professionalism, uneven digital adoption, and limited access to capital.

The Path Forward: Modernisation and reform are essential to improve governance, adopt technology, engage youth, and simplify regulations.

Conclusion: Cooperatives are vital for India's goal of becoming a developed nation by 2047. By strengthening this democratic and scalable model, India can ensure its growth is people-centered, equitable, and sustainable.

DOWN TO EARTH

1. Un SDG Report 2025: Progress Stalls or Reverses For 35% Of Targets

Context

Recent findings released ahead of the High-Level Political Forum on Sustainable Development, unveiled that about 35% of Sustainable Development Goals (SDGs) targets have either stalled or reversed.

Overview of the Sustainable Development Goals (SDGs)

Adoption: The SDGs were formally adopted in 2015 at the UN Sustainable Development Summit by all 193 UN Member States.

Scope: The framework consists of 17 interconnected goals and 169 targets, aiming for achievement by 2030.

Origins and Evolution:

- 1992: Agenda 21 adopted at the Rio Earth Summit, focusing on sustainable development.
- 2000: Millennium Development Goals (MDGs) launched to reduce extreme poverty globally.
- 2012: Rio+20 Conference set the groundwork for SDGs.
- 2015: SDGs formally launched, building on lessons from MDGs and Agenda 21.

Present Status (UN SDG Report 2025)

- Only 35% of SDG targets are on track or making moderate progress.
- Nearly 50% of targets are advancing too slowly.
- About 18% of targets have regressed, particularly in areas of hunger, poverty, and climate resilience.

Most Affected Goals

SDG1 – No Poverty & Water Crisis:

- 800 million people still live in extreme poverty.
- By 2030, 8.9% of the global population may remain in poverty, failing SDG1.
- In 2024, 2.2 billion people lacked safe drinking water, 3.4 billion lacked safe sanitation, and 1.7 billion lacked basic hygiene.

SDG2 – Zero Hunger:

4. Four out of seven targets are regressing.
5. In 2023, 9.1% of the global population (713–757 million) faced hunger, up from 7.5% in 2019.
6. Sub-Saharan Africa had the highest hunger rate (23.2%), while Southern Asia had the largest absolute number (281 million).
7. Food insecurity affected 2.33 billion people, 383 million more than in 2019.
8. Drivers include conflict, climate variability, economic shocks, with 50% of countries experiencing elevated food prices in 2023 – triple pre-pandemic levels.

SDG3 – Good Health and Well-Being:

9. Maternal mortality and universal health coverage targets show stagnation.
10. Global health systems weakened due to COVID-19, chronic underfunding, and systemic inequalities.

SDG4 – Quality Education:

11. Nearly 36% of children in low-income countries are out of school.
12. Learning proficiency remains low, hindering skill development.

SDG6 – Clean Water and Sanitation:

13. 3.4 billion people lack safely managed sanitation.
14. 1.7 billion people lack basic hygiene services.
15. Climate change and infrastructure gaps worsen global water stress.

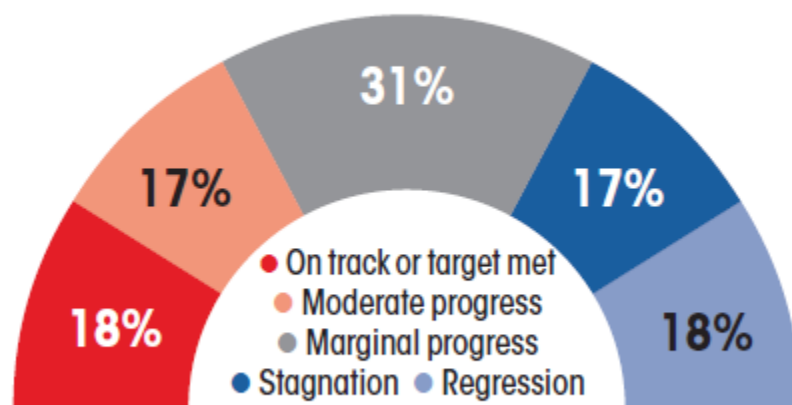
SDG8 – Decent Work and Economic Growth:

16. Half of the tracked targets have stagnated or declined.
17. Informal employment rose to 57.8% of the global workforce in 2024.
18. Youth unemployment stood at 12.9%, nearly three times the adult rate (3.7%).

SDG14 – Life Below Water:

19. 40% of its targets are regressing.
20. Issues include marine pollution, declining fish stocks, and ecosystem degradation.
21. Despite urgency, SDG14 is the least funded SDG, as highlighted at UN Ocean Conference 3 (UN-OC 3).

Overall progress across measurable targets under SDGs, based on 2015-25 global aggregate data



Note: Percentages do not add up to 100 per cent due to rounding

Climate Emergency and Funding Gaps

1. 2024 was the hottest year on record, with temperatures 1.55°C above pre-industrial levels.
2. WMO predicts an 80% chance that an even hotter year will occur before 2030.
3. Development assistance fell 7.1% in 2024, ending a 5-year growth trend.
4. The SDG financing gap now stands at \$4 trillion annually, severely impacting developing nations.

Promising Developments

1. HIV infections dropped by 40% since 2010.
2. Malaria control efforts saved 12.7 million lives since 2000.

3. Social protection coverage now reaches over 50% of the global population, showing gradual improvement.
4. SDG7 – Affordable and Clean Energy: 40% of sub-targets are on track, driven by renewable energy expansion.
5. SDG12 – Responsible Consumption and Production: 36% of sub-targets progressing, especially in sustainable procurement and R&D.

Key Challenges

Climate Change: Escalating disasters and biodiversity loss undermine development gains.

Conflict and Instability: Wars in Ukraine, Sudan, and Gaza disrupt multiple SDGs.

Debt and Financing: Developing countries face a grim economic outlook with a \$4 trillion annual SDG financing gap.

Data Deficiency: Only about 70% of indicators have sufficient coverage, especially in low-income regions.

Road Ahead – Six-Point Acceleration Plan

1. Transform food systems for resilience and sustainability.
2. Expand energy access with renewable and clean technologies.
3. Accelerate digital transformation across sectors to improve inclusion and productivity.
4. Ensure inclusive education, addressing out-of-school children and learning gaps.
5. Create decent jobs and social protection, focusing on youth and informal sector workers.
6. Protect climate and biodiversity, integrating mitigation and adaptation strategies.
7. Data Systems: Adopt the Medellín Framework for Action to build robust, evidence-driven monitoring and policy frameworks.

2. India's New Epr Framework for Nonferrous Metals

Context

Recently, the Union government's updated rules provide ambitious recycling timelines for nonferrous metals with the introduction of a new Extended Producer Responsibility (EPR) framework but provide little clarity on implementation. The Government of India has introduced a significant environmental policy by notifying the Extended Producer Responsibility (EPR) framework for non-ferrous metals. Notified under the Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2025, this framework is set to become effective from April 1, 2026. Its primary objective is to integrate key metals such as aluminium, copper, zinc, and their alloys into a structured circular economy, making producers responsible for the end-of-life management of their products.

What the Framework Promises: Key Features Explained

The EPR framework is built on several core pillars designed to create a comprehensive and accountable system for metal waste management.

Wide Coverage and Scope:

The rules are designed to be all-encompassing, applying to a vast array of products that use non-ferrous metals. This reflects the deep integration of these metals into modern life.

Examples Include:

Aluminum: Beverage cans, packaging foils, aerosol cans, kitchen utensils, window frames, and parts used in automobiles and aircraft.

Copper: Electrical wiring and cables, plumbing pipes, electronic components (circuit boards), industrial machinery, and roofing materials.

Zinc: Galvanized steel (for rust-proofing), batteries, die-casting alloys for industrial parts, and automotive components.

By covering such a broad spectrum, the framework aims to capture a significant portion of the metal waste stream that currently ends up in landfills or is processed inefficiently.

Progressive Recycling Targets:

The framework introduces a phased and incremental approach to recycling, giving the industry adequate time to build capacity and adapt. This avoids imposing an immediate and unachievable burden.

The Timeline:

1. **2026–27:** The initial target is set at a modest 10%.
2. **Gradual Increase:** The percentage will be increased steadily in subsequent years.
3. **2032–33:** The final target is set to reach 75%.

This long-term, predictable timeline sends a clear signal to the industry to invest in modern recycling technologies, collection infrastructure, and partnerships to meet future obligations.

Digital Backbone for Transparency and Efficiency:

A cornerstone of the framework is the creation of a centralized online portal by the Central Pollution Control Board (CPCB). This digital platform is intended to be the single point of contact for all EPR-related activities.

Functions of the Portal:

Registration: All stakeholders will register on the portal, creating a national database.

Compliance Monitoring: Producers will file annual returns detailing production, waste collection, and recycling data, allowing the CPCB to track progress against targets in real-time.

EPR Certificate Trading: The portal will facilitate a market-based mechanism where certified recyclers can generate EPR certificates for the quantity of waste they process. Producers who exceed their targets can sell surplus certificates to those who fall short, creating a financial incentive for over-performance.

Inclusive Stakeholder Ecosystem:

The framework mandates the registration of every actor in the metal waste value chain, ensuring that responsibility is clearly defined and shared.

Key Stakeholders and Their Roles:

Producers/Importers: Those who introduce the products into the market. They are primarily responsible for meeting recycling targets.

Manufacturers: Companies that use these metals to create final products.

Recyclers & Refurbishers: Formal entities responsible for scientifically processing waste material and bringing it back into the economy.

Collection Agents: Organizations or individuals involved in aggregating waste from various sources.

Bulk Consumers: Large industries or entities that use significant quantities of these metals and generate substantial waste.

Implementation Challenges: Hurdles to Overcome

Despite its strong vision, the framework faces several practical challenges that could hinder its successful implementation.

Overburdened Central Pollution Control Board (CPCB):

1. The CPCB has been given a massive mandate to be executed within a very tight six-month timeframe. Its responsibilities include developing the complex online portal, drafting detailed operational guidelines, verifying stakeholder credentials, conducting nationwide inspections, and organizing awareness and training programs.
2. Given the CPCB's existing responsibilities and documented limitations in manpower and resources, this timeline appears highly optimistic and risks a rushed, inefficient rollout.

Exclusion and Marginalization of the Informal Sector:

3. A vast majority of metal waste in India is currently collected, segregated, and processed by the informal sector (e.g., scrap collectors, small aggregators). This sector is the backbone of the current recycling system.
4. The framework, in its current form, focuses heavily on formal registration and digital compliance, offering no clear roadmap for integrating these informal players. These risks disrupting the existing efficient collection networks and, more importantly, could lead to the loss of livelihoods for millions of people.

High Administrative Complexity:

5. The requirement for multiple registrations, constant data submission, and adherence to complex compliance norms can be particularly burdensome for Small and Medium Enterprises (SMEs).
6. These smaller players often lack the dedicated administrative staff or financial resources to navigate such a system, which could lead to non-compliance or force them out of the market, potentially leading to consolidation in favor of larger corporations.

Lack of Clarity in Penalty Structures:

7. While the rules mention the imposition of "environmental compensation" for non-compliance, they fail to specify the methodology or formula for calculating these penalties.
8. This ambiguity creates significant uncertainty for businesses. Without a clear understanding of the financial risks associated with failing to meet targets, companies cannot effectively plan or budget for compliance, and it may also lead to arbitrary or inconsistent enforcement.

What Needs Strengthening: Recommendations for Success

To ensure the framework achieves its intended goals, the following areas require immediate attention and reinforcement.

Urgent Capacity Building:

1. The CPCB and the State Pollution Control Boards (SPCBs) must receive significant financial and technical support.
2. This includes investing in robust IT infrastructure for the portal, hiring personnel with expertise in data management and environmental auditing, and providing extensive training to existing staff to handle the new responsibilities effectively.

Formalizing and Integrating the Informal Sector:

3. A dedicated policy must be created to bring informal recyclers into the formal system.

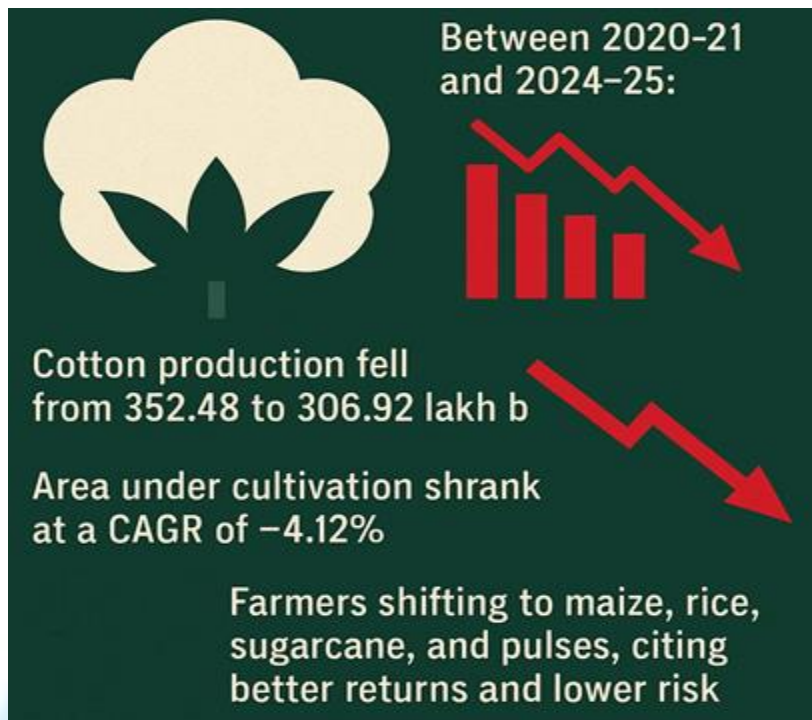
Possible Steps:

1. Simplify registration processes for them.
2. Provide training on safety, health, and advanced sorting techniques.
3. Offer financial support through subsidies or access to credit for upgrading their equipment.
4. Facilitate partnerships between informal collectors and formal Producer Responsibility Organizations (PROs) or recyclers.

Enhancing Transparency and Accountability:

4. The government must issue clear, unambiguous guidelines on critical aspects of the framework.
5. This includes publishing a transparent formula for calculating environmental compensation, establishing clear rules for the trading and pricing of EPR certificates, and defining standards for what constitutes "recycled content" to prevent fraudulent claims and ensure the system's integrity.

3. Herbicide Tolerant Cotton



What is Herbicide Tolerant (HT) Cotton?

HT cotton is a type of genetically modified crop engineered to withstand the application of specific herbicides, most commonly glyphosate. This broad-spectrum chemical is designed to kill most plants, making it an effective weed killer.

The primary advantage for farmers is simplified weed management. They can spray glyphosate across their entire field to eliminate weeds without damaging the cotton crop itself. However, this convenience comes with substantial and often severe downsides:

Rise of 'Superweeds': The widespread and repeated use of a single herbicide like glyphosate inevitably leads to the natural selection of weeds that are resistant to it. These herbicide-resistant weeds, often called 'superweeds', become extremely difficult and costly to control.

Environmental Contamination: Glyphosate can easily run off from fields into nearby streams, rivers, and groundwater. This contamination harms aquatic ecosystems, affecting fish and other organisms, and can work its way up the food chain.

Harm to Non-Target Organisms: The herbicide does not distinguish between weeds and other plants. It can kill beneficial plants, impact soil microorganisms crucial for soil health, and harm important insects, including essential pollinators like bees.

Degradation of Soil Health: Continuous exposure to powerful chemical herbicides can degrade soil quality, reduce biodiversity within the soil, and negatively impact long-term agricultural productivity.

Ecological Red Flags and Broader Impacts

The environmental concerns associated with HT cotton and glyphosate extend beyond the farm.

Threat to Keystone Species: In the delicate desert ecosystems of northwest India, the increased use of glyphosate poses a direct threat to *Prosopis cineraria* (Khejri tree). The Khejri is a keystone species, meaning it plays a critical role in maintaining the structure and health of its ecosystem by providing food, shelter, and soil stability. Its loss could have cascading negative effects on the entire region.

Lessons from Bt Cotton: The experience with another GM crop, Bt cotton, serves as a cautionary tale. While initially successful in controlling the American bollworm, pests quickly evolved. The pink bollworm developed resistance, and new threats like the tobacco streak virus (TSV) emerged, rendering Bt cotton less effective and making cultivation economically challenging for many farmers. There is a high risk that HT cotton will accelerate a similar cycle of pest and weed resistance.

Human Health Concerns: The health impacts of glyphosate remain a subject of intense global debate. Some studies and international health organizations have pointed to its potential as a carcinogen, raising serious questions about its safety for farmers and consumers.

Policy and Regulatory Failures

Despite being unapproved for commercial cultivation in India, the sale and planting of illegal HT cotton have exploded.

Massive Illegal Market: The illegal market is substantial, with sales of unauthorized seed packets jumping from an estimated 30 lakh in 2020 to over 75 lakhs in 2021.

Regulatory Inaction: The Genetic Engineering Appraisal Committee (GEAC), India's top regulatory body for GM crops, has been largely ineffective in preventing the spread of unapproved HT cotton. This failure undermines the entire regulatory framework for biosafety.

Deception of Farmers: Farmers are often drawn to HT cotton by aggressive marketing and unsubstantiated claims of doubled yields and reduced labour. However, these promises are not supported by credible agronomic data, leaving farmers vulnerable to crop failure and economic loss when the technology fails to perform as advertised.

The Path Forward

Reviving India's cotton sector requires moving away from a reliance on single-technology solutions and adopting a more sustainable and integrated approach.

Investment in Breeding: Focus should be on developing locally adapted, high-yielding hybrid cotton varieties through conventional breeding that have natural resistance to a range of pests and diseases.

Agricultural Diversification: Moving away from cotton monocultures and promoting diverse cropping systems can break pest cycles, improve soil health, and provide farmers with more stable incomes.

Ecological Farming: Investing in and promoting Integrated Pest Management (IPM) and other ecological farming practices can reduce the dependency on chemical inputs, lower cultivation costs, and create a more resilient agricultural system.

Strengthening Oversight: It is crucial to strengthen the regulatory capacity of bodies like GEAC to enforce bans on illegal GM crops and ensure that any future approvals are based on rigorous, independent, and transparent scientific evaluation.

4. Offshore Sand Mining in India

Context

Fisher communities in Kollam, Kerala, protest the government's plan to commence offshore sand mining.

1. Earlier, the Union government announced the auction of mineral blocks in the offshore areas of Gujarat, Andaman and Nicobar Islands and Kerala for extraction of lime mud, polymetallic nodules and sand.
2. Offshore sand mining is the process of extracting or dredging large quantities of sand from the seabed. This industrial activity is typically carried out at depths ranging from 22 to 45 meters to access sand deposits formed over time by marine processes. After being extracted, the sand is treated through desalination (removing salt) to make it suitable for construction purposes.

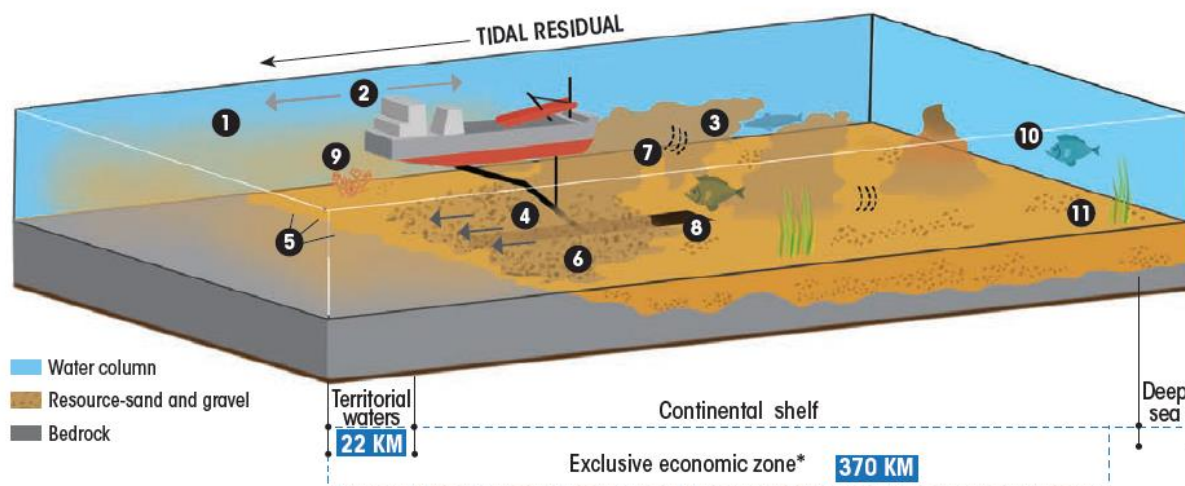
According to the Geological Survey of India (GSI), India has vast offshore sand reserves. For example, the offshore region of Kerala alone is estimated to hold 745 million tonnes of construction-grade sand, with the Kollam coast containing over 302 million tonnes.

HAZARDOUS CHURN

Offshore sand mining can result in habitat loss for marine species, adversely affecting communities that rely on fishing for livelihood

DIRECT AND INDIRECT IMPACTS OF OFFSHORE SAND MINING

1. Increased turbidity	6. Deposition from sediment plumes	9. Local extinctions, like coral loss
2. Far-field changes in tides and currents	7. Ship/Machinery noise	10. Habitat loss for marine species
3, 4. Sand plume dispersal	8. Seabed removal: bathymetric change	11. Changes in species composition
5. Seabed sediment veneers		



*India's exclusive economic zone is up to 200 nautical miles (370.4 km) from the shore or till the continental shelf, whichever is further, denoting the point till which the country can explore its resources; Source: "Grains of Gold-Excavating the Perils of Sand mining", *Journal of Environmental Sustainability*, 2021; National Centre for Polar and Ocean Research; media reports

Legal Framework

While sand is classified as a 'minor mineral' under the Mines and Minerals (Development and Regulation) Act, 1957, which typically falls under state jurisdiction, offshore mining operates differently. It is governed by the central government's Offshore Areas Mineral (Development and Regulation) Act, 2002. This act was amended in 2023 to open up the sector to private companies and allow for long-term leases of up to 50 years.

Why the Government Supports It

The government views offshore sand mining as a viable solution for several reasons:

Economic Potential: The massive reserves can meet regional construction demands for decades. For instance, Kerala's offshore sand could satisfy its needs for 25 years at an annual consumption rate of 30 million tonnes.

Revenue Generation: The activity is expected to generate significant revenue for the government through shipping, trade, and the collection of Goods and Services Tax (GST).

Environmental Justification: It is often promoted as a more sustainable alternative to riverbed and coastal sand mining. These traditional forms of mining are highly destructive, causing severe riverbank erosion, altering water flow, and destroying critical habitats.

Ecological and Social Concerns

Despite the economic benefits, offshore mining poses serious threats to the marine environment and coastal communities.

Marine Habitat Disruption: The dredging process physically removes the top layer of the seabed, destroying the habitat for **benthic organisms** (like crabs, worms, and mollusks) that live in the sediment. This also disrupts vital fish breeding and spawning grounds.

Water Turbidity and Pollution: Dredging creates large underwater clouds of suspended sediment, known as plumes. These plumes increase water turbidity, blocking sunlight needed by marine plants and corals. They can also release trapped toxins or heavy metals from the seabed into the water column.

Coastal Erosion: Removing vast amounts of sand from the seabed can alter wave patterns and tidal currents. This can weaken natural coastal defenses like rocky reefs and sandbars, leading to increased shoreline erosion.

Threats to Livelihoods: The ecological damage directly impacts coastal communities. In Kollam, for example, the proposed mining area includes the Kollam Bank, a rich fishing ground that supports the livelihoods of over 25,000 fishers. Destroying this ecosystem would have devastating economic consequences for them.

Policy and Legal Safeguards

To mitigate these risks, the regulatory framework includes several proposed safeguards:

1. Mandatory Environmental Management Plans (EMPs) must be in place before any production can begin.
2. Production plans must align with ecological safeguards to minimize harm.
3. Close coordination is required between mining companies, state authorities, and scientific institutions like the National Institute of Oceanography (NIO) to ensure responsible practices.

5. UN Frontier Report 2025: Floods Unleash Toxic Legacy Chemicals from Sediments

Context

Recently, the UNEP 'Frontiers 2025: The Weight of Time' report revealed that the intensified flooding events are remobilizing long-buried toxic chemicals from river and coastal sediments, exposing ecosystems and human populations to serious health risks.

What Are Legacy Chemicals?

1. Legacy chemicals are persistent pollutants that were widely used in the past but have since been banned or restricted due to their toxicity. These include:
 1. Heavy Metals: Lead, cadmium — toxic even at low concentrations;
 2. Persistent Organic Pollutants (POPs): Pesticides, industrial by-products, synthetic chemicals.
2. These substances do not degrade easily and accumulate in sediments of polluted rivers, lakes, and estuaries.
1. Despite regulatory bans, they remain in the environment for decades.

How Floods Mobilize Toxic Sediments

Floodwaters can:

1. Re-suspend and redistribute contaminated sediments;
2. Spread pollutants across landscapes and into water bodies;
3. Introduce toxins into the food chain, affecting plants, animals, and humans.

Report cites examples such as:

1. Hurricane Harvey (2017): Released mercury and carcinogens into Galveston Bay, Texas;
2. Niger Delta floods (2012): Mobilized polycyclic aromatic hydrocarbons (PAHs);
3. Pakistan floods (2010): Swept away 2,835 metric tonnes of obsolete pesticides.

Health and Ecological Risks

Legacy chemicals can cause:

1. Neurotoxicity and immunotoxicity;
2. Kidney and bone damage;
3. Reproductive harm and cancers;
4. Endocrine disruption

In India, rivers like the Ganga, Hindon, and Vaigai show cadmium levels in sediments that exceed safe thresholds, posing risks to aquatic life and human health.

Climate Change Intensifies the Threat

1. Increased rainfall and tropical storms are driving more frequent and severe floods;
2. Urbanization and poor waste management exacerbate sediment contamination;

3. Millions of tonnes of POP waste remain in global landfills, vulnerable to flood exposure.

UNEP's Recommendations

Nature-based solutions: Wetlands, floodplains, riparian buffers;

Traditional infrastructure: Polders, dikes, retention basins;

Integrated river basin management: Balancing flood control, conservation, and water use;

Sediment pollution mapping: Geo-profiling of riverbeds to anticipate contamination;

Monitoring pollutant pathways: Tracking how toxins travel post-flood;

6. India Leads South Asia's Remarkable Progress in Childhood Immunization

Context

India has made significant strides in child immunization, reducing the number of zero-dose children—those who have missed all vaccinations—by 43% in just one year, according to new data released by WHO and UNICEF.

1. In 2023, India recorded 1.6 million zero-dose children. That number has now dropped to 0.9 million in 2024, marking a reduction of nearly 700,000 children.

Regional Immunization Hits Historic Highs

1. South Asia, as a region, achieved its highest-ever immunization coverage in 2024:
 1. 92% of infants received the third dose of the DTP vaccine (DTP3), up from 90% in 2023.
2. It surpasses even pre-COVID-19 levels.

Country-wise Highlights

Nepal: Halved the number of zero-dose children.

Pakistan: Achieved its highest-ever DTP3 coverage at 87%.

Afghanistan: Remains a concern with the lowest immunization coverage in the region and a slight decline compared to last year.

Measles Vaccine Uptake

1. 93% of infants received the first dose.
2. 88% received the second dose.
3. Reported measles cases dropped 39% in 2024.

HPV Vaccination Efforts

1. Bangladesh vaccinated over 7.1 million girls since launching its HPV program last year. Bhutan, Maldives, and Sri Lanka also reported steady increases. India and Pakistan are set to launch their HPV vaccination campaigns later in 2025.
2. Bhutan, Maldives, and Sri Lanka also reported steady increases.
3. India and Pakistan are set to launch their HPV vaccination campaigns later in 2025.

Challenges Ahead: 2.9 million Still Un- or Under Vaccinated

1. Despite the gains, over 2.9 million children in South Asia remain either unvaccinated or under vaccinated.
2. Health officials stress that reaching these children, particularly in remote and underserved areas, remains a critical priority.

7. Intense Marine Heatwave in Mediterranean Shocks With 8°C Warming

Context

The Mediterranean Sea is currently experiencing an unprecedented marine heatwave, with sea surface temperatures soaring up to 8°C above normal.

What's Happening?

1. Peak anomalies of +8°C have been recorded off the coasts of France and Italy, with absolute temperatures nearing 31°C (88°F).
2. The western Mediterranean basin, including the Balearic and Tyrrhenian Seas, is the worst affected.

3. The deviation from normal sea surface temperatures is six standard deviations—statistically placing it in the realm of near impossibility without global warming.

What's Causing It?

1. The primary driver is a heat dome—a high-pressure system that traps heat and suppresses wind activity, preventing ocean mixing. This leads to:
 1. Accumulated heat in surface waters;
 2. Amplified warming due to reduced aerosols and altered atmospheric circulation;
 3. A feedback loop between atmospheric and marine heatwaves
2. Afghanistan: Remains a concern with the lowest immunization coverage in the region and a slight decline compared to last year.

Ecological Fallout:

1. Mass mortalities of fish and invertebrates due to low oxygen levels;
2. Coral bleaching and die-offs of seagrass beds;
3. Disease outbreaks in mussel farms;
4. Threats to endangered species like the noble fan mussel.

A study published in *Aquaculture* (July 2024) found that marine heatwaves in the Mediterranean have tripled in frequency and now last 50% longer than they did 40 years ago.

8. India Reaches 50% Non-fossil Fuel Power Capacity

Context

In a landmark achievement for clean energy, India has reached 50% of its installed electricity capacity from non-fossil fuel sources, five years ahead of its 2030 target under the Paris Agreement.

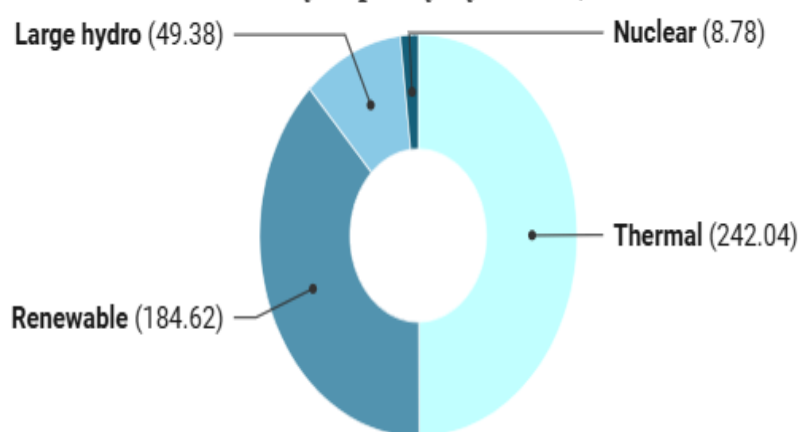
Numbers Behind the Milestone

Total installed capacity: 484.82 GW (as of June 30, 2025)

Non-fossil fuel sources: 242.78 GW (50.1%)

1. Renewables: 184.62 GW (38.08%)
2. Large hydro: 49.38 GW (10.19%)
3. Nuclear: 8.78 GW (1.81%)

Installed electricity capacity by source, in GW



It fulfills one of India's Nationally Determined Contributions (NDCs) under the Paris Agreement well ahead of schedule.

Related Efforts & Initiatives

PM-KUSUM: Promoted solar-powered irrigation and feeder-level solarisation;

PM Surya Ghar: Muft Bijli Yojana: Targeted rooftop solar for 10 million households;

Solar Parks & Wind-Solar Hybrid Policy: Enabled large-scale deployment of renewables;

Bioenergy Expansion: Boosted rural employment and circular economy goals.

What's Next?

1. 500 GW of non-fossil fuel capacity by 2030;
2. 45% reduction in emissions intensity of GDP;
3. Net-zero emissions by 2070

9. Coal: Balancing Energy Security and Climate Responsibility

Context

India, as the world's third-largest energy consumer, needs to reconcile its growing demand for power with the urgent need to address climate change.

About

1. Coal has long been the backbone of India's energy infrastructure, currently providing around 70–75% of electricity, and is projected to decline to 50% by 2030 as wind and solar expand.
2. It is abundant, cost-effective, and crucial for powering industries such as steel, cement, and chemicals.
3. Government has undertaken several key reforms to modernize the sector, including:
4. Commercial coal mining to attract private investment and boost efficiency;
5. Single-window e-auction systems to streamline coal distribution;
6. Reopening abandoned mines to maximize resource utilization.

Environmental Costs of Coal

1. Energy demand is set to double by 2030, essential for growth, livelihoods, and health.
2. Coal is a major contributor to environmental degradation, despite its economic benefits. Coal-fired power plants account for:
3. 60% of particulate emissions;
4. Over 80% of mercury emissions;
5. 45–50% of sulphur dioxide emissions;
6. 30% of nitrogen oxide emissions.
7. Water consumption is another concern — coal power plants withdraw 65% of all freshwater used by Indian industry.
8. Recognizing these impacts, the Indian government has introduced stricter emission norms and mandated recycled water usage for plants along the Ganga.

Transitioning Responsibly: Clean Coal and Renewables

1. India's approach is not to abruptly phase out coal, but to displace it gradually with cleaner alternatives. Key strategies include:
2. Supercritical technology for new coal plants to reduce emissions;
3. Coal gasification and liquefaction to diversify coal use;
4. Carbon Capture and Storage (CCS) to mitigate CO₂ emissions;
5. Investments in renewable energy, with a target of 500 GW by 2030.
6. Coal India Limited has committed to installing 5 GW of renewable energy capacity, signalling a shift toward a more sustainable energy mix. of 500 GW by 2030.

Roadmap for Decarbonising Coal Power

1. Benchmarking Efficiency: Existing plants should be required to match the performance of the best units in their category.
2. For example, older but well-maintained plants such as Tata Power's Trom Bay unit demonstrate how efficiency standards can drive emission reductions across the fleet.
3. Biomass Co-Firing: Mandating a 20% switch to biomass for co-firing can significantly cut carbon emissions.
4. Many plants already co-fire biomass, making this a scalable and practical solution.
5. Policy and Market Reforms: Technological improvements alone will not suffice. Policy incentives and structural reforms are essential.
6. The current merit order dispatch system Favors cheaper, older plants that run dirtier.

7. Ultra-supercritical plants — though cleaner — often operate at less than 50% capacity, undermining their efficiency advantage.
8. A new system must prioritize environmental performance alongside cost to displace dirty coal effectively.

10. Future of Farming: Decline of Farms and the Aging Farmer Population

Context

Farming in India is facing unprecedented challenges as farms decline worldwide, farmers age, and youth shy away from agriculture, raising urgent questions about the future of food production.

Declining Workforce in Agriculture

1. Data from the International Labour Organization shows a sharp decline in agricultural employment:
2. In 1991, agriculture accounted for 43% of global employment.
3. By 2023, this share dropped to 26%.
4. The situation is particularly stark in India, where the 2011 Census revealed that 2,000 farmers quit farming every day.

Aging Farmers and Youth Disinterest

1. The average global age of farmers is 55 years, closer to retirement. Meanwhile, fewer young people are entering farming, seeing it as unprofitable and labour-intensive.
2. It poses a serious risk to sustaining food systems in the future.

Limits of Land and Climate Pressures

1. Farming is uniquely constrained:
2. Land is finite and faces competing demands from urbanization, industry, and conservation.
3. Climate change disrupts crop cycles, adding volatility to yields.
4. Despite advances, farming remains labour-intensive, deterring new entrants.
5. Hannah Ritchie of Our World in Data notes that global agricultural land use has peaked and is now in decline, marking 'a historic moment in humanity's relationship to the planet'.

Projected Decline of Farms

1. Zia Mehrabi (University of Colorado) offers one of the first global projections for farm numbers:
2. 2020: 616 million farms worldwide.
3. 2100: Expected to drop to 272 million.
4. Key drivers of this trend include urban migration and economic growth, leading to fewer people engaged in rural farming.
5. Low-income countries may see growth until 2070, after which decline is expected there too, while farms decline in higher-income regions.

Rising Farm Sizes and Consolidation

1. As farms decline, their average size will grow:
2. By 2050, global farm size is projected to increase by 10%.
3. By 2100, it is expected to double.
4. It could bring efficiency but also risks reducing diversity in farming practices.

Food Security Concerns

1. The decline raises critical questions about feeding a growing population:
2. Today, 600 million farms sustain 8 billion people.
3. By 2100, half the number of farms will need to feed even more people.
4. Small farms — though occupying only 25% of agricultural land — produce one-third of the world's food.
5. Their decline may disrupt biodiversity, reduce resilience, and weaken food supply chains.

Conclusion

1. The future of farming hinges on urgent reforms:
2. Education and support systems for farmers.

3. Sustainable land use policies.
4. Climate-resilient agricultural practices.
5. As the world faces fewer farmers, larger farms, and increasing food demand, decisive action is essential to safeguard food security and preserve farming as a viable profession for future generations.

11. New National Agriculture Policy

Context

Recently, the Union Ministry of Agriculture & Farmers Welfare, unveiled the new 'National Agriculture Policy' aimed to address the evolving challenges of climate change, market volatility, and farmer income security, and positioning India as a resilient and self-sufficient Agri-economy.

Core Objectives of the Policy

1. Increase crop production and productivity through improved seeds, precision farming, and technology adoption.
2. Reduce cost of production by promoting efficient irrigation, mechanization, and input subsidies.
3. Ensure remunerative prices for farmers to enhance income through better market access and MSP reforms.
4. Promote agricultural diversification into horticulture, pulses, oilseeds, and allied sectors.
5. Develop post-harvest infrastructure for value addition, storage, and processing.
6. Adapt to climate change through resilient cropping systems and risk mitigation strategies.

Sector Performance and Economic Impact

1. According to the Ministry of Statistics and Programme Implementation (MoSPI), the Gross Value Added (GVA) growth rate in agriculture and allied sectors for 2024–25 is estimated at 4.6%, reflecting the sector's robust performance despite global uncertainties.
2. India's domestic market remains vast, and agricultural self-sufficiency is not just an economic goal—it carries geopolitical significance.
3. The new policy reinforces this by aligning national schemes with state-level priorities, recognizing agriculture as a state subject.

Supporting Schemes and Missions

1. Digital Agriculture Mission: Creating digital public infrastructure and crop estimation tools.
2. Clean Plant Programme: Ensuring disease-free planting material for horticulture.
3. National Mission on Edible Oils – Oilseeds (NMEO): Boosting domestic oilseed production.
4. National Mission on Natural Farming (NMNF): Promoting chemical-free, sustainable farming practices.
5. Expanded Agriculture Infrastructure Fund (AIF): Supporting community farming assets and integrated processing projects.

Vision for New India

1. The policy reflects NITI Aayog's vision of transforming Indian agriculture through innovation, inclusivity, and sustainability.
2. It emphasizes stakeholder consultations, in-house research, and strategic inputs to the Prime Minister's Office for effective implementation.

12. Groundwater Keeps Ganga Flowing in Summer: IIT Roorkee Study

Context

Recently, a study by IIT Roorkee found that the Ganga River's summer flow of Ganga River is sustained by groundwater during the dry season.

Science Behind the Discovery

1. The study used advanced isotopic analysis to trace the Ganga's water sources from its Himalayan origin to its journey across the Indo-Gangetic plains, published in Hydrological Processes. The findings are striking:

2. Glacier melt contributes almost nothing to the river's flow once it enters the plains.
3. Groundwater discharge accounts for nearly all of the Ganga's summer flow up to Patna.
4. The river's volume increases by 120% along this stretch due to groundwater input.
5. However, 58% of the river's water evaporates during summer, a massive and often overlooked loss.

Resilient Aquifer System

1. The study challenges satellite-based narratives of widespread groundwater depletion. Using two decades of field data, researchers found:
2. Central Ganga plain aquifers remain stable, supported by shallow hand pumps.
3. The underground system is robust and resilient, still feeding the river reliably.
4. It noted that the Ganga basin holds about 8,300 billion cubic metres of groundwater, with 99% in alluvial deposits.
5. The shallow aquifers (~50 metres deep) contain nearly 30% of India's total replenishable groundwater resources.

Implications for River Management

1. These findings have profound implications for water policy and river rejuvenation efforts:
2. Namami Gange and Jal Shakti Abhiyan need to prioritize aquifer recharge and tributary revival.
3. Barrages and diversions need to be managed to maintain natural groundwater flow into the river.
4. Over-extraction and neglect of tributaries, not glacier retreat, are the real threats to the Ganga's summer flow.

13. Coral Reefs in Lakshadweep

Context

According to a study published in the journal Diversity and Distributions, coral cover in Lakshadweep nearly halved between 1998 and 2022, dropping from 37.2% to just 19.1% by 2022, due to repeated marine heatwaves and bleaching events.

Heatwaves and Bleaching: A Repeating Cycle

1. Lakshadweep has endured three major marine heatwaves over the study period—1998, 2010, and 2016 — each linked to El Niño events and rising sea surface temperatures.
2. These heatwaves triggered mass coral bleaching, with the 2010 event being the most severe, registering a Degree Heating Week (DHW) of 6.7.
3. Interestingly, while coral mortality has decreased over time, this is not necessarily a sign of resilience.
4. Researchers suggest that many heat-sensitive species have already vanished, leaving behind stress-tolerant genera like Porites, Isopoda, and Favia.

Recovery Needs Time — At Least Six Years

1. One of the study's most striking findings is that coral recovery accelerates only after a six-year gap between bleaching events.
2. Shorter intervals, such as the six years between 2010 and 2016, limit the ability of fast-growing genera like Acropora to bounce back.
3. It highlights the importance of giving reefs time to heal. Without sufficient pauses between heatwaves, even the most resilient coral communities may not survive.

Why Lakshadweep's Reefs Matter

1. Lakshadweep's coral reefs are not just ecological treasures—they are lifelines for local communities. They:
2. Support rich marine biodiversity;
3. Protect shorelines from erosion and storm surges;
4. Sustain fisheries and tourism-based livelihoods;
5. The loss of coral cover threatens all these functions, making reef conservation a socio-economic imperative.

14.Environment Protection (Management of Contaminated Sites) Rules, 2025

Context

The Union Ministry of Environment, Forest and Climate Change notified the Environment Protection (Management of Contaminated Sites) Rules, 2025, under the Environment Protection Act, 1986.

Key Provisions of the 2025 Rules

Identification and Notification: State Pollution Control Boards (SPCBs) must identify suspected contaminated sites and notify them to CPCB.

Site Assessment: Detailed risk assessments must be conducted to determine the extent and severity of contamination.

Remediation Plans: Polluters or responsible parties must submit site-specific remediation plans, subject to approval by CPCB.

Time-bound Cleanup: Remediation must be completed within a defined timeline, with penalties for non-compliance.

Public Disclosure: Information about contaminated sites and cleanup status must be made publicly accessible.

Institutional Mechanism

1. The rules empower CPCB as the nodal agency for oversight, supported by SPCBs and expert committees.
2. A national registry of contaminated sites will be maintained, and technical guidelines will be issued for remediation technologies, including bioremediation, soil washing, and containment.

What Are Contaminated Sites?

1. Contaminated sites are locations where soil, groundwater, or surface water has been polluted to levels that pose risks to human health or the environment.
2. India has over 250 such sites identified by the Central Pollution Control Board (CPCB), many of which remain untreated due to lack of legal clarity and funding mechanisms.

Why These Rules Matter

1. The 2025 rules bring India in line with global best practices, such as the US Superfund program and the EU's Soil Framework Directive.
2. India's industrial legacy includes thousands of sites contaminated with heavy metals, pesticides, hydrocarbons, and other toxins. These sites:
3. Threaten drinking water sources;
4. Harm agricultural productivity;
5. Pose long-term health risks to nearby communities;

Challenges Ahead

1. Funding mechanisms for remediation, especially where polluters are defunct
2. Capacity building at state and district levels
3. Robust monitoring and enforcement

15.Breaching of Planetary Boundaries

Context

According to a landmark study published in Science Advances, humanity has crossed six of the nine planetary boundaries that define Earth's safe operating space.

What Are Planetary Boundaries?

The planetary boundaries framework is a scientific concept that defines a "safe operating space for humanity" by identifying nine critical Earth system processes that are essential for maintaining the stable environmental conditions of the last 12,000 years, a period known as the Holocene epoch. First introduced in 2009 by a group of scientists led by Johan Rockström, this framework provides measurable

limits or "boundaries" for human activities. Staying within these boundaries is crucial to prevent the risk of triggering abrupt, irreversible, and potentially catastrophic environmental changes.

The nine interconnected planetary boundaries are:

Climate Change: Focuses on the concentration of greenhouse gases (like CO₂) in the atmosphere to prevent dangerous shifts in the global climate system.

Biosphere Integrity: Pertains to maintaining the diversity and resilience of ecosystems. It has two components: genetic diversity (extinction rates) and functional integrity (the energy flow within ecosystems).

Land-System Change: Measures the conversion of natural landscapes like forests, wetlands, and grasslands into agricultural land or urban areas, which affects climate, biodiversity, and water cycles.

Freshwater Change: Assesses the disruption of the global water cycle, including both "blue water" (rivers, lakes, groundwater) and "green water" (water available to plants in the soil).

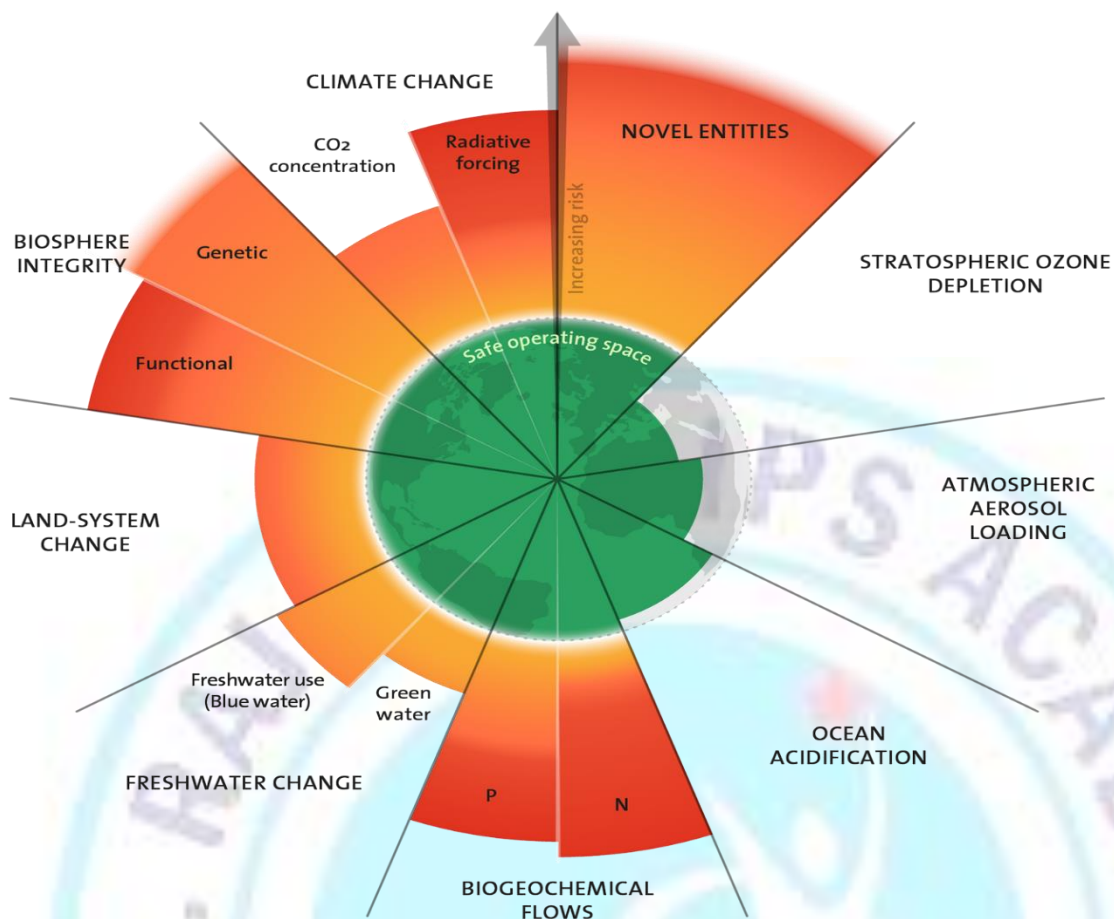
Biogeochemical Flows: Concerns the massive alteration of the global nitrogen and phosphorus cycles, primarily due to the extensive use of fertilizers in agriculture, leading to widespread pollution.

Ocean Acidification: Tracks the decreasing pH of ocean surface waters, caused by the absorption of excess atmospheric CO₂, which threatens marine life, especially organisms with shells and skeletons like corals and shellfish.

Atmospheric Aerosol Loading: Pertains to the concentration of tiny particles (aerosols) in the atmosphere from pollution, which can affect climate patterns (like monsoons) and human health.

Stratospheric Ozone Depletion: Monitors the thinning of the Earth's ozone layer, which protects the planet from harmful ultraviolet (UV) radiation. This is a success story, as global action has started to reverse the damage.

Novel Entities: A broad category for new substances created and introduced into the environment by humans, such as microplastics, industrial chemicals, endocrine disruptors, and radioactive waste, which have the potential for widespread and irreversible effects.



What Does Breaching a Boundary Mean?

Breaching a planetary boundary does not signify an immediate, apocalyptic event. Instead, it means that humanity has pushed a critical Earth system beyond its safe operating space, entering a zone of high uncertainty and risk. It significantly increases the likelihood of triggering non-linear tipping points—thresholds beyond which a small change can cause a large, rapid, and often irreversible shift in the environment.

The framework is based on the remarkably stable climate of the Holocene, the period during which agriculture, cities, and complex human civilizations developed. By using computer models and historical data, scientists have estimated the natural state of these systems during the Holocene and defined boundaries to preserve that stability.

Already Breached Planetary Boundaries

As of recent assessments, humanity has already transgressed the safe limits for six of the nine boundaries:

Climate Change: The safe boundary is considered to be an atmospheric CO₂ concentration of 350 parts per million (ppm). The current level is around 420 ppm, pushing the planet toward dangerous temperature increases, extreme weather, and sea-level rise.

Biosphere Integrity: The natural rate of extinctions has been accelerated by human activity by 100 to 1,000 times. This dramatic loss of genetic diversity weakens ecosystems and their ability to provide essential services like pollination and water purification.

Land-System Change: The safe boundary requires retaining at least 75% of the world's original forest cover. Today, only about 60% remains, leading to biodiversity loss, carbon emissions, and disrupted weather patterns.

Freshwater Change: Human activities, including dam construction, large-scale irrigation, and pollution, have profoundly altered both blue and green water cycles, leading to water scarcity in some regions and increased flooding in others.

Biogeochemical Flows: The safe boundary for nitrogen and phosphorus has been massively overshoot. Fertilizer runoff from farms pollutes rivers and coastal areas, creating vast "dead zones" where aquatic life cannot survive.

Novel Entities: The production and release of plastics, pesticides, and countless industrial chemicals have overwhelmed the planet's capacity to absorb them. These pollutants are accumulating in ecosystems, wildlife, and human bodies with unknown long-term consequences.

Global Implications

Crossing these boundaries has severe and interconnected consequences for both the planet and humanity. These include:

Ecosystem Collapse: Pushing systems like the Amazon rainforest or coral reefs past their tipping points could lead to their rapid collapse, causing a massive loss of biodiversity.

Intensified Climate Extremes: A destabilized climate system will result in more frequent and severe heatwaves, droughts, floods, and storms.

Food and Water Insecurity: Disruptions to water cycles and the collapse of pollinator populations threaten global agriculture and access to clean drinking water.

Increased Health Risks: Pollution from novel entities and the spread of pathogens from disrupted ecosystems pose direct threats to human health.

India's Role and Responsibility

As the world's most populous country, a major economy, and a region of immense biodiversity, India has a crucial role to play. The nation's rapid development contributes to planetary stress through emissions, land use, and pollution, but it is also highly vulnerable to the impacts of these changes. Experts urge India to take a leading role by:

Strengthening Environmental Regulations: Enforcing stricter laws on pollution, deforestation, and waste management.

Restoring Degraded Ecosystems: Investing in large-scale projects to reforest land, clean rivers, and protect wetlands.

Transforming Agriculture: Promoting sustainable farming practices that reduce reliance on chemical fertilizers and pesticides.

Investing in a Green Future: Accelerating the transition to clean energy sources like solar and wind and promoting a circular economy model that minimizes waste and maximizes resource efficiency.

16. Parijat Tree (Sacred Baobab)

Context

Recently, the National Green Tribunal (NGT) directed the Union Environment Ministry, the Botanical Survey of India, and state authorities to respond to concerns about the extinction risks faced by Parijat Trees (Sacred Baobab) in Uttar Pradesh due to weather vagaries and excessive harvesting.

About the Parijat Tree (Sacred Baobab)

1. The Parijat tree — botanically known as *Adansonia digitata* and commonly referred to as the sacred baobab — is one of India's most enigmatic and ecologically significant trees.
2. It is native to Africa, and often associated with legends from the Mahabharata and is considered a celestial tree that descended from heaven.
3. It is found in isolated pockets of Uttar Pradesh, particularly in Kintoor (Barabanki), Jhusi (Prayagraj), and Sultanpur, these trees are believed to be over 800 years old and are steeped in myth, medicine, and environmental importance.
4. According to the Botanical Survey of India, the tree's high internal water content — up to 79% — helps it remain structurally stable even in arid conditions.
5. However, recent studies show alarming drops in moisture levels: 45.2% in Jhusi and just 39.7% in Kintoor, making the trees vulnerable to collapse.

Medicinal and Cultural Significance

Leaves and pulp: Used in juices and food supplements;

Bark and roots: Known for anti-inflammatory, antidiabetic, and antioxidant properties;

Fruit: Rich in vitamin C, calcium, and Fiber; used in traditional remedies;

Wood and shell: Crafted into utensils and ceremonial items;

The tree is a **carbon sink**, helping mitigate climate change by absorbing atmospheric CO₂.

17. Crop Area Affected Due to Monsoon Rains

Context

1. Recently, the Union Minister of Agriculture and Farmers Welfare revealed that over 158,000 hectares of cropped area have been affected due to hailstorm, heavy rain or flood during the 2025 southwest monsoon season in India.
2. The damage spans multiple crop types, including Paddy, Wheat, Barley, Mustard, Jowar, Bajra, Maize, Onion, and Horticultural crops.

Impact on Kharif Season

1. The timing of the rainfall has been especially damaging to the Kharif season.
2. Paddy, which is typically sown between mid-June and mid-July, has seen delayed transplanting due to waterlogged fields.
3. Farmers in several districts have reported losses in maize and cotton, with fears of pest outbreaks compounding the crisis.

Government Response

1. State governments are conducting crop damage assessments;
2. Relief measures under the Pradhan Mantri Fasal Bima Yojana (PMFBY) are being activated
3. Advisories from the Indian Meteorological Department (IMD) are being issued to guide farmers on drainage and re-sowing;

Climate Extremes and Policy Challenges

1. The frequency and intensity of monsoon anomalies — early onset, flash floods, and erratic rainfall— are increasing due to climate change.
2. This year's rainfall patterns have caught forecasters off guard, with sub-daily rainfall extremes becoming more common.
3. Agricultural scientists are calling for:
4. Improved early warning systems;
5. Flexible sowing calendars;
6. Climate-resilient crop varieties;
7. Expanded insurance coverage for smallholder farmers;

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YOJANA

1. SBM-G & Jal Jeevan Mission

Two Missions – Swachh Bharat Mission–Gramin (SBM-G) for sanitation (toilets) and Jal Jeevan Mission (JJM) for drinking water (taps).

New Approach – Shifted from top-down delivery to a community-driven model called *Jan Bhagidari* (people's participation).

SBM-G (Sanitation)

Phase 1 – Achieved 100% rural sanitation (ODF) by 2019, up from 39% in 2014.

Phase 2 – Focuses on "ODF Plus"—sustaining ODF status and managing solid/liquid waste. As of July 2025, 96% of villages are ODF Plus.

JJM (Water)

Goal – Provide household tap connections.

Status – Reached over 80% rural coverage (15.67 crore homes) by July 2025.

Women – Over 24 lakh women were trained to test water quality.

Future – SBM-G is guided by a "SMART" approach (Sustainability, Making women central, etc.). JJM is extended to 2028, focusing on "Water Security" (source sustainability) instead of just "Tap Coverage".

Impact – The missions directly support SDG 6 (Clean Water and Sanitation).

2. Making Water Sources Sustainable

The Challenge – India has 18% of the world's population but only 4% of its freshwater.

'Catch the Rain' – A public movement to "Catch the rain, where it falls, when it falls". It involves rainwater harvesting, afforestation, and reviving water bodies (over 2.5 lakh *Amrit Sarovars*).

Wastewater as a Resource – SBM-G Phase II treats wastewater as a resource. Greywater is now seen as a resource to be reused for kitchen gardens, and low-cost soak pits help recharge groundwater.

Groundwater – Atal Bhujal Yojana (Atal Jal) is a World Bank-supported scheme in 7 states. It promotes community-led groundwater budgeting and Water Security Plans.

River Revival – The Namami Gange mission has built/is building over 150 Sewage Treatment Plants (STPs) and monitors industrial pollution online.

Partnerships – The model relies on SHGs, startups, CSR initiatives, and international partners (UNICEF, World Bank).

3. WASH for Women, WASH for the Nation

Women's New Role – Women have shifted from "passive users" to "active custodians, leaders, and change-makers" in WASH.

The Problem Addressed – The missions targeted the "invisible routines" (like fetching water) that limited women's education, safety, and agency.

Institutional Inclusion – It is mandated that 50% of members in Village Water and Sanitation Committees (VWSCs) must be women.

Women as Change-Makers – They serve as *Swachhagrahis* (sanitation mobilizers) and *Jal Sahiyas/Jal Sakhis* (water quality testers). Over 24.8 lakh women are trained in water testing using Field Test Kits (FTKs). Over 3.2 lakh women hold leadership roles (president, secretary, etc.) in VWSCs.

Impact – Women-led VWSCs are linked to higher user fee contributions and faster complaint resolution.

The Future – The goal is to move women's participation "from presence to power" by offering better incentives and supporting women-owned enterprises.

4. A Decade of WASH

Historical Context – Ancient India (Indus Valley Civilization) had advanced drainage. However, post-1951 efforts were fragmented, supply-driven, and lacked community involvement.

The Turning Point (2014)

SBM-G – Launched in 2014, it was the world's largest sanitation drive. It built over 10 crore toilets.

JJM (2019) – Launched to provide *Har Ghar Jal* (Water in Every Home). It aims for 55 litres per capita per day (lpcd) of quality water.

Community-Led – Gram Panchayats and VWSCs became the core drivers. Over 5.2 lakh VWSCs were formed to prepare Village Action Plans (VAPs).

Technology – The missions promoted affordable Twin Pit Toilets and climate-specific tech like insulated pipes in Ladakh and solar-powered water schemes.

Monitoring – Uses digital dashboards (IMIS), IoT sensors (flow meters, chlorine analyzers), and 2,183 water testing labs.

Women's Role – 24.8 lakh women were trained to use Field Test Kits (FTKs).

5. WASH in Schools and Anganwadis

WASH in schools is essential for children's health, dignity, and education, helping to reduce absenteeism. It aligns with the National Education Policy (NEP) 2020.

Funding – Under the Samagra Shiksha Scheme, schools receive a Composite School Grant. At least 10% of this grant is earmarked for WASH activities.

Behavior Change – Initiatives like *Swachh Vidyalaya* (Clean School) and *Swachhata Pakhwada* (Cleanliness Fortnight) promote good hygiene.

Gender & Inclusion – This includes providing separate toilets for girls and safe disposal for menstrual products. It also mandates adaptations for Children with Special Needs (CWSN), like ramps and accessible toilets.

Current Status (UDISE 2023-24)

98.3% of schools have drinking water facilities.

97.2% have functional girls' toilets.

94.7% have handwashing facilities.

34.4% have CWSN-friendly toilets.

Sustainability – Schools are encouraged to install rainwater harvesting systems and use greywater for school kitchen gardens.

Monitoring – Digital tools like UDISE+ (collects data) and the PRABANDH Portal (tracks planning and budgeting) are used.

6. Empowering Women & Nurturing Children Through WASH

WASH as a Right – Access to WASH is a fundamental human right that impacts gender equality and child development.

The Challenge – Poor WASH is linked to high rates of diarrhoea, malnutrition, and stunting in children. For women, it means a heavy time burden, health risks, and lack of safety.

MoWCD's Role – The Ministry of Women and Child Development (MoWCD) integrate WASH into its core programs.

Mission Saksham Anganwadi & Poshan 2.0 – This program reaches 10.16 crore beneficiaries via 14 lakh Anganwadi Centres (AWCs).

Infrastructure – 10.27 lakh AWCs have functional toilets, and 12.53 lakh have drinking water.

Upgradation – 2 lakh AWCs are being upgraded to "Saksham Anganwadis" with better infrastructure, including water filtration systems.

Awareness – Hygiene is promoted through *Poshan Maah* (Nutrition Month) and *Poshan Pakhwada* (Nutrition Fortnight).

Other Missions

Mission Shakti (Beti Bachao Beti Padhao) – Promotes hygiene to keep girls in school.

Mission Vatsalya – Provides funds for WASH in Child Care Institutions (CCIs).

7. Har Ghar Jal (Transforming Rural Water Governance)

The Crisis – Before 2019, only 16% of rural homes had piped water. This was linked to 21% of communicable diseases (NITI Aayog, 2018).

The Progress – JJM increased coverage from 16% (2019) to ~80% (May 2025). In 112 Aspirational Districts, coverage jumped from 7.77% to 79.13%.

Focus on Service – The goal is not just a pipe, but a reliable *public service*. The standard is 55 litres per capita per day (lpcd) of BIS 10500 quality water.

Monitoring – The Jal Jeevan Survekshan ranks districts on *functionality* (quality, quantity, regularity), not just connections.

Sustainability

Financial – VWSCs are empowered to collect community tariffs for O&M costs.

Source – Focus on rainwater harvesting, afforestation, and spring-shed development.

Technology

1. A real-time JJM dashboard ensures transparency.
2. The WQMIS portal integrates data from 2,183 labs.
3. 24.83 lakh women are trained to use Field Test Kits (FTKs).

Local Professionals – The Nal Jal Mitra Programme trains local youth for sustainable maintenance.

Impact – Saves women 3-4 hours daily and reduces the risk of harassment.

Conclusion – Water governance is evolving from a state-driven "supply" model to a community-owned "service" model.

8. Water Wisdom in Action

Traditional Systems – India has a rich history of water management, with diverse, local systems like *Baolis* (stepwells) in Rajasthan, the *Phad* (cooperative irrigation) system in Maharashtra, and the *Eri* (tank) system in Tamil Nadu.

Disruption – Colonial laws (like Riparian Rights) and a focus on state control weakened these community-led systems.

The Challenge – Water demand is projected to exceed renewable availability by 2050.

Revival – The new approach blends ancestral wisdom (community stewardship) with modern science (GIS, dashboards).

Mass Movements

Jal Shakti Abhiyan (JSA) – A movement to revive water bodies in water-stressed districts.

JSA – Catch the Rain – Uses the motto "Catch the rain, where it falls, when it falls". The 2024 theme is *Nari Shakti se Jal Shakti* (Women's Power for Water Power).

Achievements – 1.71 crore conservation structures have been built, and 139 crore saplings planted.

Jal Sanchay Jan Bhagidari (JSJB) – A campaign to create 1 million recharge structures by 2025. It has already surpassed this, with 1.8 million completed (as of May 2025).

The "Five R's" – The new water wisdom follows 5 R's – **Reduce, Reuse, Recycle, Recharge, and Respect.**

9. From Toilets to Taps

The Journey – A summary of India's transformation from the "defecation capital" to ODF, and from water scarcity to household tap connections.

SBM-G (2014) – A *behavioural change* movement that built over 10 crore toilets. It empowered women as *Rani Mistris* (toilet construction experts).

JJM (2019) – Increased tap water coverage from 17% (2019) to 80.98% (July 2025). This saves 5.5 crore hours daily, mostly for women (WHO).

Integration – The two missions create a holistic WASH ecosystem. SBM-G's focus on sanitation is linked with JJM's focus on water supply, including managing the greywater from tap connections.

Core Idea – People are treated as *stakeholders* in the system, not *beneficiaries*.

Conclusion – The journey restored dignity (toilets) and gave back time (taps), proving that sanitation and water are fundamental rights and shared responsibilities.

10. Making Every Drop Count

Constitutional Framework – Water is a State Subject. The 73rd Amendment empowered local Panchayati Raj Institutions (PRIs) to manage drinking water.

JJM's 6 Pillars – The mission's design is based on six key principles –

1. **Service Delivery** – 55 lpcd of quality water, not just infrastructure.
2. **Source Sustainability** – Conservation, recharge, and greywater management.
3. **Local Governance** – GPs and VWSCs act as local service managers.
4. **Water Quality** – Monitored using FTKs, with 5 trained women per village.

5. **Capacity Building** – The *Nal Jal Mitra* programme trains local youth for O&M.

6. **Jan Andolan** – A people's movement with the goal to "leave no one behind".

Convergence – JJM works closely with MGNREGS (for building recharge structures), SBM-G (for greywater), and NRLM (for SHG involvement).

Health Impact – WHO estimates JJM could prevent 400,000 diarrheal deaths. Nobel laureate Michael Kremer's research suggests it could save 136,000 children annually.

Social Impact – The mission saves 4.87 crore hours for women *daily*.

Self-Reliance – The model moves villages from "dependency" to "self-reliance" by empowering them to manage their own water utilities.

The Future – The goal is to run water supply as a "public utility service," where GPs act as "micro-utilities".

11. IEC & Behaviour Change

The Core Lesson – Infrastructure + Behaviour Change = Transformation.

The 4 Ps – The success of the missions is attributed to 4 Ps – **P**eople (citizen participation), **P**olitical leadership, **P**ublic funding, and **P**artnerships.

SBM-G Phase I – Was the world's largest behaviour change campaign. It used *Swachhagrahis* (motivators) and campaigns like *Darwaza Band* (with Amitabh Bachchan).

SBM-G Phase II – Focuses on *reinforcing* behavior to prevent "slippage" (returning to open defecation) and managing waste.

JJM – IEC (Information, Education, Communication) is used to create *demand* for tap water by highlighting time savings for women and to build *community ownership* via VWSCs.

Innovations

Swachh Sundar Shauchalaya (Clean Beautiful Toilet) contest made toilets aspirational.

The *Jaldoot Initiative* trained students as WASH ambassadors.

The Triple 'C' Approach – The strategy relies on **C**onvergence (with other schemes like ICDS), **C**apacity Building (training SHGs), and **C**ommunity Engagement.

Next Frontier – The goal is to move from *awareness* to *accountability*, using behavioral nudges and real-time dashboards.

12. Light House Initiative

The Concept – An initiative launched in 2022 by the government (DDWS) in partnership with the India Sanitation Coalition (ISC) and the corporate sector.

Phase 1 – Aimed to create 75 "Light House GPs" (Gram Panchayats) as models of excellence in sanitation.

Phase 2 – The focus was scaled up from 75 GPs to 43 Blocks in 14 states (from July 2024 – March 2025).

The Model – It's a partnership where corporate partners (like ITC, Ultratech, HCL) support Blocks to become "ODF Plus Model".

Goal – To demonstrate sustainable O&M models for solid and liquid waste management (SLWM) that can be replicated.

Case Studies

Solan, HP – Ultratech supported soak pits, and a user fee of ₹80/month ensures sustainability.

Assam – Tata Trusts helped link household waste composting to organic farming.

Bihar – ITC supported the creation of SLWM infrastructure.

The Vision – To achieve *Sampoorna Swachhata* (total, inclusive, and lasting sanitation) by combining government, corporate, and community efforts.

KURUKSHETRA

1. Fostering Jobs, Building Bharat – ELI Scheme as a Gamechanger

Introduction to the ELI Scheme

What it is – The Employment Linked Incentive (ELI) Scheme is a new initiative by the Government of India designed to boost job creation, enhance employability, and provide social security, specifically targeting the manufacturing sector.

Launch & Outlay – It was announced in the Union Budget 2024-25 and came into effect on 1st August 2025. The total projected outlay for the scheme is Rs. 99,446 crore.

Core Objectives

1. Ensure equitable access to economic opportunities.
2. Reduce unemployment and promote self-reliance.
3. Strengthen the industry workforce and foster sustainable economic growth.

Evolution of Employment Initiatives

Background – Government programs have evolved from broad initiatives to highly targeted, skill-focused approaches.

Key Predecessor Schemes

Skill India Mission (SIM) – Provides training, reskilling, and upskilling through programs like Pradhan Mantri Kaushal Vikas Yojana (PMKVY), National Apprenticeship Promotion Scheme (NAPS), and ITIs.

Sector Skill Councils (SSCs) – 36 industry-led councils that identify specific skill requirements.

National Skill Development Corporation (NSDC) – Supports industry-aligned training providers.

Rural Focus – Deen Dayal Upadhyaya–Grameen Kaushal Yojana and Rural Self-Employment Training Institutes focus on skills for rural youth (e.g., agriculture, handloom).

Aatmanirbhar Bharat Rojgar Yojana (2020–22) – A post-COVID scheme that incentivized job creation, benefiting over 60 lakh individuals.

Why the ELI Scheme is Distinct

Skill-Employment Linkage – Unlike past training-only schemes, ELI directly ties skill development to guaranteed employment opportunities.

Accountability – Employers, industries, and training entities are jointly responsible for actual job creation.

Demand-Driven – Training courses are tailored and mapped directly to industry requirements.

Promotes Formal Employment – The scheme encourages official job registration at government institutions.

Two-Part Implementation

1. Provides incentives for first-time employees to join the formal workforce.
2. Provides support for employers to generate *additional* employment, especially in manufacturing.

Stakeholder Integration and Implementation

Coordination – The scheme requires complex multi-agency coordination (Ministries of Labour, Skill Development, Finance; EPFO; UIDAI; NPCI; employers; auditors).

Process – It relies heavily on technology –

1. Onboarding employers and employees on digital platforms.
2. Monthly submission of Electronic Challan-cum-Return (ECR) with Aadhaar authentication.
3. Cross-verification of data with IT, GST, and PAN records.

Monitoring – Involves real-time dashboards, retention tracking, fraud detection, and random audits.

Addressing Challenges

Fake/Ghost Employees – Solved by cross-verifying EPFO, Aadhaar, PAN, and GST filings; may use biometric checks.

Salary Under-reporting – Solved by comparing ECR data with bank transfers, salary slips, and IT returns; penalties will be imposed.

Employee Attrition – Addressed through employer sensitization on retention incentives.

Low Awareness – Solved by outreach through labour offices, MSME field offices, and trade unions.

Fraud Detection – Will use AI/ML integration for real-time alerts and targeted third-party audits.

Lesson from MGNREGA – The text notes that lessons from large schemes like MGNREGA highlight the need for robust grievance redressal and data validation.

Conclusion

The ELI Scheme is a paradigm shift that bridges the gap between skill development and actual employment. By linking monetary incentives to job creation and retention, it aims to enhance employability, strengthen industry, and foster inclusive economic growth.

2. Unorganized Workers and Social Security Measures in India

The Unorganized Sector in India

Economic Significance – This sector is a defining feature of the Indian economy, employing over 90% of the workforce and contributing around 50% to the GDP.

Worker Status – Despite their economic contribution, these workers remain marginalized, often living in poverty and facing exploitation, gender discrimination, and poor working conditions.

Classification and Challenges

Four Groups (Ministry of Labor)

1. **Occupational** – Agricultural laborers, small farmers, beedi rollers, artisans.
2. **Nature of Employment** – Casual, migrant, contract, bonded laborers.
3. **Distressed Categories** – Toddy tappers, scavengers, headload carriers.
4. **Service Categories** – Domestic workers, midwives, barbers, vendors.

Key Challenges

Low Wages – No equal pay or benefits.

Lack of Job Security – No provident fund, pension, or maternity leave.

Weak Legal Protection – Vulnerable to harassment and unsafe conditions.

Deprivation – Poor sanitation, housing, and nutrition.

Poverty – Low earnings prevent entrepreneurship.

Legislative Measures

Unorganized Workers' Social Security Act, 2008 – Provided the initial legal framework for social security.

Code on Social Security, 2020 – A major reform that consolidated multiple labor laws and, for the first time, extended coverage to unorganized, gig, and platform workers.

Major Social Security Schemes

Life and Disability

PMJJBY & PMSBY – Life and accident insurance. Over 23.6 crore enrolled as of April 2025.

Retirement Security

Atal Pension Yojana (APY) – Voluntary savings. Over 7.65 crore subscribers (48% women).

PM Shram Yogi Maan-Dhan (PM-SYM) – Pension for workers earning Rs. 15,000/month. 30.51 crore enrolled.

Health and Maternity

Ayushman Bharat-PMJAY – Health insurance up to Rs. 5 lakh per family.

Livelihood Support

PM SVANidhi – Loans for street vendors (over 68 lakh beneficiaries).

Scheme for Rehabilitation of Manual Scavengers – Provides cash aid and skill training.

Food Security

PDS & PM Garib Kalyan Anna Yojana – The One Nation One Ration Card (ONORC) is critical for ensuring migrants get food grains.

Artisan Support

PM Vishwakarma Yojana – Financial and skill aid. 2.37 million artisans registered.

Progress and Way Forward

Impact – Social protection coverage in India doubled from 24.4% (2021) to 48.8% (2024), covering 920 million people (ILO Report).

Inclusivity – Over 53% of E-Shram registrations are women.

Way Forward

1. Universal registration linked to Aadhaar.
2. Portable benefits that move with the worker.
3. Simplified contribution mechanisms for those with irregular incomes.
4. Public awareness campaigns.

3. Green Technology for Sustainable Rural Jobs in India

The Green Economy and Rural Jobs

Main Idea – India's push for a clean and green economy is creating significant employment opportunities, especially in rural areas.

Renewable Energy (RE)

India employed 1.1 million people in RE (2025), ranking 4th globally. Key sectors include hydropower, solar PV, wind, biomass, and green hydrogen.

Key Initiatives – National Green Hydrogen Mission, PM-KUSUM, PM Surya Ghar.

Decentralized Solutions – Solar microgrids and irrigation pumps generate local jobs and reduce rural migration.

Skill Programs – *Suryamitra*, *Vayumitra*, and *Jal-Urjamitra* train youth (including women) in RE installation, operation, and maintenance.

Potential – PM-KUSUM alone is estimated to create 7.55 lakh job-years.

Circular Economy and Waste Management

Mission LiFE – Promotes "reduce, reuse, recycle" principles to turn waste into wealth.

Priority Streams – Solid waste, plastic, e-waste, batteries, tyres, and construction waste.

Potential – This sector could create 33 lakh additional jobs in collection, segregation, and recycling micro-enterprises.

Regulation – The Extended Producer Responsibility (EPR) framework ensures proper waste management.

Green Healthcare in Rural Areas

The Gap – Rural areas face a shortage of 2.7 million health professionals.

Green-Tech Solutions – Solar-powered health centers, telemedicine, mobile clinics, and AI diagnostics are filling this gap.

Impact – These technologies create local employment in operations, maintenance, and digital health services, enhancing rural productivity. This expansion could generate 5.4 million additional jobs (2021–25).

Skill Development and Green MSMEs

Skill Council for Green Jobs (SCGJ) – Aligns training with market needs. It has 44 approved qualifications and has trained 500,000 candidates (100,000 in solar).

Green MSMEs – MSMEs (Micro, Small & Medium Enterprises) are 90% of the manufacturing sector.

Smart Manufacturing – This involves integrating automation, analytics, and eco-conscious production.

Example – Recycling 10,000 tonnes of waste generate approximately 115 jobs.

Eco-Conscious Tourism

Impact – Eco-tourism, rural tourism, and wellness tourism create direct and indirect jobs in hospitality, handicrafts, and homestays.

Examples – Successful models are seen in Himachal Pradesh, Kerala, and Madhya Pradesh.

Conclusion

Green technologies are a key enabler for integrating environmental protection with sustainable rural employment. Challenges like skill gaps and financing exist but are being bridged by government initiatives and Public-Private Partnerships (PPPs). India's green transition is presented as a "people's movement" fostering inclusive growth.

4. Digital India and Rural Transformation

The Digital India Programme

Launched in 2015, the program aims to transform India into a knowledge-based society and ensure inclusive growth.

Key Achievements

Expanding Connectivity

BharatNet Project – Has connected 2,18,000 Gram Panchayats.

Coverage – 4G and 5G networks now cover 99.6% of districts.

User Base – Rural internet users now account for 55% of the total users.

Bridging the Divide – National Broadband Mission 2.0 and satellite internet are closing the urban-rural gap.

Innovation and Technology Adoption

Villages are adopting AI, IoT, and blockchain for digital agriculture.

Inclusivity - 60% of internet content is now in regional languages.

Examples - Yaktan (Sikkim) as a "digital nomad" village; Akodara (Gujarat) with fully digital transactions.

Skill Development and Education

PMGDISHA - Has trained 6.39 crore rural citizens in digital literacy.

Platforms - SWAYAM and PM e-Vidya provide online access to education.

Common Service Centres (CSCs) - Act as rural hubs for digital literacy, training, and financial education.

Employment Generation - The program has created new jobs in IT support, BPOs, content creation, and the gig economy, which helps reduce rural-urban migration.

Women's Participation - Women now make up 47% of internet users, empowering them in entrepreneurship.

Promotion of Rural Entrepreneurship - E-commerce and digital payments enable rural artisans, farmers, and Self-Help Groups (SHGs) to access national markets.

NASSCOM Foundation - Trained 1 lakh rural women, resulting in 83% establishing independent, women-led enterprises.

Financial Inclusion and Governance

UPI - Transactions have crossed 10 billion per month.

Governance - Digitisation of services (DigiLocker, Aadhaar, GST) has increased transparency and reduced corruption.

CSCs - 78% of the 5.6 lakh CSCs operate in villages.

Policy and Vision - Supported by the Digital Personal Data Protection Act and the National AI Mission. India aims to leverage this "Tech Decade" to achieve a \$5 trillion economy.

Conclusion

Digital India has significantly transformed rural India by enhancing connectivity, skills, and entrepreneurship. While challenges like the digital divide remain, the program is helping rural India become an active participant in building a self-reliant, knowledge-based society.

5. India-UK Free Trade Agreement (FTA) and Rural Economy

The Agreement

Context - On July 24, 2025, India and the UK signed a Comprehensive Economic and Trade Agreement (CETA).

Significance - This is India's first major trade deal in a decade and a strategic move to expand its global trade footprint post-Brexit.

Aims - Strengthen economic integration, enhance agri-exports, promote value addition, and generate rural employment.

Key Highlights

Boost to Bilateral Trade - Current trade is \$56 billion, with a target to double by 2030. The agreement provides duty-free access for 99% of India's exports.

Sectors Benefiting

1. Labour-intensive sectors (textiles, leather, footwear, gems & jewellery, toys, marine products).
2. High-value sectors (engineering goods, auto components).

Focus on Inclusivity - The FTA is designed to benefit farmers, women, youth entrepreneurs, MSMEs, startups, and artisans.

Impact on Agriculture and Processed Food

Shift in Strategy - The FTA encourages a transition from "volume to value" in the farm sector.

Coverage - Includes 1,437 agricultural tariff lines and 985 processed food lines.

Projections - Agri-exports are expected to increase by over 50% in three years.

Key Commodities - Grapes, shrimps, onions, honey, mango pulp, pickles, and spices.

Farmer Impact - The deal gives preferential access that benefits small and marginal farmers and promotes diversification.

Trade Facilitation – Simplified Sanitary & Phytosanitary (SPS) measures and certification will ease trade.

Impact on Other Rural Sectors

Marine & Plantation – Marine exports (shrimp, fish) are poised to expand, benefiting coastal fisherfolk and women in processing plants. Duty-free access for coffee, tea, and spices enhances global competitiveness.

Textiles, Leather, Gems & Jewellery – These sectors gain easier access to UK markets. This will boost employment in major rural clusters (e.g., in UP, Tamil Nadu, Gujarat, Punjab).

Inclusive Rural Development

Institutional Alignment – The FTA aligns with India's agri-export bodies (APEDA, MPEDA, Coffee & Spices Boards).

Core Goal – It encourages quality production, packaging, and certification, ensuring that benefits reach small farmers, Food Producer Organizations (FPOs), MSMEs, and rural artisans.

Conclusion

The India-UK FTA is a transformative milestone for India's rural economy. By providing duty-free access and promoting value-added exports, it strengthens rural prosperity, incentivizes quality production, and enhances India's competitiveness in global markets.

DOWN TO EARTH

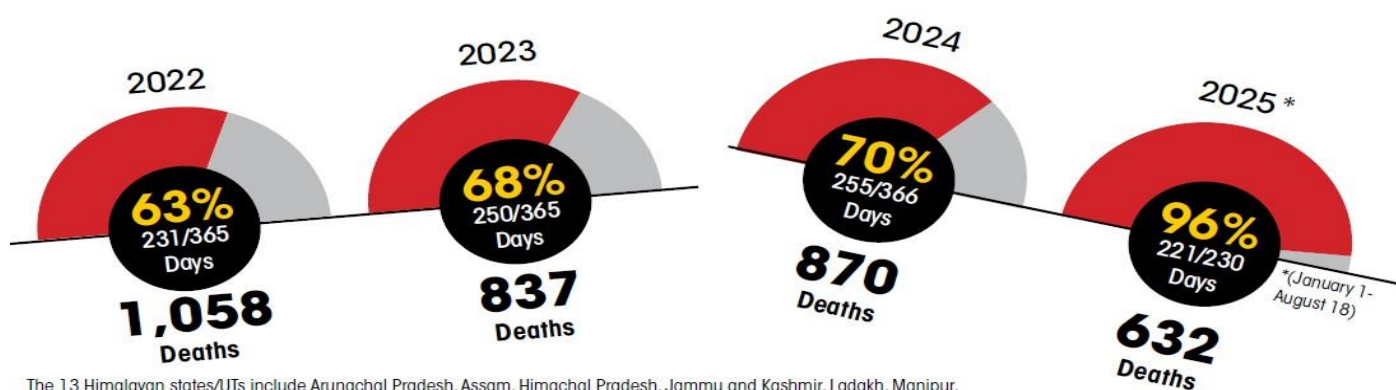
1. Disaster Zone – Himalayan Crisis Unfolding Daily

With an extreme weather event on almost every day in 2025, the Himalayas show the cost of ignoring science and warnings.

Unending catastrophe

In the first eight months of 2025 alone, the Himalayan region has endured extreme weather on 221 out of 230 days—the highest in the past four years. These weather disasters have claimed at least 632 lives

■ Number of days with extreme weather events



The 13 Himalayan states/UTs include Arunachal Pradesh, Assam, Himachal Pradesh, Jammu and Kashmir, Ladakh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Uttarakhand and West Bengal
Source: India's Atlas on Weather Disasters and analysis of government data by CSE-DTE Data Centre

A Region in Peril – The Himalayan states and Union Territories, including Uttarakhand, Himachal Pradesh, and Jammu & Kashmir, are facing a relentless series of disasters. Events such as flash floods, devastating landslides, and intense cloudbursts have become a near-daily occurrence. These disasters have resulted in a significant human toll, with 632 deaths recorded in the region in 2025 alone.

The Role of Western Disturbances

Definition – Western disturbances are extra-tropical cyclonic systems that originate in the Mediterranean region and typically bring moisture and precipitation to Northwest India during the winter months.

Anomalous Activity in 2025 – In a significant climatic deviation, India recorded 14 western disturbances between June and August 2025, a period usually dominated by the monsoon. Several of these systems were unusually persistent, lasting for up to seven days.

Mechanism of Disaster – The interaction of these moisture-laden western disturbances with the monsoon trough creates highly volatile and unstable low-pressure zones. This convergence triggers catastrophic levels of rainfall, cloudbursts, and subsequent flooding.

The Conflict – Development vs. Ecology

Anthropogenic Pressures – Rampant and often unregulated construction, widespread deforestation for infrastructure projects, and poorly planned development have severely compromised the region's natural resilience.

Creation of Disaster Hotspots – Himalayan towns such as Chamoli (Uttarakhand), Mandi (Himachal Pradesh), Dharali (Uttarakhand), and Kishtwar (Jammu & Kashmir) have transformed into hotspots for disasters.

A Dangerous Convergence – These locations exemplify a dangerous convergence where altered, intensified rainfall patterns (a result of climate change) meet fragile geology and unchecked, unsustainable urbanization, leading to catastrophic outcomes.

An Urgent Call for Action

Reassess Infrastructure – There is an immediate need to reassess all ongoing and planned infrastructure projects, particularly in ecologically sensitive and high-risk zones.

Strengthen Early Warning Systems – Investment in and enhancement of early warning systems are crucial for timely evacuations and effective disaster preparedness at the local level.

Restore Natural Buffers – A concerted effort must be made to restore the region's natural defenses, such as forests and wetlands, which act as sponges and help mitigate the impact of extreme rainfall.

Integrate Climate Science – Climate science and risk assessments must be integrated into all aspects of regional and urban planning to ensure that development is sustainable and resilient to future climatic shocks.

2. Solar Parks & India's Renewable Energy Transition

In drought-prone districts of Karnataka, solar parks promise prosperity but deliver displacement, exposing the fault lines of India's renewable energy transition.

Understanding Solar Parks

Definition – Solar parks are large, concentrated tracts of land developed with common, shared infrastructure to host multiple solar power projects set up by different developers.

Shared Infrastructure – This common infrastructure includes essential facilities like transmission lines to evacuate power, water supply for cleaning panels, internal roads, and communication networks.

Primary Objective – The model is designed to eliminate the logistical and regulatory hurdles that individual developers face, such as land acquisition and securing clearances, thereby streamlining and accelerating project execution.

The Solar Park Scheme – Policy and Scale

Government Initiative – The Ministry of New and Renewable Energy (MNRE) launched the "Development of Solar Parks and Ultra Mega Solar Power Projects" scheme in 2014.

Ambitious Targets – The scheme aimed to establish at least 50 solar parks with a capacity of 500 MW and above, targeting a cumulative capacity of approximately 38 GW by 2025–26.

Record Growth – India achieved a record addition of 24.5 GW of solar capacity in 2024. Utility-scale projects, predominantly located in these solar parks, accounted for 18.5 GW of this capacity.

Leading States – States like Rajasthan, Gujarat, and Tamil Nadu have been at the forefront, contributing to 71% of the total solar installations in the country.

The Instrumental Role of Solar Parks

They are critical in reducing project costs and minimizing transmission losses due to centralized power evacuation. They significantly speed up land acquisition and the process of obtaining regulatory clearances. The plug-and-play model has been successful in attracting both domestic and foreign investment into India's renewable energy sector. They are a cornerstone of India's strategy for the large-scale expansion of grid-connected solar power.

Challenges on the Ground – The Social and Environmental Cost

Displacement and Inequality – In drought-prone regions like Chitradurga in Karnataka, these large-scale parks have been developed on village commons, grazing lands, and agricultural plots, often displacing local communities and deepening rural inequality.

Regulatory Loopholes – A significant concern is that solar park development is often exempt from mandatory environmental and social impact assessments, which can lead to unchecked expansion without due consideration for its ecological and social consequences.

Innovative and Sustainable Alternatives

New and Innovative Solar Applications (NISA) – To mitigate land scarcity and social conflict, experts are advocating for innovative solutions that do not require large-scale land acquisition. These include –

Canal-top solar panels – Utilizing the surface of canals.

Agrivoltaics – The simultaneous use of land for both agriculture and solar power generation.

Building-integrated photovoltaics (BIPV) – Integrating solar panels into the building envelope.

Unlocking Potential – These NISA solutions could potentially unlock an estimated 4,740 GW of solar capacity without displacing communities or converting agricultural land.

Repurposing Degraded Land – Another promising alternative is to repurpose abandoned and degraded coal mine lands into solar hubs. A recent study found that over 500 sq km of such land could generate 27 GW of solar power, facilitating a "just transition" for coal-dependent regions and their workforce.

3. Decarbonising India's Coal-Based Thermal Power Sector

India's reliance on coal-based thermal power is profound, making its decarbonization one of the country's most significant climate challenges.

Backbone of Electricity Supply – Coal-fired power plants are the foundation of India's electricity grid, consistently meeting nearly 75% of the national demand.

Growing Capacity – As of 2025, India's installed capacity of coal and lignite-based power stands at 223 GW. This is not expected to shrink but rather grow, with projections indicating a rise to 307 GW by 2035 to meet rising energy needs.

Significant Emission Burden – The environmental cost is substantial. By the fiscal year 2031–32, emissions from the thermal power sector alone are projected to reach 1,100 million tonnes of CO₂.

Critical for Energy Security – Despite the remarkable growth in renewable energy, coal provides the essential base-load power needed for grid stability. The intermittent nature of solar and wind energy means that coal remains indispensable for ensuring a consistent and reliable power supply.

Current Efficiency and Technological Gaps

A major part of the problem lies in the technological profile and operational practices of the existing fleet of power plants.

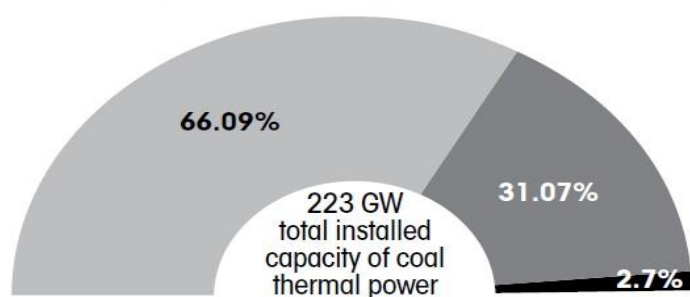
Dominance of Subcritical Technology – A significant **66% of India's coal power fleet** operates on older, less efficient **subcritical technology**. These plants operate at lower temperatures and pressures, converting less of the coal's energy into electricity and producing higher emissions per unit of power.

Underutilization of Advanced Technology – More modern supercritical and ultra-supercritical plants, which are 5–9% more efficient, are underutilized. They constitute only about 34% of the total capacity.

Largely inefficient

Least efficient subcritical technology accounts for 66% of power plants in India

■ Subcritical ■ Supercritical ■ Ultra-Supercritical



Source: CEA's 191st Quarterly Review Report, July 2025

Operational Inefficiencies – Technology alone does not guarantee efficiency. Effective **operations and maintenance (O&M)** are crucial. In some cases, older plants with superior O&M practices outperform newer plants that are poorly managed, highlighting a gap in operational discipline.

Key Opportunities for Emission Reduction

Several actionable strategies can be implemented to achieve significant emission reductions from the existing and future coal fleet.

Improve Fleet Efficiency

Benchmarking – Establish a system to benchmark all plants against the best performers in their specific technology class.

Renovation and Modernisation (R&M) – The existing R&M policy should be revamped to include all inefficient units, regardless of age, not just the oldest ones.

Retirement – Any unit that cannot meet efficiency or cost-effectiveness benchmarks after R&M interventions should be retired.

Optimize Plant Load Factor (PLF)

The Paradox – Currently, the least efficient subcritical plants have the highest average PLF (68%), while the most efficient ultra-supercritical plants have the lowest (51.2%).

Priority Dispatch – By giving priority dispatch status to the more efficient supercritical and ultra-supercritical plants, India could cut 22 million tonnes of CO₂ annually.

Accelerate Biomass Co-firing

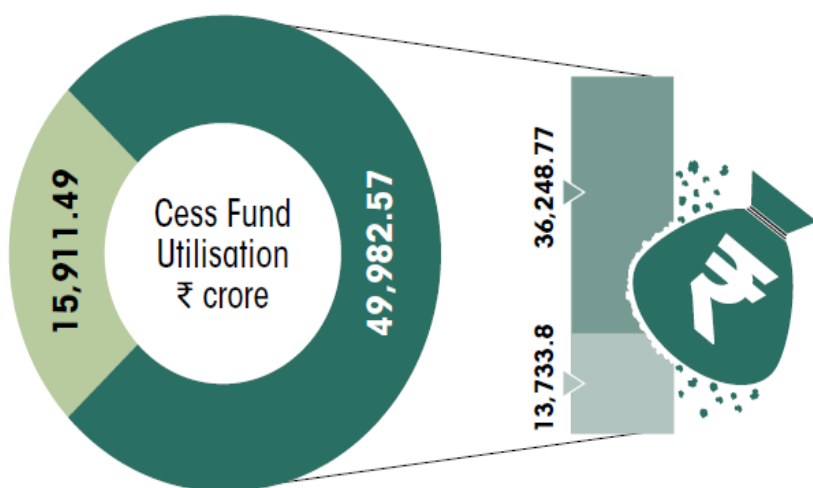
Definition – Co-firing involves burning biomass, such as agricultural residue, along with coal.

Mandate and Potential – The government has mandated a 7% biomass co-firing target from 2025–26. However, the potential is much higher. NTPC's Tanda plant has already demonstrated 20% co-firing, and international benchmarks, such as in Japan, have reached 34%.

Opportunity in coal cess

Cess fund utilisation (2010-17) (in ₹ crore)

■ Funds utilised by NCEEF* ■ Diverted revenue ■ Unutilised NCEEF* funds



Note: *NCEEF is National Clean Energy and Environment Fund in India
Source: Order/Circular issued July 3, 2017, by Department of Expenditure, Union Ministry of Finance

Decarbonisation Scenarios for 2031-32

A recent report outlines two scenarios demonstrating that the sector can reduce emissions by over 30% by 2031-32.

Scenario 1 – This scenario assumes benchmarking efficiency, an average PLF of 58%, and 20% biomass co-firing.

Result – Emissions would be reduced to 909 million tonnes of CO₂, a 31.8% cut from the business-as-usual trajectory.

Scenario 2 – This scenario involves giving a higher PLF to more efficient plants, along with the same efficiency and co-firing benchmarks.

Result – Emissions would fall further to 900 million tonnes of CO₂, representing a 32.5% reduction. This is an abatement greater than the combined emissions of India's cement and steel industries.

Essential Policy Reforms

Achieving these reductions requires a supportive policy and regulatory framework.

Reform Power Purchase Agreements (PPAs) – Long-term PPAs (25–30 years) often lock in inefficient plants. Reforms are needed to link payments to performance indicators like efficiency, emissions, and operational flexibility.

Revamp Merit Order Dispatch (MOD) – The current cost-based MOD system should be updated to incorporate environmental costs, thereby incentivizing cleaner and more efficient coal plants.

Set Emission Targets – Thermal plants, currently exempt from India's carbon credit trading scheme, must be included. Unit-specific emission intensity reduction targets are essential for driving accountability.

Promote Flexibilisation – To better integrate with renewables, existing thermal plants must be retrofitted for faster ramp rates (the ability to increase or decrease power output quickly).

Repurpose Coal Cess – After 2026, the substantial revenues from the coal cess (projected at ₹3.97 lakh crore by 2032) should be redirected to fund efficiency upgrades and emission reduction projects in coal plants.

Improve Demand Forecasting – An expert committee should be established to provide accurate and independent electricity demand forecasts. This would prevent the creation of excess capacity and reduce policy uncertainty.

Conclusion

While an immediate phase-out of coal is not feasible for India's energy security, the sector holds immense potential for significant decarbonization. Through a combination of efficiency upgrades, optimized dispatch, aggressive biomass co-firing, and critical policy reforms, India can achieve a 30% or greater reduction in emissions from the sector by 2032. The path forward requires making coal power cleaner while simultaneously accelerating the renewable energy transition, thereby balancing energy security with climate responsibility.

4. Plastic Treaty Talks End in Stalemate, Exposing Deep Divisions

The fifth session of the Intergovernmental Negotiating Committee (INC-5.2) in Geneva concluded in a stalemate, failing to advance a global treaty to end plastic pollution. The deadlock highlights the limitations of consensus-driven multilateralism and exposes the profound disagreements between nations on how to address the plastic crisis.

Background of the Treaty

The negotiations are mandated by the United Nations Environment Assembly's landmark Resolution 5/14, adopted in 2022. This resolution called for the creation of an international, legally binding treaty addressing the entire life cycle of plastics—from the extraction of raw materials and production to product design, consumption, and end-of-life waste management.

Key Points of Contention at the Geneva Session

After previous rounds in Busan, Ottawa, Nairobi, Paris, and Punta del Este, the Geneva session failed to produce a consensus on a draft treaty text. The primary areas of disagreement included –

Scope of the Treaty (Upstream vs. Downstream) – A fundamental divide emerged between countries wanting an "upstream" approach versus a "downstream" one.

Upstream – A coalition of ambitious countries argued that the treaty must address the root cause of pollution by including binding caps on plastic production and regulating hazardous chemicals and product design.

Downstream – A group of plastic- and fossil fuel-producing nations resisted production limits, insisting the treaty should focus solely on "downstream" issues like waste management, recycling, and clean-up.

Legal Language ('Shall' vs. 'Should') – Debates over key legal terms revealed the rift between ambition and reluctance.

The term 'shall' would create legally binding, mandatory obligations for member states.

The term 'should' implies a voluntary, non-binding recommendation, which significantly weakens the treaty's power.

Decision-Making Process – A proposal to allow future treaty decisions to be made by a three-quarters majority vote was rejected. Several member states insisted on maintaining a full consensus model, which effectively gives every country veto power and makes it easier to block progress.

Chemicals and Microplastics – There was significant resistance from some nations to include strong, binding language on restricting toxic chemical additives in plastics and addressing the pervasive issue of microplastics.

Financial Mechanisms – There was no agreement on how to finance the treaty's implementation, with several competing proposals on the table –

A call from oil- and plastic-producing countries for compensation funds to offset their potential economic losses. A demand from small island developing states (SIDS) for funds to support the remediation of plastic pollution, which disproportionately harms them. A proposal led by the United States for public-private partnerships, which critics fear could prioritize corporate interests over environmental protection.

Antarctic Heavy Metal Pollution Soars Tenfold in 40 Years

A recent study published in *Nature Sustainability* has revealed a shocking environmental trend in one of the world's most remote regions. Concentrations of toxic heavy metals like lead, cadmium, and

FAILED ATTEMPTS

While the world unanimously endorsed the idea of a plastics treaty, it has made little progress towards adopting such a treaty

2022

Nairobi, Kenya

February 28 - March 2

UN Environment Assembly agrees to create an Intergovernmental Negotiating Committee (INC) to develop a legally binding instrument to end plastic pollution

Punta del Este, Uruguay

November 28 - December 2

INC-1 convenes, officially beginning the formal negotiations

2023

Paris, France

May 29 - June 2

INC-2 focusses on plastic lifecycle and treaty measures, but members fail to agree on the Zero Draft

Nairobi, Kenya

November 13 - 19

At INC-3, members request the Secretariat to compile a "Revised zero-draft" by December 31, 2023

2024

Ottawa, Canada

April 21-30

Some convergence emerged at INC-4, but many bracketed options and differences remain

Busan, South Korea

November 25 - December 1

INC-5.1, initially expected to deliver a final treaty, lays bare deep divisions among countries and ends without a resolution

2025

Geneva, Switzerland

August 5-15

INC-5.2 once again ends without consensus on a draft text

mercury have increased nearly tenfold in Antarctica over the past four decades, directly linked to expanding human activity.

What the Data Shows

Analysis of recent ice cores and snow samples paints a grim picture of contamination in the once-pristine continent -

Lead Levels - Atmospheric lead concentrations have surged by over 900% since 1980.

Other Metals - Cadmium and mercury are now detectable in areas where they were previously absent.

Pollution Hotspots - The highest concentrations are clustered around zones of human activity, such as research stations and popular tourist sites. However, atmospheric transport is carrying these pollutants to even the most remote inland regions.

What's Causing the Surge?

The primary drivers of this pollution are the two main forms of human presence on the continent, both of which have grown exponentially since the 1980s -

Scientific Research Stations - Year-round operations require energy, transport, and infrastructure, all of which leave a chemical footprint. Diesel combustion from generators and vehicles is a major source of airborne heavy metals. Studies have confirmed elevated levels of arsenic and chromium near long-standing bases like McMurdo (U.S.) and Rothera (U.K.).

Tourism Operations - Antarctic tourism has ballooned from just a few hundred visitors in the 1980s to over 100,000 people annually. Cruise ships and aircraft contribute significantly to localized pollution. While regulated under the Antarctic Treaty System, enforcement across the vast continent is extremely challenging. Tourists inadvertently introduce pollutants through fuel emissions, waste, and even contaminants carried on clothing and equipment. This research serves as a stark reminder that no part of our planet is immune to the impacts of human activity.

5. Extremely Heavy Rains Lash North India

According to the India Meteorological Department (IMD), North India has been experiencing an unprecedented and devastating monsoon season. Regions from the plains of Punjab to the mountains of Himachal Pradesh and the valleys of Jammu and Kashmir have been battered by rainfall that crossed the threshold of 'extremely heavy', leading to widespread destruction.

Unprecedented Rainfall Patterns

The intensity and duration of the rainfall this season have broken numerous records, leaving little to no time for recovery between spells.

Punjab - The state witnessed an astonishing 24 out of 31 days of heavy to extremely heavy rainfall in August alone.

Himachal Pradesh - The mountainous state endured record-breaking rain for more than 90% of the days over the last three months.

Regional Impact – Between June and August, the states of Punjab, Himachal Pradesh, and the Union Territory of Jammu and Kashmir collectively saw nearly 50% excess rainfall. At their peak, weekly rainfall totals exceeded normal averages by a staggering 300–400%.

6. IMD Rainfall Classification

To understand the severity, it's important to know how the IMD classifies rainfall intensity over a 24-hour period –

Heavy Rain – 64.5 mm to 115.5 mm

Very Heavy Rain – 115.6 mm to 204.4 mm

Extremely Heavy Rain – More than 204.4 mm

Climate Change at the Core – These extreme events are a clear manifestation of the ongoing climate emergency. Rising global temperatures are severely disrupting established weather systems in several ways –

Intense and Concentrated Rain – Rainfall patterns have shifted. Instead of being spread out over a season, rain is now falling in intense, concentrated bursts, with an entire season's precipitation occurring in just a few hours or days.

Anomalous Western Disturbances – These storm systems, normally active during winter, have surged in frequency during the monsoon. By early September, 19 such disturbances had occurred, colliding with monsoon winds and amplifying rainfall to catastrophic levels.

Shifting Wind Patterns – Warming in the Arabian Sea and Bay of Bengal, along with disruptions in the Arctic, has altered wind patterns, creating highly unstable atmospheric conditions over the subcontinent.

Reckless Development Amplifies Disaster

While climate change is the primary driver, reckless and unplanned human actions have magnified the impact of the disaster.

Unsafe Construction – Widespread construction in natural floodplains without adequate drainage systems has blocked water channels.

Fragile Slopes – Encroachment on fragile mountain slopes has dramatically increased the frequency and severity of landslides.

Ignoring Geology – The Himalayas are geologically young and unstable mountain ranges. The rapid expansion of roads, housing, and hydropower projects in these sensitive and seismically active regions, ignoring their inherent fragility, has proven to be catastrophic.

The 2025 Punjab Floods – A Cumulative Catastrophe

Punjab has witnessed its worst floods since 1988, a disaster triggered by a combination of relentless rains within the state, massive water flows from swollen rivers upstream, and back-to-back extreme weather events. The devastation has been severe, with lives lost, millions of hectares of crops destroyed, and entire villages submerged.

A History of Worsening Floods

This year's disaster is part of a recurring and escalating pattern of floods in Punjab –

1988 – Previously the worst flood on record, it killed 600 people and affected 3.4 million.

2019 – Discharges from the Bhakra Dam submerged 300 villages.

2023 – A decade's worst flood at the time, it submerged over 1,400 villages.

2025 – The current flood has surpassed all past events, starkly demonstrating how systemic failures in drainage and unchecked development magnify natural hazards into full-blown catastrophes.

Scale of the Regional Devastation

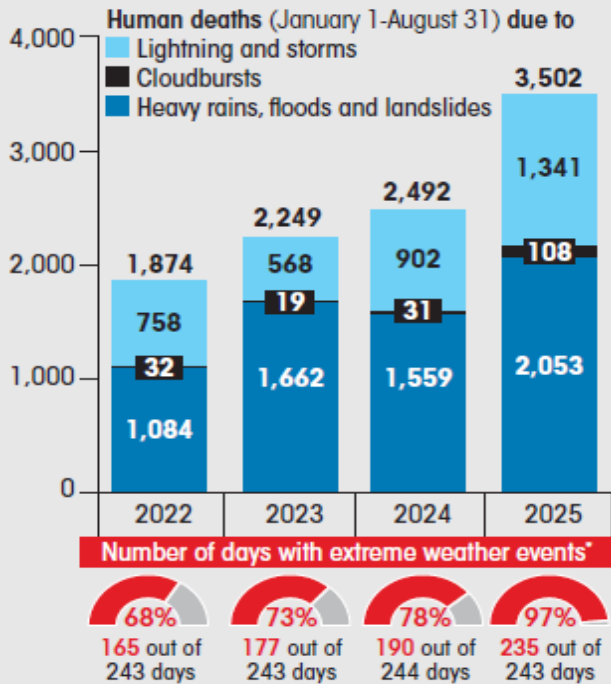
The 2025 floods were not just a Punjab-centric event but a regional crisis.

Punjab – The state recorded a 54% seasonal rainfall surplus. In the last two weeks of August alone, it was battered by 388% to 454% surplus rainfall, submerging 1.39 million hectares of crops and claiming 48 lives.

Himachal Pradesh – Extreme rain spells led to landslides and swollen rivers, with some districts receiving over 400% above-normal rainfall. This water flowed directly into Punjab's rivers.

Disastrous spike

India endured extreme weather events on 97% of the days this year, claiming 3,502 lives. This marks an alarming increase from previous years



Arabian Sea pushed monsoon systems northward.

Arctic Influence – Cold-core weather systems, known as Potential Vorticity Cut-Off Lows, detached from the Arctic jet stream and moved south, unleashing heavy rain.

Global Linkages – Warming in the Arctic and the Arabian Sea has disrupted the global temperature balance, fueling this atmospheric instability.

Conclusion

Punjab's floods of 2025 were a cumulative disaster, the result of a chain reaction of extreme weather across the entire Himalayan region. With rivers carrying unprecedented volumes of water downstream from Himachal Pradesh and Jammu & Kashmir into Punjab—a state already saturated by its own record-breaking rainfall—the catastrophe became unavoidable.

7. Fragile Recovery of Earth's Ozone Layer

A recent MIT-led study indicates that the healing of the Earth's ozone layer is not yet complete, and emerging new threats could halt or even reverse the progress made over the last several decades.

About the Ozone Layer

The ozone layer is a thin but powerful blanket of gas located in the stratosphere, roughly 10 to 50 kilometers above the Earth's surface. Composed of ozone molecules (O₃), it plays a critical role in

Jammu & Kashmir – A sudden surge in rainfall, reaching 260% surplus in a single week, swelled the Ravi river, which flows into Punjab.

Ladakh – The cold desert region recorded an astonishing 434% surplus rainfall, raising fears of Glacial Lake Outburst Floods (GLOFs), which could send even more water downstream.

A Nationwide Crisis

Data from India's Atlas on Weather Disasters reveals that this was a nationwide phenomenon. India faced extreme weather on all 92 days between June and August 2025.

Himachal Pradesh was the most affected, hit by extreme weather on 76 of the 92 days. By the end of August, 3,502 lives were lost nationwide due to weather-related disasters, a 40% increase from 2024.

The Scientific Reasons

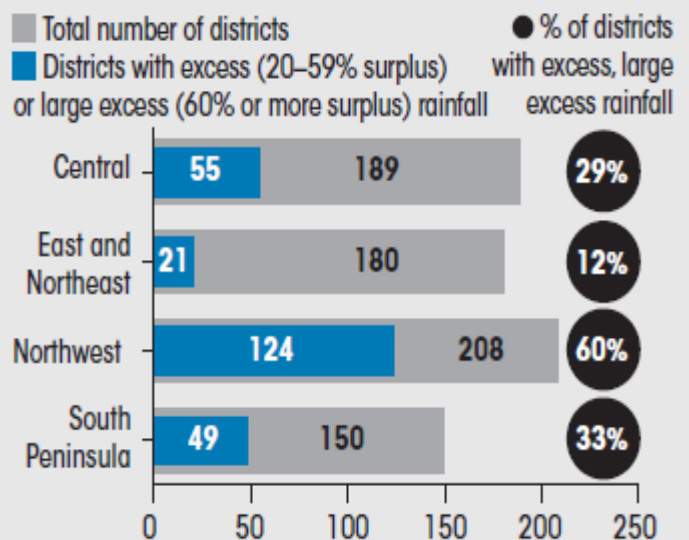
The floods were driven by a "perfect storm" of atmospheric conditions –

Western Disturbances – An unusually high number (19) collided with monsoon winds.

Anomalous Winds – Moisture-laden winds from the

Deluge in northwest

This monsoon*, 249 districts recorded excess or large excess rainfall. Over half of the districts are in the northwest



*June 1, 2025 to September 6, 2025; Source: India Meteorological Department

protecting life on Earth by absorbing the majority of the Sun's harmful ultraviolet (UV) radiation. This is especially true for UV-B rays, which are known to cause skin cancer, cataracts, and significant damage to crops and marine ecosystems.

Global Action and Success

The world first became aware of the threat of ozone depletion in the 1970s, when scientists discovered that certain human-made chemicals—most notably chlorofluorocarbons (CFCs) used in refrigerants and aerosols—were breaking down ozone molecules. This led to the formation of the infamous 'ozone hole' over Antarctica, first documented in 1985.

In a landmark display of global cooperation, nations came together to sign the Vienna Convention (1985) and the Montreal Protocol (1987). These international agreements successfully orchestrated the phase-out of nearly 100 different ozone-depleting substances (ODS).

India has been a proactive participant in these efforts, implementing measures like the India Cooling Action Plan to promote sustainable cooling technologies and significantly reducing hydrofluorocarbon (HFC) emissions. India also celebrates World Ozone Day annually on September 16, with the 2025 theme being 'From Science to Global Action'.

Signs of Healing

The global effort has yielded remarkable results. According to the World Meteorological Organization (WMO), the ozone hole in 2024 was smaller than in recent years. The ozone layer is on track to recover to its 1980 levels by mid-century. This incredible progress is largely credited to the success of the Montreal Protocol, which has led to the phasing out of 99% of ozone-depleting substances worldwide.

New and Emerging Threats

Despite the success, new threats are emerging that could undermine this fragile recovery.

Chlorinated Very-Short-Lived Substances (CI-VSLS) - These are industrial chlorine-containing gases, such as solvents, which have lifetimes of about six months. Critically, they are not regulated under the Montreal Protocol. Although short-lived, a fraction of these chemicals can reach the stratosphere through tropical convection and the Asian monsoon, where they contribute to ozone depletion. Satellite measurements confirm that stratospheric chlorine levels are declining more slowly than expected, a trend linked to rising CI-VSL emissions.

Other Scientific Warnings

Greenhouse Gases - Gases like nitrous oxide (N_2O), a potent greenhouse gas, also pose a growing threat as they can directly destroy ozone and alter stratospheric circulation patterns.

Monitoring Gaps - Long-term atmospheric monitoring is at risk due to aging instruments and uncertain funding. Without these essential satellite and ground-based measurements, it becomes impossible to track how new factors—such as major wildfires and volcanic eruptions—are affecting the ozone layer's health.

What Next? The Path Forward

Scientists are calling for renewed global action to protect the progress that has been made. Research shows that controlling CI-VSL emissions could prevent up to 25% of the projected ozone loss in the tropical stratosphere by the year 2100. Key recommendations include -

1. Expanding the Montreal Protocol to include regulations for CI-VSLS.
2. Strengthening climate action to curb emissions of greenhouse gases like nitrous oxide.
3. Ensuring global investment in new atmospheric monitoring satellites and infrastructure to avoid "flying blind" to future threats.

8. Vervet Monkeys

In recent years, Vervet Monkeys have become valuable research animals, particularly for biomedical studies of primates' brain and behaviour, metabolism and immunity, which have resulted in live-trapping of the monkeys.

About the Vervet Monkeys (genus *Chlorocebus*)

Vervet monkeys are among the most studied primates in Africa, with their expressive faces and agile limbs. They were introduced in the 17th century in the Caribbean islands. They are often referred to

as African green monkeys, and are common across East Africa, and found across the savannas and woodlands of subSaharan Africa. They are known for their complex vocalizations, vervets have distinct alarm calls for different predators – snakes, eagles, and leopards – demonstrating advanced cognitive abilities.

IUCN Status - Least Concern (LC)

9. Snow Leopards

A three-year camera-trap study by the Nature Conservation Foundation and the Wildlife Protection Department of J&K confirmed yearround presence and breeding activity of snow leopards in the Union Territory.

About Snow Leopard (*Panthera Uncia*)

It is often called the 'ghost of the mountains' and is a flagship species of the high-altitude ecosystems of Central and South Asia. It inhabits the rugged terrains of 12 countries, including India, China, Nepal, Bhutan, Mongolia, and Russia. In India, the Snow Leopard Population Assessment in India (SPAII) conducted between 2019 and 2023 revealed a population of 718 individuals across five Himalayan states and two Union Territories including Ladakh (477), Uttarakhand (124), Himachal Pradesh (51), Arunachal Pradesh (36), Sikkim (21), Jammu & Kashmir (9). Despite this, only about 34% of their habitat—about 120,000 sq km—is under legal protection.

Conservation Status

IUCN Red List - Vulnerable (downgraded from 'Endangered' in 2017);

Wildlife (Protection) Act, 1972 - Schedule-I

Conservation Efforts

Project Snow Leopard - A national initiative launched in 2009 to promote landscape-level conservation.

SPAII Protocol - A rigorous two-step framework involving camera traps and habitat modeling to assess population and distribution.

Proposal for a Snow Leopard Cell - The Wildlife Institute of India (WII) has recommended a dedicated cell for long-term monitoring and research. Internationally, programs like IUCN's Save Our Species and the Global Snow Leopard & Ecosystem Protection (GSLEP) initiative foster transboundary cooperation, community engagement, and habitat protection across Central Asia. In regions like Sanjiangyuan in China, high snow leopard densities correlate with abundant prey and minimal human disturbance, offering models for conservation success.

10. Sundarbans Tiger Reserve in West Bengal

Recently, the Sundarbans Tiger Reserve in West Bengal officially became India's second-largest tiger reserve after the National Board for Wildlife (NBWL) approved a proposal to expand its area by 1,044.68 sq km, just behind Nagarjunasagar-Srisailem in Andhra Pradesh.

About The Sundarbans Tiger Reserve

It was established in 1973, is located in the South and North 24-Parganas districts of West Bengal. It forms part of the world's largest mangrove ecosystem, shared between India and Bangladesh, and is the only mangrove forest globally known to support a significant tiger population.

Geographic & Ecological Highlights

Location - Southernmost tip of the Gangetic delta, bordering the Bay of Bengal;

Flora - 140 plant species across 59 families, including true mangroves, halophytic herbs, and epiphytes

Fauna - Royal Bengal Tiger; Fishing Cat, Estuarine Crocodile, Gangetic Dolphin; Marine turtles (Olive Ridley, Green Sea Turtle, Hawksbill); River Terrapin, King Cobra, Water Monitor Lizard

Conservation Status & Recognition

1. UNESCO World Heritage Site (1985);
2. Biosphere Reserve (1989);
3. National Park (core area designated in 1984)

About National Board for Wildlife (NBWL) - It is a statutory body constituted under the Wildlife (Protection) Act, 1972, with the primary mandate to promote the conservation and development of

wildlife and forests across India. It replaced the earlier Indian Board for Wildlife in 2003 following an amendment to the Act.

Composition

Chairperson – Prime Minister of India;

Vice-Chairperson – Minister of Environment, Forest and Climate Change;

Members – 47 total, including government officials, ecologists, environmentalists, and representatives from NGOs;

Member-Secretary – Director of Wildlife Preservation (Additional Director General of Forests);

Key Functions

1. Reviewing and approving proposals for diversion of forest land in protected areas;
2. Advising the government on wildlife conservation strategies;
3. Promoting the creation and management of protected areas;
4. Overseeing flagship programs like Project Tiger, Project Elephant, and Project Snow Leopard;
5. Facilitating inter-ministerial coordination on wildlife issues;

11. Orphan Drugs

Medicines designed to treat rare diseases have become valuable assets for big pharma companies, while millions of patients in countries like India remain underserved.

Orphan Drugs

They are developed to treat rare or 'orphan' diseases, which affect a small fraction of the population. Definitions vary,

United States – Conditions affecting fewer than 200,000 people;

European Union – Life-threatening or chronically debilitating diseases affecting fewer than 5 in 10,000;

India – No fixed numerical definition, but the Central Drugs Standard Control Organisation considers a disease rare if it affects fewer than 500,000 people;

These drugs were once commercially unviable, but incentives like tax breaks, market exclusivity, and fast-track approvals have transformed them into high-profit ventures.

Billion-Dollar Boom

Only a handful of orphan drugs existed, until the 1980s. Today, the US FDA has approved nearly 900, and in 2024 alone, 52% of new drug approvals were for rare diseases. It reflects a strategic pivot by Big Pharma, which now sees orphan drugs as lucrative investments with less competition and premium pricing.

India's Lagging Response

The National Policy for Rare Diseases (NPRD), launched in 2021, offers financial support of up to ₹50 lakh per patient; Only 1,118 patients have benefited, despite 63 rare diseases being officially notified. There is no structured incentive for domestic R&D or manufacturing of orphan drugs, which leaves patients dependent on expensive imports or charitable crowdfunding, with little systemic support.

Government Efforts

The Union Ministry of Chemicals and Fertilizers recently proposed incentives to boost local production of orphan drugs. It includes –

1. Subsidies for R&D;
2. Fast-track regulatory approvals;
3. Public-private partnerships to scale manufacturing;

There is no structured incentive for domestic R&D or manufacturing of orphan drugs, which leaves patients dependent on expensive imports or charitable crowdfunding, with little systemic support.

P L RAJ UPSC MONTHLY MAGAZINE – COMPILATION

OCTOBER 2025

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1. Education for the Visually Impaired

This section details the framework and initiatives for inclusive education for persons with visual impairment, focusing on achieving dignity, independence, and equal opportunity.

1. Empowerment Through Education

Foundation of Empowerment – For persons with disabilities, education is the foundation of empowerment, fostering independence, self-advocacy, and civic participation.

Benefits – It breaks the cycle of dependency, enhances employability, and promotes social inclusion.

Cornerstone Policies – India's vision is supported by the NEP 2020 and the Rights of Persons with Disabilities (RPwD) Act, 2016, both emphasizing inclusive, barrier-free education.

2. Legal and Policy Framework

RPwD Act, 2016 – Mandates inclusive education, accessibility, and reasonable accommodation. Sections 16–17 specifically require schools to adapt curricula, train teachers, and provide assistive technologies.

NEP 2020 – Calls for barrier-free access, curriculum adjustments, and comprehensive teacher training to support visually impaired students.

Rehabilitation Council of India (RCI) Act, 1992 – Governs the training and certification of special educators, ensuring professional support for visually impaired learners.

3. Major Government Schemes

Samagra Shiksha Abhiyan – Promotes inclusive education from pre-primary to Class XII, providing assessment, aids, and special educators for Children with Special Needs (CWSN).

SIPDA (Scheme for Implementation of the RPwD Act) – Offers financial assistance for barrier-free infrastructure, skill training, and assistive technologies.

ADIP (Assistance to Disabled Persons for Purchase/Fitting of Aids and Appliances) Scheme (Revised 2024) – Provides mobility aids like Braille kits, smart canes, and accessible mobile phones to enhance independence.

NAP-SDP (National Action Plan for Skill Development of Persons with Disabilities) – Targets skilling 2.5 million PwDs with training, mentorship, and placement support.

4. Key Enablers for Inclusive Education

Accessible Learning Materials (DALM Project) – Provides Braille, tactile, audio, and digital formats. Over 115 crore Braille pages were produced since 2015-16, benefiting 1.58 lakh students.

Assistive Technologies – Devices like Braille displays, OCR tools, AI-powered reading aids, and smart canes convert visual data into tactile, auditory, or magnified formats. These are distributed under the ADIP Scheme.

Qualified Educators – Mandated by Section 17(c) of the RPwD Act, RCI develops curricula and maintains the Central Rehabilitation Register (CRR) for certified professionals.

Barrier-Free Infrastructure (Accessible India Campaign) – Drives universal accessibility, including ramps, tactile paving, audio cues, and Braille signage across educational spaces.

5. Recent Developments (Last 10 Years)

1. RPwD Act, 2016 was enacted, legally mandating inclusive education.
2. Science stream education was introduced at NIEPVD's Model School in 2024, promoting inclusion in STEM fields.
3. DALM Project (2023 update) expanded to include talking books, e-pub, and large-print formats. Flexible assessment guidelines were introduced for visually impaired students.

2. Cultivating Creativity and Enterprise

This chapter focuses on the shift from rote learning to fostering critical thinking, creativity, and entrepreneurship, aligning education with the goals of Viksit Bharat @2047 and Industry 5.0.

1. Preparing for Industry 5.0

Focus Areas – Education must align with demands driven by AI, robotics, and machine learning, focusing on interdisciplinary learning, emotional intelligence, and a human-centric approach.

Ecosystem Building – Building innovation ecosystems within institutions empowers students with real-world problem-solving abilities.

2. AICTE Initiatives for Innovation

The All-India Council for Technical Education (AICTE) promotes innovation through several initiatives –

Smart India Hackathon (SIH) – World's largest open innovation model, engaging 15 lakh+ students.

KAPILA (Kalam Program for IP Literacy and Awareness) – Led to a 247% rise in patent filings.

Institution's Innovation Councils (IICs) – Over 16,300 councils nurturing an innovation culture across India.

National Innovation and Start-up Policy (NISIP) – Adopted by over 3,000 institutions to promote entrepreneurship.

3. Innovation at the School Level

The National Policy for Promoting Innovations in Schools fosters skills among 250 million students in 1.5 million schools.

School Innovation Ambassador Training Program (SIATP) – Trained 26,800 teachers in five domains – Design Thinking, Idea Generation, Entrepreneurship, IPR, and Finance & HR.

School Innovation Councils (SICs) – Established in over 20,000 schools, fostering local problem-solving.

Design Thinking and Innovation (DTI) module – A structured module with 1.3 lakh students enrolled in 2,400 schools.

IDE Bootcamps – Trained thousands of participants in schools and higher education through hands-on exposure and mentorship.

4. Towards a New Educational Era

Vision – These efforts are shaping an innovation-driven academic ecosystem that aligns with the goals of Atmanirbhar Bharat and Viksit Bharat @2047.

Redefinition – Education is redefined as "Shiksha for Innovation"—focusing not just on acquiring knowledge but also on creating, experimenting, and innovating.

3. Indian Knowledge System (IKS) in Education

By integrating Indian Knowledge Systems (IKS) into all levels of education, aligning modern learning with cultural heritage and SDG 4 (Quality Education).

1. Understanding IKS

Definition – IKS is India's vast body of indigenous intellectual and cultural heritage, spanning 5,000 years, preserved across regions and languages.

Scope – It includes tacit knowledge (experience/tradition) and explicit knowledge (texts/theories), covering spiritual, scientific, artistic, and social domains.

The Bharatiya Gyana Parampara – A living tradition that has evolved while retaining cultural roots.

2. IKS under NEP 2020

NEP 2020 recognizes IKS as essential for holistic education and encourages the infusion of Knowledge of India (KoI) across all stages and subjects.

Curriculum – Must be rooted in the Indian context, ethos, and heritage.

Pedagogy – Uses local stories, arts, sports, and examples to enhance relatability and creativity.

Learning – Aims to make learning experiential and culturally grounded by integrating indigenous traditions, philosophy, language, and science.

3. Subject-Wise IKS Integration (NCF 2023)

The National Curriculum Framework (NCF) 2023, formulated by NCERT, operationalizes IKS integration –

Art Education – Draws on Natyashastra, Shilpashastra, and Chitrasutra; students learn *raga*, *tala*, *laya*, *rasa*, and *bhava*.

Mathematics – Introduces India's contributions (zero, negative numbers, geometry, algebra), highlighting figures like Aryabhata and Ramanujan.

Science – Highlights India's advancements in astronomy, metallurgy, medicine, chemistry, and space research.

Social Sciences – Encourages pride in *Bharatiyata*, exploring India's democratic ideals and values like ahimsa and coexistence.

Physical Education – Integrates traditional sports like Yoga, Mallakhamb, wrestling, and archery.

4. Significance

Revitalizing IKS is about harmonizing tradition with modernity, fostering –

Holistic Learning – Integrating ethics, science, and creativity.

Identity – Building cultural pride and national identity among learners.

Innovation – Promoting critical thinking rooted in indigenous wisdom.

Alignment – Aligning education with Atmanirbhar Bharat and global standards.

4. Skill-Based Education

This section details the transformation of vocational education under NEP 2020, aiming to mainstream skill-based learning from Grade 6 onwards and bridge the education-employability gap.

1. Integration of Skills in School Education

Grades 6–8 – Students undertake 10-day 'bagless' internships with local artisans (potters, carpenters), promoting hands-on learning.

Grades 9–12 – Structured skill training through partnerships with ITIs, polytechnics, and industries, leading to certification.

Core Goal – To ensure every student gains exposure to and learns at least one vocation.

2. Key Reforms and Growth

Curriculum – National Curriculum Framework (NCF) integrates vocational components.

Digital Platforms – SWAYAM and DIKSHA expand access to virtual skill learning.

Scope – Includes Lok Vidya (traditional knowledge) alongside modern sectors like AI, Robotics, and IoT.

Expansion – Schools offering NSQF-aligned vocational subjects increased by 51% (from 12,292 in 2021–22 to 18,610 in 2023–24).

Focus Shift – Shifted from "Education for All" to "Skills for All," with a mandatory employability skills module.

3. State-Level Implementation Examples

Rajasthan – Vocational education integrated into 1,867 schools; 2.56 lakh students trained in 15 trades (2022–23).

Himachal Pradesh – Adopted '10 Bagless Days' in 2,500+ schools and implemented a 48-hub model for shared resources.

Maharashtra – Proposed mandatory internships for all industries receiving state incentives under its new Industrial Policy.

4. Challenges and Way Forward

Challenge	Way Forward (Solution)
Dropout Rate (14.1% at secondary level)	Mainstream vocational education into school timetables with clear mandates.
Societal Stigma and Academic-Vocational Divide	Shift societal perceptions through campaigns, teacher sensitisation, and promoting the dignity of labour.
Outdated Curricula and Slow Alignment	Dynamic curricula developed via continuous industry-academia collaboration.
Trainer Shortages	Develop skilled trainers by establishing state-level vocational educator cadres with certification.
Gendered Stereotypes	Encourage girls into non-traditional sectors through annual counselling and aspiration mapping.

Mains Practice Question

- Discuss the progress made and challenges faced in mainstreaming vocational and skill-based education and fostering an innovation culture to bridge the education-employability gap.
- Furthermore, critically examine the strategy and significance of integrating the Indian Knowledge System (IKS) into the school curriculum under the NEP 2020 and NCF 2023 framework. (15 Marks)

KURUKSHETRA

1. Rashtriya Poshan Maah and POSHAN Abhiyaan

This chapter discusses India's evolving nutrition policy, anchored by the community-led POSHAN Abhiyaan and its annual focal point, Rashtriya Poshan Maah.

1. Evolution of Nutrition Policy

Initial Program – Integrated Child Development Services (ICDS, 1975) was one of the world's largest community-based programs for children under six, pregnant women, and lactating mothers.

POSHAN Abhiyaan (2018) – Marked a paradigm shift by focusing on the first 1,000 days of life (from conception to a child's second birthday).

Three-pronged Approach – Jan Andolan (community-led behavior change), Digital Monitoring (via POSHAN Tracker), and Capacity Building (training 1.4 million Anganwadi Workers via ILA).

Mission Poshan 2.0 (2021) – Integrated POSHAN Abhiyaan, Anganwadi Services, and the Scheme for Adolescent Girls, serving nearly 10 crore beneficiaries across all states and UTs.

2. Rashtriya Poshan Maah – The SBCC Engine

Role – Introduced in September 2018, it is the annual focal point of a year-round Social Behaviour Change Communication (SBCC) and service delivery framework.

SBCC Strategy (Three-Tier) –

Mass Media – TV, radio, and digital platforms for large-scale outreach.

Mid-Media – Local radio, wall paintings, folk performances, and school activities for community engagement.

Interpersonal Counselling – Home visits by Anganwadi Workers using digital tools.

Evolution of Themes – Has evolved from initial awareness drives (2018) to focusing on Thematic Weekly Activities (2021), Panchayat-led initiatives (2022), the Life-cycle Approach (2023), and Swasth Naari, Shashakt Parivar (2025).

3. Significance and Challenges

Significance – Fosters Behavioural Transformation, acts as a Convergence Platform (aligning Health, Education, Panchayati Raj, etc.), ensures Community Ownership, and enables Technology-Enabled Governance.

Challenges – Regional Disparities (higher prevalence in tribal/rural areas), Behavioural Inertia (deep-rooted food practices and gender biases), Supply Chain Gaps, and Convergence Deficit across states.

Way Forward – Strengthen Last-Mile Delivery through technology, Engage Men in family nutrition, Promote Local Food Systems, and Institutionalise SBCC.

2. Nourishing India's Future

This chapter focuses on critical developmental stages and emerging threats – Infant and Young Child Feeding (IYCF), Early Childhood Care and Education (ECCE), and tackling the twin threat of **Obesity**.

1. Infant and Young Child Feeding (IYCF)

First 1,000 Days – This period (conception to age two) determines lifelong health, cognitive ability, and productivity.

Exclusive Breastfeeding (0–6 months) – Scientifically proven to be a superfood that reduces infant mortality, infections, and malnutrition. MoWCD promotes optimal feeding through Anganwadi home visits and SBCC.

Complementary Feeding (6–24 months) –

WHO advises 2–3 small meals (6–8 months) and 3–4 meals + 1–2 nutritious snacks (9–24 months).

Dietary diversity is crucial, including cereals, pulses, milk, eggs, fruits, and vegetables, while limiting sugar, salt, and oils. The Annaprashan Diwas initiative promotes local, low-cost recipes.

Responsive Feeding – Involves emotional bonding and interactive feeding, which builds healthy food preferences and reduces undernutrition and obesity risks.

2. Early Childhood Care and Education (ECCE)

Constitutional Mandate – The 86th Constitutional Amendment (2002) inserted Article 45 (ECCE for children up to six), and the RTE Act (2009) extended free pre-school education for children above three years.

Anganwadi Network – Remains the world's largest early childhood development program, reaching 46% of India's under-six population. It was universalised in 2009.

Poshan Bhi Padhai Bhi (PBPB) Initiative (2023) – Integrates play-based, inclusive ECCE at Anganwadi Centres.

Training – 14 lakh Anganwadi Workers are being trained.

Curricula – Navchetana (birth–3 years) and Aadharshila (3–6 years) provide national frameworks.

Digital Support – The Poshan Tracker app provides daily ECCE activity videos and voice notes.

Recognition – Children receive an ECCE Certificate, linked to APAAR ID and UDISE databases for school continuity.

3. Advancing Nutrition Literacy to Tackle Obesity

The Emerging Challenge – Overnutrition and obesity are emerging as twin threats, driven by sedentary lifestyles, digital habits, and the dominance of processed foods and beverages in consumption patterns.

Impacts – Leads to early-onset diabetes, cardiac risks, PCOS, cancers, and reduced productivity.

Policy Response – The 8th Poshan Maah (2025) emphasizes nutrition literacy. Key messages include – Limiting salt, sugar, and oils.

Practicing mindful eating and ensuring adequate sleep.

60 minutes of daily physical activity or yoga.

Intervention – MoWCD introduced "Oil and Sugar Boards" at Anganwadi Centres to visually prompt moderation.

3. Nutrition Sensitive Agriculture (NSA) in Rural India

This chapter focuses on integrating farming and nutrition to address India's nutrition paradox—high agricultural output despite severe malnutrition—by promoting dietary diversity and economic equity.

1. India's Nutrition Paradox and Burden

The Paradox – India is the world's largest milk producer but faces severe malnutrition, ranking 105/127 on the Global Hunger Index 2024 ("serious" category).

Rural Burden – 35.5% of children under 5 are stunted. 40% of rural children under five are anaemic (vs 28% urban). Monotonous cereal-based diets erode nutritional outcomes.

Economic Loss – Malnutrition costs India 4% of its GDP annually (approx. \$1.4 trillion).

2. Concept and Core Elements of NSA

Definition – NSA strengthens agricultural systems to improve nutrition outcomes through diversification, equity, and health linkages.

Key Components –

Crop Diversification – Promoting millets, pulses, fruits, and vegetables.

Biofortification – Developing crops like Zinc-rich wheat and iron-fortified millets. Example – Rice – CR Dhan 310 (10.3% protein in polished grain).

Women's Empowerment – Crucial, as women form 70–80% of the agricultural workforce but own less than 13% of land.

Health Linkages – Nutrition education and convergence with public health schemes.

Potential Impact – World Bank (2022) estimates NSA could reduce child stunting by 20% by 2030.

3. Implementation and Impact

Policy Integration – NSA is integrated into POSHAN Abhiyaan and the Biofortification Mission (2022–25).

Successful Initiatives –

ICAR "Seeds for Nutrition" (2020) – Distributed 50 million seed packets; resulted in a 30% rise in iron-fortified millet cultivation in Rajasthan.

UNICEF "Nutrition-Smart Villages" (Bihar) – Dietary diversity rose from 3.5 to 4.7 food groups.

Case Studies – NSA districts in Kerala show 15% lower stunting than Bihar. Odisha saw a 16% reduction in anaemia using iron-fortified crops.

4. Challenges and Way Forward

Challenges – NSA receives only 5% of agriculture budgets. Only 40% of targeted districts have operational NSA plans. Persistent gender inequities and weak inter-ministerial convergence.

Way Forward – Expand digital and AI-based crop-nutrition advisories. The National Agriculture Policy 2025 (draft) proposes ₹2.5 lakh crore to scale NSA, targeting 50% dietary diversity coverage by 2030.

4. Digital Transformation in Healthcare

This chapter outlines how digital innovations are making healthcare accessible, efficient, and equitable, especially in rural India, with key focus on the Ayushman Bharat Digital Mission (ABDM).

1. Context and Global Precedent

Digital Surge – India has seen a surge in digital health innovations (telemedicine, EHRs, health-tech startups).

COVID-19 Catalyst – The pandemic accelerated digital health adoption, with India's CoWIN platform serving as a global model.

Telemedicine Growth – The eSanjeevani platform delivered over 150 million consultations, making it the world's largest telemedicine initiative.

2. National Digital Initiatives (ABDM Ecosystem)

ABDM (2021) – Seeks to create a unified digital health infrastructure.

Pillars – Includes the Health Facility Registry, Healthcare Professionals Registry, Ayushman Bharat Health Account (ABHA), and Unified Health Interface (UHI).

Progress – As of August 2025, over 3.3 lakh facilities and 4.7 lakh professionals are registered.

Regulation – The Digital Personal Data Protection Act (2023) and Health Ministry guidelines safeguard patient data and consent.

3. Digital Health and Rural India

Addressing Health Gaps – Digital tools are crucial, given the high rural malnutrition burden (35.5% stunting, 57% women anaemic).

Frontline Empowerment – Apps empower ASHA and Anganwadi workers to track anaemia and immunisation in real time.

POSHAN Tracker – Integrates nutrition data for targeted interventions.

Innovation – Pilot "Health ATMs" (digital kiosks with diagnostic tools) in Uttar Pradesh and Bihar are bridging rural health gaps.

4. Challenges and Way Forward

Challenges – Connectivity gaps (rural internet penetration is 38% vs 70% urban), Provider adaptation (lack of digital training), Privacy risks, and Fragmentation.

Way Forward – Build interoperable EMRs with open APIs, strengthen capacity building for ASHAS, ANMs, and clinicians, and integrate nutrition and health data into national dashboards.

DOWN TO EARTH

1. Redefining The Global South's Clean Tech Landscape

According to a report by the Net Zero Industrial Policy Lab (NZIPL), there is a transformative surge of Chinese capital – exceeding \$220 billion since 2022 – which is flowing across 54 countries, focusing on key sectors such as batteries, solar, wind, new energy vehicles (NEVs), and green hydrogen.

Unprecedented Pace and Scale of Investment

The report emphasizes that China's overseas cleantech financing has now surpassed the US Marshall Plan's inflation-adjusted total (\$200 billion in 2024 dollars), underscoring the scale of its global industrial footprint. Significantly, three-quarters of these projects are located in emerging markets, positioning the Global South as a central hub in the energy transition. Drawing from the China Low Carbon Technology FDI database – which catalogs 461 projects from 2011 to mid-2025 – the NZIPL report reveals an extraordinary acceleration since 2022 – Over 80% of all projects were launched post-2022, amounting to \$210 billion (88% of total pledged capital). 2024 alone saw a record 165 project announcements. More than 60 megaprojects each exceed \$1 billion in committed investment, signaling long-term industrial expansion. It reflects a shift from early solar-heavy investments to a full-spectrum clean tech strategy, covering the entire value chain – from raw materials to advanced manufacturing.

Strategic Investment Breakdown

Battery Materials Manufacturing (\$62 Billion) – Now the single largest category, battery material projects underscore China's drive to secure upstream supply chains, particularly across Southeast Asia and Latin America's Lithium Triangle (Chile, Bolivia, Argentina).

Battery Production (\$49 Billion) – Concentrated in Europe, this investment wave supports the continent's expanding EV ecosystem, with Hungary emerging as a major hub.

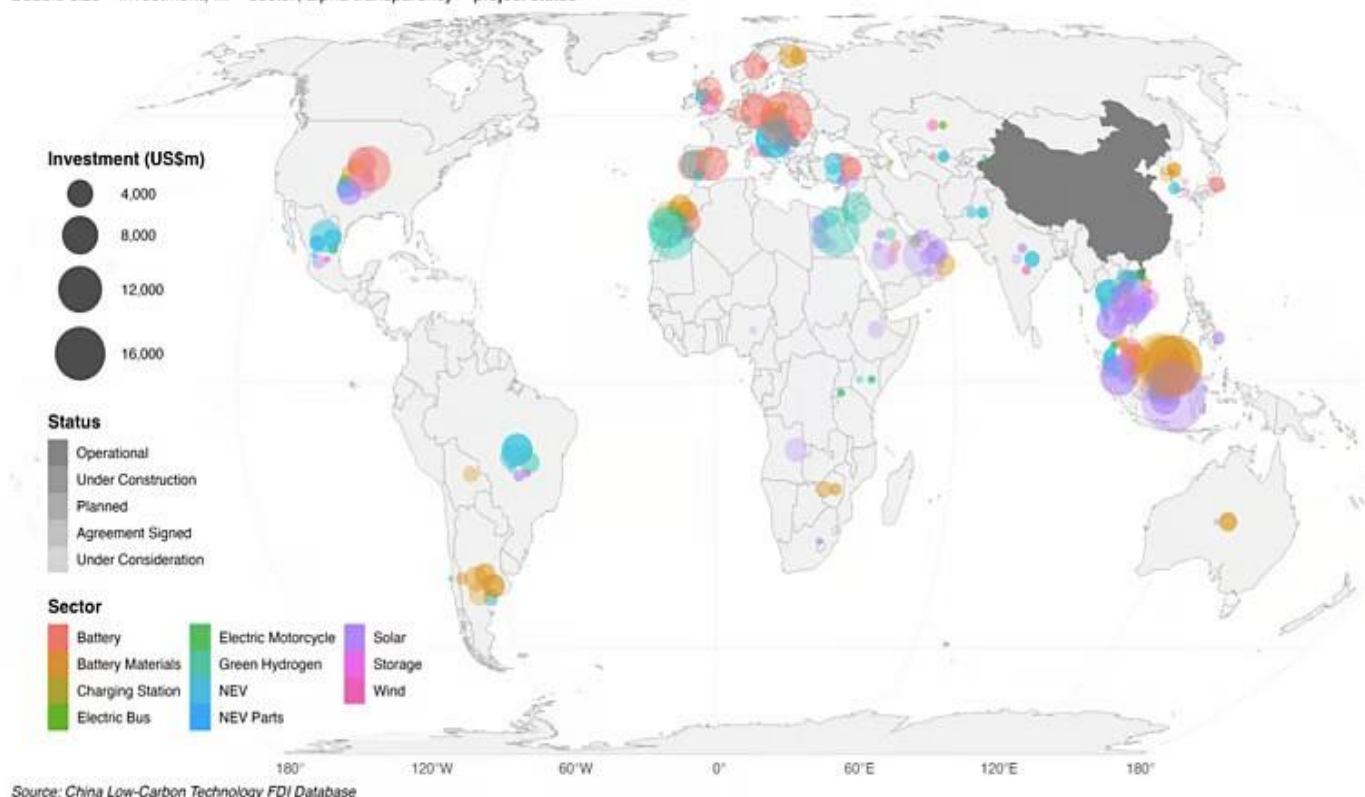
Solar Manufacturing (\$57 Billion) – Distributed across 135 projects globally, these initiatives reinforce China's long-standing dominance in solar value chains.

Green Hydrogen (\$27 Billion) – Primarily located in MENA countries, these projects — averaging \$2 billion each — are pioneering renewable hydrogen capacity for export markets.

EV & Wind Sectors – Investments remain geographically diverse but exclude the U.S., reflecting caution amid rising trade barriers and geopolitical tensions.

Chinese Green Manufacturing Investments Overseas

Bubble size = investment; fill = sector; alpha transparency = project status



Motivations Behind China's Clean-Tech Expansion

The report identifies three primary motivations driving Chinese firms' global strategy –

Access to raw materials – Indonesia's nickel reserves have made it a top destination for battery material processing.

Access to local markets – Countries like Hungary attract downstream production to serve European demand.

Access to third-country markets – Morocco leverages duty-free EU access, while Southeast Asia benefits as a re-export hub.

Emerging Trends – From Rapid Expansion to Strategic Consolidation

The pace of growth appears to be moderating in 2025, with 68 new projects announced in the first half of the year, signaling a phase of consolidation and strategic recalibration. Amid trade restrictions and sanctions risks, Chinese firms are increasingly adopting 'light-asset' strategies — such as technology licensing, contract manufacturing, and OEM partnerships — to maintain market access without heavy capital exposure. It suggests that while physical construction may slow, commercial engagement and technological diffusion are likely to continue expanding.

Implications for Host Governments and Global Partners

For developing economies, this capital influx presents a historic opportunity to attract green industrialization and clean infrastructure investment. However, success will depend on –

Creating tailored investment incentives;

1. Integrating resource advantages into Chinese supply chains;
2. Expanding infrastructure capacity to support megaprojects.

3. International partners must also adapt trade and climate finance policies to respond effectively to China's accelerating outward green manufacturing drive.

2. Suicide In India's Farm Sector In 2023 – NCRB Report

Recent NCRB's 2023 report (NCRB's Accidental Deaths and Suicides in India 2023 Report) highlighted a troubling persistence of suicides among farmers and agricultural labourers.

Key Findings from the NCRB (2023)

Over 10,000 suicides were recorded among individuals engaged in farming-related activities. Maharashtra, Karnataka, and Telangana continue to report the highest numbers. Agricultural laborers accounted for a growing share of these deaths, indicating worsening conditions for landless workers. Debt burden, crop failure, and lack of access to institutional credit remain the leading causes.

Structural Challenges

1. Fragmented land holdings and climate volatility have made farming increasingly unsustainable.
2. Input costs have risen sharply, while market prices remain volatile and often below Minimum Support Price (MSP).
3. Mental health support in rural areas is virtually nonexistent, leaving farmers with few coping mechanisms.

Rising Deaths Linked to Health and Mental Illness

Suicides due to illnesses increased by 3.2%, with mental health disorders cited in 13,978 cases. Sudden deaths from heart attacks saw a 10% surge, reflecting growing lifestyle and stress-related health risks. Alarmingly, abortion-related fatalities rose by 59%, resulting in 127 maternal deaths, pointing to critical gaps in women's healthcare access and safety.

Nature's Deadly Role

External and environmental factors added to the tragedy. In 2023, 6,444 accidental deaths were caused by natural forces, with lightning emerging as the most lethal—responsible for nearly 40% of such fatalities. Additionally, animal attacks injured or killed 1,742 people, emphasizing the vulnerability of rural populations to climate and wildlife-related hazards.

Policy Response

PM-KISAN – Direct income support to farmers.

Crop Insurance Schemes – To mitigate losses due to natural calamities.

Kisan Credit Cards – For easier access to institutional loans.

3. WHO Report Highlights Global Gaps in Tobacco Reduction Progress

A new report released by the World Health Organization (WHO) has revealed that global efforts to reduce tobacco use are progressing unevenly.

Key Findings

Only three WHO regions are currently on track to achieve the Global Action Plan for the Prevention and Control of Non-Communicable Diseases (NCDs) target—a 30% reduction in tobacco use between 2010 and 2025.

Regions Making Progress

According to the report, the following regions are on course to meet the target –

African Region – This region continues to show strong policy commitment and steady declines in tobacco consumption, attributed to widespread implementation of WHO's Framework Convention on Tobacco Control (FCTC) measures.

Region of the Americas – Many countries in the Americas have strengthened tobacco taxation, advertising bans, and smoke-free laws, contributing to substantial reductions in tobacco use.

South-East Asia Region – Public awareness campaigns, stricter regulation, and community health initiatives have significantly curbed tobacco use in this region.

Regions Lagging Behind

Other WHO regions—including Europe, the Eastern Mediterranean, and the Western Pacific—are not on track to meet the 2025 goal. These regions face challenges such as –

1. Slow policy adoption;
2. Tobacco industry interference;
3. Rising use of alternative nicotine products;

Global Implications

The uneven progress underscores the urgent need for stronger tobacco control policies, enhanced public health education, and greater international cooperation. WHO stresses that accelerated action is essential to reduce the burden of tobacco-related noncommunicable diseases, which remain leading causes of death worldwide.

4. India's Carbohydrate-Heavy Diet – Rising Diabetes and Obesity Rates

A new study by the ICMR–India Diabetes (INDIAB) has revealed an alarming link between India's dietary habits and the growing prevalence of type 2 diabetes and obesity across the nation.

Carbohydrates Dominate Indian Diets

According to the report, Indians derive about 62% of their daily calories from carbohydrates, primarily from white rice, refined grains, and added sugars. This dietary pattern, while traditional, is increasingly being associated with metabolic health challenges in both rural and urban populations.

Increased Diabetes Risk

The study, which surveyed 121,077 adults across the country, found that a higher carbohydrate intake raised the risk of newly diagnosed type 2 diabetes by 14%. It occurs when the body becomes resistant to insulin or fails to produce enough of it, resulting in elevated blood sugar levels.

Lifestyle Factors Intensify the Problem

Researchers highlighted that the surge in diabetes cases is not solely due to diet, but linked to sedentary lifestyles, overweight, and poor nutritional diversity. Rapid urbanization, processed food consumption, and reduced physical activity are compounding the problem.

Call for Nutritional Shift

Experts stress the need for dietary rebalancing, advocating a move toward whole grains, pulses, vegetables, and proteins while reducing refined carbohydrates and sugars. Public health initiatives emphasizing awareness, prevention, and lifestyle modification are critical to curbing this growing epidemic.

Conclusion

India's evolving dietary landscape is having profound consequences on public health. As the ICMR–INDIAB study reveals, unless substantial changes in nutrition education and food policy are implemented, the nation's diabetes and obesity burden is likely to escalate further.

5. Collective Denial – A Decade After the Paris Agreement

Despite the pledge to limit global warming to well below 2°C—and ideally to 1.5°C at the Paris Agreement of 2015—countries are collectively planning more fossil fuel production than ever before. The

Production Gap Report 2025, released on September 22 ahead of COP30 in Belém, Brazil, reveals an alarming expansion in fossil fuel plans, threatening to derail global climate ambitions.

Expanding Production Gap

According to the report, governments plan to produce 120% more fossil fuels by 2030 than would be consistent with the 1.5°C target. It marks a widening gap compared to the 2023 assessment, showing a disturbing retreat from the Paris goals rather than progress toward them.

Coal – It remains the most misaligned energy source –

500% higher production projected for 2030 than 1.5°C-consistent levels.

330% higher than 2°C-consistent levels.

Oil and Gas –

Oil production plans for 2030 exceed Paris-aligned limits by 31%.

Gas production exceeds the 1.5°C benchmark by 92%.

Major producers – China, the United States, Saudi Arabia, Brazil, and Nigeria—are expanding extraction efforts, contradicting both global and national net-zero targets.

Coal, oil and gas on the rise

Global production levels in 2030 are on track to be 500%, 31%, and 92% higher for coal, oil and gas, than the 1.5°C-consistent pathway, and 330%, 16%, and 33% higher than the 2°C-consistent pathway

Country-Level Contradictions

Despite climate pledges, many nations are increasing fossil fuel production –

1. Nigeria has doubled its 2030 oil target.
2. Brazil projects a 47% rise in oil output by 2030.
3. China and India are slowing coal phase-outs.

Of the 20 countries profiled in the report, 17 plan to expand at least one fossil fuel by 2030, while 13 anticipate significant gas increases. Alarmingly, 11 countries are now planning higher fossil fuel production than they did in 2023.

Economic Lock-In and Climate Risk

The report warns that time lost to inaction will make future reductions both harder and costlier. Continued investment in fossil fuel infrastructure throughout the 2020s will 'lock in' carbon emissions and stranded assets, pushing the world further from its net-zero trajectory. Even with immediate and decisive action, fossil fuel production in 2030 is expected to exceed levels consistent with the 1.5°C pathway. Cumulative production over this decade will already have surpassed climate-safe thresholds.

Human and Environmental Costs

Neil Grant of Climate Analytics describes the situation as 'intolerably unjust', emphasizing the human toll of continued fossil expansion. Vulnerable communities will bear the brunt of worsening heatwaves, floods, and displacement, even as renewable energy technologies have become economically competitive.

Need for a Just Transition

To close the production gap, countries must enact coordinated policies for a just transition away from fossil fuels. Only a few—such as Germany, Norway, and the UK—are developing production scenarios aligned with their net-zero goals. Most nations continue to plan expansions incompatible with global climate limits. Reaching net-zero emissions in the second half of the century requires steep, immediate declines in coal, oil, and gas use. Failure to act decisively now will leave future generations with an even steeper and costlier transition. At current emission rates, the remaining carbon budget for 1.5°C may run out in just over three years—a stark reminder that the window for meaningful action is rapidly closing.

6. Ultra-Processed Foods (UPFS)

Over the past few decades, food companies have exploited basic human instincts to sell ultraprocessed products (UPFs) that are fuelling a silent addiction epidemic.

About the Ultra-Processed Foods (UPFs)

These are industrial formulations made mostly or entirely from substances extracted from foods (oils, fats, sugar, starch, protein isolates) or synthesized in laboratories (flavor enhancers, colorings, emulsifiers). The NOVA classification system, widely used in nutrition science, categorizes foods based on the extent and purpose of processing. UPFs fall into the fourth category, representing the highest level of processing.

NOVA Classification

Group 1 – Unprocessed or minimally processed foods (fruits, vegetables, grains, meat).

Group 2 – Processed culinary ingredients (oils, butter, sugar, salt).

Group 3 – Processed foods (canned vegetables, simple cheese, tinned fish).

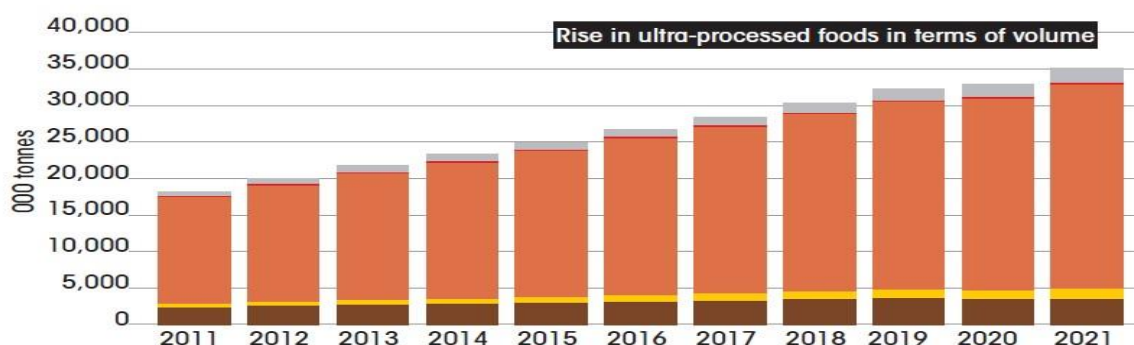
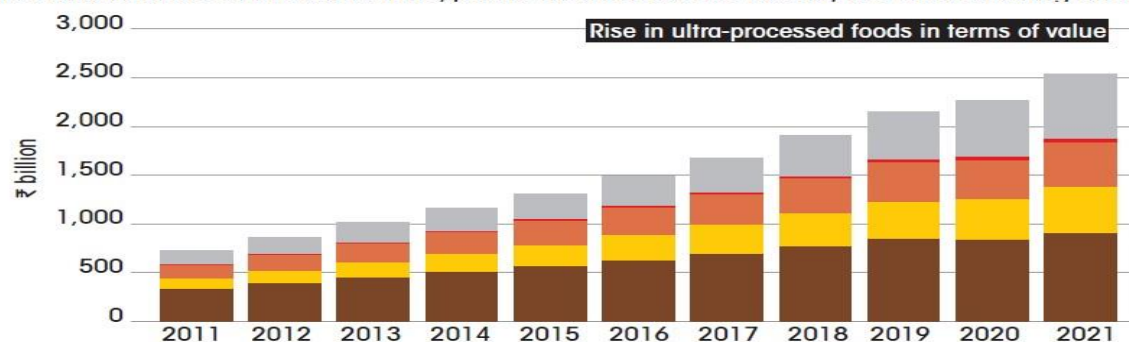
Group 4 – Ultra-processed foods (soft drinks, biscuits, candies, ready meals, chips, and instant noodles).

It is estimated that UPFs contribute to \$7 trillion in hidden costs globally—stemming from healthcare burdens, environmental degradation, and reduced labor productivity.

India's Growing Appetite for Junk

INDIA'S CLEAR GROWTH TRAJECTORY

Over the past decade, ultra-processed food categories are steadily rising in India in terms of both sales and volume. At the same time, public health risks like obesity are also showing an increase



Source: "The growth of ultra-processed foods in India", August 2023; National Family Health Survey reports

India's economic growth and changing lifestyles have accelerated the shift toward UPFs. Between 2006 and 2019, consumption surged from \$900 million to \$37.9 billion, growing at over 33% annually. The Economic Survey 2024–25 flagged the alarming rise in UPF consumption and emphasized the need for stringent labeling rules to protect youth health. According to the Household Consumption Expenditure Survey 2022–23, about 10% of urban and rural food budgets are spent on processed foods and beverages. Salty snacks, biscuits, chocolates, and ready-made meals dominate retail sales. Sweet biscuits alone account for over 43% of the chocolate and sugar confectionery category. The National Family Health Surveys (NFHS) reveal that obesity prevalence rose by more than 10 percentage points between 2005–06 and 2019–20.

Health & Environmental Impacts

1. Obesity and metabolic disorders;
2. Cardiovascular diseases;
3. Type 2 diabetes;
4. Mental health challenges like depression and anxiety;

The Economic Survey 2024–25 and Nutritional Advocacy in Public Interest (NAPI) reports expose how major food corporations influence policymaking to delay or weaken health regulations. For example, India's proposed front-of-package warning label (FOPL) system was stalled under industry pressure. Instead, regulators introduced a diluted 'Health Star Rating' masking the dangers of high-sugar or high-fat foods.

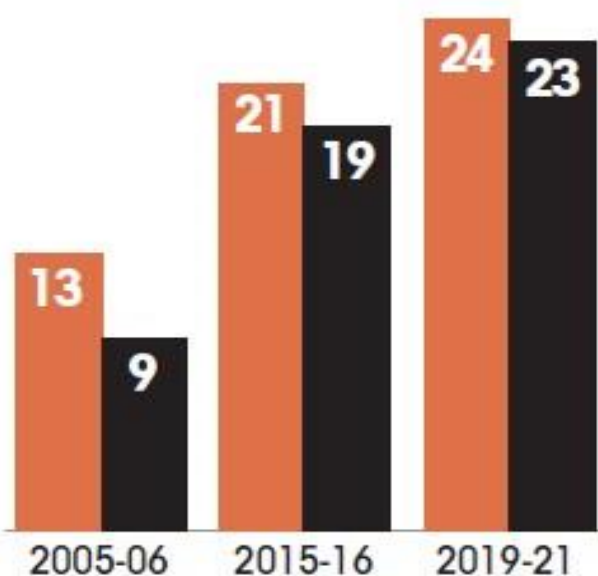
Why Are UPFs So Hard to Resist?

UPFs are engineered to be hyper-palatable—high in sugar, salt, and fat—making them addictive and easy to overconsume. Their convenience, long shelf life, and aggressive marketing make them especially appealing in urban and rural settings alike.

Policy Measures Around the World

% of people overweight or obese in India

■ Women ■ Men (Figures in %)



Globally, more than 45 countries—including the UK, Mexico, and South Africa—have imposed taxes on sugary drinks. A smaller number, such as Chile, Israel, and Peru, have extended these to other UPFs and adopted front-of-package warning labels. These measures have been effective in curbing unhealthy food consumption and improving consumer awareness. In India, Kerala introduced a 'fat tax' in 2016 on fast foods like burgers and pizzas, but nationwide efforts remain inconsistent. The Economic Survey 2024–25 now recommends a broader 'health tax' on UPFs. The Food Safety and Standards Authority of India (FSSAI) has formed a dedicated panel to address the challenges posed by UPFs. It includes –

1. Reviewing safety standards for processed and ultra-processed foods;
2. Developing rapid detection kits for food adulteration;
3. Promoting front-of-pack labeling to inform consumers;

Way Forward – Recognizing Food Addiction

To combat the growing epidemic of obesity and diet-related diseases, policymakers must first acknowledge ultra-processed food addiction as a legitimate disorder. This recognition could lead to –

1. Stricter advertising and marketing regulations, especially targeting children.
2. Mandatory warning labels on unhealthy products.
3. Reformulation of food products to reduce sugar, fat, and salt.
4. Independent public health campaigns to counter industry influence.

Formal classification of UPF addiction would mark a turning point—pushing governments to act decisively against one of the most pervasive and profitable health threats of our time.

7. What The H-1B Visa Angst Reveals About India

India's response to the recent turmoil over the US H1B visa reveals a deeper issue in its development model. The government expends considerable diplomatic and financial effort to facilitate the migration of skilled professionals abroad, but fails to create comparable opportunities for innovation and research at home.

India's H-1B Dependence

The H-1B visa, a key pathway for global tech workers to access opportunities in the U.S., has long symbolized success for India's STEM graduates. In 2024, Indians received 71% of all H-1B approvals – 283,397 visas – far surpassing China's 12%. For individual professionals, the visa represents access to world-class technology ecosystems and career mobility.

China's Strategic Countermove – The 'K Visa'

China introduced the 'K visa', a program aimed at attracting young STEM professionals to fuel its technological rise. It was built on China's longstanding talent repatriation programs, such as the Thousand Talents Plan (2008), designed to lure eminent scientists and innovators – both overseas Chinese and foreigners – to its universities and laboratories. By offering generous funding, research freedom, and modern infrastructure, China has managed to attract Nobel laureates and MacArthur 'genius grant' winners, embedding them in its innovation ecosystem.

Missing Vision in India

While the Global Innovation Index (2025) saw China enter the top 10 for the first time – a historic feat for a middle-income nation – India languished at rank 38. India, by contrast, lacks a coherent strategy to attract or retain high-caliber talent. Nobel laureate Venkatraman Ramakrishnan bluntly summarized the problem – India is not a magnet for global science due to inadequate funding, infrastructure, and academic freedom.

Beyond the Visa – A Call for Innovation at Home

The H-1B visa crisis may, ironically, serve as a wakeup call. If U.S. restrictions persist, India will have little choice but to create a more vibrant domestic ecosystem for technological innovation. It requires –

1. Policy reform to improve research funding and autonomy.
2. Public-private partnerships that foster industrial innovation.
3. Incentives for returnees and global talent to collaborate with Indian institutions.
4. Long-term vision, modeled on China's future-focused strategy.

8. National Biodiversity Authority (NBA)

The National Biodiversity Authority's Poor Record in Benefit Sharing. Less than 27% of funds disbursed to local communities since 2008.

About National Biodiversity Authority (NBA)

It was established in 2003 under the Biological Diversity Act (BDA), 2002, was created to ensure equitable sharing of benefits derived from India's biological resources. However, recent data obtained through the Right to Information (RTI) Act, 2005, reveals a significant shortfall in the NBA's performance.

Funds Collected vs. Disbursed

Between 2008–09 and 2024–25, the NBA received a total of ₹224.28 crore from companies, institutions, and individuals as Access and Benefit Sharing (ABS) payments. Shockingly, only ₹60.44 crore (less than 27%) has been disbursed to the rightful beneficiaries.

1. ₹12.25 crore was transferred to Biodiversity Management Committees (BMCs);
2. ₹9.40 crore went to State Biodiversity Boards (SBBs) (including administrative costs);
3. ₹38.79 crore reached local communities and other beneficiaries;

How Benefit Sharing Works?

The three-tier structure under BDA comprises –

1. **NBA (Central level);**
2. **SBBs (State level);**
3. **BMCs (Local/panchayat level);**

Companies using biological resources for commercial purposes must compensate the source communities. They can either –

1. Pay 1 – 5% of the purchase price, or
2. Pay 0.1 – 0.5% of the sale price, depending on their scale of operations.

Of the total payment, 95% must go to local communities or BMCs, while 5% can be retained by the NBA or SBB for administrative expenses. If the 'benefit claimers' cannot be identified, the funds must be used to support biodiversity conservation and promote local livelihoods in the area where the biological resource was sourced.

Challenges in Identifying Beneficiaries

Officials acknowledge that identifying the original source of biological resources is a major challenge. For instance, a company may report buying saffron from a Delhi trader, even though the crop originates in Jammu and Kashmir. Tracing the true source in such cases is often impossible, especially when resources are grown in multiple regions.

Unutilized Funds and Interest Dispute – The undistributed funds are currently parked in fixed deposits. Companies that made payments are now requesting that 50% of the accrued interest be shared with them. The NBA has formed a committee to consider this request, and a decision is expected soon.

Case of Red Sanders – A major portion—₹100 crore—of the collected ABS funds comes from the trade of red sanders (*Pterocarpus santalinus*), a valuable species endemic to Andhra Pradesh's Chittoor, Kadapa, Kurnool, and Nellore districts. NBA claims that beneficiary communities for about ₹33 crore have been identified, and efforts are ongoing to trace farmers who supplied the resource. Another ₹75 lakh has been received from a Maharashtra-based private entity, but beneficiaries are yet to be compensated.

Conclusion

Despite its mandate to promote equitable benefit sharing and biodiversity conservation, the NBA's dismal record—disbursing less than 27% of the collected funds—reveals systemic inefficiencies. Poor documentation, lack of transparency, and bureaucratic hurdles have kept local communities, the rightful custodians of India's biodiversity, from receiving their due. Urgent reforms in traceability, data

transparency, and community engagement are needed to restore faith in the benefit-sharing framework envisioned by the Biological Diversity Act.

9. Decline Of India's Right to Information (RTI) Act

Recently, the Right to Information (RTI) Act completed 20 years—a landmark law that once empowered citizens to hold their government accountable. However, successive amendments, judicial interpretations, and administrative neglect have eroded its strength.

About RTI and Founding Principle

The RTI Act, 2005, was built on a simple democratic premise – information held by the government belongs to the people. The law presumed disclosure as the default, with only ten specific exemptions under Section 8(1).

The Digital Personal Data Protection (DPDP) Act, 2023

The DPDP Act, 2023 delivered a severe blow by amending Section 8(1)(j)—reducing its scope to a mere six words – ‘information which relates to personal information’. It eliminated the earlier public-interest test and broadened ‘personal information’ to include entities like firms, companies, and even the State. As a result, vital public data—loan defaulters’ names, officials’ asset declarations, or details of public contracts—can now be withheld on privacy grounds.

Administrative Paralysis

Transparency has also been crippled by vacancies and delays in Information Commissions –

1. 0.4 million cases are pending across the country.
2. Seven State Information Commissions (SICs) were defunct in 2023–24.

The Central Information Commission (CIC) operates with barely a fraction of its sanctioned strength. Some states, such as Chhattisgarh and Bihar, take over four years to hear appeals—rendering “information delayed” effectively ‘information denied’.

Amendments Undermining Independence

The RTI (Amendment) Act, 2019 empowered the Union government to decide the tenure, salary, and post-retirement benefits of commissioners. This move compromised their autonomy, potentially influencing decisions against government interests. By demoting commissioners’ status from that of Election Commissioners to that of secretaries, the amendment signalled a shift towards central control and weakened institutional independence.

Erosion of Transparency

RTI has historically exposed scams such as Vyapam, Adarsh Housing, and Commonwealth Games, but recent years have seen a surge in opacity –

1. Ministries deny crucial data citing privacy or ‘nonavailability’.
2. The Election Commission and Ministry of External Affairs have refused disclosures not covered by Section 8 exemptions.
3. Even powerful entities like the BCCI remain outside RTI’s ambit despite functioning as quasipublic bodies.
4. Moreover, over 100 whistleblowers have been killed since 2005, and the Whistle Blowers Protection Act (2014) remains unimplemented—further discouraging transparency.

Privacy vs. Transparency

While privacy is essential, the DPDP Act has made it absolute, overriding public interest. Earlier, Section 8(1)(j) balanced privacy with transparency by allowing disclosure if public interest justified it. Now, information crucial to public welfare—loan defaults, election funding, recruitment irregularities—is shielded as ‘personal’, contradicting democratic accountability.

Restoring the Spirit of RTI

Restore Institutional Independence – Reverse the 2019 amendment to ensure fixed tenure and transparent appointments of commissioners.

Reinstate the Public Interest Test – Amend the DPDP Act to restore the right to access information with public relevance.

Fill Vacancies Promptly – Appoint commissioners and digitise records to reduce the backlog.

Strengthen Whistleblower Protection – Implement the 2014 Act and ensure safety for information seekers.

Enhance Awareness and Accessibility – Replicate models like Gujarat’s user-friendly system and Maharashtra’s searchable RTI database.

10. Rethinking Development in the Fragile Himalayas

The recent floods, landslides, and glacial bursts across Himalayan states in India have underscored the urgent need to rethink the model of growth that the Himalayas can safely sustain.

Fragility Amplified by Unsustainable Growth

The Himalayas, stretching across five countries and nurturing the headwaters of major rivers. They are living ecosystems and cultural landscapes that sustain nearly 240 million people. Himalayan environmental degradation observed that the construction of highways, tunnels, and hydropower projects has been prioritized without adequate ecological safeguards. The Char Dham Highway project and multiple run-of-the-river hydropower dams have destabilized slopes, disrupted aquifers, and led to recurring disasters such as those in Joshimath and Chamoli. According to the National Disaster Management Authority (NDMA), the frequency of ‘compound disasters’—where landslides coincide with floods— has doubled in the past decade due to deforestation and slope destabilization. It indicates that the Himalayas are not just facing natural hazards but human-induced vulnerabilities.

Climate Change and the New Normal

Reports by the Indian Institute of Science (IISc) and the Himalayan State Climate Outlook 2025 highlight an alarming trend – the Himalayan glaciers are retreating faster than the global average. In states like Sikkim and Himachal Pradesh, glacier melt contributes to flash floods and the sudden formation of glacial lakes. The Sikkim flood (2023) was caused by the South Lhonak Lake outburst, and was intensified by unusually high rainfall and infrastructure exposure along river valleys. The combination of climate instability and overconstruction is creating a dangerous feedback loop, where developmental projects amplify climate risks, and climate risks, in turn, erode development gains. Local Livelihoods and the Displacement Dilemma – Hydropower projects, mining, and road expansion have uprooted thousands of families while offering few long-term economic benefits. MoEFCC emphasized that localized, small-scale economies – such as eco-tourism, traditional agriculture, and forest-based livelihoods – are better suited for these terrains than extractive models of growth.

Governance and Policy Gaps

1. Environmental Impact Assessments (EIAs) are often diluted, and state disaster management plans are reactive rather than preventive.
2. The National Mission for Sustaining the Himalayan Ecosystem (2023) called for integrated watershed management, but implementation remains sporadic.
3. The Himalayan Sustainable Development Forum (2024) urged the inclusion of indigenous knowledge systems and community-based monitoring into official planning. It could bridge the gap between top-down development and ground-level realities.

Path Toward Resilience

1. Rethinking development in the Himalayas requires balancing ecology, economy, and equity.
2. The region needs a 'mountain logic'—a framework that values biodiversity, water security, and cultural continuity over short-term GDP gains, rather than replicating the plains' industrial growth.
3. Resilient Himalayan development means -
4. Respecting eco-zones as no-construction areas.
5. Investing in climate-resilient infrastructure.
6. Empowering local governance institutions like Van Panchayats.
7. Integrating early warning systems for landslides and glacial lake outbursts.
8. Respecting Carrying Capacity - Development needs to stay within the region's carrying capacity.
9. Urban expansion has outpaced ecological tolerance — while population in Himalayan states grew 1.5 times between 1971 and 2021, the urban population quadrupled.
10. Urban planning needs to identify no-construction zones, establish slope-specific building codes, and develop water and sewage systems suited for mountainous terrains.
11. Rethinking Development Models - Environmentalists have argued for a 'localization model of growth' — a shift away from large-scale industrial development toward community-led, eco-sensitive initiatives. It involves -
12. Limiting construction on slopes above a certain gradient.
13. Redefining carrying capacity for Himalayan towns.
14. Restoring degraded watersheds and springs.
15. Promoting decentralized renewable energy systems.

11. Transmission Trap - Challenges with India's Renewable Energy

Despite record solar and wind installations in India, inadequate transmission infrastructure and poor demand forecasting are forcing large-scale curtailments — leaving clean energy projects idle and developers counting heavy losses.

Curtailments and Mounting Losses

At least 30 solar and wind projects across India faced curtailments, resulting in losses of up to ₹700 crore, according to industry insiders between March and August 2025. Plants in Rajasthan, Gujarat, Maharashtra, and Tamil Nadu—key renewable hubs—are among the hardest hit. In Rajasthan alone, projects totaling 4 GW of capacity were ordered to cut generation by nearly half during peak midday hours, leading to losses of around ₹250 crore. Developers such as Adani Renewable Energy, Tata Power, and Azure Power have been affected.

Transmission Bottlenecks

At the heart of the crisis lies India's slow progress in building and upgrading electricity transmission lines. Renewable projects require General Network Access (GNA) from the Central Electricity Regulatory Commission (CERC) to feed power into the grid. However, many new projects are operating on Temporary General Network Access (TGNA), which offers only conditional grid access without compensation for curtailments. The National Solar Energy Federation of India (NSEFI) reported that of 22.5 GW of commissioned solar capacity in Rajasthan, nearly 8.5 GW operates under TGNA due to delayed transmission lines. These delays often stretch 18–20 months, stalling project utilization and investment returns.

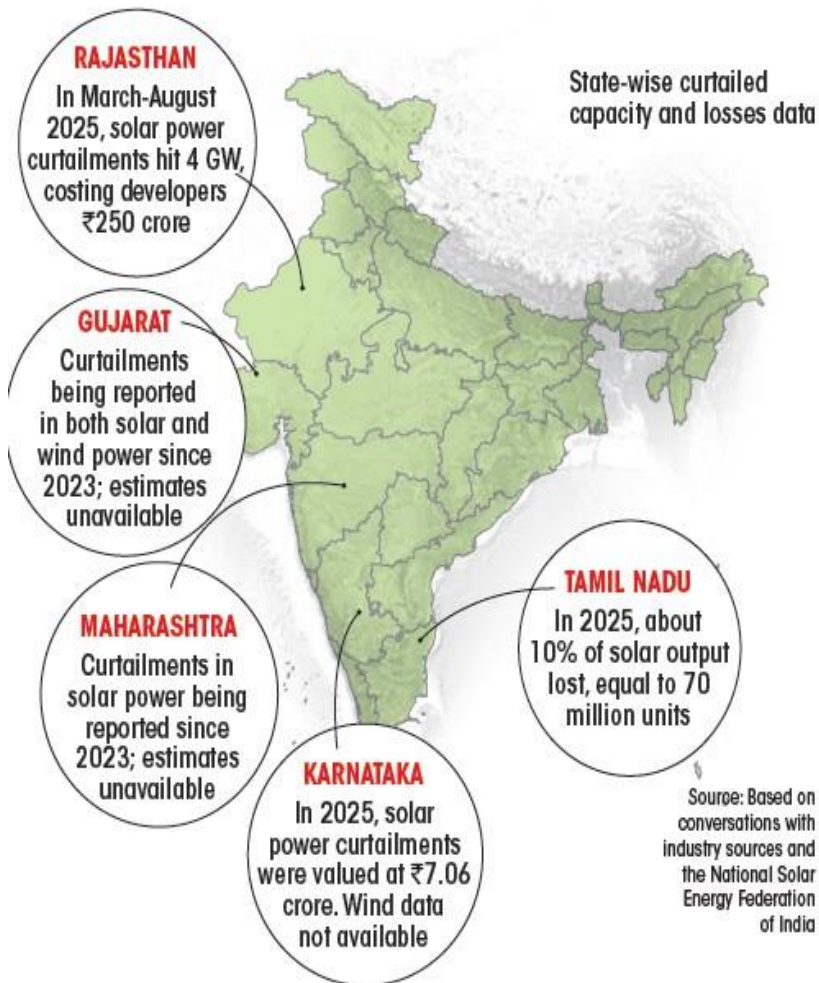
Forecasting Failures and Demand Slumps

Beyond transmission delays, inaccurate demand forecasting has worsened curtailments. The Central Electricity Authority (CEA) had predicted a 2025 peak demand of 270 GW, but unexpected monsoon patterns reduced consumption sharply. As a result, India's grid operators curtailed nearly 10

GW of power daily during low-demand hours to maintain grid stability. Even coal plants were affected, running at only 40% capacity, a level detrimental to their machinery.

A widespread problem

Since 2023, renewable energy projects across five high-generation states have lost power and profits to curtailments



Economic and Policy Impacts

The repeated curtailments are shaking investor confidence. Under GNA, developers receive compensation for forced outages through Power Purchase Agreements (PPAs). Under TGNA, however, no compensation is provided, leaving developers to absorb the full financial hit. Industry bodies warn that this uncertainty could jeopardize India's 500 GW non-fossil fuel target by 2030. New renewable tenders may face reduced participation as investors re-evaluate risks.

Underlying Causes

Transmission Delays – Construction of lines typically takes 2–3 years, outpacing the 18–24-month project timelines for solar and wind plants.

Regulatory Gaps – Limited clarity on GNA issuance and compensation for curtailed TGNA projects.

Planning Mismatch – Renewable capacity has expanded faster than infrastructure to integrate it.

Environmental and Legal Hurdles – Land acquisition and clearance delays for new lines exacerbate grid congestion.

Government Response

Officials at the Ministry of New and Renewable Energy (MNRE) acknowledge the issue but attribute curtailments to 'emergencies'. The ministry has yet to quantify the total losses but has pledged to coordinate with the CEA and Union Ministry of Power for a detailed assessment.

Proposed Solutions

Accelerate Transmission Expansion – Experts urge immediate prioritization of transmission projects in high-generation states.

High Voltage Direct Current (HVDC) lines, capable of transferring large loads over long distances, could ease congestion and link regions with varying demand profiles.

Deploy Energy Storage Systems – Battery Energy Storage Systems (BESS)—whose costs have fallen by 70% in four years—can store excess midday power and release it during peak evening demand.

Improve Forecasting and Planning – The CEA is enhancing its weather forecasting model from a 12 km × 12 km to 4 km × 4 km resolution for more localized predictions. It plans to shift from a five-year to an annual planning cycle for better responsiveness.

Regulatory and Financial Reforms – The NSEFI has proposed compensation for curtailed developers through the Power Systems Development Fund, which currently supports only public transmission upgrades.

12. Sand Replenishment Study a Legal Prerequisite for Mining Clearances – Supreme Court

Recently, the Supreme Court of India ruled that a scientific assessment of river sand replenishment is now a legal requirement for obtaining environmental clearance to mine river sand.

Background – Srinagar NHAI Project Case

The Jammu and Kashmir State Environment Impact Assessment Authority (JKEIAA) had granted environmental clearance to three sand mining sites associated with the Srinagar ring road and four-lane bypass project, despite the Jammu and Kashmir Expert Appraisal Committee (JKEAC) having earlier rejected the projects on grounds of over-exploitation and absence of a replenishment study. Case before the National Green Tribunal (NGT) highlighted multiple violations, including –

1. Absence of a replenishment study in the District Survey Report (DSR);
2. Use of prohibited heavy machinery, and
3. Violation of the J&K Minor Mineral Concession Rules (2016), which bars mining within 25 metres of river embankments.

NGT and Supreme Court Decisions

The NGT ruled that a DSR without a replenishment study is incomplete, making any environmental clearance based on it illegal. It subsequently cancelled all three ECs granted in 2022. The project proponents – Union Territory of Jammu and Kashmir and NHAI – appealed to the Supreme Court, which upheld the NGT's decision. The apex court confirmed that 'sand mining can only be granted when DSR is complete and effective. Any clearance based on a draft DSR is legally invalid'. The Court emphasized that DSRs need to comply with the Environmental Impact Assessment (EIA) Notification, 2016, and the Sustainable Sand Mining Management Guidelines, 2016 and 2020, ensuring decisions are made on scientific grounds and after assessing the annual sand replenishment rate.

Implementation Challenges and Expert Concerns

Replenishment Studies Require Time – Experts note that scientific replenishment studies are long-term exercises, as it takes at least three years of study, covering pre- and post-monsoon seasons, to estimate average replenishment accurately. Typical licences allow extraction of up to 1 metre of sand, but miners often extract up to five times that limit, causing severe ecological harm. A robust replenishment study, therefore, is essential for sustainable mining.

Accuracy and Practical Constraints – Replenishment estimates can only be 70% accurate due to unpredictable factors like rainfall, flow velocity, and weather variability. Excessive mining damages rivers, no mining at all can raise flood risks, as sediment buildup reduces a river's carrying capacity.

Conclusion

The Supreme Court's 2025 judgement establishes a critical precedent for environmentally responsible sand mining in India. By mandating replenishment studies as a legal prerequisite for environmental clearances, it reinforces the importance of scientific validation, sustainable resource management, and legal accountability.

13. Africa's Climate Resilience – Homegrown Solutions Amid Global Injustice

Africa stands at the frontline of the global climate crisis – a paradox given its negligible contribution to the problem.

About Africa – A Continent Under Unequal Pressure

Sub-Saharan Africa accounts for just 1.9% of global cumulative fossil fuel emissions, with South Africa alone responsible for 1.3%. But, the region bears a disproportionate share of climate-induced suffering. According to the Brookings Institution, seven of the ten most climate-vulnerable countries in the world are in Africa. The IPCC's Sixth Assessment Report (2021) highlights that the continent has warmed faster than the global average over the past 60 years – a pace unmatched in two millennia.

Escalating Impacts Across the Continent

The World Meteorological Organization's (WMO) 'State of Climate in Africa 2024' report, reveals that 2024 ranked as either the warmest or second warmest year in Africa's history. The year brought devastating floods, droughts, and marine heatwaves, crippling agricultural systems and threatening food security for millions. Forecasts indicate that Africa could surpass the 1.5°C warming threshold by 2040, a development that would amplify losses in agriculture, health, and infrastructure – sectors on which the majority of Africans depend for their livelihoods.

Financial Burden of Climate Ambition

African countries need an estimated US \$2.8 trillion between 2020 and 2030, to fulfill their Nationally Determined Contributions (NDCs) under the Paris Agreement. Alarmingly, only 24% of this amount is earmarked for adaptation – despite Africa's acute vulnerability to climate extremes. At the same time, economic headwinds and limited fiscal capacity have deepened dependence on foreign loans.

The UN's 'World Economic Situation and Prospects 2025' warns that African nations are expected to allocate nearly 30% of government revenue to debt servicing in 2025, with 25 countries already devoting over 10% of their revenue to net interest payments. It restricts investment in climate resilience and forces nations to borrow even more for disaster recovery.

Resilience Through Innovation and Tradition

African nations are refusing to remain passive victims, despite formidable challenges. They are forging pragmatic, hybrid solutions that blend traditional ecological knowledge with modern technological innovation. Across the continent, governments and communities are rolling out national strategies for net-zero emissions, community-based adaptation programs, and nature-based solutions such as reforestation, sustainable water management, and droughtresistant agriculture. This bottom-up, inclusive approach offers a blueprint for the broader Global South, showcasing how nations with limited resources can craft effective, locally rooted responses to global crises.

Conclusion – A Call for Climate Justice

Africa's predicament underscores a deep climate injustice – a continent least responsible for emissions, but most burdened by their consequences. As the world races to stabilize the planet's temperature, global financial systems and climate finance mechanisms need to evolve to ensure equitable access to funding, debt relief, and technology transfer. Africa's resilience and innovation illuminate a path forward – one that intertwines sustainability, equity, and indigenous wisdom.

14. Civil Society and the Climate Imperative – Reclaiming Global South Unity

In an era marked by unilateralism and fraying multilateral institutions, the climate crisis has become a casualty of geopolitical fragmentation. Global South cohesion needs to become a top priority to effectively confront climate change.

Lessons from History – Moments of Southern Solidarity

The Global South, encompassing the G77 coalition of developing nations, shares a legacy of colonial exploitation and systemic inequity. But, throughout history, solidarity among these countries has catalyzed transformative change.

Bandung Conference (1955) – Established a collective front against colonialism and initiated the nonalignment movement.

Rio Earth Summit (1992) – Introduced the principle of common but differentiated responsibilities—a cornerstone of global climate negotiations.

COVID-19 Crisis – India and South Africa led the call for a TRIPS waiver at the WTO, while Cuba demonstrated solidarity through medical diplomacy.

COP27 in Egypt – G77 unity achieved a landmark victory—the creation of the Loss and Damage Fund, marking the culmination of three decades of advocacy.

Recent Southern G20 presidencies—Indonesia, India, Brazil, South Africa—have elevated key issues like debt reform, green industrialisation, and financial equity, reaffirming the Global South's leadership potential.

Challenge of Fragmentation

The South remains divided, despite these milestones. Internal differences, shifting leadership, and Northern manipulation often fracture alliances. Moreover, the BRICS+ bloc faces internal contradictions – limited transparency, restricted civil society participation, and enduring fossil fuel dependencies. However, these critiques must be contextualised—industrial pathways and energy demands differ vastly from those of the Global North.

Climate Question – Pathways to a Just Transition

BRICS+ countries now represent 48% of the global population and nearly half of global fossil fuel output. Yet, they are also at the forefront of renewable energy expansion –

Renewables Growth – BRICS+ now produces 51% of global solar power, up from just 15% a decade ago.

Leadership in Action – China leads 74% of global solar and wind capacity construction, while India met its Nationally Determined Contributions (NDCs) five years ahead of schedule.

The BRICS Declaration (2025) emphasizes this balance, advocating for green industrial policy and 'polyalignment', a flexible approach that redefines the geopolitics of green connectivity.

Toward a New Global South Vision

The Western-led order is faltering under its own 'polycrisis'—economic instability, ecological decline, and militarism. For the Global South, long burdened by debt and dependency, this turbulence presents an opening for transformation. A renewed Southern vision should embrace multipolarity, localisation, regional integration, and green industrialisation. It needs to champion de-dollarisation, equitable finance, and technology sharing. Most importantly, it should place development and climate justice at the heart of global governance.

Role of Civil Society

Civil society must lead in rewriting the narrative. Beyond state diplomacy, grassroots networks, researchers, and activists are vital to –

1. Highlight shared struggles and solutions.
2. Build public pressure for accountable climate governance.
3. Foster a common identity rooted in sustainability and justice.

Civil society can transform the Global South from a fragmented grouping into a cohesive climate vanguard—one capable of shaping a truly equitable and green future, by amplifying collective agency.

P L RAJ UPSC MONTHLY MAGAZINE – COMPILATION

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YOJANA

1. Evolution of Indian Cinema

1. Early Beginnings (1896–1940s)

The Birth of Cinema – The journey began in 1896 when the Lumière Brothers' films were first screened in Mumbai. The first Indian motion picture appeared in the late 1910s.

The Father of Indian Cinema – Dhundiraj Govind Phalke, popularly known as Dadasaheb Phalke, released Raja Harishchandra, India's first silent film.

Transition to Sound – In 1931, Ardeshir Irani directed Alam Ara, which became India's first sound film.

First Colour Film – Kisan Kanya (1937), directed by Moti B. Gidwani, was the country's first colour film.

Regulatory Origins – The Indian Cinematography Law was passed in 1918 to license cinema halls and censor films, leading to the formation of censor boards in provinces by 1920.

2. Important Early Milestones

First Cinemascope Film – Kagaz Ke Phool (1959) by Guru Dutt.

First 70 mm Film – Around the World (1967) by Raj Kapoor.

First Sanskrit Film – Adi Shankara by G. V. Iyer.

First Indian 3-D Film – My Dear Kuttichathan (Malayalam).

3. The Golden Era & Parallel Cinema (1940s–1960s)

Golden Age – The post-Independence period is celebrated as the "Golden Age" of Indian cinema.

Parallel/New Indian Cinema – Originating in West Bengal in the 1950s, this movement was inspired by Italian Neo-Realism and served as a precursor to the Indian New Wave.

Key Figures – Satyajit Ray, Ritwik Ghatak, and Mrinal Sen.

Characteristics – It focused on realism, naturalism, serious sociopolitical themes, and rejected formulaic song-and-dance sequences.

Notable Works – Savkari Pash and Duniya Na Mane.

Global Recognition – Satyajit Ray became an internationally acclaimed filmmaker. Indians who have won Oscars include Bhanu Athaiya, Satyajit Ray, Resul Pookutty, A.R. Rahman, and Gulzar.

4. Thematic Shifts by Decade (1950s–2025)

1950s–60s (Nationalism & Realism) – Films depicted national struggles and rural distress. Haqeeqat showed the Sino-Indian War, while Do Bigha Zamin and Ray's Pather Panchali highlighted rural hardships. Films like Dahej and Devi portrayed women's limited agency.

1970s (Angry Young Man & Emergency) – Themes shifted to social injustice, corruption, and unemployment. Mrinal Sen's Calcutta 71 reflected Naxal-era turmoil. Parallel cinema expanded with films like Manthan and Sparsh.

1990s (Globalization & Cultural Shifts) – Themes of materialism, identity, and gender norms emerged. Mirch Masala and Astitva challenged patriarchy.

2000s (Realism & Social Critique) – Films like Chandni Bar and Black Friday explored the underworld and violence. The Namesake addressed migration.

Contemporary & Regional Renaissance –

Women-Centric – Films like Pink, Jaya Jaya Jaya Hey, and Kathal.

LGBTQ+ – Representation in films like Kaathal and Samo – The Equals.

OTT Revolution (Post-2020) – Streaming platforms gave space to regional cinema like The Great Indian Kitchen (Malayalam) and Court (Marathi), which were traditionally overlooked in theatres.

Industry Scale – India produces over 2,000 films annually in 20+ languages, the highest volume in the world.

2. Cinema and Indian Society

1. Positive Impacts

Global Cultural Recognition – Successes like RRR and The Elephant Whisperers have enhanced India's global cultural footprint.

Reflection of Diversity – Cinema showcases specific regional traditions –
Dedh Ishqiya – Nawabi culture of Lucknow.

Piku – Bengali domestic ethos.

Khoobsurat – Rajasthani heritage.

Changing Family Values – Moving beyond 1960s patriarchal norms, cinema now explores –

Illegitimacy – Masoom, Kal Ho Na Ho.

Divorce/Extramarital Ties – Kabhi Alvida Naa Kehna.

Intergenerational Gaps – Goodbye highlighted emotional bonds in nuclear families.

Women Empowerment – Durga Sohay depicts resilience; Nil Battey Sannata shows education as a transformative tool for women.

Tool for Social Change –

Health – Paa (progeria) and Taare Zameen Par (dyslexia) raised awareness.

LGBTQ+ Rights – Fire and Aligarh sparked conversations on dignity and rights.

Civic Duties – Swadesh and Muthu reinforced nationalism and social responsibility.

2. Negative Impacts

Gender Stereotypes & Toxic Masculinity – Films like Kabir Singh and Animal glorify aggression. "Item songs" continue to objectify women. Domestic violence is sometimes trivialised (e.g., Hum Tumhare Hain Sanam).

Unrealistic Body Standards – Promotion of fair-skin bias in casting and body shaming of both thin and overweight individuals.

Challenging Family Institutions – Films like OK Jaanu normalise live-in relationships, which some view as questioning traditional norms.

Cultural Dilution – Western dance (hip-hop) and music (rap) sometimes overshadow classical traditions like Kathak.

Poor Representation – LGBTQ+ identities have been mocked (Dostana) and disabilities ridiculed (Golmaal).

Substance Abuse – Films like Dev D portray drug use and smoking as fashionable coping mechanisms.

Political Propaganda – Certain films weaponise historical grievances to deepen social divides.

3. Institutions, Regulations, and Regulatory Framework

1. Key Institutions

Films Division of India (1948) – Focuses on documentaries, national programmes, and heritage documentation.

Central Board of Film Certification (CBFC) – A statutory body under the Cinematograph Act, 1952. It certifies films for public exhibition and has nine regional offices.

National Film Development Corporation (NFDC) (1975) – The nodal agency for promoting Indian cinema, supporting production, and international collaborations.

National Film Archive of India (NFAI) (1964) – Preserves national and world cinema and documents film heritage.

Directorate of Film Festivals (DFF) (1973) – Organises IFFI and National Film Awards, and manages the Indian Panorama.

Children's Film Society of India (CFSI) (1955) – Produces value-based entertainment for children in multiple languages.

2. Major Film Awards

Dadasaheb Phalke Award – India's highest cinema honour for outstanding contribution to the industry.

National Film Awards – Annual awards where the President confers the **Swarna Kamal** (Golden Lotus) for Best Feature Film.

3. Regulation of Content

Bharatiya Nyaya Sanhita (BNS), 2023 – Includes penal provisions against obscenity, public indecency, and content harmful to public order.

Indecent Representation of Women (Prohibition) Act, 1986 – Prohibits derogatory portrayal of women in all media.

Cable Television Networks (Regulation) Act, 1995 – Enforces Programme and Advertisement Codes for TV content.

Cinematograph Act, 1952 – Governs film certification to ensure compliance with morality, national security, and artistic integrity.

Advertising Standards Council of India (ASCI) – A self-regulatory body monitoring advertising content.

4. Indian Cinema & Its Role in Soft Power Diplomacy

1. Cinema as Soft Power

Concept – Drawing from Joseph Nye's concept of influence through attraction, cinema acts as a cultural ambassador.

Values Projected – Films propagate Indian values of family bonds, non-violence, spirituality, and resilience.

Global Impact –

Markets – Strong viewership in South Asia, the Middle East, Africa, Russia, and East Asia.

Success Stories – Dangal in China, Baahubali across Asia, and The Elephant Whisperers on global platforms.

Diplomatic Role – Cinema aids diplomacy by fostering cross-cultural understanding. Bollywood stars are global icons, and film festivals enhance diplomatic outreach.

2. Relevance to Global Aspirations

Showcasing Pluralism – Cinema highlights India's linguistic and cultural diversity (from Punjabi folk to Tamil epics), showing "unity in diversity" as a cultural asset.

Nation Branding – It projects India as a modern, democratic, and culturally confident nation, aiding tourism and investment.

Strategic Tool – As India engages with the Indo-Pacific and Africa, cinema serves to build goodwill and counter stereotypes.

5. Cinematograph (Certification) Rules, 2024

1. Objectives

To modernise the certification system, aligning it with digital workflows and global standards. To complement the Cinematograph (Amendment) Act, 2023 and improve ease of doing business.

2. Key Provisions

Digital & Time-Bound Certification – A full shift to digital platforms to reduce delays and improve transparency.

Perpetual Validity – Certificates are now valid perpetually, removing the previous 10-year limit.

Age-Based Sub-Categorization – The 'UA' category is refined into three sub-categories to aid parental guidance –

1. UA 7+
2. UA 13+
3. UA 16+.

Mandatory Accessibility – Films must include features like subtitles and audio descriptions to support persons with disabilities (RPWD principles).

Gender Representation – Mandates **one-third women** in the CBFC Board and encourages **50% women** in Advisory Panels.

Priority Screening – A facility for filmmakers with urgent release commitments to speed up compliance.

Recertification for TV – Films edited for television require fresh certification to ensure they are appropriate for family viewing.

3. Significance

Regulatory Efficiency – Enhances the productivity of the creative sector through faster timelines and digital workflows.

Inclusivity – The focus on accessibility and gender representation creates a more equitable and socially responsible regime.

Modern Governance – Adapts to the OTT era and technological shifts while reinforcing anti-piracy measures.

KURUKSHETRA

1. Rural India as a Hub of Ecotourism

1. Definition and Strategic Importance

Concept – Ecotourism is defined by the International Ecotourism Society as responsible travel that conserves the environment, sustains the well-being of local people, and involves interpretation and education.

India's Context – It serves as a strategic instrument for rural development by integrating economic diversification, environmental stewardship, and social inclusion. It is a natural fit for India due to the country's rich biodiversity and cultural landscapes.

Drivers – The surge is driven by travelers seeking low-impact, authentic, and community-centric experiences. Policymakers view it as a means for conservation financing and green economic growth.

2. Current Status and Market Dynamics

Global Standing – India ranks 10th globally in Travel & Tourism's contribution to GDP.

Tourist Arrivals – International tourist arrivals are projected to hit 30.5 million by 2028. Foreign Tourist Arrivals (FTAs) reached 9.24 million in 2023 (up from 6.43 million in 2022). Top source countries – Bangladesh (24.5%), USA (20.4%), and UK (6.9%).

Economic Contribution – The sector contributed US\$ 199.6 billion in 2022 and is projected to reach US\$ 512 billion by 2028, growing at an annual rate of 7.1%. Ecotourism specifically was valued at USD 19.8 billion in 2024 and is expected to reach USD 50.4 billion by 2033.

Employment – Tourism generated 42 million jobs in 2024 (12.57% of total employment) and is expected to create 53 million jobs by 2029.

3. Policy Landscape

National Strategy for Ecotourism (2022) – Aligns the Ministry of Tourism with MoEFCC. Key focus areas include eco-certification, carrying-capacity assessment, and community participation.

Swadesh Darshan Scheme – Since 2014-15, Rs 5,292.91 crore has been sanctioned for 76 projects.

Swadesh Darshan 2.0 – Focuses on sustainable circuits. Examples include –

Kerala – Pathanamthitta-Gavi-Vagamon-Thekkady (Rainforest trekking).

Jharkhand – Dalma-Betla-Netarhat (Wildlife-focused Forest tourism).

PRASHAD Scheme – Sanctioned Rs 1,646.99 crore for 48 projects, focusing on eco-spiritual circuits.

Capacity Building – A network of 56 Institutes of Hotel Management (IHMs) and 13 Food Craft Institutes provides training in sustainable hospitality.

4. Impacts of Ecotourism

Economic Impact – Increases household income by 35-60% and promotes micro-entrepreneurship.

Case Study – In Periyar Tiger Reserve, revenue reaches Rs 60-80 crore, with 50% shared with locals.

Case Study – Mawlynnong saw a 60% increase in incomes.

Social Impact – Reduces youth outmigration (e.g., 30% reduction in Khonoma). Empowers women (e.g., 18,000 women empowered in Kerala).

Environmental Impact – Revenues fund conservation efforts like tiger protection in MP and mangrove restoration in the Sundarbans.

5. Challenges and Solutions

Challenges

Greenwashing – Over-commercialization dilutes standards.

Carrying Capacity – Overcrowding in places like Ladakh and Jim Corbett strains water and waste systems.

Climate Threats – Glacial retreat and forest fires endanger destinations.

Way Forward – Strengthening eco-certification with mandatory audits, enforcing visitor caps (zonation), and diversifying destinations to reduce pressure on flagship sites.

2. Vibrant Villages Programme (VVP)

1. Overview and Vision

Goal – To achieve holistic development of border villages, focusing on tourism-driven growth, infrastructure, and reversing outmigration.

Strategy – It promotes eco-tourism, agro-tourism, and cultural tourism while showcasing indigenous arts and cuisines.

2. Phase I (2022-23 to 2025-26)

Scope – Covered 663 villages across 19 districts and 46 border blocks in Arunachal Pradesh, Himachal Pradesh, Sikkim, Uttarakhand, and Ladakh.

Financial Outlay – Rs 4,800 crore.

Key Achievements

Connectivity – 113 roads and 8 low-suspension bridges constructed (Rs 2,400 crore).

Digital – 4G telecom connectivity established in 342 villages.

Power – Electrification of 474 on-grid and 127 off-grid villages (43 power projects worth Rs 238 crore).

Tourism – 102 projects sanctioned (Rs 48 crore) for community homestays, eco-resorts, and adventure tourism.

3. Phase II – Expansion

New Outlay – Rs 6,839 crore, approved in April 2025, running until FY 2028-29.

Expanded Coverage – Extends to border villages in states/UTs including Assam, Bihar, Gujarat, J&K, Manipur, Meghalaya, Mizoram, Nagaland, Punjab, Rajasthan, Tripura, UP, and West Bengal.

Focus Areas

Cultural Promotion – Organizing village fairs, festivals, and national day celebrations.

Infrastructure – All-weather roads, SMART classrooms, and television connectivity.

Digital – Utilization of PM Gati Shakti for planning.

4. Best Tourism Village Competition (BTVC)

Purpose – To motivate villages to adopt sustainable practices.

Statistics –

2023 – 795 applications, 35 recognized villages.

2024 – 991 applications, 36 winners across eight categories (Adventure, Agri, Heritage, Vibrant Villages, etc.).

3. Agro-Tourism in India

1. Strategic Context

Economic Backdrop – India is the world's 4th largest economy in 2025.

Agricultural Base – India has 15 agro-climatic zones and diverse cropping patterns. The agriculture sector has shown consistent growth of ~5% annually (FY17-FY23). India is the largest producer of milk, pulses, and spices, and the second-largest producer of fruits, vegetables, wheat, rice, and cotton. Foodgrain production estimated at 347.44 million tonnes (2024-25).

2. The Agro-Tourism Model

Definition – Integrating tourism with agriculture to provide additional income to farmers while promoting eco-friendly practices.

Shift in Approach – Encourages moving from "production-centric" to "income-centric" farming strategies.

Global Alignment – Supported by UNIDO and FAO as a tool for poverty alleviation and food security, aligning with UN-SDGs.

3. State-Level Initiatives & Best Practices

Maharashtra – Established the Agro Tourism Development Corporation (ATDC) in 2005.

Scale – Covers 200+ villages with 1,000+ Agro Tourism Centres, attracting over 80 lakh tourists.

Kerala – The Agri-Tourism Multi-State Co-operative Society (ATCOS) promotes farm stays combined with spice cultivation, yoga, and naturopathy.

Sikkim – Leverages its status as India's first organic state to promote agro-tourism, focusing on rural women's participation.

Karnataka – Known for coffee plantation stays in Coorg.

Punjab – The Farm Tourism Scheme highlights the agrarian lifestyle.

4. Way Forward

Formalization – Agro-tourism should be integrated into national schemes with support for capacity building.

Integration – Leverage India's 6.65 lakh villages to create immersive experiences.

Marketing – Branding of local agricultural products should be integrated with tourism and hospitality.

4. Rural Festivals in India

1. Socio-Economic Significance

Economic Engine – Festivals act as platforms for income generation, providing seasonal employment for artisans, farmers, and small traders.

Demographics – With 65% of India's population in rural areas, festivals are crucial for increasing village cash flow.

Branding – States use festivals to build tourism identities. Notable examples include –

North East – Hornbill Festival (Nagaland).

North India – Surajkund Fair (Haryana), Pushkar Fair (Rajasthan).

South India – Pongal (Tamil Nadu), Thrissur Pooram (Kerala).

East India – Chhath Puja (Bihar), Tusu Parva (Jharkhand).

2. Government Support and Schemes

Swadesh Darshan 2.0 – Prioritizes rural, spiritual, and cultural tourism; 52 projects worth Rs 2,108.87 crore approved.

PRASHAD Scheme – Integrates rural fairs and festivals into religious tourism circuits.

Incredible India Campaign – Focuses on digital branding and taking rural festivals to a global audience.

DAY-NRLM – Empowers women Self-Help Groups (SHGs) to participate in fairs. As of June 2024, there are 10.05 crore women and over 90.8 lakh SHGs active.

TRIFED – Markets tribal products through Van Dhan Vikas Kendras during festivals.

3. Challenges and Solutions

Issues – Environmental pressure, waste management, insufficient infrastructure (toilets, accommodation), and lack of equitable economic distribution.

Solutions – Adoption of digital tools (e-ticketing), better budget allocation for local infrastructure, and year-round activities to sustain employment.

5. Vocal for Local

1. Initiative Overview

Launch – Launched by PM Narendra Modi in May 2020 under Aatmanirbhar Bharat Abhiyaan.

Objective – To promote self-reliance by encouraging the use of locally made products, empowering artisans/MSMEs, and reducing import dependency.

2. Key Policy Measures

Public Procurement Order (2017) – Mandates preference for 'Class-I Local Suppliers' (products with >50% local content) in government procurement.

Global Tender Restriction – Special approval is required for global tenders for projects up to Rs 200 crore, ensuring opportunities for local suppliers.

3. Support Schemes

PMEGP (PM Employment Generation Programme) – Provides subsidies for new micro-enterprises.

CGTMSE – Offers collateral-free credit for MSMEs.

SFURTI – Organizes traditional artisans into clusters to enhance competitiveness.

PLI (Production Linked Incentive) Scheme – Financial incentives to boost domestic manufacturing in sectors like electronics and pharma.

4. Digital and Market Enablement

GeM (Government e-Marketplace) –

'Aakanksha' Window – Highlights products from Aspirational Blocks.

Start-up Runway – Allows DPIIT-recognized startups to sell directly to the government.

ONDC – Facilitates e-commerce onboarding and financial literacy for local entrepreneurs.

Marketing – The Ministry of Textiles organizes exhibitions and social media campaigns to increase the visibility of indigenous products.

DOWN TO EARTH

1. COP30 at Belém, Brazil

The 30th Conference of Parties (COP30) to the UNFCCC opened in Belém, Brazil, on the edge of the Amazon rainforest, focusing on climate realities in the world.

Emissions Rising, Warnings Repeating

A recent UN synthesis report confirms that global greenhouse gas emissions continue to rise, placing the world on track to cross 1.5°C by the early 2030s. Even at 1.2°C, catastrophic extreme climate events now strike with terrifying frequency— from heatwaves in Europe to floods across Asia and Latin America. Extreme heat events in India and across Asia are already pushing human survivability thresholds. Global methane emissions — especially from agriculture and fossil fuels — remain uncontrolled. Multiple climate models suggest that global adaptation capacity is being breached faster than predicted.

Issue of Delhi's Pollution

Winter Smog as a Political Performance – As winter approaches, wind slows, and cold air traps pollutants close to the surface.

Delhi's air becomes among the worst in the world.

Moisture traps pollutants, worsening smog;

Only heavy natural rain or strong winds can clear Delhi's air;

Cloud-Seeding – It was attempted to generate artificial rain, but not successful.

How COP Lost Its Way?

A Broken Framework – The UNFCCC was built on the idea that historic polluters (the Global North) must cut emissions first and support developing countries (the Global South) with finance and technology to develop cleanly.

Paris Agreement (2015) diluted the principle of equity, shifting to voluntary nationally determined contributions (NDCs).

Climate Finance – Countries most vulnerable to climate change now pay more in interest on external debt than they receive in climate aid.

Much climate finance comes as loans—not grants—deepening debt burdens.

The Loss and Damage Fund (COP27), NCQG (COP29), and the Global Goal on Adaptation (COP30 agenda) all suffer from the symbolism without substance.

Global System Built on Avoidance – The world has spent 35 years avoiding difficult decisions –

1. No agreed formula to quantify equitable responsibility;
2. No accountability for unmet financial commitments;
3. No mandatory emissions cuts for major economies;
4. No structural change in development pathways;

Instead, we get panels, sessions, dialogues, communiqués—everything except implementation.

What Needs to Change?

For Delhi – The city already has a detailed action plan. It simply needs to implement it year-round.

For Global Climate Policy – COP must return to its core purpose like enforcing commitments, delivering finance, implementing adaptation strategies, and ensuring historical responsibility is not erased by diplomatic convenience.

Climate change cannot be solved by speeches, symbolism, or seasonal outrage.

COP30 – Narrowing Window as the Planet Warms Beyond Limits

As leaders gather in Belém, Brazil, for the 30th UN Climate Summit (COP30), a series of scientific and policy reports, global warming is accelerating, climate finance is collapsing, and the world is far off track to meet the Paris Agreement goals.

According to the World Meteorological Organization (WMO), 2025 is set to be the second- or third hottest year in 176 years of records.

Ocean Heat Surges Beyond Historical Highs – Ocean heat content beats 2024's records.

Marine ecosystems face collapse, biodiversity declines, and carbon-absorption capacity weakens. Hotter oceans are fuelling stronger storms, faster polar ice melt, and accelerating sea-level rise.

Sea-Level Rise Doubles in Satellite Era – 1993–2002 – 2.1 mm/yr; 2016–2025 – 4.1 mm/yr

Arctic and Antarctic sea-ice levels remain at or near record lows.

Glaciers – The hydrological year 2023–24 marked the third consecutive year of global glacier mass loss, raising sea levels by 1.2 mm, the largest since 1950.

Extreme Events Intensify – 2025 has already brought –

1. Massive floods across Africa and Asia;
2. Wildfires in Europe and North America;
3. Deadly cyclones;
4. Relentless global heatwaves;

Such disasters disproportionately affect low-income communities, often erasing decades of local development.

Greenhouse Gases at Record Highs

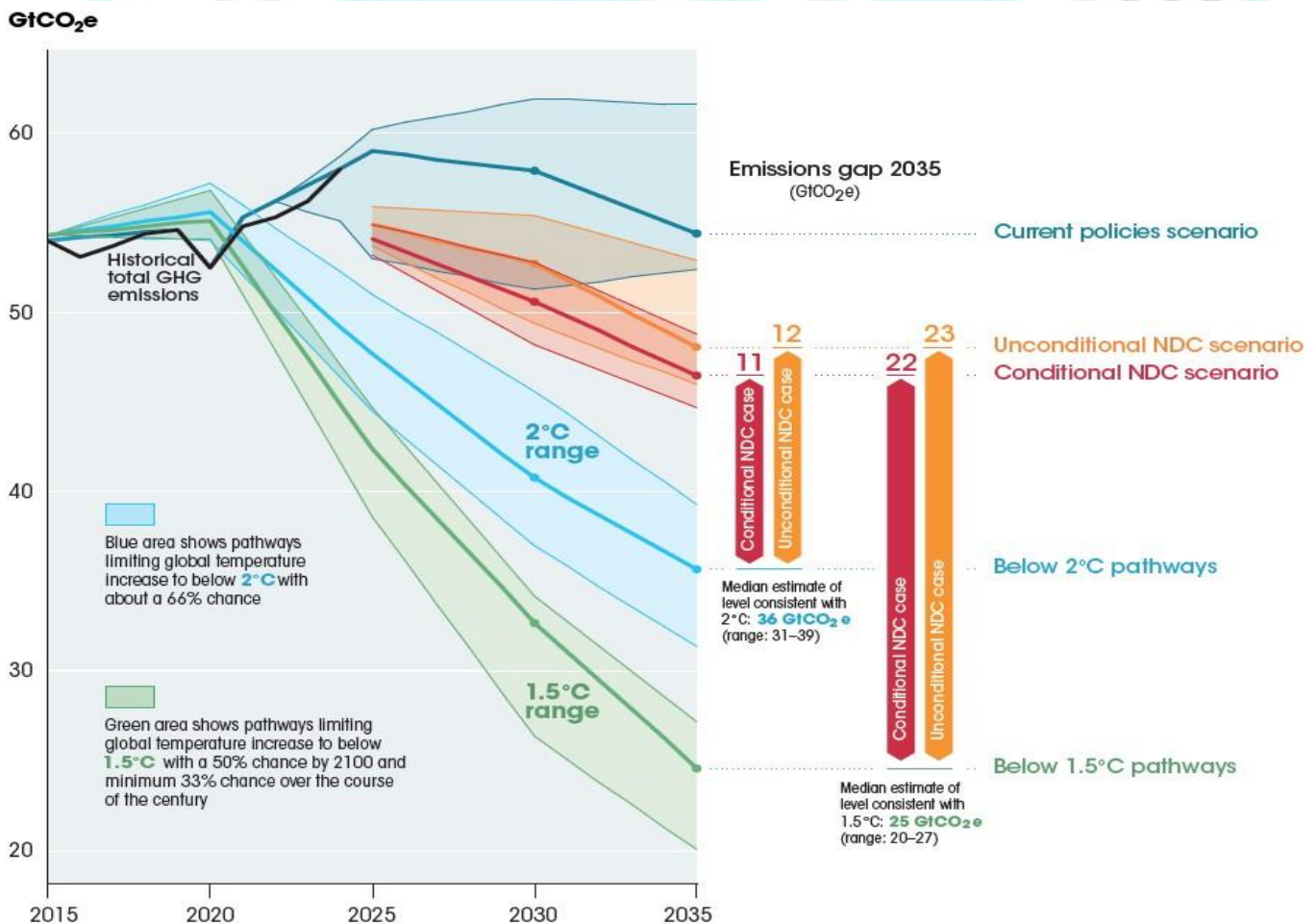
CO₂ Surges to 423.9 ppm – From 278 ppm before industrialization to 423.9 ppm in 2024—an astonishing 53% increase. The jump from 2023 to 2024 alone (3.5 ppm) is the largest in modern measurement history, and 2025 levels are expected to be even higher.

UNEP Emissions Gap 2025 – It shows –

Current policies – 2.8°C of warming by 2100;

Full implementation of pledges – 2.3–2.5°C;

Even this minor improvement is negated by methodological changes and the expected US withdrawal from the Paris Agreement.



NDCs – Only 64 of 193 parties submitted new Nationally Determined Contributions.

Implemented pledges reduce emissions by just 15% by 2035 (vs 55% needed for 1.5°C).

UNEP warns of a “huge implementation gap”.

Global Emissions Break Records – 57.7 GtCO₂e in 2024, up 2.3% from 2023.

Fossil fuels = 69% of emissions.

Fastest growth – F-gases (3.8%).

Deforestation reverses a decade-long decline with a 21% increase in 2024.

Many tropical nations—especially in Amazonia, Central Africa, and Southeast Asia—face pressure to expand extraction and agriculture, complicating deforestation goals.

Major Emitters

Top emitters – China, US, India, EU, Russia, Indonesia.

Largest year-on-year emissions rise – India and China.

Only major bloc with declining emissions – European Union (EU).

Adaptation

UNEP's Adaptation Gap Report 2025 – As Hurricane Melissa devastated Jamaica—one of the strongest storms ever to hit the North Atlantic—UNEP delivered a grim assessment.

1. Developing countries need \$310–365 billion/year by 2035 for adaptation.
2. Current public international finance – just \$26 billion (down from \$28b).

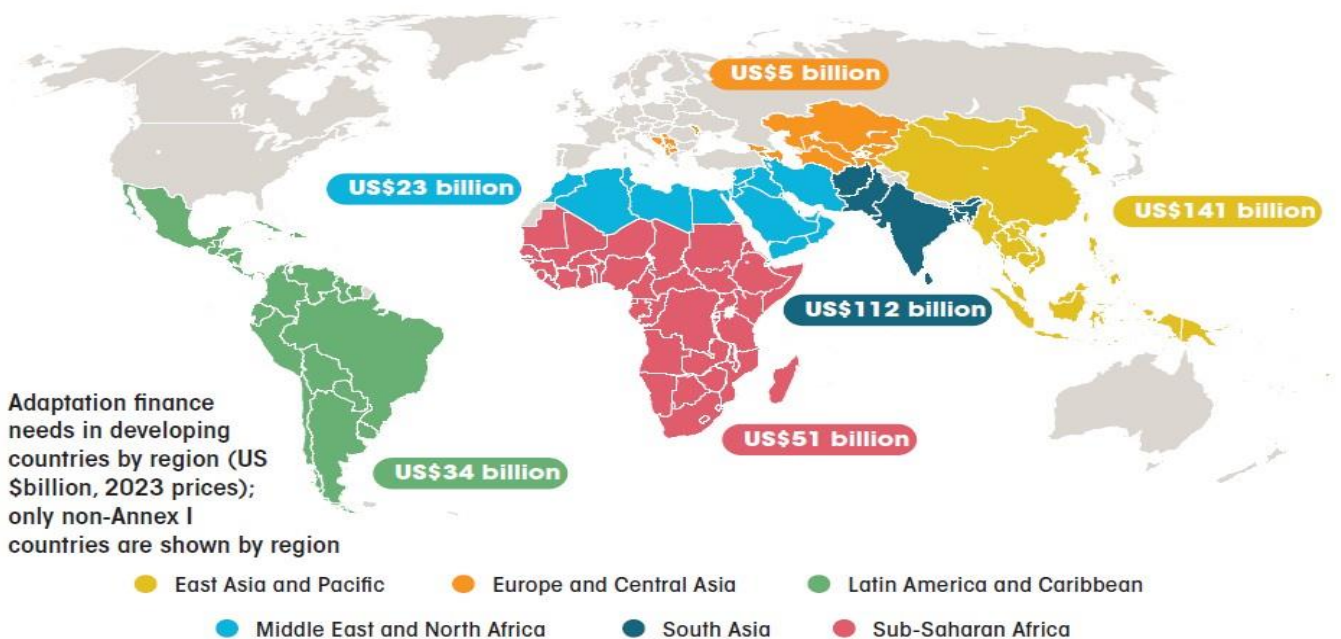
Adaptation finance gap – \$284–339 billion.

Countries need 12–14× more funding than currently provided. It has deadly consequences – coastal inundation, heatwaves, droughts, and storms push vulnerable communities to the brink.

Adaptation projects in South Asia, Africa, and small island nations are stalled due to delayed funds, high-interest loans, and donor fatigue.

Widening gap in adaptation finance

Developing countries now need 12 to 14 times more funding than current flows provide



G20's Crucial Role and the Road Ahead

High Emissions, Low Delivery – G20 countries account for 77% of global emissions but have failed to align with their own 2030 targets. Despite falling prices of solar, wind, and energy-storage technologies, political inertia and fossil-fuel dependence persist.

Technical Possibility, Political Paralysis – UNEP stresses that –

1. Renewable energy expansion is economically viable.
2. Climate governance reform is overdue.
3. Financial institutions must be redesigned to deliver accessible climate finance without worsening debt.
4. Even under the most ambitious scenario—full NDCs + net-zero pledges—the planet still warms **~1.9°C**.

Conclusion

The world enters COP30 with a narrowing window and widening gaps across emissions, finance, and adaptation. The science is unambiguous; the lived experience of vulnerable communities confirms it daily. Whether COP30 will remain another missed opportunity—or become a turning point—depends not on scientific warnings, which are deafening, but on political will, which remains fragile.

2. Wealth, Capital and Climate

The Climate Inequality Report 2025 by the World Inequality Lab — researchers show that the world's richest individuals are not only accumulating disproportionate wealth but are also disproportionately responsible for driving the climate crisis.

Key Findings

The report finds that the top 1% of global wealth-holders are responsible for 15% of consumption-based emissions, but, when accounting for emissions tied to their asset ownership (capital in high-emitting industries) that share jumps to 41%. An individual in the top 1% emits about 75 times more than someone in the bottom 50%, based purely on consumption. But when looking at asset-ownership in high-emitting industries, the per-capita emissions of someone in the top 1% are about 680 times that of someone in the bottom 50%. In countries like France, Germany and the U.S., the carbon footprint of the wealthiest 10% measured via ownership-based emissions is three to five times higher than estimates based on consumption alone.

Why the Focus on Investment and Ownership Matters?

The report emphasises that these personal consumption emissions are overshadowed by the emissions tied to their investments into high-carbon sectors (fossil fuels, heavy industry), while the rich do have high-emission lifestyles (private jets, mega-yachts, massive homes). It matters because climate policy has often focused on consumption (e.g., carbon taxes, fuel levies) rather than the underlying ownership structure that channels capital into high-carbon assets. For example, the report notes that more than 100 companies are believed to be responsible for about 71% of industrial greenhouse gas emissions since the Industrial Revolution — and much of the ownership of those companies lies with wealthy individuals and institutional investors.

Policy Response – Taxing Carbon-Intensive Wealth

One of the central recommendations of the Climate Inequality Report 2025 is taxing the carbon content of assets and financial portfolios, rather than focussing only on fossil-fuel consumption taxes. The logic is that when you tax fossil-fuels consumed, the cost is passed on to the consumer — often disproportionately affecting lower-income individuals who may lack alternatives.

The report outlines three major policy options –

1. A global ban on new fossil-fuel investments.
2. A tax on the carbon content of assets and investments.
3. A shift to public-driven decarbonisation, ensuring that new clean-energy capital does not just reinforce private wealth concentration.

According to the report, poorly designed climate policies risk deepening wealth inequality – if the transition is captured by private capital, the share of wealth going to the top 1% could increase from ~38% today to ~46% by 2050 if climate investments remain largely private-owned.

Key Findings of the Climate Inequality Report 2025

Emissions remain highly unequal – The top 10% of global emitters are responsible for nearly half of all emissions, while the bottom 50% contribute less than 10%. Within countries, the wealthiest households continue to increase per-capita emissions faster than national averages.

Climate damages disproportionately harm the poorest populations – Low-income countries—responsible for the smallest share of global emissions—face the highest exposure to heat, crop loss, flooding, and health impacts. Within countries, poorer households face higher climate risk due to lower-quality housing, limited savings, and restricted access to cooling, insurance, and healthcare.

Climate adaptation funding remains deeply inequitable – An adaptation financing gap persists, with vulnerable countries receiving far less than what is needed to prepare for rising climate impacts. Even when funds are delivered, they often do not reach the most vulnerable communities effectively.

Green investment is concentrated in wealthy countries – High-income countries dominate investment in renewable energy, green technology, and emission-reduction innovation. Low-income countries face financing barriers and higher borrowing costs, limiting their ability to transition to clean energy.

3. Drought Condition – Ganga River

A recent study has revealed that the Ganga River is experiencing its worst drought in approximately 1,300 years.

Key Findings

According to the study, from 1991 to 2020, the drop in streamflow in the Ganga basin was about 76% more intense than the severe drought of the 16th century. The study reports that the decline in annual mean rainfall over the Ganga River Basin (GRB) between 1951 and 2020 was around 9.5%. In some western parts of the basin, declines exceed 30%. During 1991–2020, multiple consecutive drought periods were recorded – e.g., 1991–1997, 2004–2010, 2014–2018.

Reasons

Reduced Monsoon Rainfall – A key driver is the weakening of the summer (southwest) monsoon over the basin. The study finds that decreased rainfall reduces river flow and groundwater recharge.

Human Activity & Groundwater Extraction – Large-scale groundwater extraction for irrigation, dense dam and barrage networks, irrigation canals diverting water – all reduce the natural flow of the Ganga.

Model Limitations & Climate Complexity – The study finds that many climate models fail to capture the severity of the drying trend in the Ganga Basin. Human interventions (irrigation, land-use change, aerosols) are not well represented in models; thus, the risk is under-estimated.

Impacts & Risks

Water and Food Security – The basin of the Ganga supports over 600 million people across India, Nepal and Bangladesh. Reduced river flow threatens irrigation, drinking water supply, ecosystems and livelihoods.

Ecosystems & Navigation – With lower flows, stretches of river that once allowed navigation are becoming impractical during the dry season. Canals and wells that depended on the Ganga are being affected.

What Can Be Done?

Prioritise environmental flows in the river – ensuring sufficient water remains in the Ganga to maintain its ecology, even as withdrawals continue.

Manage groundwater and surface water as a connected system – recharge aquifers, regulate extraction.

Improve modelling and planning by including human factors (irrigation, land use, damming) in climate-hydrology models.

Promote trans-boundary cooperation (India, Nepal, Bangladesh) for data sharing, coordinated water management, given the Ganga Basin spans political borders.

4. Kerala's Extreme Poverty-Free Status

Recently, Kerala became the first Indian state to declare itself free of 'extreme poverty', rooted in the state's Extreme Poverty Eradication Programme (EPEP).

Kerala's Declaration and the EPEP Framework

Under EPEP, the state—working with local bodies and non-profits—identified –

1. 64,006 households (103,099 individuals) as extremely poor;
 2. 59,277 households rehabilitated through micro-plans linking them to welfare schemes;
- The programme used four dimensions to assess deprivation like food, health, income and housing.

What the Government Did Not Count

Kerala did not use –

1. NITI Aayog's Multidimensional Poverty Index (12 indicators);
2. The World Bank's threshold of \$3/day;
3. It allowed many severely vulnerable groups to fall through the cracks.

Invisible Poor – Workers, Tribes, and Coastal Communities

Informal Workers Excluded – A Kerala labour official notes that workers often live on company-owned land without titles, lack income/address documentation, and remain invisible to state surveys. A 2024 study by the Gulati Institute of Finance and Taxation shows that 22% of Kerala's workforce is stuck in low-wage, insecure jobs.

Tribal Communities – Kerala has 426,000 tribal people, with Wayanad alone housing 152,000. In districts like Wayanad, Idukki, and Palakkad, over 85% of tribal households are landless.

Coastal Communities – Nearly 60% of Kerala's 580-km coastline faces moderate to severe erosion (National Centre for Earth Science Studies).

Poverty vs. Vulnerability – Experts argue that the declaration reflects reduction of visible destitution, not actual eradication of poverty. Key drivers of poverty in Kerala remain like landlessness, climate risk, gendered exploitation, income insecurity, and rising household debt.

Extreme Poverty Eradication Programme (EPEP) 2.0

Kerala has acknowledged gaps and is preparing EPEP 2.0, which aims to –

1. Update inclusion criteria;
2. Provide sustained support to previously identified families;
3. Involve self-help groups and local governments;
4. Allocate dedicated state budget resources;

5. Cloudbursts on the Plains – India's Unseen Climate Emergency

Cloudburst-like downpours are now striking India's plains with alarming frequency, redefining the country's understanding of monsoon extremes, once confined to the mountains.

Cloudbursts Beyond the Hills

Traditionally, cloudbursts—defined as rainfall exceeding 100 mm per hour over 20–30 sq km — are phenomena of hilly terrains, where orographic lift pushes moist air upwards, triggering intense convection. Every 1°C rise in global temperature, the atmosphere holds 7% more water vapour. Despite decades of research, climate models remain too coarse to forecast such hyperlocal phenomena. They can simulate trends over large regions but fail to capture specific convective patterns responsible for these cloudbursts in the plains.

EXTREME RAINFALL EVENTS RISE IN TANDEM



FORECASTS (POST-2027)

- CMIP6 models show increase in extremes post-2027
- Long-term projections expect more frequent extremes, especially under SSP5-8.5



OBSERVATIONS

- 2025: Highest June "very heavy rain events (502)
- 2023: Second highest (494 in June, 1,318 in July)
- Trend already increasing (as per India Meteorological Department and peer-reviewed studies)



INSIGHT

The rise in extreme rainfall events may already be underway, ahead of model timelines. Influence of ENSO (El Niño, La Niña) is becoming less predictable, suggesting climate change is interacting with natural variability in new ways.

Early Signs of a Global Shift

Even with gaps in data and limitations in modeling, two clear trends are emerging – Climate impacts are appearing in unpredicted regions—from India's coastal plains to its rain-shadow interiors. These disruptions are arriving sooner than most forecasts anticipated.

The 'Global Tipping Points 2025' report, produced by 160 scientists from 23 countries, declared that the Earth has crossed its first major climate tipping point—the mass die-off of warm-water coral reefs. Tipping points are thresholds beyond which human-induced warming triggers irreversible planetary changes. Earlier projections placed them between the 2030s and 2100, depending on emissions scenarios. But as this report indicates, the timeline has accelerated.

INDIA SEES REGIONAL SHIFT IN RAINFALL



FORECASTS

- Models do not show consistent national-scale spatial shifts
- Some research anticipates increased rainfall in Rajasthan



OBSERVATIONS (Monsoon seasons)

- Rajasthan (2022–2025) +60% to +64% excess rainfall
- Northeast India (2022–2025) –13% to –18% deficits
- In 2025 Northeast India experienced 2nd lowest rainfall since 1901



INSIGHT

A west-east dipole is emerging: wetter west (Rajasthan), drier northeast. While models did not predict this clearly, this regional shift may reflect changing monsoon dynamics, which must be tracked further.

PRECIPITATION RATE GETS VOLATILE TOO



FORECASTS (2040–2069)

- CMIP6 (SSP2-4.5) +0.33 mm/day
- IITM-ESM (SSP2-4.5) +0.25 mm/day
- CMIP6 (SSP5-8.5) +0.49 mm/day
- IITM-ESM (SSP5-8.5) +0.16 mm/day



OBSERVATIONS (Monsoon seasons)

- 2021 to 2022 –1.48 (annual), +0.42 (monsoon)
- 2022 to 2023 –0.42 (annual), –0.85 (monsoon)
- 2023 to 2024 +0.28 (annual), +0.94 (monsoon)



INSIGHT

Annual and monsoon precipitation rates show high inter-annual variability. Year-on-year changes already exceed the long-term projected rates, but more data is needed to confirm a systemic shift.

TROPICAL CYCLONE BEHAVIOUR



FORECASTS

- Increase in very severe cyclones
- Compound events: Rain, storm surge, sea level rise



OBSERVATIONS (Monsoon seasons)

- Cyclone Amphan (2020) Floods + sea water ingress (25 km inland)
- Frequent rapid intensification since Cyclone Okhi (2017)
- Strong link to warm Bay of Bengal waters



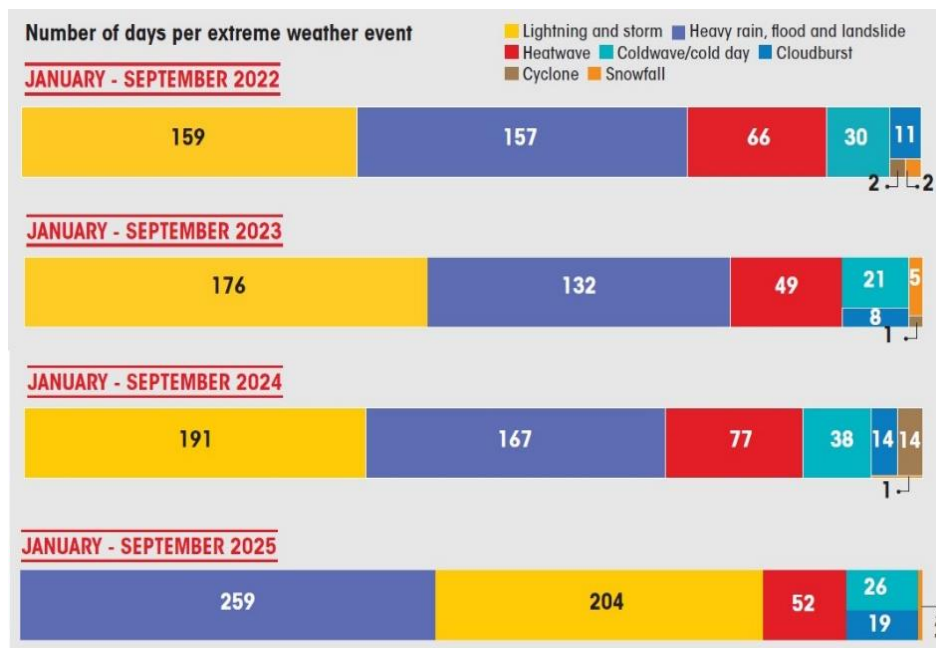
INSIGHT

Cyclone behaviour has already changed. More intense storms, rapid intensification, and excessive rainfall are compounding flood risk. India's east coast is especially vulnerable.

Why are the models struggling?

Many climate models used by the IPCC and others are coarse in spatial resolution, and are designed to identify broad regional trends—not specific extreme events in small areas (such as a cloudburst in a plain).

Feedback loops (e.g., rapid Arctic/Antarctic ice melt, weakening of the AMOC, strange jet-stream behaviour) appear to be activating earlier or faster than expected. The modelling community is thus increasingly calling for a next generation of models – greater spatial and temporal resolution, better coupling with observation systems (including palaeoclimate records), and real-time data assimilation of emerging extremes into projections.



Looking Ahead - What does it mean in practice?

More frequent and intense extremes – Each additional 0.1 °C of global warming tends to produce a disproportionately greater rise in disasters linked to extreme weather. The faster the planet warms, the earlier and stronger the disruptions – altered precipitation patterns, shifting monsoon behaviour, sea-level rise, retreating glaciers, stronger cyclones. Some changes once projected for decades ahead may already be underway.

Risks of tipping points and cascading failures

– The 'Global Tipping Points 2025' report warns that we may already have passed the first 'tipping point' (warm-water coral reef die-off). Current models may not capture all these cascading feedbacks, which

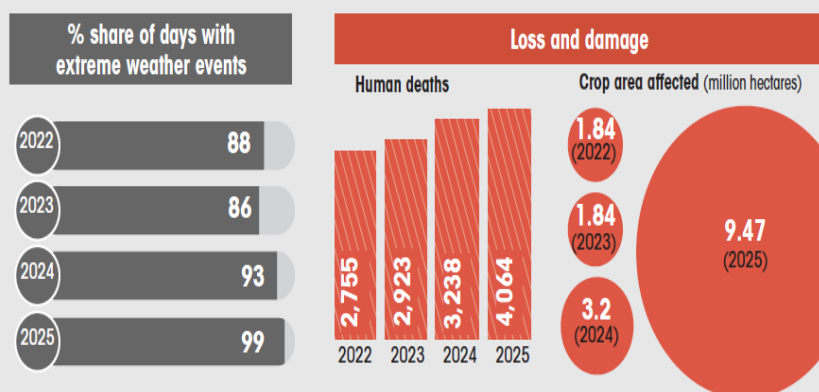
means our risk assessments may under-estimate the real-world danger.

Implications for India's Policy & Planning

India must accelerate climate adaptation – anticipating not just gradual shifts but sudden, extreme, small-scale events (e.g., cloudbursts, flash floods, short-duration heavy rainfall), especially in regions previously considered 'safe'. Urban planning, infrastructure, drainage, early warning systems, land-use regulation must all factor in this elevated risk profile. The monsoon is changing its character – growing variability, increasing extremes, shifting spatial patterns (for example, excess rain in Rajasthan but deficits in northeast India). The modelling and forecasting community in India needs to invest in higher-resolution local data and models (including sub-daily rainfall extremes) to support early warning and adaptation.

RECORD LOSSES IN FOUR YEARS

In 2025, some 99 per cent of days (in January-September) in India saw an extreme weather event, the highest in four years. The year also recorded the greatest loss and damage, with over 4,000 deaths and crops affected across 9.47 million hectares



6. ICAR'S Gene-Edited Rice Controversy

Recently, ICAR has announced the development of two gene-edited (GE) rice varieties — Pusa DST-1 and DRR Dhan 100 (Kamala) — marked as high-yielding, climate-resilient, and salt-tolerant.

Controversy – Gene-Edited Rice Underperforms

An analysis of ICAR's own trial data revealed that – No significant increase in yield was observed compared to the parental varieties. The varieties did not mature earlier, contradicting official claims. ICAR allegedly flouted crop testing norms, bypassing standard protocols and ignoring red flags in the data.

Data Discrepancies and Ethical Concerns

ICAR's internal data showed inconsistencies that should have prompted further trials or revisions. Instead, the varieties were fast-tracked for release, raising concerns about –

Scientific transparency – The lack of peer-reviewed publication and open data access undermines public trust.

Regulatory bypass – ICAR sidestepped established crop testing procedures, possibly to avoid public resistance to gene technologies.

Institutional accountability – The response from ICAR has been described as evasive, reflecting poorly on the ethics of India's top agricultural research body.

Implications for Farmers and Food Systems

Farmers may adopt crops that don't deliver promised benefits, leading to economic losses. It could erode trust in future gene-edited crops, stalling innovation in agricultural biotechnology. The controversy may fuel public skepticism toward genetically modified organisms (GMOs) and gene-editing technologies in India's food systems.

7. Land Subsidence – A Growing Urban Hazard in India and Beyond

Human activities have dramatically accelerated subsidence rates in many rapidly urbanising regions, particularly in the Global South, while natural processes drive slow, long-term settling of the Earth's surface.

Causes of Land Subsidence

Natural Drivers

Glacial Isostatic Adjustment (GIA) – Land continues to settle thousands of years after the retreat of massive ice sheets.

Natural Consolidation of Sediments – Recently deposited or soft sediments naturally compact over time, especially in river deltas and coastal plains.

Tectonic Activity – Fault movements, crustal adjustments, and long-term geological settling contribute to slow, persistent vertical land motion.

Anthropogenic Drivers

Although natural processes occur at millimetres per year, human-driven processes can increase subsidence to several centimetres annually. Major human causes include –

Excessive Groundwater Extraction – When aquifers are over-pumped, clay layers compress like squeezed sponges, causing surface-level sinking.

Oil and Gas Extraction – Removal of underground hydrocarbons destabilises subsurface pressure.

Mining Activity – Underground voids created by mining operations trigger localised collapses or widespread settling.

Why Global South Cities Are Especially Vulnerable?

Cities across the Global South heavily rely on groundwater as their primary or fallback water source due to unreliable surface water, rapid urban growth, insufficient water infrastructure, and high dependence on private borewells.

Subsidence Threat in India's Megacities – A 2023 study published in Nature Sustainability highlights alarming levels of land subsidence across India's five major metropolitan areas — Delhi, Mumbai, Kolkata, Chennai, and Bengaluru — collectively affecting 878 sq km of urban land, 13 million buildings, and ~80 million residents

Maximum Annual Subsidence Rates

Delhi – 51 mm/year;

Chennai – 31.7 mm/year;

Mumbai – 26.1 mm/year;

Kolkata – 16.4 mm/year;

Bengaluru – 6.7 mm/year;

City-wise Drivers and Hotspots

Delhi – Primary driver – compaction of alluvial deposits due to extreme groundwater extraction.

Hotspots – Bijwasan, Faridabad, Ghaziabad (up to 38.2 mm/year). Some areas like Dwarka are uplifting (15.1 mm/year) due to successful aquifer recharge and rainwater harvesting policies implemented between 2005–2015.

Chennai – Fastest sinking around the Adyar River floodplains and central districts including Valasaravakkam, Kodambakkam, Alandur, Tondiarpet. Drivers – compaction of Holocene alluvium + groundwater extraction. Chennai shows the highest future structural damage exposure compared with other cities.

Mumbai – Subsidence is low in most areas except dense, economically weaker regions like Dharavi. Urban load from vertical development adds to subsidence pressures.

Kolkata – Caused by the settlement of Pleistocene and Holocene sediments in the Ganga delta. Long-term groundwater dependence continues to trigger compaction.

Bengaluru – Minimal subsidence due to stable igneous and metamorphic bedrock (gneiss, granodiorite, granite). Subsidence risk increased in late 2022 due to a surge in groundwater extraction during drought-like conditions.

Strategies to Prevent or Slow Subsidence

Early Monitoring and Data Systems – Groundwater monitoring networks using in-situ sensors. Satellite-based deformation tracking (e.g., InSAR) to detect early warning signs of aquifer stress.

Regulation and Governance –

Sustainable yield thresholds and borewell permitting systems. Phased regulation rather than blanket bans – particularly important where communities have no alternative water supply. Public awareness campaigns on sustainable groundwater use.

1. Diversified Urban Water Portfolios –
2. Surface water augmentation
3. Wastewater recycling
4. Rainwater harvesting

Managed Aquifer Recharge (MAR) – recharge basins, rooftop-to-recharge systems, and revival of tanks and wetlands.

Risk-Sensitive Urban Planning – Incorporating subsidence risk maps into building codes and zoning plans. Designing infrastructure with expected long-term settlement in mind.

Road Ahead – Sustainable Groundwater Management

For India's megacities – and others across the Global South – the path forward requires –

1. Proactive monitoring rather than crisis response;
2. Adaptive groundwater governance that accounts for equity;
3. Urban design that treats water as a foundational element, not an afterthought;
4. Community-led recharge and conservation initiatives;

Sustainable groundwater use is not only essential for water security but for safeguarding the geological stability of the cities themselves.

8. Ethnomedicinal Heritage of the Sumi Nagas

The ethnomedicinal practices of the Sumi Nagas are a living knowledge system transferred orally through generations. Unless protected through legal frameworks, the knowledge may be lost and faces risk of biopiracy.

About the Ancient Wisdom in the Hills of Nagaland

In the misty hills of Zunheboto district, Nagaland, the Sumi Nagas have preserved a vibrant tradition of healing through plants and rituals. These ethnomedicinal practices are orally transmitted, forming a living knowledge system that blends biodiversity with cultural identity.

Living Knowledge System of the Sumi Nagas

Oral Transmission and Practice – The Sumi Nagas do not rely on formal pharmacopoeias.

Instead, their ethnomedicinal knowledge is embedded in narratives, songs, the expertise of tribal healers—bonesetters, midwives, elders—and passed verbally from one generation to the next.

Traditional Treatments

Albizia Chinensis (locally Amwosu) – powdered bark used as an anthelmintic to eliminate parasites without harming the host.

Albizia Lebbeck (Azuyisu) – used for blood toxicity, bronchial disorders and night-blindness.

Artemisia Indica (Ahupi) – versatile—treats asthma, gastritis, skin ulcers; a paste of leaves applied to a child's head to prevent convulsions.

Artemisia Nilagirica (Achupi) – leaf decoction for piles, juice rubbed on forehead for headaches; roots used as tonic/antiseptic.

Bambusa Tulda (Awuti) – the bamboo shoots flavour meals; a paste from the plant used to treat chicken-pox and poisonous bites.

Curcuma Angustifolia (Anashibo) – rhizome crushed gives a fragrant scent. Used for jaundice, blood purification, ulcers, kidney-stones.

Azadirachta Indica (Akhosuba, neem) – from fever to gum disease; its smoke is believed to ward off viruses and insects.

Debregeasia Longifolia (Awukhu-nabo) – bark used as cleansing shampoo; fruits aid digestion.

Khollethi (Phyllanthus Emblica) – Rich in vitamin C; used to treat scurvy, diarrhoea, dysentery, headache and grey hair. The seed is used in treatment of asthma, bronchitis and biliousness.

Mughuniye (Fagopyrum Esculentum; Buckwheat) – It is used particularly to treat fragile capillaries; also helps strengthen varicose veins and treat chilblains.

Tughami Subo (Alstonia Scholaris) – The bark is used to treat asthma, dyspepsia, chronic diarrhea and to stop bleeding of wounds.

Khakhuthi (Solanum Indicum) – Treats asthma, bronchitis, skin diseases, relieves labour pain and toothache.

Nebathi (Ficus Benjamina) – Leaf decoction used to treat ulcer; tender shoots for cough, dysentery.

Tachisu (Callicarpa Arborea) – Cures fever, gastritis and skin diseases.

Qopupu (Bauhinia Glauca) – Decoction of bark is used for dysentery, its infusion is used in poisonous bites.

Sumugha (Allium Ascalonicum; Shallot) – Decoction of bulbs mixed with milk, butter and Ferula asafetida and paste is applied to treat paralysis

Shenhanibo (Ricinus Communis; Castor) – Leaves are anthelmintic. Leaves are heated with steam and placed on swellings, boils and rheumatic joints. Oil is purgative, used in skin inflammation and leprosy

Lavatsuna (Allium Tuberousum) – Decoction of herbs used in urinary infection, is considered a good diuretic.

Lutusu (Ainus Nepalensis) – Bark paste is used to cure stomach-ache and dysentery. The leaf paste is applied on cuts and wounds.

Threats to Traditional Knowledge

Biopiracy – Without legal safeguards, pharmaceutical companies may exploit indigenous knowledge without compensation or recognition.

Loss of biodiversity – Deforestation and climate change are endangering the very plants that sustain these cures.

Cultural erosion – Younger generations are drifting away from traditional practices, risking the loss of centuries-old wisdom.

Need for Community-Centred Legal Frameworks

Recognition of collective ownership – Traditional knowledge is often not the creation of an individual inventor but the result of communal practice and oral transmission.

Legal frameworks must allow for collective rights rather than individual patents.

Free, Prior and Informed Consent (FPIC) – Communities must have the right to decide if, how and on what terms their knowledge may be used.

Benefit-sharing mechanisms – When medicinal plants or knowledge lead to commercial products, communities should share in the rewards, not be excluded.

Customary law alignment – The frameworks should respect local customary laws and knowledge practices.

Sui generis protection – A tailored legal regime (rather than forcing traditional knowledge into classic patent systems) may be appropriate—one that recognises the intergenerational, evolving, communal character of the knowledge.

Documentation and databases (with control) – While oral transmission is central, strategic documentation (with community control) can help protect the knowledge from misappropriation and serve as evidence of prior use (prior art) to prevent wrongful patents. Acts like the Biological Diversity Act 2002 and the Forest Rights Act 2006 provide some rights, but they are inadequate to protect orally transmitted, communal knowledge.

9. Hasdeo Arand Forest

Recently, the Chhattisgarh High Court ordered upholding mining operations in the Hasdeo Arand forest—despite community challenges.

Background – Ghatbarra Community Forest Rights Case

FRA Recognition and Later Revocation – In 2013, Ghatbarra village in Surguja district received Community Forest Rights (CFR) under the Forest Rights Act, allowing access to 810 ha of forestland for fuelwood, minor forest produce, and grazing. In 2016, the District Level Committee (DLC) revoked these rights, claiming they were granted ‘in error.’

High Court’s Ruling – The court agreed that a DLC has no authority to cancel CFR titles. Despite this, it dismissed the petition on technical grounds—stating villagers could not prove residence or eligibility—effectively undermining their recognized rights.

Mining, Approvals, and Procedural Violations

Mining Interests in Hasdeo Arand – Hasdeo Arand—one of India’s largest contiguous forest blocks—contains the Parsa East–Kanta Basan (PEKB) coal block, allotted to Rajasthan Rajya Vidyut Utpadan Nigam Ltd (RVUNL), where Adani Enterprises holds the majority stake.

Questionable Clearances – The Forest Advisory Committee initially rejected diversion proposals in 2011 due to non-compliance with FRA. In-principle approval was later granted conditionally, requiring settlement of forest rights. Final forest clearance followed, though Gram Sabha consent—mandatory under FRA and PESA—was never obtained.

Community Opposition and Legal Battles

Resistance on the Ground – Between 2012–2013, multiple Gram Sabhas and Van Adhikar Samitis passed resolutions demanding a halt to mining activities, citing violations of –

1. Forest Rights Act (FRA), 2006
2. Panchayats (Extension to Scheduled Areas) Act (PESA), 1996;

NGT and Supreme Court Interventions – The National Green Tribunal (2014) suspended mining after finding illegalities in forest diversion. The Supreme Court later allowed continuation of Phase-1 mining while litigation continued. Meanwhile, the Union government advanced permissions for Phase-2 mining, which began in 2022, despite active disputes over rights and consent.

Concerns Over the Court’s Reasoning

Undermining of CFR and Gram Sabha Powers – If CFR titles existed, forest clearance should be deemed illegal without community consent. The judgment allows authorities to disregard the FRA and reduces Gram Sabha consent to a formality.

Fifth Schedule and PESA Violations – Hasdeo Arand lies in a Fifth Schedule Area, where PESA empowers Gram Sabhas to decide whether mining may occur. The Supreme Court’s Niyamgiri judgment (2013) reaffirmed this power

Ecological Concerns – Hasdeo Arand is rich in biodiversity and hosts critical catchments for major rivers. These include –

1. destruction of elephant corridors;
2. fragmentation of dense forest;
3. long-term hydrological damage;
4. loss of indigenous livelihoods;

Community Rights Before Relocation

The Union Ministry of Tribal Affairs (MoTA) Issues Policy on Rights of Communities in Tiger Reserves, titled as 'Reconciling Conservation and Community Rights - A Policy Framework for Relocation and Co-existence in India's Tiger Reserves'. It urges cooperation from the MoEFCC and stresses that conservation must respect constitutional guarantees, legal safeguards, and human dignity.

Core Principles of the New MoTA Framework

MoTA reiterates that no forest-dwelling community can be relocated unless -

1. All individual and community forest rights are first recognized.
2. The free, prior and informed consent of the gram sabha is obtained.
3. Relocation is strictly voluntary and adheres to both the FRA and the Wild Life Protection Act (WLPA), 1972.

It mandates -

1. Land-for-land compensation, secure housing, and livelihood restoration.
2. Long-term rehabilitation support and transparent monitoring of outcomes.
3. Commitment to zero forced displacement.

Rights-Based Conservation

Co-existence - Allowing Forest communities to continue living within tiger habitats with legal protections.

Voluntary Relocation - Providing fair compensation, livelihood guarantees, and transparent procedures.

10. India Sets Legally Binding Emission-Cut Rules for Four Key Sectors

Recently, India took a significant step toward meeting its Paris Agreement commitments by notifying the Greenhouse Gas Emission Intensity (GEI) Target Rules, 2025. These rules are the country's first legally binding emission reduction mandates for industrial sectors.

Sectors Under Regulation - The rules apply to four high-emission industries - Aluminium, Cement, Chlor-alkali, and Pulp and Paper.

At least 282 industrial units will be required to comply with emission intensity targets for 2025-26 and 2026-27, focusing on reducing emissions per unit of product output.

Operationalising India's Carbon Market

The GEI Target Rules are designed to operationalise the Carbon Credit Trading Scheme (CCTS), 2023, which forms the backbone of India's domestic carbon market. Industries achieving or exceeding targets will earn carbon credits. Non-compliant entities will need to purchase credits to offset their emission shortfalls. It ensures flexibility while driving overall emission intensity reductions across sectors.

Policy Integration and Governance

The rules fall under the Energy Conservation Act, 2001 (as amended in 2022), empowering the Bureau of Energy Efficiency (BEE) to monitor and enforce compliance. According to the MoEFCC, it aligns with India's Nationally Determined Contributions (NDCs) - specifically, to reduce the emissions intensity of GDP by 45% by 2030 compared to 2005 levels.

Sectoral Implications

Cement & Aluminium - Both sectors are part of the Perform, Achieve, and Trade (PAT) program under BEE.

These new rules build on the program's experience in tracking and benchmarking industrial efficiency.

Pulp & Paper, Chlor-Alkali - These sectors face challenges in energy efficiency and process optimization; emission caps will accelerate technological shifts toward low-carbon manufacturing.

Global Context

The notification precedes COP30, hosted in Brazil, where India is expected to highlight it as part of its strengthened domestic climate policy, to 'bridge the gap between voluntary pledges and enforceable emission accountability'.

Outlook

1. Strengthen market-based climate governance.
2. Stimulate investment in green technologies.
3. Support India's vision of achieving net-zero emissions by 2070.

However, industry groups have called for clear monitoring guidelines and capacity-building to ensure smooth compliance.

11. Record Emissions & Renewable Surges

The World Meteorological Organization (WMO) has confirmed that global atmospheric carbon dioxide recorded a new high, marking extreme weather events, rising global temperatures, and unstable ecosystems.

Global Energy Shift - Renewables Rise, Fossil Fuels Resist

According to Ember's 'Global Electricity Mid-Year Insights 2025, the first half of 2025 witnessed renewable energy surpassing coal as the world's leading source of electricity. Solar power has doubled in the past three years, driven largely by China, which contributed over half the global increase, and India, where government programs such as the National Solar Mission have rapidly expanded installed capacity to over 90 GW (MNRE, 2025).

However, natural gas-based generation has risen by 1.6%, as countries turn to fossil fuels to meet soaring AI data center energy needs and to counter the effects of intensifying heatwaves.

China and India - Double-Edged Progress

China is simultaneously leading solar deployment and constructing 95 GW of new coal capacity (CarbonBrief, 2025).

India, while advancing in solar and green hydrogen initiatives, continues to expand coal capacity to ensure grid stability and energy security.

Electric Vehicles (EV) Revolution

The International Energy Agency (IEA) reports that 20% of global new car sales in 2024 were electric, with China leading (almost half of its new cars are EVs). India is emerging as a strong regional player, with over 3 million EVs registered (Vahan Portal, 2025) and new policies such as the FAME II and National Electric Mobility Mission Plan driving adoption.

However, geopolitical frictions are reshaping the landscape -

China's dominance over rare earth minerals and battery supply chains has caused Western nations to rethink EV subsidies and delay ICE phase-out timelines. Export restrictions on lithium and graphite are intensifying supply chain vulnerabilities, potentially slowing the pace of global electrification.

Financing Gap - Real Barrier to Transition

The IMF's World Economic Outlook (2025) underscores the economic imbalance haunting the climate transition - for the first time since 2000, the poorest countries now spend more on debt servicing than they receive in official development assistance. It means that nations most vulnerable to climate impacts lack the fiscal space to invest in green technologies, trapping them in a cycle of energy poverty and dependence. According to MoEFCC, international climate finance remains well below pledged levels, impeding efforts to meet Paris Agreement targets.

Conclusion

The world stands at a crossroads between technological optimism and economic hesitation. Renewable energy, electric mobility, and low-carbon pathways are no longer future prospects—they are the present reality. But without a coordinated global financing framework, equitable technology access, and political courage, the climate transition risks stalling at the halfway mark.

12. Alarming Rise in Global Deaths Among Young People

According to The Lancet's Global Burden of Disease Study 2023, global life expectancy has rebounded to 76.3 years for women and 71.5 years for men, nearly returning to pre-pandemic levels. However, a worrying trend has emerged — rising deaths among young people aged 10–29 years, particularly women.

Rising Mortality Among Young Women

The study reports that death rates for young women (15–29 years) are 61% higher than earlier estimates. Key causes include –

1. Pregnancy and childbirth complications;
2. Road accidents, particularly in developing nations;
3. Lack of access to reproductive healthcare, as noted by UNFPA and MoHFW.

India's National Health Mission (NHM) data also show that maternal mortality among adolescents remains high due to early marriages and limited prenatal care access.

Shift to Non-Communicable Diseases (NCDs)

Globally, NCDs account for nearly two-thirds of all deaths, surpassing infectious diseases, highlighted an alarming rise in heart disease, diabetes, and stroke among youth due to –

1. Sedentary lifestyles
2. Ultra-processed food consumption
3. Tobacco and alcohol use

In India, NITI Aayog's Health Index shows a 30% rise in NCD-related deaths in the 15–35 age group since 2015.

Mental Health

Mental health disorders surged sharply, anxiety disorders increased by 63%, and depressive disorders by 26%. It links to social media addiction, unemployment, and post-pandemic isolation. India's National Mental Health Survey (2023) also reported a sharp rise in depressive symptoms among college students and first-time job seekers.

Environmental and Climate Risks Intensify

The Lancet report underlined the growing impact of climate-related health risks – Deaths due to heat and cold exposure rose 6% annually between 2013–2023. India Meteorological Department (IMD) and MoEFCC reports indicate that extreme heat days have tripled since 1980, leading to more cases of dehydration, cardiac arrest, and mental fatigue among youth.

Way Forward

1. Youth-focused health policies integrating mental health, reproductive care, and road safety.
2. Climate-resilient healthcare systems to mitigate environmental risks.
3. Education and employment reforms to address stress and mental health concerns.

13. IUCN World Conservation Congress 2025

Recently, the International Union for Conservation of Nature (IUCN) convened its World Conservation Congress (held once every four years) in Abu Dhabi, marking a pivotal moment for global environmental assessment and action.

Ecosystem in Crisis

The Global Land Outlook Thematic Report on Ecological Connectivity and Land Restoration, launched jointly by the UN Convention to Combat Desertification (UNCCD) and the Convention on the Conservation of Migratory Species (CMS), revealed that nearly one-third of the Earth's land surface has been profoundly transformed by human use.

Land degradation affects up to 40% of the planet, placing nearly half of humanity at risk. Deforestation, infrastructure expansion, and agriculture-driven fragmentation are rapidly diminishing ecological connectivity – essential for biodiversity and ecosystem resilience.

Loss of Natural Habitats

More than 60% of the world's rivers have been dammed or diverted, while road networks are expected to expand by 60% by 2050, intensifying habitat fragmentation. These pressures are eroding the capacity of ecosystems to regenerate. MoEFCC notes that habitat fragmentation and urban encroachment are key threats to over 680 native species listed under the Wildlife Protection Act (1972).

Species on the Edge – IUCN Red List Update

1,256 of 11,185 bird species (11.5%) are globally threatened. Of 1,360 reassessed bird species, 61% now show declining trends, a sharp rise from 44% in 2016. Six species have been officially moved to the Extinct category, including the Christmas Island shrew (*Crociodura trichura*) and slender-billed curlew (*Numenius tenuirostris*).

Warming Intensifies Arctic Threats

The hooded seal (*Cystophora cristata*) has been uplisted to Endangered. The bearded and harp seals are now considered Near Threatened, primarily due to melting ice and declining prey populations. Climate-linked habitat loss has made these species sentinels of the planet's warming trajectory.

India's Red List Updates – Signs of Distress

Four Indian bird species — key indicators of grassland health — have been uplisted –

1. Indian Courser (*Cursorius coromandelicus*) – Least Concern → Near Threatened;
2. Indian Roller (*Coracias benghalensis*);
3. Rufous-tailed Lark (*Ammomanes phoenicurus*);
4. Long-billed Grasshopper-Warbler (*Locustella major*);

According to MoEFCC's India Biodiversity Status Report (2024), Grassland ecosystems, once widespread across India, are among the most neglected biomes.

Protected Areas Under Pressure

The IUCN Outlook Report (2025) shows worrying trends in India's conservation zones –

Sundarbans National Park – Downgraded from Good with Some Concerns (2020) to Significant Concern (2025).

Manas National Park and **Western Ghats** – Continue under Significant Concern.

Kaziranga, Nanda Devi, and Keoladeo National Parks – Classified as Good with Some Concerns.

Deforestation, tourism, and climate stress are key drivers of this deterioration.

Equal Risks Beneath the Waves

The dugong populations in the Gulf of Kutch and Andaman and Nicobar Islands are nearing functional extinction, warns a 2025 Wildlife Institute of India (WII) report. In the Gulf of Mannar–Palk Bay, sightings have dropped by over 70% in a decade, largely due to trawling and seagrass bed destruction.

Green Shoots – Tiger Conservation as a Model

The IUCN's first Green Status Assessment for Tigers (*Panthera tigris*) highlights conservation-driven hope. Despite being critically depleted across its native range, proactive recovery in India, Bhutan, and Nepal shows that targeted conservation can restore populations. The Green Status complements the Red List by tracking species recovery and conservation success, providing a roadmap for future rewilding initiatives.

Policy and Global Action

India reaffirmed its commitment to the Global Biodiversity Framework 2030 and 30x30 conservation targets — protecting 30% of terrestrial and marine ecosystems by 2030. The National Mission on Biodiversity and Human Well-being, spearheaded by the Office of the Principal Scientific Adviser, aims to integrate biodiversity into climate adaptation and sustainable livelihoods. At the global level, the Congress endorsed a UN-backed Restoration Acceleration Platform, designed to support countries in scaling up land and species recovery efforts.

14. Soil Security – Existential Challenge of Humanity

At the recent IUCN World Conservation Congress, a historic step was taken toward protecting the soil by the adoption of 'Motion 007 – Soil Security Law' marked the first formal move to give soil security global legal recognition.

Defining Soil Security – Five Dimensions

Motion 007 defines soil security as, 'Responsible management and preservation of soil to ensure its continued ability to perform vital functions, provide essential ecosystem and biophysical services, and protect against emerging threats to support life on Earth'.

It outlines five guiding dimensions –

Capacity – The soil's ability to sustain life and provide ecosystem services.

Condition – The physical, chemical, and biological state of soil.

Capital – The economic and social value soil contributes to human welfare.

Connectivity – The interlinkages between soil, water, biodiversity, and climate systems.

These principles aim to guide nations in integrating soil health into environmental frameworks, shaping a potential Global Soil Convention.

Why Soil Matters More Than Ever

Soil is increasingly recognized as the eighth existential issue—alongside climate change, food and water security, biodiversity loss, energy transition, environmental maintenance, and human well-being. According to the UN Convention to Combat Desertification (UNCCD), if nations fail to act decisively, 16 million square kilometers of land could be severely degraded by 2050, with annual global economic losses exceeding US \$878 billion. Land degradation is already undermining the planet's capacity to sustain humanity. Over 33% of Earth's soils are degraded, affecting food production for billions. India alone loses 5.3 billion tonnes of soil annually due to erosion and poor land management, according to the Indian Council of Agricultural Research (ICAR, 2024).

Missing Link in Global Conventions

While the world has established international conventions for climate (UNFCCC), biodiversity (CBD), and desertification (UNCCD), soil has remained largely invisible in global governance. Healthy soil contributes directly to 12 of the 17 UN Sustainable Development Goals (SDGs) – from climate action (SDG 13) to ending hunger (SDG 2). The FAO's Global Soil Partnership and India's Soil Health Card Scheme focus on soil conservation is essential for sustainable food and water systems.

Building on Existing Frameworks

Many countries, including India, already align soil conservation programmes with climate and desertification frameworks. The National Mission for Sustainable Agriculture (NMSA) and the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) emphasize soil and water health integration. India's National Bureau of Soil Survey & Land Use Planning (NBSS&LUP) is working on soil carbon mapping to align with UNCCD Land Degradation Neutrality (LDN) goals. Motion 007 builds on these foundations, urging countries to re-orient policies to prioritize soil security at their core.

15. India's Wild Elephant Population Falls By 18% - DNA Census

Recently, India's first-ever DNA-based elephant census, developed by the Project Elephant Division of the MoEFCC, was released.

Key Findings of the DNA-Based Census

It was compiled using genetic samples from over 1,100 locations across 15 elephant range states, and estimates the current wild elephant population at 22,446. It has revealed a sharp 18% decline in the wild elephant population since 2017. Karnataka continues to host the largest number of wild elephants, followed by Assam and Kerala. The overall population shows a decline from approximately 27,312 in 2017 to 22,446 in 2025. The Eastern Himalaya and Northeast regions reported the steepest drops, with severe habitat fragmentation noted in parts of Assam, Arunachal Pradesh, and West Bengal.

Causes Behind the Decline

Habitat Fragmentation - Expanding infrastructure, rail lines, and human settlements have severely fragmented elephant corridors.

India's 101 identified elephant corridors are shrinking due to encroachments, agricultural expansion, and mining. It forces elephants to move through human-dominated landscapes, increasing encounters and casualties.

Human-Elephant Conflict - Between 2018 and 2023, official records show more than 2,500 human deaths and 500 elephant deaths due to conflict incidents. Elephants stray into farmlands in search of food, while retaliatory killings and electrocutions have surged. MoEFCC data highlights Assam, Odisha, and Tamil Nadu as the worst-affected states.

Poaching and Illegal Ivory Trade - Though large-scale ivory poaching has declined since the 1990s, there is a resurgence in small-scale poaching in parts of central and northeastern India. Increased demand from illegal trade networks and the use of snares for bushmeat pose a persistent threat.

Conservation Efforts and Policy Responses

Project Elephant and Corridor Protection - Initiated in 1992, Project Elephant aims to protect elephant populations, restore habitats, and reduce humanelephant conflict. Recent policy efforts include -

The National Elephant Action Plan (2023–2032) focusing on corridor restoration and coexistence models. Establishment of Elephant Reserves, such as the Agasthyamalai and Dandeli–Anshi reserves, to secure migratory routes. Implementation of the Gaj Yatra campaign by the Wildlife Trust of India to raise public awareness.

Use of Technology in Conservation – The DNA-based census marks a paradigm shift. Combined with satellite telemetry, AI-powered camera traps, and GIS-based conflict mapping, authorities hope to create a more adaptive conservation framework.

Road Ahead

1. Landscape-level conservation planning rather than isolated forest patches.
2. Community-based conflict mitigation, including early warning systems and crop insurance schemes.
3. Stronger anti-poaching surveillance and crossborder cooperation with Nepal, Bhutan, and Bangladesh.

16. Parbati–Kalisindh–Chambal (PKC) River Linking & Irrigation Project

The National Tiger Conservation Authority (NTCA) raised ecological concerns about the Parbati–Kalisindh–Chambal (PKC) river linking and irrigation project because of its proximity to the Kuno National Park.

About Parbati–Kalisindh–Chambal (PKC) River Linking Project

It is a pivotal component of India's National Perspective Plan for river interlinking, spearheaded by the Ministry of Jal Shakti and executed by the National Water Development Agency (NWDA). It aims to enhance water availability in droughtprone regions of Madhya Pradesh and Rajasthan by transferring surplus water from the Parbati and Kalisindh rivers to the Chambal basin.

Project Components

Patanpur Diversion Dam on the Parbati River – Transfers 464 million cubic meters (Mm³) of water via a 55.37 km canal (including 6.61 km tunnel);

Mohanpura Diversion Dam on the Newaj River – Transfers 403 Mm³ of water via a 73.17 km canal (with two tunnels totaling 4.39 km);

Kundaliya Storage Dam on the Kalisindh River – Receives water from Patanpur and Mohanpura and channels it to the Chambal basin;

Irrigation & Water Supply Benefits

1. Irrigate over 2.8 lakh hectares of agricultural land;
2. Provide drinking water to water-scarce regions;
3. Recharge groundwater and improve ecological balance;
4. Support industrial and urban water needs in Rajasthan and Madhya Pradesh;

Environmental Concerns – Threats to the Cheetah Habitat

The NTCA, which oversees tiger and other apex predator habitats, expressed concerns that largescale construction and deforestation near Kuno could disrupt the fragile grassland ecosystem vital for cheetahs' survival. The Kuno National Park, spread across 748 square kilometers, has been the focal point of India's cheetah reintroduction programme since 2022, hosting cheetahs translocated from Namibia and South Africa. Experts warn that habitat fragmentation due to the irrigation project could –

1. Disturb prey-predator balance;
2. Reduce corridor connectivity;
3. Increase human-wildlife conflicts;

17. Himachal's Plea for Forestland Rehabilitation

According to the Himachal Pradesh State Disaster Management Authority (HPSDMA), the state witnessed 47 cloudbursts and 148 major landslides, resulting in 468 deaths and the loss of 29,534 animals.

State Assembly's Unanimous Resolution

The Himachal Pradesh Legislative Assembly unanimously passed a resolution urging the Central government to declare the disaster a 'national calamity', and sought temporary rehabilitation

permissions on forestland, citing lack of alternative land for relocation. Under the Forest (Conservation) Act (FCA), 1980, diversion of forestland for non-forest purposes requires Central approval. Therefore, the state requested a special exemption under Section 2 of the FCA to allocate small plots—1 bigha (0.08 ha)—to families who lost their land.

Land Crunch – Forests as the Only Option

Data from the Union Ministry of Agriculture (2005) reveals that out of 4.547 million ha, only 12.21% is cultivable, while 24.06% is forested and 33.63% comprises pastures and grasslands. As per the India State of Forest Report 2021, 68.16% (37,948 sq km) of the state's total area is legally classified as forestland.

Gaps in Rehabilitation Framework

Himachal Pradesh lacks a formal rehabilitation policy, unlike neighboring Uttarakhand. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 can be applied to disaster related resettlement. However, implementation requires forest diversion clearance—again invoking FCA restrictions. Further, the National Disaster Management Act (NDMA), 2005 places responsibility for post-disaster rehabilitation on the Central government, involving data-driven processes like Memorandum of Loss and Damages (MLD) and Post-Disaster Needs Assessment (PDNA). The comprehensive impact data for the 2025 disaster will likely be available between October and December, as per NDMA protocols.

Climate Change and Himalayan Vulnerability

Climate change has amplified monsoon intensity in the Western Himalayas. The Indian Meteorological Department (IMD) notes that extreme rainfall events in Himachal have doubled since 2010, linked to increased moisture flux from the Arabian Sea. Unplanned urbanisation, road expansion, and hydropower tunnelling have weakened natural drainage and slope stability. According to the National Institute of Disaster Management (NIDM), over 1,500 villages in Himachal are now classified as “climate-sensitive zones” prone to landslides and flash floods.

Way Forward – Balancing Ecology and Human Need

Experts advocate a ‘temporary-use model’ for forestland—allowing low-impact, eco-sensitive settlements with reforestation commitments. Policy reforms could include –

1. Special exemption under FCA for disaster-induced rehabilitation.
2. Creation of a Himalayan Disaster Rehabilitation Fund jointly managed by NDMA and states.
3. Mandatory vulnerability mapping before resettlement.
4. Integration of afforestation and slope stabilization measures.

18. Warm-Water Corals – First Ecosystem to Collapse in a Warming World

The Global Tipping Points Report 2025 confirms the world has crossed its first ecological tipping point – the collapse of warm-water coral reefs. Widespread bleaching and mortality across tropical and subtropical seas mark the irreversible decline of these vital ecosystems.

Coral Tipping Points

According to the IPCC, a tipping point is a ‘critical threshold’ where minor changes trigger self-reinforcing, often irreversible shifts. Coral reefs, reliant on symbiotic algae (zooxanthellae) for nutrition and colour, are acutely temperature-sensitive. Once ocean heat exceeds their tolerance, corals expel algae, turning white – a process known as bleaching. Repeated and prolonged heatwaves since 2023 have triggered the fourth global bleaching event, affecting 85% of reefs across 80+ nations. Even resilient coral genera in the Great Barrier Reef (GBR) are now dying at unprecedented rates, with over 70% hard coral loss in parts of Queensland.

Other Tipping Points

Beyond reefs, the report warns of imminent thresholds –

1. Amazon and Boreal Forest dieback;
2. Collapse of Atlantic Meridional Overturning Circulation (AMOC);
3. Accelerated permafrost thaw;

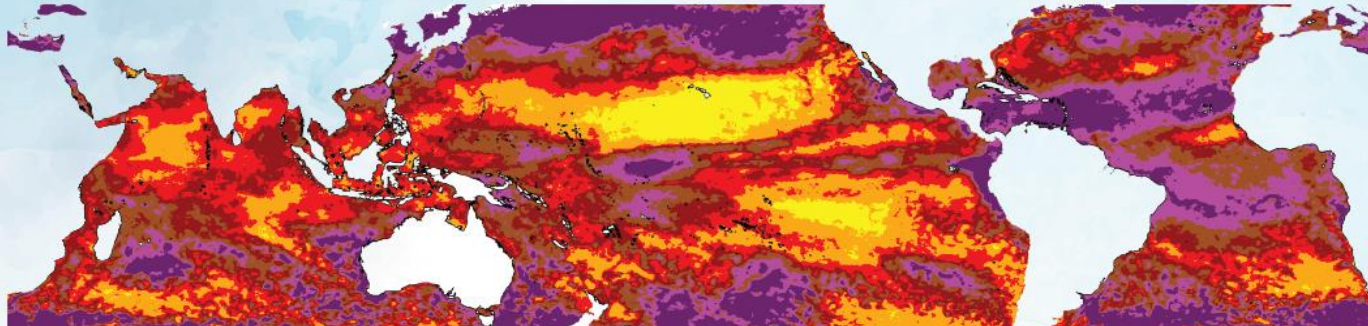
4. Mountain glacier retreat;

CORAL REEFS IN HOT WATER

The ongoing fourth global coral bleaching event is the biggest so far. Since January 1, 2023, bleaching-level heat stress has impacted 84.4 per cent of the world's coral reef area

□ No Stress □ Watch □ Warning □ Alert Level (AL) 1 □ AL2 □ AL3 □ AL4 □ AL5

NOAA CORAL REEF WATCH'S 5 KM BLEACHING ALERT AREA



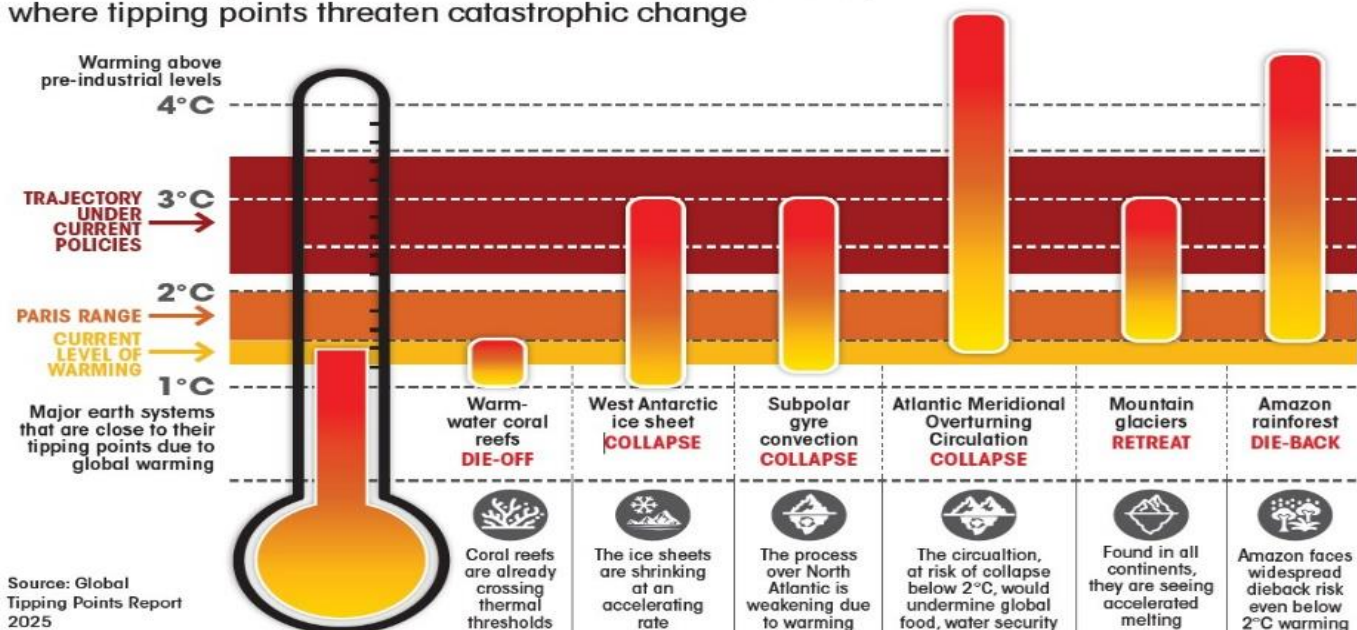
Note: This map displays the maximum accumulated heat stress experienced by coral reefs around the world from January 1, 2023, to September 20, 2025. The dark red and brown areas (AL 1 and AL 2) show the accumulated heat stress capable of causing reef-wide bleaching with mortality of heat-sensitive corals. The light brown (AL 3), pink (AL 4), and dark purple (AL 5) areas indicate locations where the magnitude of extreme heat stress exceeds the AL 2 threshold for bleaching, leading to multi-species or near complete mortality on a coral reef. Source: NOAA Coral Reef Watch

Global Impacts and Local Fallout

Warm-water coral reefs sustain nearly one billion people through fisheries, tourism, and coastal protection. Their collapse imperils livelihoods, food security, and biodiversity. In India, the Gulf of Mannar, Lakshadweep, and Andaman & Nicobar reefs – identified by the MoEFCC – have reported record bleaching since 2023, aligned with NOAA Coral Reef Watch alerts. Bleaching in Lakshadweep has become an annual event, with coral cover in Minicoy and Kavaratti falling by nearly 40% since 2018. The Gulf of Mannar Biosphere Reserve Trust noted rising disease incidence and coral rubble replacing live cover.

ESCALATED RISKS

Global warming has pushed the planet into a danger zone, where tipping points threaten catastrophic change



Great Barrier Reef and Beyond

In Australia, bleaching now occurs biennially across the GBR. Ocean warming of 1.5°C has reached unprecedented depths and durations. Even southern protected zones – once refuges – are

showing 'reef-to-rubble' transformation. Similar phenomena are reported in the Caribbean, where bleaching is now desynchronised from El Niño cycles.

Race to Save Corals

Cryopreservation and Bio-Banking – At the Taronga CryoDiversity Bank in Sydney, scientists collect coral spawn during annual spawning events for cryopreservation.

Even southern protected zones – once refuges – are showing 'reef-to-rubble' transformation.

Partnering with the Smithsonian Conservation Biology Institute and Reef Restoration and Adaptation Program (RRAP), researchers aim to reintroduce resilient coral breeds and restore genetic diversity.

Breeding Heat-Resilient Corals – Through assisted evolution and selective breeding, researchers cultivate coral varieties capable of tolerating higher temperatures.

Trials in the GBR show coral recruits produced using cryopreserved sperm survive as well as – or better than – those from fresh sperm.

Indian Coral Conservation Efforts – The National Coral Reef Research Centre (NCSCM) and Zoological Survey of India are implementing reef restoration using coral transplantation and artificial reef modules in the Gulf of Mannar and Lakshadweep. Under the National Adaptation Fund for Climate Change (NAFCC), India's 'Coral Restoration Initiative 2030' aims to restore 500 hectares of degraded reef using microfragmentation and larval rearing techniques.

Way Forward

Limiting global warming to below 1.5°C is imperative. Restoration can only buy time. There is a need for –

1. Rapid emission reductions under COP30 pledges;
2. Expanding marine protected areas (India's 2025 MoEFCC plan targets 30% coverage by 2030);
3. Investing in coral gene banking and community-based reef management;

19. Affordable Medicines in India

Indian courts and the Patent Office have taken decisive steps to prevent multinational drug companies from unfairly extending their monopolies through evergreening—the practice of making minor changes to existing drugs to claim new patents.

Legal Backbone – Section 3(d) of the Patent Act

At the heart of this shift lies Section 3(d) of the Indian Patents Act, 1970 – an innovative legal safeguard that bars new patents on known substances unless they show enhanced therapeutic efficacy. Added in 2005 to align with WTO obligations under the TRIPS Agreement, this clause ensures that incremental modifications without real clinical benefit cannot be patented. As the Department for Promotion of Industry and Internal Trade (DPIIT), Section 3(d) was designed to preserve the delicate balance between fostering innovation and protecting public access to affordable medicines. It has been repeatedly defended in domestic and international forums against lobbying from global pharmaceutical lobbies.

Judicial Endorsement of Public Health Over Monopoly

The Delhi High Court and Supreme Court of India have repeatedly emphasized that intellectual property rights cannot override constitutional guarantees under Article 21 (Right to Life). In line with this, India's National IPR Policy (2016) – explicitly commits to preventing abuse of the patent system through frivolous or repetitive filings.

India's Role in Global Generic Leadership

India's generics industry supplies nearly 60% of global vaccines and 20% of the world's generic medicines, as per Pharmaceuticals Export Promotion Council (PHARMEXCIL) data. By curbing evergreening, India reinforces its global image as the 'pharmacy of the developing world'—a phrase often used by the World Health Organization (WHO). Such decisions echo the landmark 2013 Supreme Court ruling against Novartis' cancer drug Glivec, where the court denied a new patent for lack of enhanced efficacy—establishing a precedent that continues to shape Indian pharmaceutical jurisprudence.

Way Forward – Strengthening Section 3(d) of the Patent Act

1. Regular scrutiny of patent applications to detect disguised evergreening.

2. Public transparency through mandatory disclosure of clinical data.
3. Faster judicial resolution of patent disputes to prevent prolonged monopolies.
4. Policy support for domestic innovation under India's Pharma Vision 2030.

20. Record Turtle Breeding Season at Delhi's Asola Bhatti Wildlife Sanctuary

The Asola Bhatti Wildlife Sanctuary in South Delhi has recorded its most successful turtle breeding season to date, marking a significant milestone in the city's conservation efforts.

About the Asola Bhatti Wildlife Sanctuary

Initially set up to shelter trafficked, injured, and rescued turtles, the camp now provides refuge to around 250 turtles spanning four native species –

1. Indian Flapshell Turtle (*Lissemys punctata*);
2. Indian Roofed Turtle (*Pangshura tecta*);
3. Black Pond Turtle (*Geoclemys hamiltonii*);
4. Yellow-Spotted Pond Turtle (*Geoclemys* spp.)

Eco-Restoration Measures – To enhance the living environment for the turtles, the Forest Department has introduced several habitat-improvement measures –

1. Native grasses and aquatic vegetation for natural feeding and cover;
2. Basking logs and sandy sun spots for thermoregulation and nesting;
3. Rock-lined pond edges to prevent erosion and provide secure resting zones;

A Model for Urban Biodiversity Conservation

The Asola Bhatti has become a critical biodiversity hotspot within the Ridge ecosystem, offering refuge not only to turtles but also to porcupines, monitor lizards, and over 200 bird species. The sanctuary's wetland restoration and antipoaching surveillance efforts have been key to reducing illegal wildlife trafficking and improving survival rates for rescued reptiles.

21. Global Land Outlook Report – Restoring Ecological Connectivity

The Global Land Outlook Thematic Report on Ecological Connectivity and Land Restoration, launched at the IUCN World Conservation Congress, underscores an urgent need to reconnect fragmented ecosystems worldwide.

Key Highlights

Serengeti-Mara Crisis – In the Serengeti-Mara, a transboundary landscape between Tanzania and Kenya, wildlife migrations once spanned vast open plains. Today, fences and expanding farmland are constraining these ancient migration routes. It jeopardizes the annual wildebeest migration, a keystone event for the region's ecological balance and one of Earth's last great natural spectacles. According to IUCN scientists, these disruptions could lead to severe declines in migratory species and alter the hydrological and vegetation dynamics of the region.

Land Degradation and Policy Gaps

Habitat fragmentation is a global pattern—not limited to Africa. India, for example, faces similar threats in –

1. The Aravalli hills, where encroachments restrict wildlife corridors.
2. The Western Ghats, where plantation expansion and infrastructure divide forests.

Unplanned linear infrastructure – roads, railways, and power lines – continues to break up vital ecological corridors.

Restoration Through Connectivity

The UNCCD-backed report stresses ecological connectivity as central to effective land restoration. Connectivity allows species to migrate, pollinate, and adapt to climate change. It suggests –

1. Rewilding degraded landscapes through native vegetation.
2. Community-managed buffer zones around protected areas.
3. Cross-border cooperation, especially for migratory routes shared by multiple nations.

India's Role and Commitments

The Government of India, through its National Land Degradation Neutrality Target (2030), aims to restore 26 million hectares of degraded land. Initiatives under CAMPA, Green India Mission, and Eco-

sensitive Zone declarations align with the report's recommendations. The National Biodiversity Authority (NBA) integrating connectivity into land-use planning can help prevent biodiversity loss and sustain ecosystem services vital for rural livelihoods.



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1. Infrastructure- India on the Fast Track to Viksit Bharat@2047

GS Paper III- Economic Development

Topic

1. Infrastructure- Energy, Ports, Roads, Airports, Railways, etc.
2. Investment Models.
3. Indian Economy and issues relating to planning, mobilization of resources, growth, development, and employment.

Introduction

Infrastructure acts as the backbone of productivity and competitiveness, serving as the primary engine for India's transition toward Viksit Bharat @ 2047. Through sustained public investment and integrated planning over the last decade, India has shifted from a fragmented approach to a holistic, technology-driven infrastructure ecosystem.

1. Economic Impact & Progress Indicators

Surge in Capital Expenditure (Capex)- Public investment has witnessed a massive jump from Rs 2 lakh crore (2014-15) to Rs 11.21 lakh crore (2025-26).

Global Competitiveness- India's rank in the World Bank's Logistics Performance Index (LPI) improved significantly from 44 (2018) to 38 (2023).

Economic Growth- Infrastructure spending supports India's status as the fastest-growing major economy, with a GDP growth projection of 6.5-6.6% for 2024-25.

2. Bharatmala Pariyojana (The Highway Revolution)

Overview- Launched in 2017 with an investment of Rs 8.5 lakh crore, it is India's largest highway program aimed at optimizing freight movement.

Targets vs. Achievements (Phase-I)

1. Target- 34,800 km.
2. Awarded- 26,425 km.
3. Completed (mid-2025)- 20,770 km.

Network Expansion

National Highways (NH)- Expanded by ~60%, growing from 91,287 km (2014) to 1,46,342 km (2025).

Construction Pace- Accelerated from 12 km/day (2014-15) to a robust 29-34 km/day post-2020.

Key Components

1. Development of Economic Corridors (8,737 km).
2. Construction of Expressways (2,422 km).
3. Border & International connectivity roads (1,619 km).
4. Port/Coastal connectivity roads.

Outcome- Logistics costs have declined from 16% to ~10% of GDP, moving closer to global benchmarks.

3. Expressways & Strategic Infrastructure

Greenfield Expressways- Focus on high-speed corridors to improve freight efficiency.

Status (2025)- 25 expressways announced (10,000 km); 6,669 km awarded; 4,610 km completed.

Beneficiary States- Maharashtra, Rajasthan, Uttar Pradesh, and Madhya Pradesh (promoting regional integration).

Strategic & Border Security- Dual-use infrastructure serving both economic development and strategic defense.

Iconic Projects

1. Atal Tunnel & Sona-marg Tunnel (Himalayan connectivity).
2. Bogibeel Bridge (Assam-Arunachal).
3. Maitri Setu (India-Bangladesh).

4. Sudarshan Setu (Gujarat).

4. Financing & Implementation Reforms

Core Challenges

1. Land acquisition delays.
2. Environmental clearances.
3. Funding gaps and contractor capacity issues.

Digital Interventions (Reforms)

1. Bhoomi Rashi Portal- Digitized and expedited land acquisition.
2. Parivesh Portal- Streamlined environmental clearances.
3. Adoption of online approvals and better inter-state coordination.

Innovative Financing

Asset Monetization- NHAI plans to raise funds through public InvITs (Infrastructure Investment Trusts).

Revenue Potential- Targeted revenue generation of Rs 15 lakh crore through asset monetization to bridge funding gaps.

5. Employment & Structural Transformation

Job Creation

1. Current employment in logistics- 22 million.
2. Projected additional jobs by 2027- 10 million.

Qualitative Shift- Focus on formalization, digitalization, and skilling to enhance productivity and leverage India's demographic dividend.

6. PM Gati-Shakti National Master Plan (2021)

Objective- Coordinated planning and execution of infrastructure projects to bring down logistics costs.

Mechanism

1. Integrates 57 ministries and 36 States/UTs.
2. Utilizes a GIS-based platform with 1,700+ data layers.

Six Guiding Principles

1. Integrated development.
2. Connectivity improvement.
3. Reduced ecological impact.
4. Expedited clearances.
5. Allied infrastructure planning.
6. Faster land acquisition.

Network Planning Group (NPG)

1. Conducted 100 meetings (till Oct 2025).
2. Evaluated 293 projects worth Rs 13.59 lakh crore to ensure multimodal connectivity.

7. National Logistics Policy (NLP), 2022

Role- Complements PM Gati-Shakti by focusing on "soft infrastructure" (process reforms, digitization, policy) rather than just physical construction.

Digital Platforms

1. ULIP (Unified Logistics Interface Platform)- For data integration.
2. LDB (Logistics Data Bank)- For tracking EXIM (Export-Import) cargo.

Vision- Create a trusted, resilient, cost-efficient, and technologically enabled logistics ecosystem.

Operational Framework

1. Executed through CLAP (Comprehensive Logistics Action Plan).
2. Focus areas- Regulatory reform, standardization, skilling, and performance monitoring.

8. Multi-Modal Logistics Parks (MMLPs)

Status- 35 MMLPs approved under Bharatmala.

Key Locations- Chennai, Nagpur, Indore, Bengaluru.

Goal- 5 operational by 2027; aimed at improving warehousing efficiency and enabling seamless modal shifts (Road-Rail-Water).

SMILE Programme (with ADB)- Focuses on "Integrated State and City Logistics Plans" to reduce costs at the local level.

9. Key Challenges in Logistics Sector

Modal Imbalance (Skewed Mix)

1. Roads- Carry 70–71% of freight (High cost/congestion).
2. Railways- Carry only ~18% (NITI Aayog, 2021).

MSME Burden- High logistics costs erode the profit margins and global competitiveness of MSMEs.

Unorganized Sector Dominance- 90% of logistics players are small/informal (KPMG, 2022), preventing economies of scale.

Digital Divide- Low tech adoption among small operators, especially in rural areas.

Regulatory Complexity- Issues with overlapping Centre–State rules and GST inconsistencies.

Skill Deficit- Lack of trained manpower for modern warehousing and multimodal operations.

10. The Way Forward

Rebalancing Modal Mix- Shift freight from road to rail and waterways to lower costs and carbon footprint.

Technological Integration

1. Use of automation (IoT, scanners).
2. End-to-end data integration via ULIP.
3. Adoption of app-based, on-demand warehousing.

New Business Models- Support for Omnichannel retail, Quick Commerce, and BOPIS (Buy Online, Pick-up In-Store).

Promote PPPs- Encouraging collaboration between startups and small fleet owners.

Case Study- Rivigo's AI-based route optimization reduced fuel use and travel time.

Regulatory Harmonization- Simplify licensing and ensure GST consistency across states.

Green Logistics- Push for energy-efficient fleets and sustainable warehousing to meet climate goals.

2. Indian Industries- Issues, Challenges and Opportunities

GS Paper III- Economic Development

Topic- Indian Economy and issues relating to planning, mobilization of resources, growth, development and employment.

Sub-Topic- Changes in industrial policy and their effects on industrial growth.

Introduction

India's industrial sector has undergone a massive structural shift since Independence. It has evolved from a base of small-scale handicrafts and textiles (pre-1947) to State-led industrialization (post-1950), and finally to Liberalization, Privatization, and Globalization (LPG) after 1991. Today, the sector spans diverse fields like electronics, defense, and renewable energy, and is increasingly integrated into global value chains.

1. Structural Profile of Indian Industry

GDP Contribution

Industry- Consistently contributes 28–30% of GDP.

Manufacturing- Accounts for 14–16%.

Construction- Accounts for 8–10%.

Sectoral Shift- Agriculture's share has dropped from ~50% to ~15%, while the Services sector now dominates employment and output.

Global Standing- India's share in global manufacturing remains below 2%, missing the 25% of GDP target set by the National Manufacturing Policy (2011).

Regional Disparity– Industrial growth is uneven across different states and regions, hindering inclusive development.

2. Post-1991 Reforms & Outcomes

The 1991 Policy– Abolished licensing, encouraged private players, and opened sectors to Foreign Direct Investment (FDI).

Positive Outcomes

1. Increased efficiency, modernization, and domestic competition.
2. Growth in capital-intensive and import-intensive industries.
3. Expansion of exports and integration with global supply chains.

Persistent Concerns

High Import Intensity– Exports often rely heavily on imported components.

Jobless Growth– Manufacturing has seen a decline in labor intensity.

Sectoral Skew– Over-reliance on specific sectors (e.g., Automobiles alone contribute nearly 50% of manufacturing output).

3. Key Challenges Facing Indian Industry

A. Fragmented Structure

MSME Dominance– 7 crore MSMEs make up ~99% of enterprises.

The Problem– While this aids entrepreneurship, it leads to small-scale, poor-quality control, and weak global competitiveness.

Dilemma– Balancing the need for large-scale production vs. preserving employment in small units.

B. Infrastructure & Logistics

High Cost– Logistics costs are ~14% of GDP (vs. 8–10% in developed nations).

Bottlenecks– Power shortages, transport delays, and unreliable supply chains reduce competitiveness.

C. Regulatory & Governance Issues

Complexity– No "one-size-fits-all" regulation exists due to the diversity of enterprises.

Ghost Companies– Nearly 1/3rd of 29 lakh registered companies is inactive, complicating oversight.

D. Cross-Subsidization Burden

Railways– High freight tariffs are used to subsidize cheap passenger fares.

Power– High industrial power tariffs subsidize agriculture and households.

Result– Industries shift freight to roads and build captive power plants, reducing efficiency.

E. Environmental & Social Constraints

Closures– Plants often face closure due to environmental violations (e.g., Sterlite Copper).

Pharma Gap– Closure of Pharma PSUs has increased dependence on imported bulk drugs (APIs).

F. Employment & Informality

Unorganized Sector– Employ Over 85% of the workforce, leaving them without social security.

G. Technology Gaps

Industry 4.0– Adoption requires high capital and skilled labor, which is difficult for MSMEs to afford.

4. Emerging Opportunities

Demographic Dividend– One of the world's youngest workforces ensures a large labor pool and strong domestic demand.

New Tech & Models (Industry 4.0)– Use of AI, IoT, Robotics, and 3D printing. Shift from "product ownership" to "service-based" models.

Green Manufacturing– High growth potential in EVs, renewable energy, and battery storage, aligning with climate goals.

Policy Support

PLI Scheme (2020)– Covers 14 sectors; attracted Rs 1.76 lakh crore investment and created 12 lakh jobs.

Semiconductor Mission– Rs 76,000 crore support to boost electronics.

Defense– Rising manufacturing and exports are adding depth to the sector.

Infrastructure Push

Projects- National Infrastructure Pipeline (NIP), Bharatmala, Sagarmala, and Dedicated Freight Corridors (DFCs).

Corridors- Development of Industrial Corridors like Delhi-Mumbai Industrial Corridor (DMIC).

Port Capacity- Target expansion to 10,000 MTPA.

5. The Way Forward

1. Competitiveness- Focus on scale, standardization, and strict quality control.
2. Skilling- Align workforce skills with Industry 4.0 and automation.
3. Logistics- Reduce costs through multimodal transport (Rail-Road-Water integration).
4. Export Focus- Promote capital-intensive sectors like defense for exports.
5. Flexible Regulation- distinct regulations for small vs. large enterprises.
6. 'Brand India'- Establish India as a symbol of quality while allowing inefficient firms to exit naturally.

Conclusion

India is transitioning from a service-led, consumption-driven economy to a balanced industrial powerhouse. By leveraging the National Manufacturing Mission, robust policy support (PLI), and infrastructure upgrades, India aims to fix structural constraints. If successful, Indian industry will emerge as a resilient, globally competitive engine driving inclusive growth and the vision of Viksit Bharat.

3. Education for the Next Century

GS Paper II- Social Justice & Governance

Topic- Issues relating to development and management of Social Sector/Services relating to Health, Education, Human Resources.

Sub-Topic- Skill Development, National Education Policy (NEP) 2020, and Government Policies for development.

GS Paper III- Economic Development

Topic- Employment and Inclusive Growth.

Introduction

India sits on a historic demographic opportunity with a large working-age population and a low dependency ratio. However, the central challenge is converting this "demographic bulge" into a "dividend" by ensuring sustained employability and decent jobs, moving beyond simple enrolment numbers to actual skill acquisition.

1. The Changing Nature of Work

21st Century Reality- Characterized by rapid tech changes and shorter skill life-cycles.

New Requirements- High demand for soft skills and adaptability.

Paradigm Shift- The boundary between education and work is blurring; the focus has shifted from "front-loaded education" (learning only in youth) to "Lifelong Learning".

2. NEP 2020- The Conceptual Foundation

Core Philosophy- Focuses on "Learning how to learn" rather than rote memorization.

Removing Silos- Eliminates hard separations between

- a) Arts and Sciences.
- b) Vocational and Academic streams.
- c) Curricular and Co-curricular activities.

Goal- To create a flexible skills ecosystem where adaptability is valued over static degrees.

3. National Credit Framework (NCF)

Unified System- Developed jointly by UGC, AICTE, and NCVET to integrate School, Higher Education, and Skilling.

Micro-Credentials- Recognizes short, focused certifications (e.g., a specific solar safety module) that align with industry needs.

Credit Accumulation– Allows students to "stack" these small credits to earn larger qualifications (Degrees/Diplomas) over time.

Benefit– Prevents fragmentation of learning; a technician can upgrade skills incrementally without restarting education.

4. Quality Assurance (NCVET)

Regulator– The National Council for Vocational Education and Training (NCVET) acts as the quality watchdog.

Standardization– Sets "National Occupational Standards" and guidelines for micro-credentials.

Credibility– Mandates industry validation and assessment norms to ensure certificates are a "trusted currency" for employers, addressing the issue of poor recognition (ILO, 2025).

5. Institutional Modernization– Upgrading ITIs

Transformation– Converting Industrial Training Institutes (ITIs) into "Centres of Excellence" with modern simulators and industry-aligned curriculum.

PMSETU Scheme (Approved May 2025)

- a) Goal– Upgrade 1,000 Government ITIs.
- b) Establish– 5 National Centres of Excellence for Skilling.
- c) Funding– Enables multi-source financing and industry collaboration.

Impact– Improves placement wages and supports MSMEs with shared testing facilities.

6. Digital Public Infrastructure (Skill India Digital Hub)

Integration– A unified platform for courses, assessments, credentials, and job discovery.

Smart Features– Provides digitally verified, portable learner profiles. Offers Smart Career Guidance (e.g., guiding a machine operator to become a 3D printing technician).

Target Groups– Critical for women re-entering the workforce and workers transitioning to Green/Digital economy jobs.

7. Way Forward

Shift in Metrics– Move from counting "number of people trained" to measuring real outcomes

- a) Skill acquisition levels.
- b) Job placement rates.
- c) Wage growth and productivity.

Execution– Ensure education aligns with real-world workplace experiences.

Conclusion

India is dismantling the traditional divide between "learning" and "earning" by integrating Micro-credentials, Modern Institutions (PMSETU), and Digital Infrastructure. These reforms are moving from intent to execution. If implemented effectively with a focus on outcomes, this ecosystem will secure India's demographic dividend, boost industrial productivity, and drive the transition to an innovation-led economy.

4. India's Quantum Leap in the Global Innovation Landscape

GS Paper III– Economic Development & Science and Technology

Topic–

1. Indian Economy and issues relating to planning, mobilization of resources, growth, development and employment.
2. Indigenization of technology and developing new technology.
3. Effects of liberalization on the economy.

Introduction

India has achieved a historic milestone in the global innovation landscape, jumping 42 positions in the Global Innovation Index (GII)—from Rank 81 (2015) to Rank 38 (2025). This makes India the fastest-

improving large economy, the top innovator in Central and Southern Asia, and an "innovation overperformer" relative to its GDP per capita.

1. Global Innovation Index (GII) Performance

Published by- WIPO, Cornell University, and INSEAD.

Metrics- Evaluates 139 economies on 80 indicators (Inputs vs. Outputs).

India's Strength- Ranks 22nd globally in "Knowledge and Technology Outputs," highlighting its efficiency in converting inputs into tangible results.

2. Policy Architecture & Startup Ecosystem

Startup India (2016)

Reforms- Single digital portal for ease of entry, tax exemptions for the first 3 profitable years, and a Rs 10,000 crore Fund of Funds.

Growth- Recognized startups grew from ~500 (2016) to Over 1.61 lakh (2025).

Impact- Created ~17 lakh jobs.

Inclusivity- ~51% of new startups are from Tier-2 and Tier-3 cities.

Insolvency and Bankruptcy Code (IBC)- Improved the "exit mechanism," encouraging entrepreneurial risk-taking. Accounted for 48% of bank recoveries in FY24 with a recovery rate of 32–33%.

3. Digital Public Infrastructure (DPI) as Enabler

Foundation- The Digital India Mission (2015) built the "India Stack" (Aadhaar, UPI, Open APIs).

Democratization-

UPI- Processed Rs 24.9 lakh crore in transactions (Sept 2025).

ONDC- Enabling inclusive digital commerce.

Account Aggregators- Facilitating MSME lending.

Global Leadership- This digital backbone supports micro-entrepreneurs and has propelled India to Rank 1 globally in ICT services exports.

4. Manufacturing & R&D Integration (PLI Scheme)

PLI Scheme (2020)- Covers 14 sectors; mobilized Rs 1.76 lakh crore investment and created 12 lakh jobs.

Sectoral Success

Electronics- 146% surge (Rs 2.13 lakh Cr to Rs 5.25 lakh Cr).

Telecom- Achieved 60% import substitution.

Drones- Sector expanded seven-fold.

Strategic Shift- With PLI 2.0 and the Rs 1 lakh crore RDI Scheme, India is shifting focus from "Make in India" to "Design, Invent, and Make in India".

5. Education, Research & Knowledge Creation

NEP 2020- Promotes interdisciplinary, research-driven learning.

Funding- Anusandhan National Research Foundation (ANRF) established with Rs 50,000 crore.

Outcomes

Rank 3rd globally in research publications (Output up 142% since 2015).

PhD Enrolment- Doubled to 2.34 lakh.

Gender Parity- Female enrolment increased by 135.6%.

IP Awareness- Programs like KAPILA are aligning higher education with industry IP needs.

6. Institutional Capacity & IP Ecosystem

Infrastructure- Established 42 new Central Higher Educational Institutions since 2014. Rs 11,828 crore approved to expand 5 new IITs (adding 6,500 seats).

Atal Innovation Mission (AIM)- Set up 10,000 Atal Tinkering Labs in schools. Incubated 3,500+ startups, generating 32,000 jobs.

Intellectual Property (IP)- Rank 6th globally in patent filings (64,480 in 2023).

Indigenization- 55.2% of filings are now by domestic residents, signaling homegrown innovation.

7. Way Forward

R&D Spending- Increase Gross Expenditure on R&D (GERD) from 0.7% to 2% of GDP.

Collaboration- Deepen participation of the private sector and promote MNC-Startup-University co-innovation.

Decentralization- Expand innovation hubs to the district level and push DPI/ONDC to the hinterlands (Vocal for Local).

Commercialization- Accelerate the process of turning patents into marketable products.

Conclusion

India's ascent in the GII represents a structural transformation driven by coordinated reforms in Policy, Digital Infrastructure, and Education. By sustaining these investments and decentralizing the ecosystem, India is transitioning from a "technology adopter" to a "Global Innovation Originator," capable of shaping solutions for the 21st century.

5. NISAR- Science from Orbit, Impact on Earth

GS Paper III- Science and Technology

Topic

1. Awareness in the fields of Space, Computers, Robotics.
2. Indigenization of technology and developing new technology.
3. Disaster and Disaster Management.

Introduction

NISAR (NASA-ISRO Synthetic Aperture Radar) is a Low Earth Orbit (LEO) Earth-observing satellite. It represents the largest-ever civil space collaboration between ISRO and NASA. Launched on 30 July 2025 by GSLV Mk-II (F16), it is placed in a Sun Synchronous Polar Orbit (SSPO) at an altitude of 747 km.

1. Mission Capabilities

Global Mapping- Maps the entire globe every 12 days.

Data Consistency- Generates spatially and temporally consistent data.

Key Monitoring Areas- Ecosystems, ice mass, vegetation biomass, sea-level rise, groundwater, and natural hazards (earthquakes, tsunamis, volcanoes, floods, landslides).

2. Payload and Technological Innovation

Dual-Band SAR- Equipped with two radar frequencies for all-weather, day-night imaging (penetrates clouds/darkness)-

L-Band- Produced by NASA (Better for thick vegetation/forests).

S-Band- Produced by ISRO (Better for crop monitoring/soil moisture).

Sweep SAR Technology- First global mission to use this, enabling a massive swath of ~240 km while maintaining high resolution.

Hardware- Features a massive deployable 12-meter reflector and boom.

Spacecraft Bus- Uses ISRO's 13K bus with advanced power, thermal management, and High-Data-Rate downlink.

Protection- Includes an indigenously developed shield to protect the fuel tank from micrometeoroids and orbital debris.

3. Science Applications Over India

Given India's diverse topography and disaster vulnerability, NISAR provides specific benefits-

Disaster Management

Rapid Response- Capable of rescheduling observation within 24 hours and delivering data within 5 hours.

Flood/Inundation- Mapping at high resolution.

Cryosphere (Ice) Monitoring

Himalayas & Antarctica- Monitors deformation every 12 days at ~100m scale.

Specifics- Tracks glacier faces, wet snow cover, and sea-ice drift near Indian Antarctic stations.

Agriculture & Ecology

1. Crops- Monitors growth and soil moisture at 100m resolution.
2. Mangroves- Annual mapping of India's cover at 25m resolution.
3. Forests- Maps above-ground biomass and disturbances at hectare scale.

4. Joint Collaboration & System Integration

The mission is a perfect blend of capabilities

NASA Contribution- Boom-reflector system and L-Band Radar.

ISRO Contribution- Satellite Bus (UR Rao Satellite Centre) and S-Band Radar.

Joint Effort- The Integrated Radar Instrument (IRIS) was jointly developed by JPL (NASA) and SAC (ISRO).

Testing- involved four stages, harmonizing design philosophies and standards over a decade of cooperation.

5. In-Orbit Deployment and Operations

Post-Launch- Successfully deployed solar panels and established Earth-pointing orientation.

First Light- Achieved in August 2025 for both S-SAR and L-SAR.

Data Volume- Expected to generate ~80 TB of data during its science phase.

- a) L-band data- Downlinked at NASA stations.
- b) S-band data- Downlinked at ISRO stations.

6. Strategic and Governance Relevance

Resilience- Strengthens India's disaster preparedness and climate resilience.

Resource Management- Aids in water and agricultural planning.

Global Role- Enhances India's contribution to global climate monitoring and Sustainable Development Goals (SDGs).

Science Diplomacy- Positions India as a credible partner in high-end, complex space technologies.

Conclusion

NISAR marks a quantum leap in Earth observation by combining cutting-edge Sweep SAR technology with deep institutional collaboration. It translates orbital science into actionable insights for disaster management and climate action, showcasing the maturity of the ISRO-NASA partnership in solving global challenges.

KURUKSHETRA

1. Khadi- Innovation, Sustainability and India's Textile Renaissance

This chapter traces Khadi's journey from a historical symbol of resistance to a modern, eco-conscious textile.

Concept & Significance

Khadi is a hand-spun and handwoven fabric made from natural fibers like cotton, silk, or wool. It is characterized by breathability, thermal versatility (cool in summer, warm in winter), and an extremely low carbon footprint. Beyond a textile, it generates rural employment and empowers women artisans.

Historical Evolution

Ancient Roots- Archaeological findings at Mohenjo-Daro suggest early handwoven textiles. Chanakya's *Arthashastra* (Mauryan period) references organized textile production.

Freedom Struggle- Gained political significance in 1918 when Mahatma Gandhi launched the Khadi Movement to resist colonial economic exploitation. The *charkha* became a symbol of *Swadeshi* and self-reliance.

Institutional Framework

The Khadi and Village Industries Commission (KVIC) was established under the KVIC Act of 1956 to promote the sector. Its mandate includes supplying raw materials, improving techniques, quality control, and marketing.

Renaissance & Innovation

Designer Revival- In the late 1980s-90s, designers like Ritu Kumar repositioned Khadi as a premium, artisanal fabric.

Material Innovation- New blends with bamboo, hemp, Tencel, and silk improve durability and drape.

Tech Interventions- Solar-powered dyeing units and improved charkhas enhance productivity while preserving the handmade character.

Global Context- While the global fashion industry is water-intensive and polluting, Khadi offers a sustainable alternative with minimal electricity usage and a low carbon footprint.

2. Khadi- Strengthening the Rural Economy and India's Journey Towards Self-Reliance

This chapter focuses on the economic performance, employment generation, and government schemes supporting the sector.

Economic Milestones (2024-25)

Turnover- The sector achieved a historic turnover of ₹1.70 lakh crore.

Growth (Last Decade)

1. Production- Increased by 347% (from ₹26,109 crore in 2013-14 to ₹1,16,599 crore).
2. Sales- Increased by 447% (from ₹31,154 crore to ₹1.70 lakh crore).
3. Employment- Supports 1.94 crore people, reflecting a 49% growth over the decade.

Women Empowerment- Women constitute 80% of Khadi artisans. In training programs, 57.45% of the 7.43 lakh trainees were women. Artisan wages have increased by 275% in the last 11 years.

The "3P Approach"- The Ministry of MSME follows the Protect, Promote, and Propel strategy to modernize production and expand markets.

Key Government Schemes

1. PMEGP- Promotes micro-enterprises; established over 10 lakh units creating 90 lakh jobs.
2. SFURTI- Cluster-based regeneration of traditional industries.
3. Khadi Gramodyog Vikas Yojana (KGVY)- Provides budgetary support and infrastructure.
4. MMDA (Modified Market Development Assistance)- Deregulates pricing for market competitiveness.
5. ISEC- Offers concessional loans (4% interest) for working capital.

3. Khadi as a Driver of Sustainable Agriculture

This chapter connects Khadi to the agrarian economy, highlighting the "Farm-to-Fabric" linkage.

Farm-to-Fabric Linkage

Khadi sources raw materials directly from agriculture- Cotton (farms), Silk (sericulture), Wool (sheep rearing), and Jute. This creates an ecosystem that supports farmers, spinners, weavers, and allied workers.

Livelihood Security

Provides off-season employment to farmers, reducing vulnerability to crop failures and climatic shocks. It offers income diversification for small and marginal farmers.

Sustainability & Climate Action

Eco-friendly Practices- Uses organic cotton, natural dyes, and minimal water.

Net Zero- Aligns with India's Net Zero 2070 goals due to negligible carbon emissions from hand-spinning.

Millet Mission- Integration with the Millet Mission (Shree Anna) strengthens climate-smart livelihoods in dry regions.

Digital & Market Expansion

1. e-Khadi platforms enable direct artisan-to-consumer sales.
2. Solar Charkha Mission promotes renewable energy in production.
3. Global Reach- Khadi trademarks are registered in 15 countries; exports stood at ₹37.88 crore (2023-24).

4. Khadi- Eco-friendly Textile and Living Cultural Heritage

This chapter emphasizes the environmental benefits and the need to preserve Khadi as a living heritage.

Eco-Friendly Production

Low Energy- Manual production eliminates dependence on heavy machinery.

Biodegradable- Natural fibers avoid microplastic pollution, unlike synthetic fabrics.

Circular Economy- Follows zero-waste principles where fabric scraps are reused for paper and quilts.

Challenges in the Sector

Competition- From cheap, machine-made fabrics and fast fashion.

Authenticity- Threat from machine-made imitations; need for stricter "Khadi Mark" certification.

Skill Gap- Younger generations moving away from manual crafts.

Scalability- High production costs limit mass-market reach.

Way Forward

Design Modernization- Innovate designs while maintaining cultural integrity.

Heritage Tourism- Integrate Khadi craft villages into heritage tourism circuits.

Global Branding- Promote the "eco-friendly narrative" to appeal to conscious global consumers.

GS Paper- GS Paper I- History, Culture

GS Paper III- Economic Development, Agriculture, Environment

Topic

GS I- The Freedom Struggle (Swadeshi Movement); Indian Culture (Heritage Crafts).

GS III- Inclusive Growth; Major crops-cropping patterns; Food processing and related industries in India (scope and significance); Conservation and Environmental Pollution (Sustainable Development).

Sub-Topic- Khadi and Village Industries (KVI), Rural Economy, Sustainable Textiles, Women Empowerment, Government Schemes (PMEGP, SFURTI).

DOWN TO EARTH

1. Promise And Paradox of Rooftop Solar Power

Context

Despite the technological and environmental promise, the transition to rooftop solar has not scaled up as expected in India, because of the deep structural challenge of integrating solar energy into existing power systems.

Solar Power in India

India has an ambitious goal of achieving 500 GW of renewable energy capacity by 2030, with 280 GW expected from solar. Within this, rooftop solar (RTS) — decentralized power generated on residential and commercial buildings — emerges as both a promise and a paradox. It faces systemic hurdles that challenge its scalability, while it promises democratized energy access and reduced carbon footprint.

Promise- Democratizing Energy Generation

Decentralized Energy Access- According to the MNRE, rooftop solar installations empower consumers to become 'prosumers'—both producers and consumers of energy. It reduces transmission losses and strengthens grid resilience.

Environmental and Economic Benefits- A 1 kW rooftop solar system can offset around 1.2 tonnes of CO₂ per year, contributing substantially to India's Nationally Determined Contributions (NDCs). Furthermore, RTS offers long-term savings—reducing household electricity bills by 30–40%.

Job Creation and Local Economies- MNRE reports indicate that every megawatt of rooftop solar installed creates around 24 direct jobs—far higher than centralized coal or hydro projects. It includes opportunities for local technicians, electricians, and maintenance services.

Paradox- Potential vs. Reality

Lagging Behind Targets- Despite a target of 40 GW by 2022, as per Central Electricity Authority, only 11 GW has been achieved. The reasons are multifold—policy inconsistency, poor implementation, and limited consumer awareness.

Financial Barriers- Even with government subsidies under schemes like the Grid Connected Rooftop Solar Programme (Phase II), upfront installation costs remain prohibitive for middle-class households. Financial institutions often perceive RTS loans as high-risk, limiting credit flow.

Distribution Companies' (DISCOMs) Reluctance- DISCOMs view rooftop solar as a threat to revenue. Reduced electricity consumption from grid-connected customers affects their financial stability, leading to delays in net-metering approvals and cumbersome bureaucratic procedures.

Technological and Maintenance Challenges- Issues like poor panel quality, inefficient inverters, and lack of skilled maintenance services affect long-term system reliability—dampening public confidence in rooftop solar projects.

Integration Challenge- As per the CEA, India's power demand during evening hours (6 pm–11 pm) accounts for nearly 30% of daily consumption, precisely when solar power is unavailable. Without efficient storage or pricing mechanisms, this imbalance puts pressure on distribution companies (discoms).

Kerala's Case Study

The Kerala State Electricity Board (KSEB) has installed 1.5 GW of rooftop solar, covering 2% of households. It exposed the financial vulnerability of utilities while celebrated as a success. The Kerala State Electricity Regulatory Commission (KSERC) introduced new rules requiring mandatory battery storage for systems above 10 kW, scaling up over time to include smaller setups. It aims to ease grid pressure by encouraging local storage and peak-hour supply. However, it raises installation costs, potentially discouraging middle-class adoption. According to the International Energy Agency (IEA), distributed solar systems could meet up to 45% of global electricity demand by 2050—if integrated with smart grids and affordable storage. Without these, excess daytime generation and inadequate nighttime supply could destabilize national grids.

Building the Solar Future

India and other nations need to rethink how electricity systems are designed to make rooftop solar truly transformative. Some key steps include

Grid Modernization- Smart meters and dynamic pricing to reflect real-time demand.

Battery Incentives- Subsidies or tax rebates to reduce upfront storage costs.

Peer-to-Peer Trading- Allowing local power exchange between solar homes and businesses.

Decentralized Mini-Grids- Especially in rural areas without reliable grid connectivity.

Tariff Reforms- Encouraging power use during daylight and disincentivizing heavy nighttime consumption.

2. India's Climate Catastrophe- PLOS Climate

Context

A recent study published in PLOS Climate warns that India is on track for catastrophic climate events, with multiple systems — atmospheric, oceanic, and cryospheric — undergoing alarming transformations.

Key Findings

India's average temperature has risen by 0.9°C between 2015–2024, compared to the 1901–1930 baseline. The frequency and duration of heatwaves have increased significantly, with most regions now experiencing 5–10 more 'Warm Days' per decade. 2024 alone witnessed more than 200 heatwave days across India, with states like Rajasthan, Gujarat, and Uttar Pradesh recording temperatures above 47°C. Urban heat islands have further exacerbated local warming due to unplanned construction and dwindling green cover.

Monsoon in Disarray- The southwest monsoon, the backbone of Indian agriculture, is becoming erratic. Extreme precipitation events have intensified in central India and coastal Gujarat, while mean rainfall has declined across the Indo-Gangetic plains and the Northeast. 2023 saw record-breaking rainfall anomalies, with floods in Himachal Pradesh and droughts in Bihar within the same season — a paradox that reflects the growing instability of the monsoon system. Climate models now project a 6–8% rise in all-India mean monsoon rainfall by 2050, driven by increased moisture in a warmer atmosphere.

Warming Oceans- The tropical Indian Ocean, which plays a critical role in shaping India's climate, is heating at 0.12°C per decade — faster than the global average. The PLOS Climate paper projects that marine heatwaves could last for nearly 200 days annually by 2050, compared to just 20 days in the recent past. These heatwaves have already led to coral bleaching in the Lakshadweep and Andaman Islands and are disrupting monsoon circulation patterns.

Melting Himalayas- The Hindu Kush Himalaya is warming at 0.28°C per decade, nearly twice the global rate. The study projects a 30–50% reduction in glacier volume by 2100, even under moderate warming scenarios (1.5–2°C). It has grave implications for water security — rivers such as the Ganga, Brahmaputra, and Indus, which sustain over 700 million people, depend heavily on glacial melt.

Human and Economic Toll- India lost over 3,000 lives to extreme heat in the last five years, and the World Bank estimates climate-related losses could cost India up to 2.8% of its GDP annually by 2050. Urban centers face heat stress and air pollution, while rural communities grapple with crop failures and groundwater depletion. India's food security is at risk, with wheat and rice yields projected to decline by 10–15% under current warming trends.

Way Forward

An integrated approach combining climate-resilient agriculture, early warning systems, urban green planning, and renewable energy expansion. India's updated National Action Plan on Climate Change (NAPCC) must prioritize local adaptation, not just mitigation. Community-led water management and afforestation efforts — as seen in parts of Maharashtra and Rajasthan — show promise, but scaling them nationally remains a challenge.

3. India's Draft Seeds Bill, 2025

Context

Recently, the Union government's Draft Seeds Bill, 2025 seeks to 'modernize and digitize' the seed sector, while farmer groups and seed keepers see it as a threat to traditional practices and community rights.

Background- Policy Context

The Bill revises the long-pending Seeds Bill, 2019, which itself was meant to replace the Seeds Act of 1966. The 2025 draft aligns with the Centre's push toward digital governance and agri-standardization, complementing schemes like Digital Agriculture Mission and PM Kisan Samriddhi Yojana. However, it is argued that such policies prioritize market efficiency over seed sovereignty and agrobiodiversity.

Key Provisions of the Bill

Mandatory Seed Registration- All seed varieties—domestic or imported—must be registered with the Centre, except farmers' traditional varieties and seeds produced exclusively for export.

Value for Cultivation and Use (VCU) Testing- Only varieties passing VCU tests, which assess performance, yield, and adaptability, can be approved for sale. The bill mandates minimum standards for germination, purity, and seed quality.

Dealer Registration- Seed dealers, producers, and distributors must obtain a state-issued registration certificate before engaging in seed trade, import, or export.

Digital Traceability- Every seed container must carry a QR code generated through the Centre's Seed Traceability Portal, ensuring end-to-end tracking and verification.

Concerns from the Ground

Threat to Community Seed Systems- Farmer organizations warn that the Bill categorizes community seed groups, including Farmer Producer Organisations (FPOs) and women's seed collectives, as commercial entities, bringing them under the same regulatory obligations as corporate seed firms.

Bias Toward Hybrid Varieties- VCU trials often favour uniform, high-input hybrid varieties typically produced by large agribusinesses. It marginalizes indigenous, open-pollinated, and climate-resilient varieties, which may perform well in diverse local conditions but not under standardized testing.

Digital Divide and Compliance Burden- Mandatory digital reporting through the Seed Traceability Portal poses challenges for smallholder farmers and rural seed keepers with limited internet access or digital literacy. Rural seed producers fear exclusion from the formal system due to 'digital-heavy compliance norms.

Lack of Farmer Representation- The Bill does not clearly specify mechanisms for farmer participation in the registration or testing process. Farmer unions demand local-level consultation and the inclusion of traditional knowledge holders in decision-making.

Environmental and Economic Implications- India's informal seed sector—dominated by farmer-to-farmer exchanges—supplies nearly 60% of all seeds used. Overregulation could disrupt these informal networks, potentially increasing dependence on commercial seed companies and narrowing the genetic base of cultivated crops. Moreover, the shift to centralized digital systems raises questions about data privacy, seed patenting, and corporate control over agricultural information.

Public Consultation and the Way Forward

The Bill is open for public comment until December 11, 2025. Civil society organizations urge the government to Exempt smallholder and community seed exchanges from licensing. Create region-specific VCU criteria for diverse agro-climatic conditions. Ensure digital inclusion through local-language interfaces and offline mechanisms. Establish a National Farmers' Advisory Council to oversee seed governance.

4. Global Rise and Risks of Ultra-Processed Foods

Context

According to a three-part series in The Lancet published recently, the ultra-processed food (UPF) corporations have embedded themselves deeply into scientific research, policy-making, and public health narratives—often under the guise of 'stakeholders.

Ultra-Processed Foods (UPFs)

UPFs are industrial formulations made from cheap food-derived ingredients, additives, and preservatives. These include chips, biscuits, carbonated drinks, and ready-to-eat meals, often engineered for hyper-palatability and long shelf life. UPFs are designed to replace traditional diets and maximize profit margins, unlike minimally processed foods. Such products dominate global markets due to aggressive marketing, convenience, and affordability, especially in low- and middle-income countries.

Health Consequences

Scientific consensus increasingly links UPF consumption to chronic non-communicable diseases (NCDs), including

1. Obesity and Type 2 Diabetes;
2. Hypertension and Cardiovascular Diseases;
3. Chronic kidney disease;
4. Gastrointestinal and metabolic disorders;

Regular consumption of UPFs contributes to gut microbiome imbalance, promoting inflammation and metabolic dysfunction. Moreover, the hidden sugar, salt, and fat content often exceeds WHO-recommended limits.

India's Emerging Challenge

In India, UPFs are gaining rapid market share, particularly among urban and adolescent populations. About 68% rise in packaged snack consumption between 2011 and 2021, correlating with an increase in childhood obesity and early-onset diabetes. Experts warn that UPF industries are replicating tobacco-style tactics—funding misleading studies, sponsoring sporting events, and rebranding products as 'healthier alternatives.

Policy and Global Health Implications

Independent research funding free from corporate influence; Front-of-pack warning labels for UPFs; Stricter regulation of food marketing to children; Fiscal policies (taxes/subsidies) to promote fresh foods; Governments need to resist industry lobbying and prioritize public health over profit to prevent UPFs from overwhelming food systems worldwide.

5. Reclaiming the Ravines- Chambal's Badlands

Context

The ravines of the Chambal River—spanning Rajasthan, Madhya Pradesh, and Uttar Pradesh are reshaping both the landscape and its fragile ecosystems.

Overview- Chambal Ravines

The Chambal Ravines are a unique geomorphological feature formed by severe gully erosion along the Chambal River basin (a tributary of the Yamuna). The process is largely anthropo-geomorphic—human activity has intensified natural erosive forces. The ravines are a natural consequence of the semi-arid region's geomorphology formed by centuries of water and wind erosion. From soil erosion due to unscientific agricultural practices, deforestation, and natural weathering of the alluvial plains. Steep slopes and the semi-arid climate accelerate runoff erosion, cutting deep gullies into the terrain.

Ecological Significance

The ravines host patches of dry deciduous forest, grassland, and scrub habitats supporting Indian gazelle (chinkara), Indian fox, and mugger crocodiles near the riverine tracts. The National Chambal Sanctuary (est. 1979) protects species like the gharial, Gangetic dolphin, Indian Skimmer and red-crowned roofed turtle.

Socio-Economic Impact

The ravines render large tracts unfit for cultivation, causing economic distress and migration among local communities. Historically, the Chambal valley was associated with dacoit activity, fostered by the rugged terrain and poor governance.

Government Initiatives

Ravine Reclamation Projects (since 1980s) – coordinated by the Central Soil and Water Conservation Research and Training Institute (CSWCRTI). NITI Aayog's 2020 Initiative – plan to convert ravines into productive agroforestry lands through a public-private partnership model. Madhya Pradesh Ravine Reclamation Project – aims to reclaim 60,000 hectares using bioengineering, check dams, and agroforestry.

Recent Developments (2020–2024)

ISRO and NRSC mapping initiatives have classified ravine severity for targeted land restoration. Pilot projects in Morena and Bhind districts demonstrate successful carbon sequestration via tree plantations.

Challenges

1. Continued illegal sand mining and deforestation.
2. Fragmented policy coordination between central and state agencies.
3. Lack of community participation in restoration programs.

6. India's Data Centre & Hidden Water Crisis

Context

India is setting up large-scale data centres in water-scarce regions as it races to expand its digital capabilities, raising alarms about the long-term sustainability of India's digital growth.

More About News

India is rapidly positioning itself as a global hub for data centres—the backbone infrastructure powering the world’s digital operations. These facilities store and process vast amounts of data generated by online activities, artificial intelligence (AI) systems, and cloud services. However, behind this technological leap lies a pressing environmental challenge— the immense water requirement for cooling servers and maintaining system efficiency.

India’s Emerging Data Centre Hub

The 1990s saw the birth of data centres, but the rise of cloud computing, internet penetration, and AI workloads has exponentially increased their demand. McKinsey & Company (2024) projects that by 2030, 70% of new data centre capacity will cater to AI-related operations. According to a Deloitte report (2025), India now hosts around 150 operational data centres across major Tier-1 cities, with a combined IT load capacity of 1,200–1,300 MW. The report predicts India will record the highest capacity addition in the Asia-Pacific region between 2024 and 2026, outpacing countries like Japan and Singapore. India’s advantages—lower operational costs, skilled workforce, and strategic location—make it a global favourite. But these benefits mask a growing environmental cost.

Data Centres and Their Thirst for Water

A data centre houses high-performance servers, routers, and storage systems, all of which generate substantial heat during operation. Most facilities use water-based cooling systems, drawing from groundwater or surface water sources to prevent overheating. A 1 MW data centre with water-based cooling typically consumes about 26 million litres of water annually. Yotta’s facility, with a capacity of 30 MW, could potentially use 780 million litres per year—enough to meet the annual domestic water needs of around 15,830 urban residents. Although Yotta claims to use air-based cooling technology, limiting water use to 6 million litres per year, its total approved limit stands at 43 million litres annually.

Hidden Cost– Water Stress and Environmental Impact

India ranks among the top 25 most water-stressed countries, as per the World Resources Institute’s Aqueduct Water Risk Atlas. Their concentration in already water-stressed areas could exacerbate regional water crises, with data centres being heavy water consumers. A 2025 Planet Tracker analysis found that 50 data centres in India are located in ‘extremely high’ water-stressed regions, second only to Indonesia in Asia. The water footprint of these facilities varies by climate, size, and technology, but collectively, they pose a substantial risk to groundwater sustainability.

Environmental Clearance and Oversight Gaps

Data centre projects in Uttar Pradesh require environmental clearance from the State-level Environmental Impact Assessment Authority (SEIAA), based on recommendations from the State-level Expert Appraisal Committee (SEAC). Yotta received clearance in 2020, conditional upon obtaining groundwater extraction permission from the Central Ground Water Authority (CGWA). However, officials have not confirmed whether such permission was granted, and the company maintains that no borewells have been dug. Furthermore, Yotta has not published an Environmental, Social, and Governance (ESG) report, despite growing calls for corporate transparency in sustainability practices.

Local Impacts and the Road Ahead

Investigations in Bengaluru and Gautam Buddha Nagar, two of India’s major IT hubs, reveal growing tensions between technological progress and local water security. Residents face the daily

reality of declining groundwater levels and insufficient water access, while companies highlight innovation and economic growth. India's digital expansion could deepen existing inequalities and environmental degradation, without stronger environmental regulation, transparency, and water-efficient technologies.

7. Reviving Punjab's Borewells for Flood Mitigation and Groundwater Replenishment

Context

The state of Punjab in India needs to shift from short-term recovery to long-term flood management, as it faced the worst flood in four decades due to the southwest monsoon in 2025.

Punjab's Borewells & Agricultural Role

It has 1.4 million abandoned borewells that became central to Punjab's agricultural landscape during the Green Revolution of the 1960s. The number of borewells multiplied rapidly—especially after 1997–98, when water tables stood around 12 metres, as farmers switched to groundwater irrigation. However, decades of over-extraction have since pushed groundwater levels down to depths of 150 metres or more, rendering many borewells defunct.

Turning a Threat into an Opportunity

Research by the ICAR–Indian Institute of Soil and Water Conservation (IISWC) demonstrates that abandoned borewells can be revived into effective underground recharge systems with minor modifications. It begins with a hydrogeological assessment to verify the borewell's depth, water quality, and structural condition. Once deemed safe, the borewell is cleaned, flushed, and refitted with slotted PVC pipes to facilitate filtration and infiltration.

Recharge Pit Design– A recharge shaft is then constructed following the Indian Standard IS 15797–2008. The shaft's filter media—a layered combination of coarse sand, gravel, and pebbles—ensures that only clean water percolates downward. A recharge pit surrounds the borewell, lined with brick, stone, or reinforced concrete. Rainwater runoff passes through a silt trap or settling chamber before entering the borewell, preventing clogging. The design includes safety features such as protective grills and annual disinfection. Routine maintenance—particularly desilting before each monsoon and cleaning the filter media every two to three years—ensures optimal performance.

Proven Models of Success– Case Studies

Gujarat– In Navagam village, Panchmahal district, ICAR–IISWC's installation of runoff filters (2017–20) increased the average groundwater table by 1.84 metres. The improved availability expanded the irrigated area by 12 hectares and enhanced crop yields—cotton productivity rose by 0.8 tonnes per hectare, and maize by 0.6 tonnes per hectare. Farmers' incomes increased by ₹16,000 per hectare, with return-to-cost ratios ranging between 1.65 and 2.89.

Karnataka– In Maramannahali village, Chitradurga district, a farmer transformed a low-yielding borewell into a recharge system and adopted drip irrigation. Annual income jumped from ₹53,500 in 2016–17 to ₹1.75 lakh in 2020–21, because of improved water availability and cultivation of high-yielding tomato and chilli varieties.

Blueprint for Punjab's Water Future

Punjab has the unique opportunity to turn a liability into a lifeline, with 1.4 million unused borewells. Large-scale conversion of abandoned borewells into recharge units could help–

Absorb floodwaters during heavy monsoons, reducing surface runoff. Replenish depleted aquifers, supporting long-term water security. Lower public spending on flood infrastructure and groundwater extraction. Enhance agricultural resilience by stabilizing irrigation sources. If implemented through village-level programs, with technical support from ICAR-IISWC and state agencies, this approach could redefine climate adaptation in the Punjab plains—turning every abandoned borewell into a portal of renewal.

8. Mission Food, Fodder, And Water (FFW) Project

Context

Kerala's forest department plants fruit and fodder trees to ease human-wildlife tensions.

About the Mission Food, Fodder, and Water (FFW) Project

It is envisioned as a multi-sectoral rural resilience initiative launched to address three interconnected crises—food insecurity, fodder scarcity, and water stress. It builds upon the Jal Shakti Abhiyan (2019), National Fodder Mission (2012–2018), and National Food Security Mission (NFSM), integrating their outcomes under a single operational vision of climate-adaptive resource management.

Key Objectives

Ensure Ecological Balance– Replenish natural food and water sources within forests and buffer zones.

Prevent Human-Wildlife Encroachment– Reduce crop raiding, livestock attacks, and resource competition.

Promote Coexistence– Support local communities through compensation and sustainable livelihood programs.

Restore Forest Ecology– Improve degraded forest patches to sustain native herbivores.

Components of the Mission

Food Security Component– Promotion of climate-resilient crops (millets, pulses, and oilseeds).

Introduction of biofertilizers and micro-irrigation to boost yields. Integration of kitchen gardens and nutri-gardens in rural schools and Anganwadis.

Fodder Security Component– Expansion of fodder banks and silage units under cooperative models. Revival of common grazing lands through reseedling and rotational grazing. Linking livestock missions with dairy productivity and veterinary care.

Water Conservation Component– Construction of check dams, farm ponds, and percolation tanks. Revival of traditional water bodies like baolis, talabs, and johads. Emphasis on rainwater harvesting and aquifer recharge through community labour.

Policy Linkages

United Nations Sustainable Development Goals (SDGs)– SDG 2 (Zero Hunger), SDG 6 (Clean Water and Sanitation), SDG 13 (Climate Action), and SDG 15 (Life on Land).

India's National Action Plan on Climate Change (NAPCC)—specifically the National Mission for Sustainable Agriculture (NMSA) and National Water Mission (NWM).

9. Iceland Declares AMOC Collapse a National Security Threat

Context

Recently, Iceland declared the potential collapse of the Atlantic Meridional Overturning Circulation (AMOC) as a direct threat to its national security and existence.

About Atlantic Meridional Overturning Circulation (AMOC)

It is a large system of ocean currents that transports warm, salty water from the tropics northward and returns cooler, deeper water southward, often referred to as the 'climate engine' of the Atlantic Ocean. It governs the movement of warm and cold water across vast oceanic distances, influencing weather patterns, sea levels, and global temperatures. It is driven by differences in temperature (thermal) and salinity (haline) – hence the term thermohaline circulation. The most well-known component of the AMOC is the Gulf Stream, which carries warm water from the Gulf of Mexico across the North Atlantic toward Europe.

AMOC Matter

Regulate regional temperatures, particularly keeping northern Europe's climate milder. Distribute ocean nutrients, supporting marine ecosystems and fisheries. Stabilize weather patterns, reducing the frequency of extreme events. Control sea levels, especially along the eastern coast of North America.

Signs of Weakening

In recent decades, scientists have observed signs that the AMOC is slowing down. Key indicators include- Accelerating Greenland ice melt, which adds freshwater to the North Atlantic and disrupts salinity. Rising ocean temperatures, which alter density gradients and reduce water sinking. Shifts in Atlantic sea-surface patterns, observed through satellite and ocean buoy data. A study in Nature Climate Change (2021) suggested that the AMOC is now at its weakest point in over a millennium, signaling a potential tipping point.

Consequences of an AMOC Collapse

A complete or partial collapse of the AMOC could trigger severe and irreversible climate changes, including- Harsher winters and shorter growing seasons in Europe. Rising sea levels along the U.S. East Coast due to redistribution of ocean mass. Disruption of monsoon systems, affecting billions of people in Africa and Asia. Shifts in marine biodiversity and collapse of key fisheries. These cascading impacts could destabilize economies, ecosystems, and even geopolitical relations.

10. Urgent Need to Halt Biodiversity Loss

Context

The decline of species across the globe shows little sign of slowing, despite decades of awareness and action. Ecologists have warned of a sixth mass extinction, a crisis unlike any before, driven by aHomo sapiens, since the 1990s.

India's Biodiversity Loss

Humanity's footprint has disrupted every major ecosystem on Earth, from climate change and pollution to the relentless exploitation of land and oceans. At least 680 vertebrate species have gone extinct since 1500, with extinction rates accelerating as global temperatures rise. India is a global biodiversity hotspot, harboring nearly 8% of plant species and 7.5% of animal species, many of them endemic, with just 2.4% of the world's land area. At the IUCN World Conservation Congress in Abu Dhabi (2024), India announced the National Red List Assessment Initiative to evaluate species conservation status and fulfill India's commitments under the Kunming-Montreal Global Biodiversity Framework (2030).

Findings from the Living Planet Report 2024

According to the World-Wide Fund for Nature (WWF) and the Zoological Society of London's 2024 Living Planet Report, the world's wildlife populations have declined by an average of 73% in just five decades.

1. Terrestrial Species- down by 69%
2. Marine Species- down by 56%
3. Freshwater Species- down by an alarming 85%

The report identifies habitat loss and degradation, driven largely by agricultural expansion, as the most widespread threats, followed by overexploitation, invasive species, and disease. These losses are not mere statistics; they are warning signals of collapsing ecosystems that sustain all life.

Declines- Taxonomic Bias

Lesser-known species like frogs, snakes, birds, and pollinators are quietly vanishing, undermining ecosystem stability. India's vulture species have declined dramatically- white-rumped vulture (-67%), Indian vulture (-48%), and slender-billed vulture (-89%). Native bee populations in Odisha have fallen by 80% since 2002, threatening pollination systems critical to agriculture. Knowledge gaps persist about key insects, flies, beetles, and butterflies—that underpin food security.

Alarming State of Global Biodiversity (UN 2024–2025 Reports)

The United Nations Environment Assembly (UNEA, 2024) reaffirmed that biodiversity loss has accelerated beyond prior projections. According to the latest UN System of Environmental Economic Accounting (SEEA, 2024), over 50% of assessed ecosystems are now degraded, with coral reefs, wetlands, and tropical forests experiencing the sharpest declines. The UNEP Global Biodiversity Outlook (2024) reported that species extinction rates are now 100–1,000 times higher than natural background levels, largely due to agricultural expansion, pollution, and climate-induced habitat shifts. The 2024 UN General Assembly report on the "Triple Planetary Crisis" underscored that biodiversity loss, alongside climate change and pollution, threatens to derail the 2030 SDGs.

Economic and Social Implications- Development–Nature Nexus

A UN DESA Working Paper revealed a staggering \$300 billion annual biodiversity financing gap, with developing nations bearing 80% of ecosystem loss costs. At the same time, the degradation of mangroves and wetlands is directly reducing resilience against climate disasters, especially in South Asia. The UN's Financing for Development Report (2025) emphasizes that biodiversity loss could reduce global GDP by up to 10% by 2050 if current trends persist. The report calls for "nature-positive investment" as a fiscal strategy, not merely an environmental goal.

Flagship Successes- Tigers and Lions

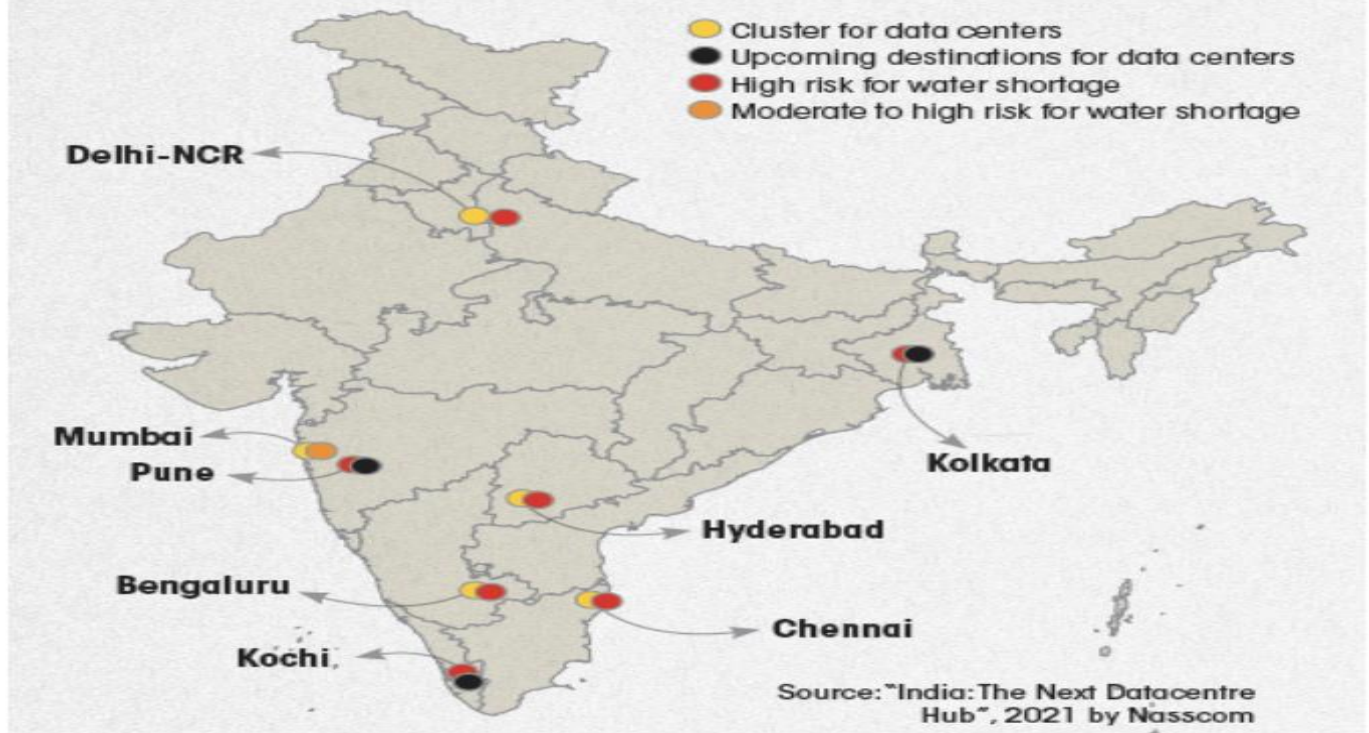
Projects such as Project Tiger and Project Lion have become global success stories. Tiger populations are rebounding in Madhya Pradesh, Uttarakhand, and Maharashtra. The Asiatic lion population in Gujarat's Gir forest has increased from 674 (2020) to 891 (2025), prompting a change in its IUCN status from Endangered to Vulnerable.

Fresh Policy Initiatives- From Kunming to COP16

Building upon the Kunming–Montreal Global Biodiversity Framework (GBF) of 2022, COP16 (scheduled for 2025 in Colombia) aims to operationalize the 30x30 conservation goal—protecting 30% of land and oceans by 2030. UN policy briefs released in December 2024 stress that only 17% of global

Water scarce

Many data centre clusters, current and emerging, are located in water-scarce areas



terrestrial ecosystems and 8% of marine areas are currently under effective protection, revealing a serious implementation gap.

II. Species Demanding Conservation Attention in India

Mishmi Takin (*Budorcas Taxicolor Taxicolor*)

Habitat- It is found in Arunachal Pradesh of India (Mishmi Hills, Eastern Himalayas); also found in China and Myanmar. China is also home to two other subspecies- the Golden Takin (*Budorcas Taxicolor Bedfordi*) and the Sichuan Takin (*Budorcas Taxicolor Tibetana*). A fourth subspecies, the Bhutan Takin (*Budorcas Taxicolor Whitei*), as its name suggests, is found in Bhutan.

Conservation Status- Vulnerable under IUCN Red List Schedule I in WPA, 1972

Major Threats- Habitat loss due to logging, hunting, large infrastructure projects.

Sangai Deer (*Rucervus Eldii Eldii*)

It is endemic to south-east Asia and their range of distribution extends from Manipur in India to Burma, Thailand, Cambodia, Laos, Vietnam and Hainan. It is recognised as the State animal of Manipur, found in the Northern end of Keibul Lamjao National Park, Manipur. It lives on phumdis, floating biomass of vegetation which gives it a distinctive, graceful movement.

Conservation Status- Endangered under IUCN Red List Schedule I of the Wild Life (Protection) Act, 1972

Conservation Action Plan (2016–2025)- A joint initiative by the Wildlife Institute of India, Manipur Forest Department, and MoEFCC, funded by the National CAMPA.

Studbook Program- The Central Zoo Authority and WII maintain a national studbook to track captive populations and support breeding programs.

Major Threats- Inbreeding depression, habitat loss due to pollution, agricultural runoff.

Nilgiri Tahr (*Nilgiritragus Hylocrius*)

It is recognised as the State animal of Tamil Nadu, found in the Southern parts of Western and Eastern Ghats in Tamil Nadu and Kerala. In ancient Tamil Sangam literature the ungulate, called varayādu or mountain goat.

Conservation Status- Endangered under IUCN Red List Schedule I under WPA, 1972

Major Threats- Habitat loss due to deforestation and invasive species, occasional hunting.

Kashmir Markhor (*Capra Falconari Cashmiriensis*)

It is recognised as the National animal of Pakistan, primarily found in Pakistan, Pakistan-Occupied Kashmir, Afghanistan and Jammu and Kashmir.

Conservation Status- Near Threatened under IUCN Red List; Schedule I of WPA, 1972 UNGA declared May 24 as the 'International Day of the Markhor'.

Major Threats- Unwise developmental activities, heavy livestock grazing, poaching.

Grey Slender Loris (*Loris Lydekkerianus*)

It is found in the Indian states of Tamil Nadu, Karnataka, Kerala and parts of Andhra Pradesh.

Conservation Status- Near Threatened under IUCN Red List Schedule I of the Wild Life (Protection) Act, 1972

Major Threats- Hunting for body parts, illegal pet trade, roadside captures

Nilgiri Langur (*Trachypithecus Johnii*)

It is found in high-altitude forests of Kerala, Tamil Nadu, and parts of Karnataka.

Conservation Status- Vulnerable under IUCN Red List; Schedule I of WPA, 1972

Major Threats- Poaching, habitat loss and road kill

Phayre's Leaf Monkey (*Trachypithecus Phayrei*)

It is found in Indian states of Assam, Tripura, Mizoram, and Bangladesh.

Conservation Status- Endangered under IUCN Red List; Schedule I of WPA, 1972

Major Threats- Habitat loss, forest fragmentation, hunting

Gee's Golden Langur (*Trachypithecus Geei*)

It is found in the Indian states of Assam.

Conservation Status- Endangered under IUCN Red List

Major Threats- Habitat loss, forest fragmentation and hunting

Western Hoolock Gibbon (*Hoolock Hoolock*)

It is recognised as the State animal of Arunachal Pradesh, primarily found in Indian states of Assam, Arunachal Pradesh, Meghalaya, Mizoram, Manipur, Nagaland and Tripura.

Conservation Status- Endangered under IUCN Red List

Major Threats- Habitat loss, forest fragmentation, hunting

Lion-Tailed Macaque (*Macaca Silenus*)

It is found in the Indian states of Kerala, Karnataka and Tamil Nadu.

Conservation Status- Endangered under IUCN Red List

Major Threats- Expanding plantations, fragmentation, tourism

Royle's Pika (*Ochotona Roylei*)

It is found in the Western Himalayas.

Conservation Status- Least Concern under IUCN Red List

Major Threats- Climate change, population isolation

Pygmy Hog (*Porcula Salvania*)

It is found in the grasslands of Assam's Manas National Park and Orang National Park.

Conservation Status- Endangered under IUCN Red List

Major Threats- Grassland degradation due to uncontrolled grass burning, illegal cattle grazing, rapid habitat succession

Madras Hedgehog (*Paraechinus Nudiventris*)

It is found in the Peninsular India, primarily across Tamil Nadu, Kerala, Andhra Pradesh and parts of Karnataka.

Conservation Status- Least Concern under IUCN Red List

Major Threats- Grassland degradation due to uncontrolled grass burning, illegal cattle grazing, rapid habitat succession

Fishing Cat (*Prionailurus Viverrinus*)

It is recognised as the State animal of West Bengal, primarily found in Indus basin; Ganga and Brahmaputra floodplains and delta of West Bengal and Bangladesh; Mahanadi, Godavari and Krishna basins.

Conservation Status- Vulnerable under IUCN Red List

Major Threats- Habitat loss due to degradation, destruction of wetlands

Blyth's Tragopan (*Tragopan Blythii*)

It is found in the Indian states of Arunachal Pradesh, Nagaland, Mizoram, and Manipur.

Conservation Status- Vulnerable under IUCN Red List

Major Threats- Small, fragmented population declining due to hunting, habitat loss.

Cheer Pheasant (*Catreus Wallichii*)

It is found in the Western Himalaya from northern Pakistan and Kashmir through Himachal Pradesh and Uttarakhand to central Nepal.

Conservation Status- Vulnerable under IUCN Red List Schedule I under WPA, 1972; Appendix I of CITES

Major Threats- Small, fragmented populations, increasing human and livestock pressures, hunting, changing land-use patterns.

Black-Necked Crane (*Grus Nigricollis*)

It is recognised as the State bird of Ladakh, primarily found in Ladakh and Arunachal Pradesh.

Conservation Status- Near Threatened under IUCN Red List Schedule I under WPA, 1972; and appears in Appendices I and II under CITES.

Major Threats- Changing agricultural practices, predation by free-ranging dogs, rapid and unregulated development around high-altitude wetlands

Western Tragopan (*Tragopan Melanocephalus*)

It is found in the Western Himalayas.

Conservation Status- Vulnerable under IUCN Red List

Major Threats- Forest loss, habitat degradation

Red-Crowned Roofed Turtle (*Batagur Kachuga*)

It is found in the Ganga river basin.

Conservation Status- Critically Endangered under IUCN Red List

Major Threats- Inbreeding depression

Bengal Florican (*Houbaropsis Bengalensis*)

It is found in the Terai region of Uttar Pradesh and Assam.

Conservation Status- Critically Endangered under IUCN Red List

Major Threats- Land-use change, expansion of agriculture, change of river course, invasive plant species, fire mismanagement

Indus River Dolphin (*Platanista Minor*)

It is recognised as the State aquatic animal of Punjab, primarily found in a 70-km stretch of the Beas, particularly between Beas bridge and Harike in Punjab, India; Indus River and tributaries in Pakistan.

Conservation Status- Endangered under IUCN Red List

Major Threats- Extensive fishing, bycatch, sedimentation, dams, river pollution

King Cobra (*Ophiophagus Hannah*)

It is recognised as the National Reptile of India, primarily found in South and Southeast Asia.

Conservation Status- Vulnerable as per IUCN (in revaluation)

Major Threats- Habitat destruction, human hostility

Mains Questions

1. "Khadi is not just a cloth, but a thought." Discuss how Khadi reflects Mahatma Gandhi's ideals of *Gram Swaraj* and dignity of labor, and assess its relevance in contemporary India's 'Aatmanirbhar Bharat' mission. (250 words)
2. The textile sector is often criticized for its environmental footprint. Analyze the potential of Khadi as a "climate-smart" alternative in contributing to India's circular economy and Net Zero 2070 commitments. (250 words)
3. Despite significant government support through schemes like SFURTI and PMEGP, the traditional artisan sector faces challenges from machine-made goods. Suggest measures to balance heritage preservation with economic viability for rural artisans. (250 words)

Essay Topics

1. "Khadi- Where heritage meets sustainability in India's development journey."
2. "From charkha to climate action- Reimagining Khadi for a green and inclusive future."

P L RAJ UPSC MONTHLY MAGAZINE – COMPILATION

JANUARY 2026

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YOJANA

1. Empowering Bharat, Envisioning 2047

GS Paper II - Constitution, Government Policies, and Interventions for Development.

GS Paper III - Indian Economy and issues relating to Planning, Mobilization of Resources, Growth, and Development.

As the nation celebrates its 77th Republic Day, this annual commemoration serves as a profound affirmation of the foundational principles—Justice, Liberty, Equality, and Fraternity—enshrined in the Indian Constitution. The vision of Viksit Bharat (Developed India) by 2047 is positioned not merely as an economic target but as the modern manifestation of these enduring republican ideals.

I. The Vision for 2047

The journey toward the centennial of independence is defined by aspirations that transcend traditional economic metrics like GDP or per capita income.

Economic Goal - Targeting a \$30 trillion economy.

Social & Governance Goals - Aiming for a society that is socially just, environmentally sustainable, and exceptionally well-governed to secure a dignified life for every citizen.

A "Republic of Equals" - The goal is to break systemic stereotypes and ensure women are socially, economically, and politically empowered during this Amrit Kaal (2025-2047).

II. Infrastructure - Physical and Digital

India's recent trajectory provides compelling evidence of its potential through phenomenal growth in both physical and digital connectivity.

Physical Connectivity - Rapid expansion of metro networks, highways, and ports is consolidating the nation's physical infrastructure and bringing opportunities closer to people.

Digital Public Infrastructure (DPI) - The revolutionary triad of Aadhaar, UPI, and Jan Dhan has acted as a force multiplier.

Financial Inclusion Impact - This technology stack has expanded financial inclusion from 21 percent to over 80 percent.

Service Delivery - Facilitated transparent and citizen-centric public service delivery at an unprecedented scale, bringing millions into the formal economy.

III. Addressing Persistent Challenges

The path to development requires an honest confrontation with existing disparities to lend credibility to the national endeavor.

Inequality - The UNDP Human Development Report 2025 notes that while India has made progress in its Human Development Index (HDI), there is a significant loss in development due to glaring inequality.

The Urban-Rural Gap - There remains an urgent need to bridge the disparity visible in the income share of the richest versus the poorest and the opportunities available in urban versus rural areas.

IV. Four Key Social Segments (Pillars of the Republic)

The vision for 2047 is structurally aligned with the constitutional pillars by centering around four key segments –

Women (Nari Shakti) – Initiatives focus on correcting gender disparities, increasing labor force participation, and ensuring equal access to opportunities.

1. **The Poor** – A multidimensional approach to poverty alleviation ensures the principle of "Justice for all" so no Indian is left behind.
2. **Youth** – Focused on thriving innovation and the constitutional ideal of Liberty to pursue dreams through a robust startup ecosystem and the 'Make in India' drive.
3. **Farmers (Annadata)** – Integral to the collective national effort of reaching economic prosperity and social justice.

V. Governance and Security

Realizing Viksit Bharat demands that citizens translate the Constitution's promise into action through innovation and ethical governance.

Accountability – Leveraging digital transformation to bring the government and citizens closer, ensuring the state truly works for its people.

Collective Effort – The transformation from a developing to a developed nation is a national effort requiring social and environmental responsibility.

2. From Passive Beneficiary to Active Citizens

GS Paper II – Governance, Constitution, and Social Justice.

GS Paper II Topic – Important aspects of governance, transparency and accountability, and citizen's charters.

This chapter traces the evolution of the Indian citizen's role in the development process, highlighting a transition from being mere recipients of state welfare to becoming active co-creators of progress.

I. The Historical Context (Post-Independence)

Centralized Planning Era – In the early years, nation-building was shaped by the Five-Year Plans, which prioritized large-scale industrialization and agricultural expansion.

Top-Down Approach – This model positioned the state at the center and citizens as passive recipients of schemes, often disregarding local knowledge and creating a culture of dependency.

The Shift in the 1970s – By the late 60s and 70s, the limitations of the centralized model became apparent due to issues with sustainability and a lack of local ownership.

Vedic and Gandhian Influence – Thinkers like Mahatma Gandhi and Paulo Freire influenced a shift toward recognizing community-led practices and collective decision-making.

II. Phase I – Participatory Development (Mid-1980s to Early 1990s)

The government began experimenting with community involvement in natural resource management through key ministries.

Natural Resource Management – Programs like Social Forestry (1976) and Joint Forest Management (1988) promoted the formation of Village Forest Committees.

Watershed Management – The Ministry of Rural Development piloted watershed programs (IWDP 1989, NWDPRA 1990–91), institutionalizing user groups and community-based planning.

Education Sector – The District Primary Education Programme (DPEP 1994) formalised community engagement through Village Education Committees and School Management Committees.

Impact – These initiatives moved India away from expert-led models, recognizing communities as partners, which improved accountability and service delivery.

III. Phase II – Institutionalizing Participatory Governance (1992–1993)

The most significant turning point for Indian democracy was the constitutionalization of local self-government.

73rd and 74th Amendments – These amendments affirmed Panchayati Raj Institutions (PRIs) and Urban Local Bodies (ULBs) as constitutional bodies.

Statutory Mechanisms – Participation shifted from temporary project committees to mandated structures like **Gram Sabhas**, ward committees, and standing committees.

Decentralized Planning – Citizens gained the power to directly influence resource allocation and monitoring of development programs.

Integration – By the early 2000s, earlier participatory groups (watershed/forest committees) began interfacing directly with PRIs, strengthening local leadership.

IV. Phase III – Women's Collectives and Economic Resilience (1998–2010s)

This period saw the formalization of livelihood-based participation.

Self-Help Groups (SHGs) – Policies like the Swarna Jayanti Gram Swarozgar Yojana (1999) used SHGs as primary vehicles for poverty alleviation.

Nari Shakti as Public Actors – SHG federations acquired bargaining power with banks and markets, allowing women to influence Panchayat decisions and public programs.

Farmer Producer Organisations (FPOs) – Institutionalized in the 2000s and scaled through the 10,000 FPO Scheme (2020), these enabled smallholders to aggregate produce and access technology.

V. The Modern Era – Governance 2.0 (2015–Present)

Gram Panchayat Development Plan (GPDP) – Since 2015, every Gram Panchayat is mandated to prepare annual plans through participatory processes involving the Gram Sabha and SHG federations.

Social Audits – Participation has been institutionalized at scale, transforming the interface between the citizen and the state.

Dissolving Boundaries – Participation is no longer a separate activity but an integral function of governance, leading to the rise of new leaders from marginalized groups.

VI. Challenges and The Way Forward

Addressing Social Hierarchies – Participation is an inherently political process; dominant social norms regarding caste and gender can still silence marginalized voices even when they are physically present.

Beyond Reservation – Empowerment requires deliberate facilitation and leadership development, not just the creation of seats.

Viksit Bharat Vision – Looking toward 2047, the focus is on investing in citizenry education, awareness for youth, and integrating digital technology to deepen participatory governance.

3. Gender Budgeting & Legislative Measures

GS Paper II – Government policies and interventions for development in various sectors and issues arising out of their design and implementation.

GS Paper II Topic – Welfare schemes for vulnerable sections of the population by the Centre and States and the performance of these schemes.

This chapter details the foundational legal frameworks and fiscal strategies, specifically Gender Budgeting, that India has utilized to ensure social equality and gender inclusivity throughout its growth trajectory.

I. The Constitutional and Legal Foundation

India's commitment to gender equality is rooted in its Constitution, which was promulgated 76 years ago and embraced universal adult suffrage at its inception.

Key Constitutional Provisions

Article 14 – Guarantees the Right to Equality.

Article 15 – Prohibits discrimination on grounds of religion, race, caste, sex, or place of birth.

Article 16 – Ensures Equality of Opportunity in matters of public employment.

Article 243 – Provides for the Reservation of seats for women in Panchayats and Municipalities.

Article 51A – Urges citizens to renounce practices derogatory to the dignity of women.

Constitutional Amendments

73rd and 74th Amendments – Mandated a minimum 33% reservation for women in local governance.

106th Amendment (Nari Shakti Vandan Adhiniyam) – Reserves one-third of seats for women in the Lok Sabha, State legislative assemblies, and the NCT of Delhi.

II. Protective and Enabling Legislations

To ensure safety, security, and dignity, several laws have been enacted and revamped.

Workplace Safety – The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013, provides a legal framework for safe environments. The SHe-Box portal was revamped in 2024 to speed up online complaint remedies.

Social and Domestic Protection – The Protection of Women from Domestic Violence Act (2005) and the Dowry Prohibition Act (1961) address systemic domestic issues.

Modernized Justice – The Bharatiya Nyaya Sanhita, Bharatiya Nagarik Suraksha Sanhita, and Bharatiya Sakshya Adhiniyam (effective July 1, 2024) aim for a modernized criminal justice system.

Labour Reforms – Four new Labour Codes (effective Nov 21, 2025) promote transparency and equal opportunities for women in the workforce.

III. Gender Budgeting – Ramping Up Resources

Gender Budgeting is a fiscal tool to ensure that development benefits reach women effectively.

Budget Structure – The Gender Budget Statement consists of three parts –

Part A – Schemes with 100% allocation for women/girls.

Part B – Schemes with 30-99% allocations.

Part C – Schemes with allocations below 30%.

Fiscal Growth – The 2025-26 Budget Estimates for Gender Budgeting are 19% higher than the Revised Estimates of 2024-25.

Total Allocation – The Gender Budget as a percentage of the total budget has increased from 6.8% in 2024-25 to 8.9% in 2025-26.

IV. Progress in Key Parameters

The commitment to gender equality is reflected in measurable improvements across various sectors.

Parameters	Earlier Period	Later Period
Maternal Mortality Rate (per lakh live births)	167 (2011-13)	97 (2018-20)
Female Labour Force Participation Rate (%)	23.3 (2017-18)	41.7 (2023-24)
Women-owned MSMEs (Number)	4.86 lakh (2021)	2.49 crore (Oct 2025)
Women elected to Lok Sabha (Number)	59 (2009)	74 (2024)
Life Expectancy of Women at Birth (Years)	70.0 (2011-15)	72.7 (2021-25*)

V. The Road to Viksit Bharat@2047

Empowering Impact – Strategic investments in science, education, health, and governance are essential for economic growth.

Breaking Stereotypes – To achieve the 2047 mission, women must be socially, economically, and politically empowered to create a "republic of equals".

4. Paradigm Shift – Women-Led Development

GS Paper II – Welfare schemes for vulnerable sections; Social Justice.

GS Paper III – Indian Economy and issues relating to employment; Inclusive growth.

This chapter details the strategic transition from merely developing women to fostering an environment where women lead the nation's developmental agenda.

I. The Vision – Nari Shakti to the Forefront

Mission Viksit Bharat 2047 – Transitioning from "women's development" to "women-led development" is a critical pillar for a transformative approach to gender equality.

Government Priority – For the past nine years, the central government has placed *Nari Shakti* (women's power) at the forefront of its policy agenda.

Economic Impact – The IMF estimates that increasing female labor force participation by 5.8% could boost the GDP of emerging economies by 8%.

II. Pathways to Empowerment

Women-led development is pursued through two primary channels – increasing access to employment and promoting enterprise development.

Entrepreneurship – As of October 31, 2025, approximately 48% of all recognized startups (95,316 out of 1.97 lakh) have at least one-woman director or partner.

Self-Help Groups (SHGs) – Under the DAY-NRLM, 10.04 crore women have been mobilized through more than 90.76 lakh SHGs, promoting economic resilience and collective action.

Education and Skill Development

Higher Education Enrollment – Total female enrollment reached 2.07 crore (roughly 50% of the total 4.33 crore students) in 2021-22.

Vocational Training – Under Skill India, young women are taking courses in IT, healthcare, and hospitality.

PMKVY – Over 72 lakh women have been trained, contributing to 45% of the total candidates trained across the country.

III. Breaking Barriers in Diverse Sectors

Women are increasingly entering non-traditional and elite roles, reflecting long-term structural changes in society.

Civil Services – In recent years, women have constituted 34.3% of the candidates recommended for appointment in bureaucratic offices, from the IAS to the lower judiciary.

Civil Aviation – India has 1,767 female pilots (out of 11,775), accounting for 15% of the workforce—a figure that significantly exceeds the international average of 5-6%.

Corporate Leadership – In 2024-25, the female workforce in top companies reached 8.4 million, with women holding 17% of board positions.

STEM Education – Policies like supernumerary seats at IITs (introduced in 2018) have helped these institutions meet the mandate of 20% female students.

IV. Political Voice and Grassroots Leadership

While representation at the national level remains a work in progress, the grassroots level shows a significant shift.

Panchayati Raj Institutions (PRIs) – Approximately 46.94% of representatives in local governance are women.

Scale of Leadership – Nearly 1.3 million of India's 3.1 million local elected officials are women.

Impact of Female Sarpanches – Research indicates that female village leaders spend more on water and education and serve as role models, raising the educational aspirations of girls in their villages.

Legislative Progress – In September 2023, Parliament passed a law to reserve one-third of seats in the Lok Sabha and state assemblies for women to strengthen their voices in policy-making.

V. Financial Inclusion and Quality of Life

Housing – Secure housing provided through PMAY-G (Pradhan Mantri Awas Yojana-Gramin) empowers rural women to invest more in their children's education and health.

Banking – Women own 39.2% of bank accounts in India; this ownership is higher in rural areas at 42.2%.

Market Participation – Between March 2021 and November 2024, the total number of DEMAT accounts in India rose from 33.26 million to 143.02 million, indicating growing participation in the stock market.

5. Economy — The Next Leap

GS Paper III – Indian Economy and issues relating to planning, mobilization of resources, growth, and development; Banking and Financial Institutions.

This chapter explores the next phase of India's economic strengthening, which is built upon three pillars – deepening financial inclusion, simplifying the tax regime, and ensuring equitable credit access.

I. Financial Inclusion – From Outreach to Usage

Financial inclusion has moved from basic account opening to creating a comprehensive digital ecosystem for formal finance.

The FI-Index – The RBI's Financial Inclusion Index rose to 67 in 2025 (up from 53.9 in 2021), reflecting gains in access, usage, and quality.

Account Ownership – Approximately 89–90% of adults now hold financial accounts, a significant jump from 77–78% in 2021.

PM Jan Dhan Yojana (PMJDY) – As of November 2025, accounts exceeded 57.11 crores with deposits totaling ₹2.74 lakh crore.

Infrastructure Growth – Banking channels have expanded to 1.60 lakh branches by March 2024, supported by interoperable digital payments like UPI and Aadhaar-linked KYC.

II. Tax Simplification – The "Next-Gen" Reforms

India is transitioning from a complex, colonial-era framework to a moderate, IT-driven, unified system.

New Income Tax Act 2025 – Set to replace the 1961 Act starting April 1, 2026. It reduces the number of sections from 819 to 536 and chapters from 47 to 23. It introduces a digital-first, faceless regime and the "Tax Year" concept.

Tax Slab Rationalization – The NIL threshold has been expanded to ₹12 Lakhs in the 2025–26 Union Budget to provide relief to millions.

Next-Gen GST (September 2025) – The multiple-slab structure was rationalized into a simpler two-slab system (5% and 18%) for most transactions. A 40% rate remains for selected "luxury/sin" goods.

Efficiency – Faceless assessments and the *Vivad Se Vishwas* scheme have reduced taxpayer hassles while significantly increasing collections.

III. Credit Access and Discipline

The banking sector's ecosystem has been strengthened through transparent recognition of NPAs and governance reforms like the Insolvency and Bankruptcy Code.

Credit Growth – The banking sector registered a growth of 11.4% in FY2025.

Priority Sector Lending (PSL) – As of FY2024, PSL stood at ₹59.1 trillion (45.1% of adjusted net bank credit), ensuring credit flows to agriculture and small businesses.

Non-Banking Financial Companies (NBFCs) – NBFCs and fintech lenders are playing a critical role in consumer finance and MSME loans, maintaining strong capital buffers with a CRAR of 25.8% as of March 2025.

Credit Infrastructure – Matured credit reporting systems have reduced information asymmetry, helping lenders assess creditworthiness across a broader section of borrowers.

IV. Challenges and Future Strategy

Rural Outreach – There is a critical need to strengthen rural banking and simplify collateral documentation.

Financial Literacy – Scaling financial literacy is essential for equitable long-term growth.

Integrated Approach – Achieving *Viksit Bharat* requires the simultaneous synchronization of financial inclusion, tax transparency, and affordable credit.

6. Sustainability – Climate Finance

GS Paper III – Conservation, Environmental Pollution and Degradation, Environmental Impact Assessment.

GS Paper III Topic – Disaster and Disaster Management.

Addressing climate change requires massive financial resources and wise investments to lower emissions, encourage adaptation to felt effects, and increase resilience. Climate finance acts as a bridge for developing nations like India to transition toward a green and sustainable economy.

I. The Global Context of Climate Finance

Definition – Refers to local, national, or transnational financing—drawn from public, private, and alternative sources—that seeks to support mitigation and adaptation actions.

The Paris Agreement – Reaffirms that developed countries should lead in mobilizing climate finance from diverse sources, instruments, and channels to assist developing nations.

Core Principle – Operates on the basis of "common but differentiated responsibilities and respective capabilities," acknowledging that wealthy nations have a greater historical contribution to climate change and more means to address it.

Resource Distribution – A key goal is achieving an equilibrium in resource provision between mitigation (reducing emissions) and adaptation (building resilience).

II. International Financial Mechanisms

Several international funds exist to facilitate the transfer of resources to developing economies –

Green Climate Fund (GCF) – Established in 2010; currently the world's largest climate fund.

Global Environment Facility (GEF) – Operates as a financial mechanism for multiple environmental conventions since 1992.

Special Climate Change Fund (SCCF) & Least Developed Countries Fund (LDCF) – Both established in 2001 to support adaptation programs.

Adaptation Fund (AF) – Created under the Kyoto Protocol to finance specific projects in nations highly susceptible to climate impacts.

Fund for Responding to Loss and Damage – Established at COP 28 (2023) to assist vulnerable economies facing adverse climate effects.

III. National Initiatives and the Vision for 2047

India's goal is to transform into a developed country by 2047, with environmental sustainability as a core pillar.

Financial Requirements – India has improved its 2030 NDCs and targeted net-zero emissions by 2070.

Investment Needs – It is estimated that India needs to spend more than \$2.5 trillion to meet mitigation targets by 2030. An additional \$1 trillion is required for adaptation and resilience between 2015 and 2030.

Current Funding Status – Domestic banks and government budgets fund the majority of India's climate actions, yet tracked investments currently meet less than 25% of predicted needs.

IV. Domestic Policy Instruments

The Indian government and the RBI have introduced several tools to scale green finance –

Sovereign Green Bonds – Debt securities issued by the Union government to fund green infrastructure, renewable energy, and waste management.

Green Deposits – A type of fixed deposit where funds are specifically earmarked for eco-friendly projects.

RB-CRIS (Climate Risk Information System) – A system announced by the RBI to close data gaps and ensure the comparability of financial impact assessments related to climate change.

Sustainable Finance Group (SFG) – A dedicated unit within the RBI established in 2021 to lead regulatory initiatives in sustainable finance.

National Adaptation Fund for Climate Change (NAFCC) – Established in 2015 to assist States and Union Territories with adaptation costs.

Priority Sector Lending (PSL) – Bank loans up to ₹35 crore for renewable energy projects (solar, wind, biomass) are now classified under priority sector lending.

V. Strategic Outlook

Private Sector Mobilization – Achieving climate goals is essential and requires mobilizing significant private investments to work alongside public initiatives.

Biodiversity Linkage – Climate finance also supports the preservation of "jewels" like water and food, aligning with SDG 2 (Zero Hunger), SDG 6 (Clean Water and Sanitation), and SDG 13 (Climate Action).

7. Civilisational Heritage – Integrating Indigenous Knowledge Systems

GS Paper I – Indian Culture – Salient aspects of Art Forms, Literature and Architecture from ancient to over modern times.

GS Paper II – Issues relating to development and management of Social Sector/Services relating to Education, Human Resources.

India's Indigenous Knowledge Systems (IKS) encompass a vast intellectual heritage spanning philosophy, mathematics, astronomy, Ayurveda, arts, and architecture. The current policy focus is on integrating this codified and textually preserved wisdom with modern curricula to foster holistic problem-solving and cultural continuity.

I. Defining the IKS Framework

Global vs. Indian Context – Globally, IKS refers to place-based, community-held wisdom (e.g., Aboriginal or Māori traditions). In India, it specifically denotes a highly developed, codified intellectual heritage documented in over a thousand ancient texts.

Holistic Framework – IKS draws from ancient texts, oral traditions, and lived experience to offer a comprehensive understanding of life and the universe.

Core Purpose – The framework seeks to harness traditional wisdom for sustainable development, innovation, and contemporary challenges in health and agriculture.

II. NEP 2020 – Future-Ready and Holistic Learning

The National Education Policy (NEP) 2020 acts as the primary vehicle for reviving IKS within the formal education system.

Mother-Tongue Instruction – The policy recommends instruction in the mother tongue at least until Grade 5, as early education in a native language enhances cognitive development and comprehension.

Interdisciplinary Approach – NEP 2020 promotes flexible learning that mirrors the interconnected reasoning found in both IKS and modern scientific inquiry.

Skill Development – It prioritizes 21st-century skills—such as critical thinking, digital literacy, and adaptability—while remaining grounded in cultural understanding.

III. Modern Science and Indic Knowledge

Complementary Systems – Modern science (based on evidence and experimentation) and IKS (based on lived experience and philosophical reasoning) provide two reinforcing ways of understanding the world.

Historical Precedents – Ancient universities like Takshashila and Nalanda were global hubs for multidisciplinary study.

Scientific Stalwarts – Figures such as Aryabhaṭa (mathematics), Suśruta (medicine), and Panini (linguistics) shaped fields ranging from engineering to shipbuilding and strategic games like chess.

IV. Documentation and Knowledge Management

India has institutionalized IKS through several large-scale digital and academic initiatives –

Traditional Knowledge Digital Library (TKDL) – Documents over 450,000 formulations from Ayurveda, Unani, Siddha, and Yoga to prevent global misappropriation and patent disputes.

IKS Division (AICTE) – Promotes research and curriculum development through more than 32 specialized centers across the country.

ASMITA Project – Aims to produce 22,000 high-quality books in Indian languages over five years to enrich higher education content.

Gyan Bharatam (2025) – A Ministry of Culture mission creating a unified national digital repository for manuscripts, historical documents, and artworks.

V. Implementation Challenges and Impact

Digital Divide – While 95% of villages have connectivity, only 16.7% of rural households have home internet, and just 4–5% own a personal computer.

Pedagogical Complexity – IKS is often context-specific and orally transmitted, making it difficult to standardize against modern scientific frameworks.

Employability – Integrating IKS equips students with practical skills for sustainable agriculture, herbal medicine, and environmental management.

Case Study – The National Institute of Ayurveda (Jaipur) serves as a successful model of traditional knowledge providing vocational relevance and sustainable outcomes.

8. Grassroots Finance – Microfinance in India

GS Paper III – Inclusive growth and issues arising from it; Indian Economy and issues relating to mobilization of resources.

Microfinance in India has evolved from pilot projects into a vital regulatory paradigm aimed at providing credit to low-income households and promoting financial inclusion through institutional players.

I. Historical Evolution

Self Help Group-Bank Linkage Programme (SBLP) – Started as a pilot project by NABARD in 1992, it laid the foundation for building financial and technological capabilities in rural India.

Regulatory Recognition – In the late 1990s, the RBI recognized microfinance as a new paradigm with immense potential for growth.

Strategy Documents – The RBI prepared a vision document on financial inclusion in 2015 and the National Strategy for Financial Inclusion (NSFI) for 2019–2024, focusing on access, usage, and quality.

II. The Regulatory Framework

To protect borrowers and ensure fair practices, the RBI established a comprehensive framework for NBFC-MFIs.

Income and Loan Limits – Microfinance loans are defined for households with an annual income of up to ₹3 lakhs.

Interest Rates and Margins – NBFC-MFIs must maintain an aggregate margin cap of no more than 12%. Interest on individual loans cannot exceed 26% per annum on a reducing balance basis.

Debt-Income Ratio – The total monthly repayment of all outstanding loans for a household must not exceed 50% of the household income.

Multiple Lending Restrictions – To prevent over-indebtedness, no more than two NBFC-MFIs are permitted to lend to the same borrower.

Prudential Norms – New NBFC-MFIs must have minimum Net Owned Funds (NOF) of ₹5 crores (₹2 crores in the North Eastern Region) and maintain a Capital Adequacy Ratio (CAR) of at least 15%.

Risk Weights – Microfinance loans categorized as consumer credit are subject to a risk weight of 100%, following a review in February 2025.

III. Key Developmental Initiatives

PMJDY and BC Model – The Pradhan Mantri Jan Dhan Yojana (2014) and the use of Banking Correspondents (BCs) have enabled at least one bank account per household and expanded rural access.

Infrastructure Growth – The number of banking outlets in villages has surpassed 12 lakh.

Priority Sector Status – Loans provided by banks to NBFCs for on-lending to small borrowers are classified as Priority Sector Lending (PSL).

Financial Literacy – The RBI has established over 1,000 Centers for Financial Literacy (CFL) to promote awareness and education.

IV. Performance of the Sector (2023–24)

Lender Composition – Scheduled Commercial Banks (SCBs) and NBFC-MFIs are the primary providers, with SCBs mobilizing nearly half of the sector's funds.

Portfolio Growth – The gross loan portfolio saw a sharp rise of 16.2%, and the average loan amount per borrower increased to ₹46,636.

Asset Quality – The Gross Non-Performing Asset (GNPA) ratio of the sector declined from 10.31% in 2022–23 to 8.72% in 2023–24.

V. Challenges and Strategic Suggestions

Recovery and Due Diligence – Despite improvements, GNPA levels remain high, requiring effective recovery machinery and strict adherence to loan policies.

Operational Costs – Technology-based operations and partnerships with FinTech firms are suggested to counter high overhead costs and improve service quality.

Borrower Protection – Lenders must ensure transparency in charges, avoid "ghost borrowers," and implement robust grievance redressal systems.

Stressed Assets – Policies for rescheduling installments and granting loan moratoriums for up to two years are in place for borrowers facing external crises.

9. Gig Economy – The Advent of Quick Commerce

GS Paper III – Indian Economy and issues relating to planning, mobilization of resources, growth, and development.

GS Paper III Topic – Effects of liberalization on the economy, changes in industrial policy and their effects on industrial growth.

Quick commerce (q-commerce) represents a momentous revolution in India's retail landscape, shifting the focus from traditional e-commerce to ultra-fast, "convenience-based" delivery models.

I. Defining Quick Commerce vs. E-commerce

While seemingly analogous, q-commerce is a distinct subset of e-commerce with unique operational characteristics –

Delivery Speed – E-commerce typically takes 1–4 days, whereas q-commerce promises delivery within 10–30 minutes.

Warehousing – E-commerce relies on mega-warehouses in industrial estates; q-commerce uses "Dark Stores" (small fulfillment centers) located near residential areas.

Product Range – Focuses on high-frequency items like groceries, household essentials, medicines, and "Ready-to-Eat" meals.

Consumer Behavior – Approximately 31% of Indian customers rely on q-commerce for main grocery needs, and 45% use it for snacks.

II. Market Size and Projections

The sector is witnessing explosive growth, reshaping the digital economy –

Revenue – The Indian q-commerce market is expected to reach US\$ 5.38 billion in revenue in 2025.

Growth Rate – It is projected to display a Compound Annual Growth Rate (CAGR) of 16.07% between 2025 and 2029.

Gross Merchandise Value (GMV) – Estimated to grow from US\$ 7.47 billion in 2025 to over US\$ 23 billion by FY 2028.

User Base – The number of quick commerce users in India is expected to reach 65 million by 2030.

III. Key Growth Drivers

Multiple factors are fueling the rapid expansion of the q-commerce ecosystem –

Technological Foundation – Increasing smartphone shipments (7% y-o-y growth in Q3 2025) and the 5G revolution enable seamless app-based transactions.

Unified Payments Interface (UPI) – UPI processed over 20.7 billion transactions in October 2025, providing the real-time payment backbone for instant orders.

ONDC (Open Network for Digital Commerce) – Launched in 2021 to make digital commerce accessible for small businesses and startups; it has processed over 326 million cumulative orders.

National Logistics Policy (NLP) – Enhances connectivity and streamlines logistics via "City Logistics Plans," reducing costs and improving final-leg delivery.

Foreign Direct Investment (FDI) – 100% FDI through the automatic route is permitted to encourage the participation of foreign players.

IV. The Workforce – Gig Economy

The q-commerce sector is the primary engine for the modern gig workforce -

Employment Demand - Demand for gig workers in q-commerce is expected to increase by 60% in 2025 compared to 2024.

Future Estimates - Niti Aayog estimates India's 10 million gig workforce could reach 23.5 million by 2029-30.

Legislative Support - The "New Labour Codes 2025" (effective Nov 21, 2025) are vital in providing formal encouragement and security to gig workers.

V. Major Challenges and Objections

Despite the boom, the sector faces significant hurdles -

Unethical Trade Practices - Bodies like the AICPDF (representing 1.25 crore Kirana stores) and CAIT have alleged that q-commerce firms use predatory pricing and deep discounts to hurt traditional retail.

Operational Profitability - High "Customer Acquisition" costs and small average order values (e.g., just bread or milk) result in weak "Earnings Per Order" (EPO).

Infrastructure Stress - Managing real-time inventory and last-mile delivery amidst depraved road conditions, traffic, and unfavorable weather is highly complex.

Regulatory Compliance - Upcoming requirements under the Digital Data Protection Act (DDPA) and Environmental, Social, and Governance (ESG) standards require significant financial and administrative devotion.

10. Smart Solutions — Innovation in Governance

GS Paper II - Important aspects of governance, transparency and accountability, e-governance-applications, models, successes, limitations, and potential.

Governance in the 21st century faces multifaceted challenges, including rapid technological transformation, climate change, and the necessity for citizen-centered transparency. Innovation in this sector is not merely about adopting technology but about creating resilient, inclusive, and responsive systems that uphold human dignity.

I. Democratising Policy Frameworks

The shift from a centralized planning system to cooperative federalism has been a cornerstone of recent governance reforms.

NITI Aayog - Established in 2015, it replaced centralized planning with a model focused on data analytics, policy primers, and aspirational targets.

Aspirational Districts Programme (ADP) - Launched in 2018 to uplift 112 underdeveloped districts using real-time dashboards to monitor 49 key performance indicators (KPIs).

Aspirational Blocks Programme (ABP) - Initiated in January 2023 to extend the ADP paradigm to 500 underdeveloped blocks across 27 States and 4 Union Territories.

Smart Cities Mission (2015-2025) - Integrated Integrated Command and Control Centres (ICCCs) as the "nervous systems" of urban governance, improving traffic, safety, and waste management.

II. Digital Governance Innovation

Digital Public Infrastructure (DPI) serves as the backbone of democratic decentralization in India.

The India Stack - Aadhaar (covering ~140 crore residents) provides a single digital identity that underpins welfare schemes, bank accounts, and mobile connections.

Digital Payments - UPI handles over 20 billion transactions monthly, reaching 20.7 billion in October 2025.

Education and Health - Platforms like DIKSHA-SWAYAM provide multilingual school education, while the Ayushman Bharat Digital Mission has created 79.9 crore health accounts and linked over 67 crore records.

Document Storage - DigiLocker has grown to nearly 54 crore users, enabling authentic digital access to certificates and licenses

III. Inclusive Participation and Feedback

Innovation has provided new avenues for citizens to transition from passive recipients to active participants in policy.

MyGov Platform – Launched in 2014 as the official citizen engagement portal, it allows citizens to contribute ideas to policy and provide feedback.

UMANG App – Integrates over 2,300 citizen services from central and state agencies into a single mobile platform.

Grievance Redressal – The CPGRAMS system empowers citizens to report issues; new 2024 guidelines reduced the maximum advised redressal time from 45 days to 21 days.

Performance Benchmarking – Tools like the National e-Services Delivery Assessment institutionalize accountability by comparing performance across states and departments.

IV. Promoting Excellence and Capacity Building

Recognizing and incentivizing good governance is essential for fostering a culture of innovation among public servants.

Prime Minister's Awards for Excellence – Honors outstanding work in public administration, signaling that problem-solving and experimentation are integral to professional roles.

Mission Karmayogi – A national program for civil services capacity building designed to nurture creative, proactive, and technology-comfortable officials.

V. The Road to Governance 2.0

Future governance opportunities lie in improved performance benchmarking and automated systems.

Outcome-Based Benchmarking – Utilizing AI to reduce forecasting errors or court pendency by at least 30% within five years.

Default Digital Systems – Moving toward a system where certificates and benefits have clear maximum time limits with automatic escalation for missed deadlines.

Collaborative Networks – Building "co-learning networks" where states and districts share successful experiences in disaster management, health, and agriculture.

Scenario-Planning – District-level governance can be strengthened through annual planning for risks like floods, heat, or drought with pre-agreed response triggers.

II. Legacy — Dr. M. S. Swaminathan – Architect of Abundance

GS Paper III – Economics of Animal-Rearing; Food Security; Major Crops/Cropping Patterns in various parts of the country.

This chapter commemorates the birth centenary of Dr. M. S. Swaminathan (August 7, 1925 – September 28, 2023), the geneticist who transformed India from a nation on the brink of famine into a global leader in food production.

I. Early Life and Educational Turning Point

Formative Years – Born in Kumbakonam, Tamil Nadu, Swaminathan witnessed the devastating 1943 Bengal famine, which claimed 3 million lives.

Choosing Agriculture – Despite qualifying for the prestigious Indian Police Service (IPS), he chose a UNESCO fellowship in the Netherlands to pursue agricultural science.

Global Academic Foundation – He secured his PhD from the University of Cambridge and conducted postdoctoral research at the University of Wisconsin before returning to India in 1954.

II. The Green Revolution – A Lifeline for India

In the early 1960s, India faced an acute grain shortage and a humiliating reliance on low-quality foreign aid like the American PL-480 program.

The Collaboration – Swaminathan collaborated with Dr. Norman Borlaug to adapt Mexican semi-dwarf wheat to Indian conditions.

High Yield Variety (HYV) Seeds – The introduction of IR-8 rice and resilient wheat varieties turned barren fields into "goldmines of grains".

Technological Shift – The revolution brought improved irrigation, chemical fertilizers, and mechanized farming equipment to the forefront.

Production Surge – Wheat production rose from 10 million tonnes in 1965 to roughly 23 million tonnes in less than a decade.

III. International Contributions and Environment

Dr. Swaminathan's influence extended far beyond Indian borders through his leadership in global scientific organizations.

Director-General of IRRI – He led the International Rice Research Institute in the Philippines from 1982 to 1988.

World Food Prize – He was the first-ever recipient of the World Food Prize in 1987, using the funds to establish the M. S. Swaminathan Research Foundation (MSSRF).

Coastal Protection – A pioneer in mangrove conservation, he advocated for their role in coastal safety, which was proven vital during the 2004 Indian Ocean tsunami.

Global Leadership – He served as the president of the Pugwash Conferences on Science and World Affairs and co-chaired the UN Millennium Project on Hunger.

IV. Concept of "Biohappiness"

Harmonious Progress – Swaminathan championed "biohappiness," the idea that real happiness occurs when humans and the natural environment thrive together.

Sustainability – He advocated for adopting sustainable growing methods and protecting biodiversity rather than pursuing progress at the cost of the environment.

Agricultural Centrality – He famously stated, "If agriculture goes wrong, nothing else can go right".

V. Timeless Legacy

The Everlasting Revolution – His birth centenary (2025–26) serves as a moment of national pride, celebrating his role as the "Father of Economic Ecology".

Inspiration for Youth – Today's youth stand to benefit from his commitment to science, sustainability, and social equality.

Continuing Work – His passion for service lives on through the MSSRF and his daughter, Dr. Soumya Swaminathan

KURUKSHETRA

1. Startups Transforming Education & Skill Development

GS Paper II – Issues relating to development and management of Social Sector/Services relating to Education and Human Resources.

GS Paper III – Indian Economy and issues relating to planning, mobilization of resources, growth, development and employment.

Current Ecosystem – India is the world's third-largest startup ecosystem with over 1.4 lakh registered startups and 118 unicorns by mid-2025. A new unicorn emerges approximately every 20 days.

NEP 2020 Alignment – The National Education Policy 2020 advocates for a shift from rote learning to a multidisciplinary, skill-based system. It introduces flexible entry and exit options to empower learners and remove the stigma of "dropping out."

Technological Innovations

Personalized Learning – Startups use data analytics and AI-powered adaptive algorithms to tailor content to individual learning paces and styles.

STEM & Early Skilling – Platforms like Cuemath foster scientific temperament, while startups like SpeakX and Flintobox focus on foundational literacy and numeracy through play-based content.

Assistive Tech – Startups like Tinkerbelle Labs empower Children with Special Needs (CWSN) through accessible devices and AI-based support.

The Skill India Mission – Startups like UpGrad and Coursera India bridge the academia-industry gap by offering micro-credentials in emerging fields like AI-ML, coding, and digital marketing.

Challenges – Key hurdles include maintaining robust technological infrastructure, ensuring long-term financial viability, and the need for comprehensive teacher training to leverage these tools.

2. Empowering Farmers through Agri Startups

GS Paper III – Major crops/cropping patterns; e-technology in the aid of farmers; Issues related to direct and indirect farm subsidies and minimum support prices.

Growth Profile – Agri-startups have grown at a rate of approximately 25% per annum since 2016, with over 3,200 registered by 2024.

Functional Domains

Precision Agriculture – Use of IoT, drones, and satellite imaging for soil monitoring and increased yield (e.g., Fasal, Cropin).

Supply Chain & Logistics – Reducing post-harvest losses through optimized farm-to-fork delivery (e.g., DeHaat, Ninjacart).

Agri-Fintech – Addressing financial inclusion through AI-based risk profiling and collateral-free loans (e.g., Samunnati).

Government Catalysts

RKVY-RAFTAAR – Specifically the "Innovation and Agri-Entrepreneurship Development" program, which has supported over 1,100 agri-startups.

Incubation Network – India now hosts over 100 agriculture-focused incubators and accelerators like AGRI UDAAN.

Regional Variation – Western and Southern states (Maharashtra, Karnataka, Gujarat) dominate the ecosystem, contributing nearly 50% of agri-tech startups.

3. Social Startups – Catalyst of Change

GS Paper II – Development processes and the development industry – the role of NGOs, SHGs, various groups and associations, donors, charities, institutional and other stakeholders.

GS Paper III – Inclusive growth and issues arising from it.

Purpose-Driven Enterprise – These startups combine business rigor with measurable social impact goals in sectors like healthcare, climate action, and gender inclusion.

Impact Models

Barefoot College – A pioneer in training rural "Solar Engineers" and healthcare professionals, reaching over 10 million lives across 96 countries.

Access to Entitlements – Haqdarshak has served over 7.6 million families by helping them access welfare schemes.

Inclusive Skilling – Trestle Labs and BleeTech provide assistive technologies, while ventures like Atypical Advantage focus on employment for the differently-abled.

Government Framework – Support comes through the Startup India initiative, Atal Innovation Mission (AIM), and NITI Aayog's Aspirational Districts Programme.

New Financial Architecture – SEBI's Social Stock Exchange offers a transparent platform for social enterprises to raise capital.

4. Startups Promoting Entrepreneurship in Rural India

GS Paper III – Indian Economy and issues relating to employment; Government Budgeting.

GS Paper II – Welfare schemes for vulnerable sections of the population by the Centre and States.

Startup Village Entrepreneurship Programme (SVEP) – A component of DAY-NRLM that has helped establish over 3 lakh enterprises and created over 6.2 lakh job opportunities.

DST Initiatives – The NIDHI-PRAYAS program supports early-stage innovators by converting ideas into working prototypes suitable for rural adoption.

District-Level Training – One Rural Self-Employment Training Institute (RSETI) has been established in every district. At least 70% of trainees must be from rural Below Poverty Line (BPL) categories.

State Policies –

Gujarat – Student Startup and Innovation Policy (SSIP) 2.0.

Karnataka – AVGC–XR Policy focusing on animation, visual effects, and gaming.

Uttar Pradesh – Targets at least one incubator per district.

Emerging Rural Sectors – Startups are entering medicinal farming (Chhattisgarh), eco-tourism (Bastar), and the "creator economy" via affordable internet access.

5. New Labour Laws 2025 – Employment Regulation

GS Paper II – Government policies and interventions for development in various sectors.

GS Paper III – Issues relating to employment; Indian Economy (Labour reforms).

Consolidation – 29 fragmented, colonial-era laws have been merged into four cohesive codes – Wages (2019), Industrial Relations (2020), Social Security (2020), and Occupational Safety (2020).

Key Reforms for a Modern Workforce

Gig Workers – Formal recognition and the creation of a social security fund where aggregators must contribute 1–2% of annual turnover.

Women Workers – Permission to work night shifts (with consent and safety measures) and mandatory representation in grievance committees.

Employee Benefits – Mandatory appointment letters for all, a National Floor Wage, and double wages for overtime.

Fixed-Term Employment – Equal benefits to permanent workers and faster gratuity eligibility after just one year (instead of five).

Compliance – Introduces a "one license, one registration, one return" framework to reduce administrative burden.

6. Rural Women Entrepreneurs – Foundation of 'Aatmanirbhar Bharat'

GS Paper I – Role of women and women's organization; Social empowerment.

GS Paper III – Major crops/cropping patterns (Seed saving/Organic farming).

Agroecological Leadership – Women are acting as innovators in seed saving, establishing over 80 community-managed seed banks in Telangana alone to preserve climate-resilient crop varieties.

Economic Upliftment – The Female Labour Force Participation Rate rose to 41.7% in 2023–24, driven largely by rural women entrepreneurs. Over 40% of UDYAM-registered MSMEs are now women-owned.

Sustainable Micro-enterprises – Women lead production of organic inputs (vermicompost, bio-enzymes) and cottage industries (pickles, upcycled handicrafts).

Success Indicators – A study on rural women entrepreneurs revealed that autonomy, personal development, and "mastery" are primary drivers of their happiness and success.

7. Regional Spotlights – Himalayan States & North East Hubs

GS Paper III – Conservation, environmental pollution and degradation; Internal Security (Regional development).

Waste Management in Himalayan States

Kedarnath – A Digital Deposit Refund System (DRS) uses QR codes on plastic bottles to track and refund deposits digitally via UPI.

Leh – A solar-powered solid waste management facility processes 30 tonnes per day, repurposing recovered waste into pavement tiles.

North East India Startup Hub

Current Status – Over 2,000 recognized startups, with Assam and Manipur leading the region.

Core Sectors – Agriculture, handloom/textiles, and tourism are the region's natural strengths.

Challenges – Significant gaps in seed funding, mentorship, skilled managerial manpower, and logistical connectivity to larger markets.

Nagaland's Resilience – Transitioning from jhum (shifting) cultivation to settled horticulture, forest-based enterprises, and cultural tourism via the Hornbill Festival.

DOWN TO EARTH

1. Eco-Anxiety – Emotional Crisis of a Changing Planet

In 2024, UNEP released Navigating New Horizons – A Global Foresight Report on Planetary Health and Human Wellbeing highlighting the world's youth are facing a growing emotional and psychological crisis known as eco-anxiety or climate grief.

Eco-Anxiety

Eco-anxiety refers to chronic fear, stress, or grief related to environmental damage and climate change. It can show up as –

1. Persistent worry about the future;
2. Feelings of helplessness or guilt;
3. Anger at institutions or older generations;
4. Grief for ecosystems, animals, or lost futures;
5. Importantly, eco-anxiety is not a mental disorder. It is a natural response to the environmental crisis, especially among younger generations who feel the future is uncertain.

Why Is Eco-Anxiety Increasing?

Do you feel that the climate is changing around you?

■ Yes ■ No ■ Somewhat ■ Not sure
(figures in %)



Constant exposure to alarming news via social media and 24/7 headlines;

Lack of control over large-scale political and economic decisions;

Moral pressure to live 'perfectly sustainable' lives;

Unclear futures, especially around jobs, homes, and family planning;

When threats feel global, invisible, and slow-moving, the brain struggles to process them, leading to chronic stress rather than short bursts of fear.

Evidence of a Generation's Distress

A survey among over 300 people aged 16–25 years reveals how deeply eco-anxiety has taken root.

88% said they feel the climate is changing around them.

67% reported that these changes already affect their daily lives and habits.

Does it impact your daily life/lifestyle?

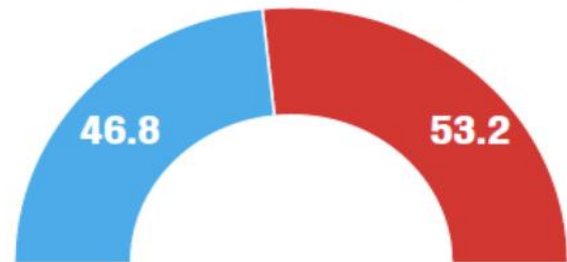
Yes No Somewhat Not sure
(figures in %)



Do you think that climate change disproportionately affects:

Rural Urban

(figures in %)



Income groups: Rich Poor Middle
All groups (equally) (figures in %)

This generation, born into an era of climatic

instability, may have never experienced what earlier generations called a 'normal' climate.

Living Through a Changed Climate

Erich Fischer of ETH Zurich likened the climate's behavior to 'an athlete on steroids'. Data from Climate Central further show that anyone born after February 1986 has never experienced a month with normal global temperatures, every single month has been warmer than average.

What Young People Notice

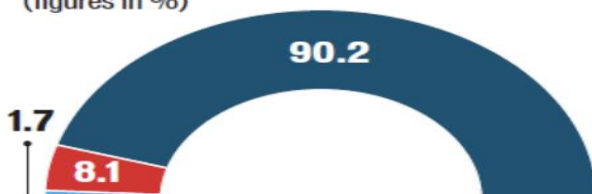
Survey identified nine common manifestations of climate change as observed by youth -

1. Warmer temperatures and unseasonal heat/rainfall recognized by more than two-thirds.
2. Smog and fog were cited by 40%.
3. Changes in food quality noted by 36%.
4. Extreme cold mentioned by 38%.
5. Rising insects and pests experienced by 32%.

These symptoms reflect how climate change permeates everyday experiences from weather patterns to food and health.



Gender based: Men Women All genders
(figures in %)



Inequality in Impact

While 61% of respondents believed that climate change affects all social classes equally, others disagreed asserting that the poor bear the brunt of environmental degradation.

On gender differences, nearly **90%** said the impacts are felt equally by men and women, suggesting a shared sense of vulnerability.

Emotional Landscape

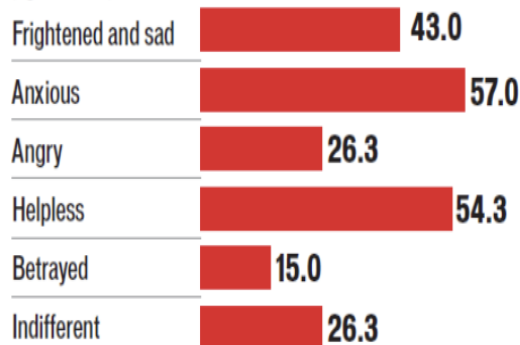
The emotional cost is profound. When asked about their feelings toward climate change -

- 57%** felt anxious;
- 54%** felt helpless;
- 43%** felt frightened or sad;

Many also reported feeling angry or betrayed; These findings underline that eco-anxiety is not a fringe emotion, it is a widespread psychological response to a global threat.

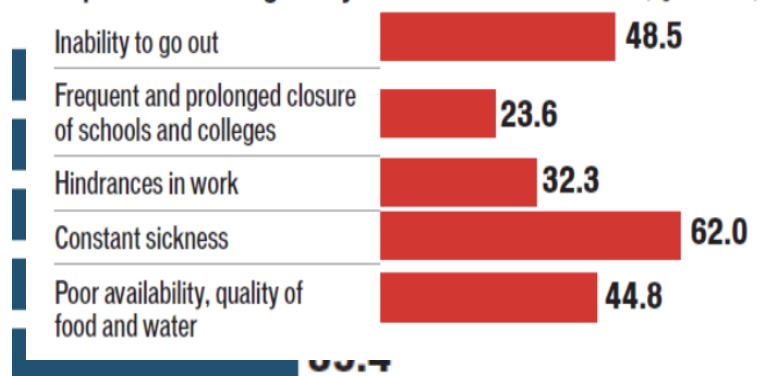
How do you feel about the changing climate?

(figures in %)



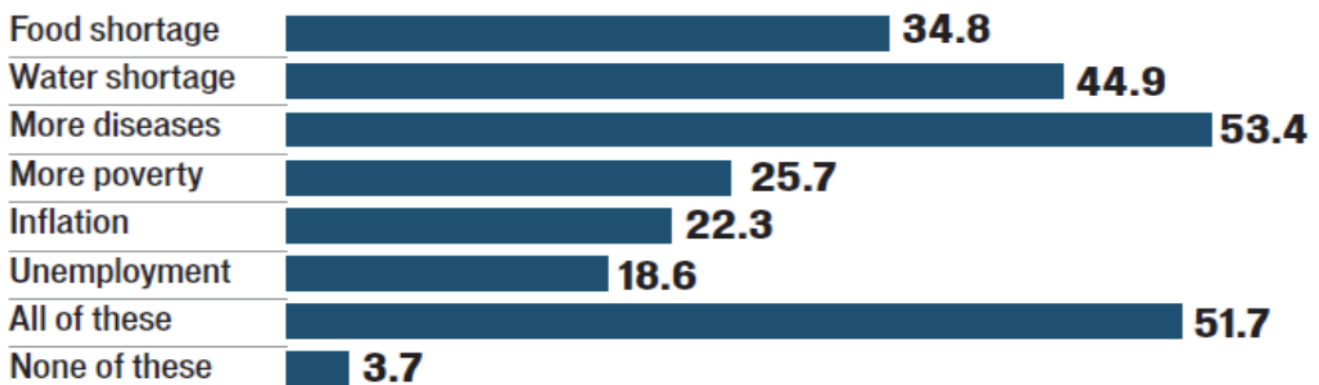
Which specific consequence of climate change triggers unpleasant feelings for you?

(figures in %)



In your opinion, climate change in future will lead to:

(figures in %)



Fears for the Future

1. 53% expect climate change to increase diseases.
2. 45% foresee water shortages.
3. One-third anticipate food crises.

About 94% expressed worry about their future, while half described government action as 'disappointing'.

How worried are you about your future because of climate change?

■ Not at all ■ A little ■ Moderately ■ Highly ■ Extremely (figures in %)



Conclusion

Eco-anxiety is not merely a personal issue; it is a societal signal. The distress felt by today's youth mirrors the urgency of our planetary crisis. As UNEP's 2024 report emphasizes, addressing this emotional

catastrophe requires not only stronger environmental policies but also mental health support for a generation inheriting a rapidly changing world.

2. Waste, Infrastructure, And Eco-Anxiety on the Edge of an Expanding City

Urban India faces a complex intersection of waste generation, infrastructural strain, and climate-linked psychological stress. Recent studies reveal that unregulated urban expansion and poor environmental governance have intensified eco-anxiety, particularly among peri-urban communities and youth.

About

India's urban population reached 510 million in 2024, projected to exceed 650 million by 2036 (Census of India, 2024). It has blurred the boundaries between rural and urban zones, creating 'urban edges' that lack the governance, infrastructure, and ecological planning found in city cores. Recent research identifies these peripheral zones as hotspots of climate-induced psychological vulnerability, driven by unmanaged waste, pollution, and infrastructural neglect.

Urban Expansion and Infrastructural Inequality

Growth of Peri-Urban Zones – Peri-urban areas such as Gurugram's Sohna belt, Bengaluru's Whitefield periphery, and Hyderabad's Gachibowli fringe have seen exponential growth. However, 47% of new housing in these regions lacks basic waste disposal infrastructure. It results in mixed waste dumping, open burning, and contamination of water sources. These practices cause rising public health anxiety and stress symptoms consistent with eco-anxiety frameworks.

Infrastructural Deficit – A 2025 NITI Aayog survey found that urban peripheries receive less than one-third of the municipal waste management budget per capita compared to central urban wards. In cities like Delhi, the Ghazipur landfill (65 meters high in 2025) symbolizes infrastructural collapse. Fire incidents at landfills, now occurring every 10–14 days, expose residents to methane and PM2.5 levels exceeding 400 µg/m³ during peak summer months.

Waste, Ecology, and Psychological Strain

New Waste Economy – India now produces 74 million tonnes of solid waste annually (CPCB, 2025), up from 62 million in 2022. Only 28% is scientifically processed. The remainder accumulates in peripheral dumping sites like Bhandewadi (Nagpur), Okhla (Delhi), and Perungudi (Chennai). Residents living within 3 km of such dumps show two times higher risk of chronic anxiety and respiratory distress, a correlation linked to perceived environmental hopelessness.

Waste Workers and Environmental Precarity – Informal waste pickers face compounding stressors – toxic exposure, stigma, and exclusion from formal municipal systems. These 'eco-precarious livelihoods' reflect a psychological toll rooted in systemic neglect rather than direct climate events, a form of 'slow eco-anxiety'.

Eco-Anxiety in India

Prevalence and Patterns – About 42% of Indian youth aged 16–24 experience moderate to severe eco-anxiety. Rates are higher among young women (54%) and residents of flood-prone urban slums (62%). The 'environmental helplessness' as a major psychological pattern among urban youth witnessing infrastructural collapse and pollution.

Psychological Edge of the Expanding City – Climate anxiety in South Asian cities often centers around 'infrastructural betrayal', a feeling that governance systems have failed to protect citizens from ecological harm. Peripheral populations in cities like Delhi NCR, Chennai, and Pune show symptoms of chronic worry, fatigue, and disengagement from civic participation.

Policy, Infrastructure, and Emotional Resilience

Integrating Peripheries into Waste Governance – Urban governance reforms recommend ward-level waste management autonomy, prioritizing decentralized composting and inclusion of informal workers. Sustainability frameworks must integrate mental health and ecological literacy, recognizing eco-anxiety as a legitimate public health issue.

Circular Economy and SDG Alignment – New waste management strategies align with UN SDG 11 (Sustainable Cities) and SDG 13 (Climate Action). Cities like Indore and Surat have piloted Zero Waste Zones, cutting landfill dependency by 35% since 2023. However, urban fringes lag behind, requiring both infrastructural upgrades and psychosocial resilience training to address eco-anxiety.

Climate Change & Impact on Sports

Climate change is no longer a distant environmental issue, it is a present-day reality reshaping many aspects of human life, including sports. From grassroots community games to elite international competitions, rising temperatures, extreme weather events, and environmental degradation are increasingly influencing how, when, and where sports are played.

Rising Temperatures and Athlete Health

1. One of the most immediate effects of climate change on sports is increasing heat.
2. Heat stress and dehydration raise the risk of heat exhaustion and heatstroke.
3. Endurance sports such as marathons, cycling, tennis, and football are particularly vulnerable.
4. Athletes may experience reduced performance, slower recovery, and higher injury risk.

Extreme Weather Disrupting Competitions

Climate change is increasing the frequency and intensity of extreme weather events, including storms, floods, droughts, and wildfires.

Common disruptions include

1. Flooded stadiums and pitches causing match cancellations;
2. Storm damage to sports infrastructure;
3. Poor air quality from wildfire smoke affecting outdoor events
4. These disruptions create financial losses, scheduling chaos, and safety concerns for athletes and spectators alike.

Changing Playing Conditions and Performance

Climate change alters the environment in which sports are played, affecting performance in subtle but important ways –

1. Hotter air reduces endurance capacity
2. Wind pattern changes influence sports like golf, sailing, and athletics
3. Water temperature changes affect swimming, rowing, and open-water events
4. Athletes now train for climate adaptability, not just physical skill.

Economic and Social Impacts

1. Higher insurance costs for events and venues;
2. Increased maintenance and repair expenses;
3. Loss of revenue from canceled or relocated events;

At the community level, climate change can reduce access to sport, particularly in vulnerable regions where facilities are damaged or unsafe.

Sports as Part of the Climate Solution

While sports are affected by climate change, they also play a powerful role in climate action.

Positive steps include

1. Building energy-efficient stadiums
2. Reducing travel emissions
3. Eliminating single-use plastics
4. Promoting public awareness through athlete advocacy

Because sports have massive global audiences, they are uniquely positioned to influence public behavior and attitudes toward sustainability.

Future of Sports in a Warming World

Adapting to climate change is no longer optional for sports organizations. The future will likely involve

1. Climate-resilient infrastructure;
2. Flexible scheduling models;

3. New rules and safety standards;
 4. Stronger collaboration between sports bodies, scientists, and policymakers;
- The challenge is significant, but so is the opportunity—for sports to lead by example.

3. Oraon Adivasi Tribe of Jharkhand & Destruction of Nature

The Jharkhand plateau has long been known as the land of forests. For centuries, its dense sal forests, rivers, and hills have been home to many Adivasi (indigenous) communities. Among them, the Oraon tribe (aka Kurukh) stand out for their deep spiritual, cultural, and economic relationship with nature.

About Oraon Tribe

The Oraons are traditionally settled cultivators and forest dwellers. Their worldview sees humans as part of nature, not masters over it. Forests are not merely resources; they are sacred living spaces. Key aspects of Oraon life connected to nature include -

Agriculture - Rain-fed farming using indigenous seeds and traditional knowledge.

Forests - Source of food, fuel, medicine, and livelihood.

Water bodies - Rivers and ponds are central to daily life and rituals.

Sacred groves (Sarna) - Worship sites protected by strict customary laws.

Their main festival, Sarhul, celebrates the marriage of the Earth and the Sun, symbolizing renewal of forests and life. Cutting trees or polluting water is traditionally considered a moral and spiritual offense.

Traditional Ecological Knowledge

The Oraons possess generations of ecological wisdom -

1. Use of herbal medicines derived from forest plants;
2. Rotational farming to prevent soil exhaustion;
3. Protection of biodiversity through sacred forest patches;

This sustainable lifestyle allowed humans, animals, and forests to coexist harmoniously for centuries.

Destruction of Nature in Jharkhand

In recent decades, Jharkhand has become a hub for mining and industrial projects due to its rich reserves of coal, iron ore, and bauxite. While these activities contribute to national economic growth, they have devastated local ecosystems.

Major causes of environmental destruction

Mining and quarrying - Large-scale deforestation and land degradation;

Industrial pollution - Contamination of rivers and groundwater;

Commercial logging - Loss of sal forests and wildlife habitats;

Dams and infrastructure projects - Displacement of villages;

These changes have directly affected Oraon livelihoods, food security, and health.

Impact on the Oraon Community

Loss of Forests - Forests that once provided fruits, firewood, medicines, and grazing land are disappearing. With them vanish traditional knowledge systems and cultural practices.

Displacement and Migration - Many Oraon families are forced to leave ancestral lands due to mining projects. Displacement often leads to poverty, loss of identity, and migration to cities as unskilled laborers.

Cultural Erosion - When sacred groves are destroyed, rituals like Sarhul lose their meaning. The younger generation, disconnected from land and forests, risks losing language, songs, and traditions.

Health and Nutrition Crisis - Polluted water, reduced forest foods, and exposure to industrial waste have increased malnutrition and disease among Oraon communities.

Resistance and Environmental Movements

Despite these challenges, the Oraons have not remained silent. They have been at the forefront of forest and land rights movements in Jharkhand, often invoking traditional laws and constitutional protections like the Forest Rights Act 2006.

1. Village councils, women's groups, and youth organizations continue to fight for -
2. Protection of forests and sacred groves;
3. Community control over natural resources;
4. Sustainable development that respects indigenous rights;

4. Shift To Sustainable Materials Is Inevitable – Banofi Leather Leads the Change with Banana Fibre-Based Innovation

Banofi Leather (Banana fibre-based products) uses banana waste to produce vegan leather and has partnered with major fashion brands.

Rise of Sustainable Alternatives in Fashion

The search for sustainable materials has become imperative with over 92 billion tonnes of textile waste generated annually and leather tanning identified as one of the most polluting industries. Among the most promising innovations is Banofi Leather, a vegan leather made from banana stem waste, a byproduct of the world's fourth-largest agricultural crop. It offers a cruelty-free, low-carbon, and biodegradable alternative to animal leather.

Environmental Urgency for Change

Traditional leather production contributes to 13% of the fashion sector's total carbon emissions. Tanning processes release toxic chromium compounds into waterways. As consumers increasingly demand ethical and eco-friendly products, the global vegan leather market, valued at USD 73.38 billion in 2023, is projected to reach USD 92.36 billion by 2028. Plant-based leathers, including those derived from pineapple (Piñatex), cactus (Desserto), and banana (Banofi), are gaining traction among both luxury and fast-fashion brands.

Banofi Leather

Banofi Leather, developed in India, upcycles banana stem waste, typically discarded after fruit harvesting into durable, flexible sheets that mimic the texture and resilience of animal hide.

Production Process

1. Extraction of banana fibre from discarded stems.
2. Processing using eco-friendly binders and natural resins.
3. Finishing into fabric sheets with minimal water and energy use.

The production of Banofi leather reduces water consumption by 85% and CO₂ emissions by up to 90% compared to traditional leather.

Industry Adoption and Global Collaborations

Banofi Leather has partnered with major fashion labels to integrate banana-based vegan leather into accessories and apparel. Recent reports highlight collaborations with luxury footwear, sustainable handbags, and apparel designers in Europe and Asia. In 2024, Banofi was featured in the Sustainability Directory as one of the top five startups revolutionizing eco-materials in fashion. The company's circular model supports local banana farmers, enhancing rural livelihoods while preventing millions of tonnes of agricultural waste.

Consumer Behaviour and the Gen Z Effect

A study on urban Indian consumers found that 67% of Gen Z buyers prefer brands using bio-based materials, citing ethical sourcing and environmental preservation as key motivators. Banofi's narrative, combining sustainability, innovation, and social impact aligns perfectly with this generational demand.

Economic and Social Implications

Each tonne of banana stem waste converted into Banofi leather prevents 2.5 tonnes of CO₂ emissions and provides additional income for farmers. It aligns with India's national sustainability goals and the UN SDG 12 – Responsible Consumption and Production.

Future Outlook – Toward a Circular Fashion Economy

As material science advances, innovations like Banofi leather could replace up to 25% of conventional leather by 2030. Continuous R&D, combined with brand collaborations and government incentives, could make banana-based leather mainstream within the next decade.

5. Pollution – Turning Ordinary Living into an Expensive Exercise in Survival

Clean air and water have become premium commodities, once a free and basic human right.

About

According to the World Bank (2024), environmental degradation now costs low- and middle-income countries up to 8% of GDP annually due to healthcare costs, productivity loss, and premature deaths. Pollution, whether in the air we breathe, the food we eat, or the water we drink has silently inflated the cost of living, transforming daily existence into a survival struggle.

Air Pollution and the Cost of Health

Recent data reveals that chronic exposure to PM2.5 pollution increases healthcare expenditures by up to 20% in urban households. Similarly, a study found that respiratory illnesses among schoolchildren were three times higher in polluted zones, leading to elevated family medical spending and absenteeism costs. Air purifiers, face masks, and air-quality apps have now become essentials, adding to daily household expenses. The global air purifier market grew by 12.4% in 2025 (OECD report). Cities like Delhi, Beijing, and Lagos recorded air quality index (AQI) values over 300 for more than 120 days in 2024, making filtered air a privilege, not a guarantee.

Water Scarcity and Toxicity

A study reported that over 2 billion people lack access to clean water, forcing many to rely on bottled alternatives. Water purification costs in urban areas of Nepal, India, and Sub-Saharan Africa have risen by 35–60% due to industrial pollution. WHO (2024) estimates that polluted water contributes to 1.4 million deaths annually. In Nigeria, rising fossil fuel use and wastewater contamination led to a 40% increase in household utility expenses. As clean rivers turn toxic, families spend more on bottled water, filtration systems, and health treatments for waterborne diseases, costs that disproportionately affect the poor.

Economic Erosion – Pollution and Housing Costs

Environmental pollution doesn't just threaten health—it reshapes real estate markets. Pollution in Chinese cities reduces housing rents by 15–30% in affected areas, while pushing cleaner suburban zones into higher price brackets. Ironically, those who can least afford it end up living in the most polluted neighborhoods, a vicious cycle of environmental and economic inequality.

Agricultural Fallout

A study demonstrated that soil contamination from pesticides and heavy metals reduces crop yields by up to 18%, inflating food prices. Additionally, microplastic pollution is now present in over 90% of global table salt (UNEP, 2024), increasing long-term health risks and dietary costs through medical dependence. Organic produce has become a necessity for safe consumption, yet remains financially inaccessible for many.

Pollution and Psychological Costs

A study found that exposure to urban air pollution correlates with higher levels of anxiety and depression. It has led to rising mental health treatment costs and increased demand for green spaces and eco-tourism as psychological refuges. In polluted cities, tranquility itself has become commodified—manifesting in the booming wellness and eco-retreat industries.

New Class Divide

Pollution has created a new socioeconomic hierarchy – those who can afford clean air, water, and organic food versus those who cannot. Pollution negatively correlates with the Quality-of-Life Index, especially among low-income groups. For millions, surviving pollution means paying for health insurance, filtration devices, energy-efficient homes, and green-certified transport, all of which widen economic gaps globally.

Pathways Forward

Governments need to integrate pollution reduction with economic policy, to reverse this costly trajectory. Green finance initiatives can fund sustainable urban infrastructure. Low-carbon transport systems like Kampala's electric BRT can reduce dependency on fossil fuels. Eco-innovation in agriculture and urban planning must be subsidized to make sustainable living affordable.

6. Uninhabitable Heat, Drought, And Extreme Weather

It seems unfair to bring an innocent life into a world sliding towards uninhabitable heat, drought and extreme weather

Ethical Dilemma of Birth in a Warming World

As climate change accelerates, with 2025 marking one of the hottest years on record, a growing number of young adults are rethinking the morality and practicality of having children. Extreme heat, droughts, and climate disasters now threaten the very habitability of large regions of the planet. It has given rise to what sociologists call 'reproductive climate anxiety', where people question whether it is fair or even ethical, to bring new life into a collapsing biosphere.

A Planet Nearing Critical Heat Thresholds

According to the One Earth, 2025 report, global surface temperatures are now averaging 1.5°C above pre-industrial levels, with projections suggesting an overshoot beyond 2°C by 2040 if emissions remain unchecked. The Asian Development Bank's 2025 Heat Study found that extreme heat exposure has tripled since 1980, with regions in South Asia and the Middle East already facing 'lethal wet-bulb temperatures', conditions under which human survival is impossible beyond several hours.

1. One-third of humanity could experience 45°C heat regularly by 2070.
2. Drought duration has increased by 29% since 2000, devastating crops and groundwater.

The World Bank's 'Water in a Heated World' (2024) report warns that freshwater availability will fall by half in key basins like the Indus and Nile before 2050. These trends suggest not just discomfort, but uninhabitability for many regions within a single generation.

Psychological and Ethical Dimensions

70% of young people (ages 16–25) report feeling 'very worried' about climate change, and 39% say they are hesitant to have children. Psychologists now classify this concern as eco-reproductive anxiety, a blend of fear, grief, and guilt regarding future generations. Women in climate-affected regions express heightened trauma, as drought and displacement disrupt reproductive health and autonomy. The fairness question thus becomes not merely philosophical, it is deeply psychological, affecting family planning decisions globally.

Harsh Realities

India's heat index reached a record 60°C in May 2024, killing over 2,000 agricultural workers. Horn of Africa droughts (2020–2025) displaced 5 million people, creating new 'climate orphans' (UNHCR, 2025). Australia's 'uninhabitable zones' are expanding due to lethal heat and bushfires. Pacific islands are facing total submersion, forcing intergenerational relocation.

7. Farms, Food Systems, And Food Habits

Modern food systems, driven by industrial agriculture, global supply chains, and hyper-consumerism, have widened the gap between people and the land that sustains them. According to the FAO (2025), global food production now contributes to over one-third of greenhouse gas emissions, while 30% of all food produced is wasted. It comes at a grave ecological and cultural cost.

Evolution of Modern Food Systems

From Subsistence to Industrial Agriculture – Traditional farming practices were local, diverse, and regenerative. However, post-1950s industrialization shifted focus toward monocultures, mechanization, and chemical fertilizers. The EU's food system has become one of the least sustainable sectors, with nutrient depletion and soil erosion accelerating despite policy efforts like the Farm to Fork Strategy.

Global Supply Chains and Hidden Costs – The global food web today moves goods across thousands of miles before they reach our plates. The consumers often lack awareness of these hidden environmental and ethical costs, perpetuating unsustainable demand cycles.

Environmental Consequences of Detachment

Soil and Biodiversity Loss – The UNCCD (2024) warns that over 24 billion tons of fertile soil are lost annually due to intensive farming. Monoculture cropping has driven the extinction of local crop varieties, reducing biodiversity by an estimated 75% since 1900.

Water Scarcity and Pollution – Agriculture consumes 70% of global freshwater, and chemical runoff contributes to 'dead zones' in major aquatic systems such as the Gulf of Mexico. The World Resources Institute (2024) found that one-third of rivers in agricultural regions now contain unsafe nitrate levels.

Greenhouse Gas Emissions – Livestock farming remains a major emitter, responsible for 14.5% of all human-induced GHGs (FAO, 2025). The global shift to meat-heavy diets has intensified methane emissions, making diet reform a crucial component of climate action.

Human and Cultural Impact

Loss of Food Traditions – Urbanization and globalization have eroded regional cuisines and local food knowledge. The 'fast-food culture' not only affects nutrition but also severs intergenerational connections to farming wisdom and traditional preparation methods.

Health Consequences – Industrialized diets high in processed foods have triggered a global nutrition crisis where obesity coexists with malnutrition. The Lancet Global Health Report (2024) revealed that over 2.3 billion adults are overweight or obese, while 800 million remain undernourished reflecting a deep imbalance in global food equity.

Emerging Solutions – Reconnecting with the Land

Regenerative Agriculture Movement – Regenerative practices such as crop rotation, composting, and agroforestry are regaining ground. These methods restore soil health and sequester carbon. A 2025 Nature Food analysis showed that regenerative farms can reduce emissions by 30% and increase biodiversity by 50% compared to industrial monocultures.

Urban and Local Food Systems – Urban agriculture and local food networks, from rooftop gardens to farmers' markets, help reforge direct relationships between consumers and producers. The FAO's 2024 'City Food Initiative' estimates that urban farms could supply up to 20% of city vegetable needs, promoting food security and awareness.

Conscious Consumption – The rise of 'farm-to-fork' movements, zero-waste lifestyles, and plant-based diets indicate a cultural reawakening. Apps like Too Good To Go and Imperfect Foods are examples of technology reconnecting ethics and appetite.

8. Cascading Effects of Species Disappears from a Land

When a species disappears from a land, the loss extends far beyond the species itself.

About

The disappearance of a species from an ecosystem represents more than the loss of a single organism as it initiates a cascade of ecological, economic, and cultural repercussions. Recent research underscores that biodiversity decline disrupts food webs, alters nutrient cycles, and weakens ecosystem resilience against climate change. According to the IPBES Global Biodiversity Report (2024), an estimated one million species are at risk of extinction, and many local extinctions are already reshaping ecosystems worldwide.

Ecological Web – Interconnectedness of Life

Trophic Cascades and Food Web Instability – When a species vanishes, the delicate balance of the food web collapses. A study found that local extinction of pollinators in Himalayan regions led to a 32% decline in alpine plant regeneration, illustrating how the loss of one group triggers widespread ecological decline. Predators, herbivores, and decomposers all rely on complex interdependencies, the disappearance of even a single keystone species can send shockwaves through the entire system.

Keystone Effect – Species such as wolves, bees, or mangroves act as ‘keystones’ and their removal destabilizes entire ecosystems.

Cultural and Economic Consequences

Livelihoods at Risk – Species loss jeopardizes human economies. The global decline of beneficial insects has cost agriculture over \$577 billion annually in lost pollination services. Communities dependent on fisheries, forest products, or ecotourism face social and economic collapse following species disappearance.

Cultural Erosion – Indigenous communities suffer cultural loss when species that form the core of traditional knowledge and spiritual identity vanish. The disappearance of medicinal plant species from Amazonian regions has erased centuries of ethnobotanical wisdom.

Hidden Cascades – Soil, Climate, and Water Systems

Soil Degradation – Species extinctions disrupt microbial and fungal symbioses, degrading soil fertility. Studies published in *Nature Ecology & Evolution* (2024) highlight that soil biodiversity loss correlates directly with declining carbon sequestration capacity, reducing ecosystem climate resilience.

Hydrological Impacts – Wetland species extinctions, such as the decline of amphibians and aquatic plants, disturb water purification systems. The World Water Development Report (2024) found that watersheds losing native aquatic species show a 40% decrease in natural filtration efficiency.

Recent Global Trends and Data

1. UNEP (2024) reported that 68% of vertebrate populations have declined since 1970.
2. Insects are declining by 2% annually, risking collapse of pollination networks.
3. Forest biodiversity loss has reduced global carbon storage by 7 billion tons annually.
4. Coral reef extinction is projected to affect 500 million people relying on marine biodiversity.
5. Local bird extinctions in European grasslands have reduced natural pest control by 26%.

Pathways to Recovery

Restoring Ecological Networks – Rewilding initiatives like reintroducing lost species like bison or wolves have shown promise.

The **European Rewilding Network (2025)** reported measurable recovery in soil and water quality following species reintroduction

Technological and Policy Innovations – DNA barcoding, habitat restoration drones, and AI-based monitoring are emerging tools.

The Global Biodiversity Framework calls for protecting 30% of Earth’s land and oceans by 2030, integrating community-based conservation and technology.

9. From Clean Cities to Contaminated Water – Hidden Crisis Beneath Indore’s Tragedy

Indore, India’s cleanest-ranked city, recently faced deaths caused by contaminated drinking water.

Water Supply and Sewage

Every litre of water supplied to households eventually returns as wastewater by 80%. But, most urban governance focuses on providing water, not managing what flows back. India’s flagship urban mission, the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), acknowledges the importance of water and sewage management. But, the spending pattern reveals misplaced priorities –

1. 62% of funds directed to water supply;
2. 34% to sewerage projects;

3. Only 3% to rejuvenating waterbodies;

The majority has gone into expanding supply, not managing waste out of ₹1.93 lakh crore spent on 3,500 projects. This imbalance needs to change, not by spending more, but by redesigning smarter, affordable systems.

A Sewage-First Approach – Affordable, Inclusive, and Circular

Use Onsite Systems as the Foundation – Onsite systems need not be a liability, they can be a sustainable solution if properly managed. Toilets need to be regularly desludged, and excreta needs to be transported to treatment sites where water and solid waste are recycled as usable resources (for irrigation or manure).

Redesign AMRUT for Sewage Priority – AMRUT guidelines should shift from water-centric to sewage-first frameworks, emphasizing –

1. Full interception of household excreta;
2. Use of existing septic tanks and tanker-based transport to treatment sites
3. Performance-based financing tied to the volume of wastewater and sludge reused
4. Integrate Water Projects with Local Sources – Reconnecting water supply to local waterbodies is essential.
5. It reduces dependence on distant sources, cuts energy use, and promotes groundwater recharge.

However, this is only possible if local lakes and reservoirs remain free from sewage pollution, making wastewater treatment a prerequisite for water security.

10. Madhav Gadgil – Ecologist Who Made Kerala Rethink Development

Recently, Madhav Gadgil, celebrated ecologist, academic, and founder of the Centre for Ecological Sciences at the Indian Institute of Science, Bengaluru, passed away at the age of 83.

Madhav Gadgil (1943–2026) – Architect of Ecological Thinking in India

Early Life and Academic Journey – Born in Pune, Maharashtra, Graduated from the University of Pune and PhD in Zoology from Harvard University. Later founded and led the Centre for Ecological Sciences (CES) at the Indian Institute of Science (IISc), Bengaluru.

Key Contributions and Ideas

Chairman of Western Ghats Ecology Expert Panel (WGEEP), set up by India's Ministry of Environment and Forests in 2010. The Gadgil Report (2011) provided a landmark scientific framework for conserving the ecologically sensitive Western Ghats, a UNESCO World Heritage Site.

Key Recommendations

1. Classifying the Ghats into Ecologically Sensitive Zones (ESZs) based on environmental fragility.
2. Promoting decentralized governance through local bodies (gram sabhas).
3. Restricting mining, quarrying, and large-scale construction.
4. Advocating sustainable livelihoods rather than blanket bans.

People's Biodiversity Registers (PBRs) – Gadgil pioneered the concept of People's Biodiversity Registers, a system for documenting local ecological knowledge, species diversity, and community practices. These registers empowered local communities to take part in managing their biological resources, laying the groundwork for India's Biological Diversity Act (2002) and subsequent Biodiversity Management Committees (BMCs) across the country.

Linking Science, Democracy, and Ecology – Gadgil consistently argued that ecological science must be democratic, accessible to ordinary people and accountable to their realities. He believed that conservation should not come at the cost of livelihoods, but should integrate community wisdom with scientific understanding. His approach contrasted with top-down models of conservation, often led by bureaucracies disconnected from ground realities.

Work on Ecological History and Human-Nature Relationships – Gadgil's research extended beyond environmental policy into human ecology, studying how societies interact with ecosystems over time.

Silent Valley Movement and Early Environmental Advocacy – Gadgil questioned the proposed hydropower dam in Kerala’s rainforest during the Silent Valley controversy of the 1970s–1980s. He put scientific legitimacy to grassroots environmental activism, influencing public perception that development projects must pass ecological scrutiny.

Advisory and Global Roles – Served on the Scientific Advisory Council to the Prime Minister of India. Member of several international panels on biodiversity, conservation, and sustainable development, including for the UNESCO Man and Biosphere Programme. Recipient of prestigious honors such as the Padma Bhushan (2006) for his contributions to environmental science and policy.

11. US Seizure of Venezuela – Oil, Power, And Global Repercussions

Recently, US forces entered Venezuela and abducted President Nicolás Maduro and his wife, and later Trump promised a US-led overhaul of Venezuela’s oil sector, declaring that American energy firms would ‘go in, spend billions of dollars, fix the badly broken infrastructure’.

Venezuela – World’s Largest Oil Reserves

Venezuela holds 303 billion barrels of crude oil, around 18% of global proven reserves, yet it produces barely 1 million barrels per day (bpd), a fraction of its 1990s peak of 3.5 million bpd. The heavy crude from Venezuela makes up about two-thirds of national production and roughly 4.5% of global heavy oil supply. Such crude is particularly suited to U.S., Chinese, and Indian refineries designed for dense, sulfur-rich oil. Years of economic mismanagement, sanctions, and infrastructure decay have reduced output to historic lows.

Impact on Oil Markets

Brent crude briefly rose above \$60 per barrel, while West Texas Intermediate (WTI) hovered around \$55, before easing when Trump imposed a blockade on Venezuelan shipping in mid-December 2025. Following Maduro’s capture, prices firmed slightly, Brent between \$60–61 and WTI between \$56–58.

Winners and Losers

US Diversion Strategy – More Venezuelan crude redirected to US refineries, reducing availability in Asia.

Instability Scenario – Political and security chaos that disrupts exports entirely. Both scenarios threaten Asian importers, especially China and India, which rely on heavy crude. In the long term, even if Venezuela stabilizes under US control, most new production will likely flow to American refineries, which hold the world’s largest heavy oil refining capacity.

India’s Limited Exposure

Past sanctions had already curtailed imports of Venezuelan crude. However, Indian public-sector firms such as ONGC Videsh, IOC, and Oil India hold stakes in Venezuelan projects worth hundreds of millions in unrepatriated dividends, about \$536 million since 2014.

Reviving the Petrodollar Debate

Beyond oil flows, the intervention revives discussion around the petrodollar system, the global practice of trading oil in US dollars, which anchors America’s financial dominance.

Petrodollar System

Origins and Mechanics of the Petrodollar – Nearly all crude oil has been priced and traded in US dollars, regardless of its origin or destination since the 1970s. It compels oil-importing nations to maintain large dollar reserves to secure energy imports, reinforcing global demand for the greenback. Meanwhile, oil-exporting countries accumulate vast dollar revenues, which are frequently recycled into US Treasury Bonds and financial markets. It finances America’s budget deficits and cements the dollar’s role as the world’s dominant reserve currency.

Attempts to Challenge the System

Venezuela earlier sought to sell oil in Euros, Yuan, and even digital assets to sidestep US sanctions. However, these initiatives were constrained by limited export volumes and restricted access to international financial networks. Venezuela managed to sustain oil production near 900,000 barrels per day, with China emerging as its principal buyer despite sanctions. China supported Venezuela

through currency swap arrangements and investments in Venezuelan oil fields, signaling a potential long-term shift toward de-dollarized trade.

Strategic Implications for the United States

The dollar-based oil trade provides the U.S. with crucial economic advantages -

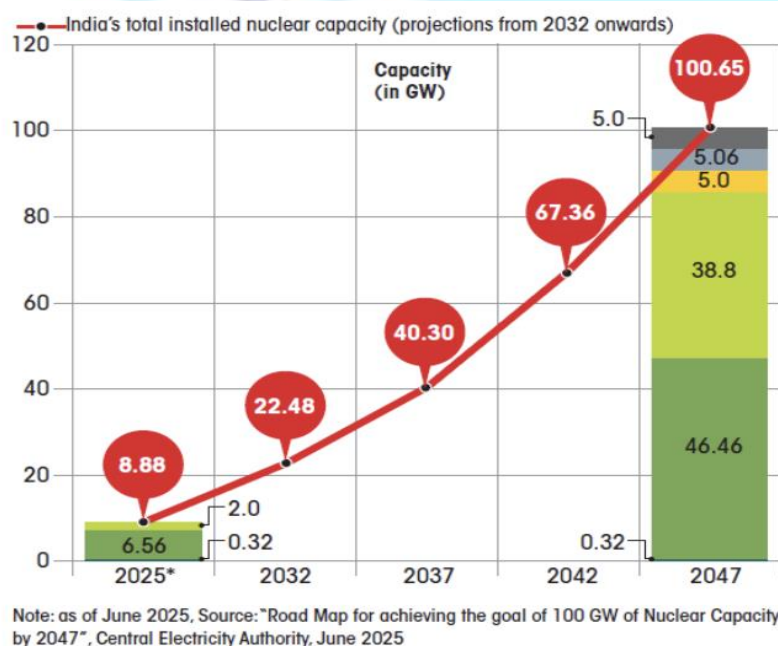
1. It lowers borrowing costs by ensuring continuous demand for US debt.
2. It supports large-scale government spending without triggering capital flight.
3. It enhances the power of U.S. financial sanctions, enabling asset freezes and trade restrictions that can cripple targeted economies.

12. India's Nuclear Power Reforms Under the Shanti Act, 2025

A new comprehensive law opens up the nuclear sector to private players, while diluting disaster liability and safety provisions

About SHANTI Act, 2025

The Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India (SHANTI) Act, 2025 repeals the Atomic Energy Act, 1962 and the Civil Liability for Nuclear Damage Act, 2010, ending the government's monopoly over nuclear power generation. It opens the sector to private and foreign participation in areas including uranium mining, reactor construction, operation, and manufacturing, subject to licensing and regulatory oversight. India's Nuclear Energy Mission targets 100 GW of installed nuclear capacity by 2047.



Boiling Water Reactor - Generates electricity by boiling water in reactor vessel;

Fast Breeder Reactor - Uses a liquid sodium coolant and converts fertile uranium-238 or thorium-232 into usable fuel, crucial for India that has large thorium reserves;

Pressurised Heavy Water Reactor (PHWR) - Uses deuterium oxide as both coolant and moderator, allowing use of natural, unenriched uranium as fuel;

Light Water Reactor - Uses ordinary water as both coolant and moderator, using low-enriched uranium as fuel.

Pressurised Water Reactor (PWR) is a

common variant of this technology, using pressure to keep the water from boiling;

Bharat Small Reactor - Compact 220 MW PHWRs being developed with private sector participation;

Bharat Small Modular Reactor - Compact reactors (around 200 MWe) being developed using PWR technology;

Private and Foreign Entry into Nuclear Power

Foreign direct investment (FDI) up to 49% is permitted, enabling private partnerships and joint ventures under the Act. The move marks a major structural shift in India's nuclear governance while NTPC and other public entities like NPCIL will retain control over sensitive parts of the fuel cycle. As of mid-2025, India's installed nuclear capacity stands at 8.8 GW, contributing around 3% of total electricity generation, a 71% rise since 2014. Another 10 reactors (8 GW) are under construction, with 10 more in pre-project stages, potentially taking capacity to 22.5 GW by 2031-32.

Pursuit of Small Modular Reactors

India is emphasizing indigenous technology, notably the 200-MW Bharat Small Modular Reactor (BSMR) under development at the Bhabha Atomic Research Centre (BARC). Nuclear power has historically hovered between 2–4% of India's electricity mix.

Concerns Over Safety and Control

Weaken Regulatory Safeguards – Granting operational control of fissile material to private entities increases the risk of catastrophic accidents. The Act introduces composite licenses, allowing a single entity to operate across multiple stages of the fuel cycle, potentially concentrating systemic risk.

Capped Liability and the Moral Hazard Debate – Section 13 of the Act caps nuclear liability at 300 million Special Drawing Rights (SDRs). The government assumes liability beyond this amount. The Act removes the operator's right of recourse against suppliers, effectively shielding foreign equipment providers.

Regulatory Oversight and Exemptions – The SHANTI Act allows the Union government to appoint board members of Atomic Energy Regulatory Board (AERB), and Section 44 empowers it to exempt any facility or technology from licensing or liability if deemed of 'insignificant' risk, a term left undefined.

Further, Section 39 enables the government to restrict publication of nuclear information, overriding the Right to Information Act. **Economic Viability and Investment Challenges** – Nuclear plants are capital-intensive with long gestation periods. The success depends on predictable tariffs, power purchase agreements, and dispute resolution frameworks.

Operational Reality and Resource Allocation – According to the International Atomic Energy Agency (IAEA) and the World Nuclear Industry Status Report 2025, seven Indian reactors are in 'suspended operation' or 'long-term outage' due to ageing and technical issues. These reactors are still counted in capacity statistics, masking operational shortfalls.

Legislative Overhaul			
Area	Atomic Energy Act, 1962	Civil Liability For Nuclear Damage Act, 2010	SHANTI Act, 2025
Ownership & Participation	100% state monopoly	No change	Private and foreign participation, subject to licensing
Fuel cycle licensing	Fragmented control under government entities	Not addressed	Composite licences – one operator to hold licence for multiple fuelcycle stages
Operator liability cap	Not specified	Rs 1,500 crore per incident	Graded caps based on reactor size, ~Rs 100 crore to Rs 3,000 crore
Total liability cap	Not specified	300 million Special Drawing Rights	300 million Special Drawing Rights; Centre assumes additional liability
Supplier liability	Not applicable	Statutory right of recourse for operators against suppliers for defective equipment/services	No statutory right of recourse
Liability periods	Not specified	Up to 10 years (property damage) and 20 years (personal injury)	Retains the 10/20-year extinction periods
Regulatory structure	AERB set up without statutory status for	No change	AERB gets statutory status

	certain regulations, safety functions		
Executive exemptions	Not specified	Not specified	Allows exemptions from licensing, liability or other provisions for facilities deemed to pose 'insignificant risk'
Access to justice	Not specified	Claims through designated authorities; civil remedies preserved	Criminal complaints restricted to authorised persons; claims limited to three years, with extinction after 10/20 years
Environmental safeguards	Environmental impact assessment mandatory	No change	No change
Information disclosure	Right To Information (RTI) Act applicable, with exemptions	RTI Act applicable	Centre empowered to prohibit publication and disclosure under RTI Act once notified

13. Dismantling Of MGNREGA & Critical Look at the VB-G RAM G Act, 2025

The Union government repealed the Mahatma Gandhi National Rural Employment Guarantee Act, 2005 (MGNREGA) and replaced it with the Viksit Bharat–Guarantee for Rozgar and Aajeevika Mission (Gramin) Act, 2025, or VB-G RAM G Act.

About the MGNREGA (2005)

It was the world's largest social security programme, guaranteed 100 days of wage employment to every registered rural household. Its rights-based, demand-driven design made it revolutionary, the State was legally obliged to provide work or pay an unemployment allowance.

Over a decade, the programme -

1. Increased rural employment from 21 million to 55 million person-days.
2. Helped 69% of households avoid hunger and reduced migration by 57%.
3. Supported coping during illness and prevented hazardous labour.
4. Created durable rural assets like roads, water bodies, and afforestation projects.

VB-G RAM G Act, 2025

From Rights to Allocations - MGNREGA's legal guarantee of work has been replaced by a centrally sponsored scheme where employment depends on annual allocations decided by the Centre. It effectively converts a demand-driven entitlement into a supply-constrained scheme.

Curtailing State Autonomy - Under Sections 4(6) and 22(5), states can only expand guarantees within procedures defined by the Centre. It undermines fiscal federalism and limits states' ability to respond to local needs.

Reduced Fiscal Support - Funding has shifted from a 90 -10 Centre-State ratio to 60 -40, placing heavier burdens on fiscally weaker states. Estimates suggest that states collectively would have borne an additional ₹31,000 crore under this formula in FY 2025.

'Switch-Off' Clause - The Act allows work to be suspended for 60 days during peak agricultural seasons to ensure labour availability for farmers. It weakens workers' bargaining power and may push them back into exploitative labour arrangements.

Significances & Key Justifications

1. Raising the guaranteed days from 100 to 125 per household.

2. Rationalising permissible works into four themes ie water security, infrastructure, livelihoods, and climate resilience.
3. Introducing digital monitoring and concurrent evaluations to curb leakages.
4. Ensuring tighter timelines for wage payments and unemployment allowances

However, the average employment under MGNREGA has historically been 46–50 days, far below the statutory limit. Thus, merely extending the ceiling does little to enhance actual employment levels.

Related Concerns

Erosion of Universal Coverage – The new law allows the Centre to notify which rural areas are covered, opening space for arbitrary exclusions.

Centralised Power – The Centre gains unprecedented control over budget allocations and implementation norms.

Weakened Federalism – The higher state cost share risks punishing opposition-ruled or financially weak states.

Supply-Limited Design – Normative allocations replace the open-ended, demand-driven guarantee that made MGNREGA unique.

Did MGNREGA Need Reform?

1. Uneven state performance and low capacity in poorer states.
2. Delays in wage payments.
3. Quality concerns over created assets.
4. Leakages and corruption through fake job cards.
5. While the new Act attempts to address some of these, particularly through digital tools and normative allocations, most reforms merely formalise existing guidelines rather than innovate.
6. Without administrative strengthening, these changes may not improve outcomes.

India's Tryst with Rural Wage Employment Guarantee

Rural Manpower Programme 1960 – First wage employment programme that aims to provide 100 days of employment to 2.5 million people

Crash Scheme for Rural Employment, 1971 – Three-year programme to provide employment to 1,000 persons per annum in each district, via development projects such as road construction, infrastructure for irrigation, soil conservation, afforestation, land reclamation and other works

Pilot Intensive Rural Employment Project, 1972 – Three-year action-research project offering work to 1,000 people a district for 10 months annually

Maharashtra Employment Guarantee Act, 1977 – State programme guaranteeing employment to all adults who volunteer to do unskilled manual work in rural areas

Food for Work Programme, 1977 – Launched with the intention to reduce rural unemployment and improve nutritional status, with wages partially or fully in foodgrains for people employed in construction and development projects

Integrated Rural Development Programme, 1978–79 – Launched to cater to needs of farmers, workers and families living below the poverty line (BPL), by giving them access to income-generating assets, access to credit and other inputs

National Rural Employment Programme, 1980 – Revised and revamped version of FWP, aiming to generate additional gainful employment for unemployed and underemployed persons in rural areas for 300–400 million human days per year

Rural Landless Employment Guarantee Programme, 1983 – Aims to provide 100 days' employment to at least one member of each landless rural household

Jawahar Rozgar Yojana, 1989–90 – Merging the provisions of NREP and RLEGP, the programme targets BPL populations, prioritising Scheduled Castes, Scheduled Tribes and freed bonded labour. Only unskilled labour work provided, instead of mechanised work, to increase employment

Rural Employment Reset

Employment Assurance Scheme, 1993 – Merged with the second stream of JRY, the programme is introduced in 1,775 backward blocks for 100 days of unskilled work during lean agriculture season, for minimum wage.

Features	MGNREGA (2005)	VB-G RAM G (2025)
Guaranteed Days	100 days per household	125 days per household
Nature of Guarantee	Demand driven – Funding is open ended. If a worker demands work, the government must provide and fund it	Supply-Constrained – ‘Normative Allocation’ (fixed budget cap). Any expenditure above this allocation must be borne entirely by the State
Funding Pattern	Centre pays 100% of unskilled wages and 75% of material costs. States pay only unemployment allowance and 25% material	Cost Sharing – sharp increase in the state share of programme expenditure, from 10% to 40% (with exceptions for northeast, Himalayan states and UTs). Crucially – States pay 100% of costs if they exceed the Center’s ‘normative allocation’
Work Availability	Year-round – Workers can demand work at any time	Restricted – Clause 6 mandates a 60-day ban on labour works during peak agricultural seasons (sowing/harvesting)
Wage Payment	Wages paid by Centre (100%). Delays compensated by state; weekly payment	Wages paid via 60 –40 split. Weekly payment mandated, but state liability for unemployment allowance remains
Planning Unit	Gram Panchayats mandate 50% of works. Shelf of projects created locally.	National Stack – retains 50% work through Gram Panchayats; ‘Viksit Gram Panchayat Plans’ are aggregated into a ‘Viksit Bharat National Rural Infrastructure Stack’; Focus is on ‘saturation’ rather local demand
Work Categories	Four Categories – Natural resources management, individual assets for vulnerable households; common infrastructure for SHGs; general infrastructure	Four Thematic Domains – Water Security, Core Rural Infra, Livelihood Infra, Disaster Mitigation.
Tech & Monitoring	Social Audits and Muster Rolls	Heavy Tech Reliance – Retains social audit; adds digital tools and concurrent evaluation

Swarnajayanti Gram Swarozgar Yojana, 1999 – A merger of six programmes, including IRDP, that covers all aspects of self-employment such as organisation of self-help groups, training, credit, technology, infrastructure and marketing

Jawahar Gram Samridhi Yojana, 1999 – Revised JRY, focusing on planned development of village infrastructure assets

Sampoorna Grameen Rozgar Yojana, 2001 – Merger of JGSY and EAS, the programme aims to provide additional and supplementary wage employment, food security and improve nutritional levels in all rural areas

National Food for Work Programme, 2004 – Launched to provide supplementary wage employment in the 150 most backward districts of the country where rural unemployment is high

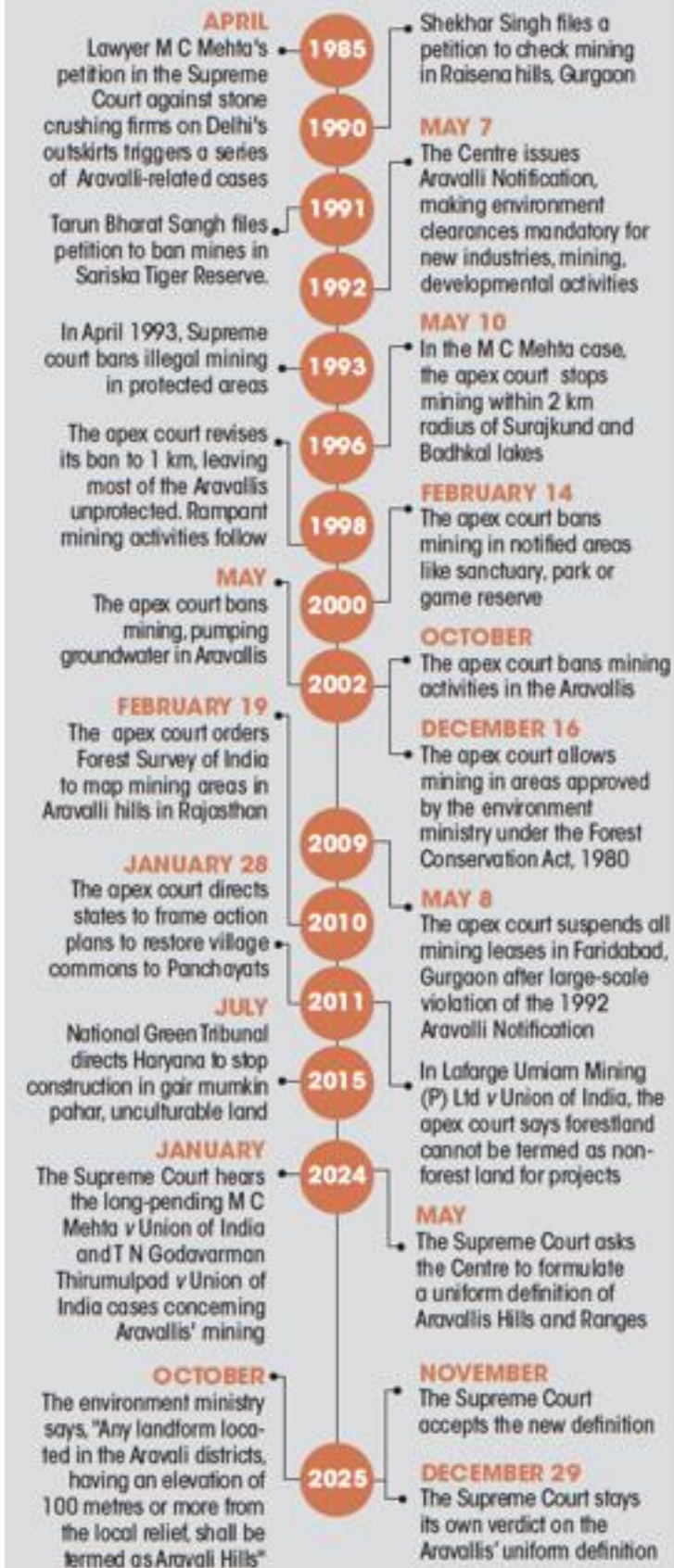
MGNREGA (2005) - Launched with the provision of mandatory guaranteed wage employment for a minimum of 100 days each year for unskilled labour. The first to recognise work as a right of people
VB-G RAM G (2025) - Replaces MGNREGA, with provisions including 125 days of employment, weekly wage payment, cost sharing between Centre and states

14. Aravalli Mountain & Supreme Court of India



UNDER SCRUTINY

40 years of litigation has not saved the Aravallis from damage



Recently, the Supreme Court of India stayed its own judgment that had accepted a 'uniform definition' for the Aravalli hills and ranges. The earlier ruling had classified Aravalli 'hills' as landforms with a minimum elevation of 100 metres above local relief and defined a 'range' where two or more such hills lay within 500 metres of each other.

Aravallis Range

It represents a complex geological history stretching over billions of years. Formed in phases, it includes

1. Bhilwara gneiss (~3 billion years old)
2. Quartzites from mountain-building between 2–1.8 billion years ago
3. Post-Delhi magmatic rocks (850–750 million years ago)
4. Recent studies reveal that the Aravallis do not end near Delhi but continue underground to Haridwar, forming a buried spine dividing the Ganga and Indus River basins.

Though the Aravallis appear stable, their Delhi Fold Belt is seismically restless, a zone where ancient faults still react to distant tectonic stresses.

Why the 100-Metre Rule Fails the Aravallis?

The Aravallis' ecological functions like sand-barrier formation, aquifer recharge, grassland habitats, and wildlife corridors depend on the continuity of the entire range, not just prominent peaks. Analysis using NASA's Shuttle Radar Topography Mission data found that, under the Supreme Court's definition, only 9% of the 12,081 mapped hills meet the 100-metre requirement. Consequently, over 90% of the Aravalli terrain would be exposed to mining and urbanization. Public protests and petitions followed, prompting the Supreme Court to stay its own order and appoint a high-powered committee to re-examine the scientific validity and

ecological implications of the 100-metre elevation rule.

Genesis of a Flawed Definition

In May 2024, the Court directed the Centre to create a uniform definition of the Aravalli hills to avoid conflicting judgments across states. The resulting committee, led by MoEFCC, adopted Rajasthan's 2002 landform classification, which relied on Richard Murphy's 1968 model defining hills as landforms rising over 100 metres above local relief. However, as the committee's own report noted, the Aravalli terrain shows wide internal variation and cannot be uniformly defined by elevation or slope alone, and it retained the 100-metre threshold, contradicting its findings.

Scientific and Conceptual Critiques

Applying Murphy's academic classification to determine land use is scientifically unsound. The 100-metre threshold has no universal or ecological basis, as hills vary regionally by relief and environmental context. Haryana's fragile forest cover (just 3.6%) would shrink further if low-elevation areas lost legal protection. According to the Geological Survey of India (GSI), the data used to justify the definition was never ground-verified, relying on unverified elevation datasets.

Flawed Process, Legal Ambiguity

The committee and the Court's earlier acceptance of its report, arguing that adopting Rajasthan's mining criteria does not equate to defining the Aravallis. There are several procedural inconsistencies like missing signatures from GSI and FSI officials, and the conflation of 'operational' and 'uniform' definitions. The Court itself admitted that public dissent stemmed from 'ambiguity and lack of clarity', leading it to pause implementation until further review.

Mining Interests and Policy Loopholes

The MoEFCC committee identified critical minerals such as lithium, nickel, graphite, and rare earth elements in the Aravalli-Delhi belt, recommending limited mining for 'strategic and atomic minerals'. It could become a loophole for renewed mining, as the line between 'strategic' and 'commercial' extraction often blurs. It is a case of 'administrative opportunism', arguing that the ecological impact of lithium drilling is no different from granite quarrying. Historical evidence backs his concern - a 2018 Central Empowered Committee (CEC) report found that 25% of the Aravallis in Rajasthan had already been lost to illegal mining since 1967-68.

Environmental Fallout

The loss of 5,772.7 sq km of forest cover already marks a 32% reduction in the Aravalli's green cover. Further mining could accelerate desertification in Haryana and Rajasthan. The Delhi-NCR region faces the threat of deteriorating air quality, depleted groundwater, and loss of climate resilience. The forest policy target i.e. 33% forest cover in plains and 66% in hills becomes unattainable under the current height-based classification.

Need for Coherent Judicial and Ecological Policy

The Court's order appointing a High-Level Committee to define the Aravallis continues on the flawed premise of facilitating mining rather than ensuring conservation.

1. Before drafting any mining plan, the Supreme Court needs to ensure -
2. Full compliance with the Ashok Sharma and Godavarman orders.
3. Comprehensive GIS-based mapping of all forest categories.
4. Protection of PLPA lands, and wildlife corridors.

15. Groundwater and the Hidden Labour Crisis

Field and academic evidence shows sharp falls in casual agricultural employment at places where groundwater access declines.

Scale of the Decline

According to the Central Ground Water Board (CGWB) report Dynamic Ground Water Resources of India 2024, India's annual groundwater recharge stands at 448.5 billion cubic metres (bcm), with an extractable resource of 407.8 bcm. About 247.2 bcm is extracted each year of this. In the CGWB's 2023 block-level assessment, 736 of 6,553 units (11%) were classified as over-exploited, drawing more water than they replenish. Hundreds more are critical or semi-critical. These regions are now the epicentres of both hydrological and employment stress.

Linkage of Falling Water Table & Employment

Casual agricultural labour remains a major source of rural income—roughly one in four rural workers are casual labourers, as per the 2022–23 Periodic Labour Force Survey (PLFS). Groundwater irrigation has historically enabled multiple cropping seasons and higher labour demand. When wells dry or pumping costs rise, farmers respond by cutting irrigation, shifting to less labour-intensive crops, or reducing cropped area. Each of these decisions means fewer hiring days for casual workers, triggering out-migration, underemployment, and wage decline.

Field Evidences

Purulia and drought-prone districts – Household surveys published in Mitigation and Adaptation Strategies for Global Change (2024) report sharp declines in casual farm work following groundwater depletion.

Long-run irrigation data (1996–2020) – Research in Environmental Science and Pollution Research (2023) shows that reduced groundwater access significantly lowers agricultural labour demand.

Marathwada, Vidarbha, Bundelkhand – Multiple studies across Beed, Latur, Dharashiv, Dongargaon, and Jhansi reveal parallel declines in irrigation-based employment. At the national level, past gains in rural employment and poverty reduction, once driven by groundwater expansion are being reversed. Women face the brunt, with limited non-farm alternatives and rising unpaid water-fetching duties. The outcome is deepening food insecurity, debt, and distress migration.

Emerging Solutions – Managing Water, Reviving Work

Community-Based Groundwater Management – Under the Atal Bhujal Yojana, community-led monitoring, recharge structures, and IoT-enabled piezometers have successfully restored local aquifers. These projects not only raise water levels but also create short-term employment, demonstrating a dual win for ecology and livelihoods.

Smarter Subsidies – Electricity subsidies for pumps encourage over-extraction. Replacing blanket subsidies with metered power and targeted direct transfers would balance conservation with equity, ensuring smallholders are protected without promoting waste.

Job-Linked Recharge Works – State rural employment programmes can prioritize watershed development and recharge structures in over-exploited blocks. Such public works create immediate jobs while improving aquifer health, a direct bridge between water recovery and rural employment.

Labour-Aware Water Governance – District administrations should integrate groundwater data into employment planning and social protection systems. When a block turns ‘critical’, safety nets such as work guarantees, food transfers, and skill programmes need to automatically expand to cushion job losses.

From Hydrology to Human Livelihoods

Treating groundwater merely as a hydrological statistic blinds policymakers to its social and economic role. It is a form of shared capital that sustains millions of informal rural jobs. If India aims for resilient rural livelihoods, groundwater must be managed not as a private commodity but as a collective labour asset. The policy choice is clear – Act now to revive the invisible employer—or watch rural precarity deepen as wells run dry.

16. India's First National Household Income Sample Survey

India is set to launch its first-ever National Household Income Sample Survey, marking a pivotal shift in how the nation measures poverty and prosperity. It aims to present a comprehensive financial balance sheet for Indian households, encompassing all income and expenditure streams.

What the Survey Will Measure

The survey will collect detailed information on –

1. Household incomes and expenditures, across all occupations and community groups.
2. Input and output costs of farmers.
3. Tax payments, loan burdens, and investment earnings of taxpayers.
4. Irregular and multiple income sources for informal workers.

5. Monetary valuation of welfare benefits and household assets such as land, homes, and farms.

By combining these data points, the survey seeks to compute household 'profits' and provide a realistic picture of economic well-being at the micro level.

Need for an Income-Based Survey

India has long relied on household expenditure surveys by the National Statistics Office (NSO) to estimate poverty. Expenditure served as a proxy for income, with the last official poverty estimate released in 2012 and the national poverty line updated in 2014. Although two more consumption surveys were carried out after 2014, their results were never used to update poverty figures. As a result, India currently lacks an official poverty estimate, despite running numerous poverty alleviation schemes.

Data Deficit and Its Implications

The Household Consumption Expenditure Survey (2022–23) raised expectations for new poverty figures, but none were published officially. In the vacuum, independent economists have made their own poverty assessments, findings that remain highly contested. Meanwhile, the government has cited a decline in multidimensional poverty, which measures deprivation across areas like health, education, and living standards. However, multidimensional poverty is not a substitute for income-based poverty, and it is not recognized in global poverty monitoring standards.

Challenges of Measuring Income

1. Income surveys are notoriously difficult to execute while conceptually sound.
2. Across countries like the US, China, and Bangladesh, challenges often arise from the sensitivity around income disclosure and the complexity of informal sector earnings.
3. India's earlier attempts from 1955 to 1970 and again in 1983–84 suffered from -
4. Underreporting of income due to reluctance and recall errors.
5. Difficulty in quantifying non-cash earnings and irregular work patterns.
6. Inability to account for returns on investments, rents, or savings interest.

Lessons from the Pre-Test

The NSO conducted a pre-test in August 2025 before the nationwide rollout. The findings reaffirmed earlier concerns – 95% of respondents hesitated to disclose income from various sources. A similar proportion of taxpayers refused to reveal their tax information. Expenditures were overstated while incomes were understated, often because respondents were unaware of small or irregular earnings like interest and dividends. These findings highlight the cultural and methodological barriers to accurate income measurement in India.

Looking Ahead

India's decision to pursue a direct income survey in 2024 signals a strong intent to modernize poverty assessment despite repeated setbacks. If successful, the initiative could transform policymaking, offering a clearer and more equitable basis for welfare planning. However, data reliability remains the key challenge. Unless respondents are encouraged and assured to report truthfully and data collection methods evolve accordingly the survey risks replicating past failures.

17. Pink Water Lilies in Kuttanad, Kerala

Surge of vibrant pink water lilies (Omarana Water Lily; *Nymphaea* × *Omarana* Bisset) in Kuttanad, Kerala, provides socio-economic benefits, but the plant's ecological impacts need to be understood.

About Kerala's Kuttanad Region

It is often called the 'Rice Bowl of Kerala', lies 1–2 meters below sea level, making it India's lowest altitude region. It is spread across Alappuzha, Kottayam, and Pathanamthitta districts, it forms a vital part of the Vembanad Kole Wetland Ecosystem, a Ramsar site. It is famous for its 'below sea level farming' and recognized by the UN FAO as a Globally Important Agricultural Heritage System in 2013.

Ecological Roots of the Bloom of Pink Water Lilies

The 2018 floods in Kuttanad drastically damaged paddy crops but surprisingly enhanced soil fertility. The floodwaters washed away acidic residues and heavy metals, replenished the soil

with nutrient-rich silt, and reduced pest populations, creating ideal conditions for both paddy and water lilies. Additionally, the Thanneermukkam saltwater barrage, built in the mid-20th century, plays a crucial role. It prevents saltwater intrusion into paddy fields, and its delayed opening in recent years has limited the natural 'salt cleanse'. It has allowed aquatic weeds, including water lilies, to flourish unchecked.

Dual Nature of the Water Lily

Economic and Agronomic Benefits

1. Improving soil quality and nutrient cycling.
2. Aiding in phytoremediation, removing heavy metals.
3. Controlling noxious weeds such as weedy rice.
4. Reducing dependence on broad-spectrum herbicides.
5. Environmental Risks (Invasive nature of *Nymphaea × omarana*) -
6. Hinders water navigation and blocks sunlight.
7. Reduces water quality, affecting fish populations.
8. Decomposition releases methane, a potent greenhouse gas.
9. Alters biodiversity by attracting new animal species, increasing chemical use for pest control.
10. Potential pollination interference with land crops due to increased insect activity.

Towards Sustainable Balance

To sustain both economic and ecological health, integrated management strategies are essential -

Eco-friendly control - Mechanical removal during land preparation can help manage overgrowth.

Biological solutions - A moth caterpillar species that feeds on water lilies shows promise for natural control.

Optimized barrage operation - Timely opening of the Thanneermukkam barrage to allow periodic saltwater entry could naturally limit proliferation.

Community engagement - Collaborative governance among farmers, local bodies, and scientists can ensure a balanced approach.

Continuous monitoring - Long-term studies are needed to assess ecological impacts and prevent outcomes similar to water hyacinth or giant salvinia invasions.

18. Asian Waterbird Census 2026

The Asian Waterbird Census (AWC) 2026 has recorded around 9,000 birds belonging to 131 species along the Yamuna floodplains in Delhi.

About the Asian Waterbird Census (AWC)

It is a long-running, citizen-science-based waterbird monitoring programme conducted annually across Asia and parts of Australasia. It focuses on counting waterbirds in wetlands such as rivers, lakes, marshes, floodplains, estuaries, and coastal areas.

Timing & Locations

The AWC is held every January, coinciding with the peak wintering period for migratory waterbirds. Surveys are carried out across South Asia, Southeast Asia, East Asia, and parts of the Middle East, covering thousands of wetlands.

Coordinating Agencies

The AWC is coordinated internationally by Wetlands International, a global non-profit working on wetland conservation. In India, the census is coordinated by the Bombay Natural History Society (BNHS), with support from state forest departments, research institutions, and volunteers.

AWC Importance

The Asian Waterbird Census plays a critical role in conservation by -

1. Tracking long-term population trends of waterbirds;
2. Identifying declining species and threatened wetlands;
3. Supporting the designation of Ramsar sites (wetlands of international importance);
4. Providing data for policy decisions, environmental impact assessments, and conservation planning;

19. Siau Tagulandang Biaro Islands Regency

According to Indonesia's National Disaster Mitigation Agency, the floods in North Sulawesi severely impacted the Siau Tagulandang Biaro Islands Regency.

About Siau Tagulandang Biaro Islands Regency

It is an island regency located in North Sulawesi, eastern Indonesia. It consists primarily of three main islands i.e Siau, Tagulandang, and Biaro, along with several smaller surrounding islands. Mount Karangetang, one of Indonesia's most active volcanoes, is located on Siau Island, making the area geologically vulnerable to natural disasters such as volcanic eruptions, landslides, and flash floods. It is particularly prone to natural disasters due to its island geography, limited infrastructure, and high rainfall.

20. Stingless Bees

In a landmark move, stingless bees native to the Peruvian Amazon have become the world's first insects to be granted legal rights.

About Stingless Bees

They are small, social bees belonging to the tribe Meliponini, primarily in tropical and subtropical regions. India hosts more than 30 species of Stingless Bees. They are among the most important pollinators in tropical and subtropical ecosystems.

21. Forever Chemicals – Per and Polyfluoroalkyl Substances (PFAS)

Recently, France's ban on use of 'forever chemicals' in cosmetics and clothing industries came into force.

Per- and Polyfluoroalkyl Substances (PFAS)

PFAS, aka forever chemicals, are a large family of man-made chemicals that have been used since the 1940s. They do not break down easily in the environment or in the human body. Their defining feature is a strong carbon-fluorine bond, one of the strongest chemical bonds known. It makes PFAS –

1. Highly resistant to heat, oil, stains, and water;
2. Extremely persistent in soil, water, wildlife, and people;

PFAS found

PFAS have been widely used in everyday and industrial products, such as –

1. Non-stick cookware (e.g., older Teflon coatings);
2. Water- and stain-resistant fabrics (rain jackets, carpets);
3. Food packaging (grease-resistant wrappers, pizza boxes);
4. Firefighting foams (especially AFFF used at airports and military bases);
5. Cosmetics and personal care products;
6. Industrial processes (electronics, metal plating)

PFAS as a concern

Potential health effects – Increased cholesterol levels, Thyroid disease, Liver damage, Reduced vaccine response in children, Hormonal and immune system disruption, and Increased risk of certain cancers (e.g., kidney, testicular).

Environmental effects – Long-term contamination of water sources, Bioaccumulation in fish and wildlife, Difficulty and high cost of cleanup. Even very low concentrations (parts per trillion) can be concerning.

Can PFAS be removed?

Activated Carbon (GAC) – effective for many PFAS

Reverse Osmosis (RO) – very effective but expensive

Ion Exchange Resins – increasingly used by utilities

22. India's First Urban Night Safari Proposed In Lucknow

Recently, the Government of Uttar Pradesh unveiled a proposal to establish India's first urban night safari at the Kukrail Reserve Forest in Lucknow.

Overview of the Night Safari Project

A First-of-Its-Kind Urban Initiative – The Kukrail night safari aims to promote tourism while offering educational and recreational opportunities to the public. It is expected to be developed in multiple phases, expanding gradually while maintaining a balance between tourism and conservation.

Proposed Features

1. Boosting Eco-Tourism and Employment
2. Animal enclosures designed for nocturnal species
3. Walking trails and safari routes

Environmental Concerns

Threat to Kukrail's Ecological Balance – The Kukrail Reserve Forest is a protected green zone and home to diverse flora and fauna, including endangered species of reptiles and birds. Construction of enclosures and trails may lead to mass felling of trees. Artificial lighting and human activity could disturb nocturnal wildlife

Balancing Development and Conservation

1. Limiting construction to non-core forest zones
2. Implementing eco-friendly infrastructure
3. Ensuring continuous monitoring of wildlife health and behavior
4. Engaging independent environmental experts in the planning process

23. H5N1 Avian Influenza

Recently, Kerala confirmed 11 outbreaks of the highly pathogenic H5N1 avian influenza, leading to the death of 54,100 birds, predominantly ducks. The World Organisation for Animal Health (WOAH) issued an international alert, notifying other member countries about the confirmed outbreaks in Kerala.

Understanding H5N1 Avian Influenza

H5N1 avian influenza, commonly known as bird flu, is a highly pathogenic viral disease that primarily affects birds. It is caused by a strain of the Influenza A virus, belonging to the Orthomyxoviridae family.

Origins and Global Spread

The H5N1 strain was first identified in 1996 in Geese in China and subsequently spread across Asia, Europe, the Middle East, and Africa. Major outbreaks in the early 2000s caused significant losses in the poultry industry, with millions of birds culled to control transmission. Periodic resurgences, including recent ones in India, Japan, and parts of Europe, highlight the virus's persistent threat to both agriculture and public health.

Transmission

Among Birds – The virus spreads mainly through direct contact with infected birds' secretions like saliva, nasal fluids, and feces. Contaminated feed, water, and equipment can serve as indirect transmission routes. Migratory wild birds act as natural reservoirs, facilitating cross-border spread.

To Humans – Human infections occur rarely, typically through close contact with infected birds or contaminated environments. Human-to-human transmission is extremely limited and has not resulted in sustained outbreaks.

Symptoms

In Birds – Sudden death without prior symptoms; Swelling of the head, comb, and wattles; Drop in egg production; Respiratory distress and loss of appetite;

In Humans – High fever, cough, sore throat; Conjunctivitis (eye infection); In severe cases, pneumonia and multi-organ failure. The mortality rate among confirmed human cases exceeds 50%, according to the WHO.

Impact on Economy and Food Security

H5N1 outbreaks cause mass culling of infected and at-risk birds, leading to -

1. Heavy economic losses for poultry farmers
2. Disruptions in food supply chains, especially in developing regions
3. Reduced consumer confidence in poultry products
4. In states like Kerala, India, where duck farming is an important livelihood, outbreaks can significantly affect rural economies and employment.

Prevention and Control

Biosecurity measures - Regular cleaning, disinfection, and restricted access to poultry farms.

Vaccination - Used in some countries to limit viral spread.

Surveillance programs - Early detection and rapid response to suspected cases.

Public awareness - Educating farmers and handlers about hygiene and early symptom reporting.



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DECEMBER 2025

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1. Editorial — Wellness – Our New North Star

GS Paper I – Urbanization, their problems and their remedies.

GS Paper II – Issues relating to development and management of Social Sector/Services relating to Health.

GS Paper III – Conservation, environmental pollution and degradation.

GS Paper IV – Human Values (Mindful living and resilience).

1. The Paradigm Shift – From Sick-Care to Wellness

The editorial highlights a fundamental transformation in the Indian approach to health. For decades, health was perceived through a reactive lens—a "sick-care" model addressed only when the body broke down, often confined to hospitals and insurance claims. Today, however, there is a profound shift toward a proactive pursuit of wellness. Wellness is no longer viewed as a luxury for the privileged but as a necessary survival imperative for the entire population.

2. The "Hidden Tax" of Modernity – Mental Health

While India has achieved monumental success in eradicating infectious diseases, modern progress has levied a "hidden tax" in the form of stress, anxiety, and depression.

Mental Health as Foundation – In a high-velocity, hyper-connected urban existence, the mind is often the first to fracture. The editorial asserts that mental health is finally being recognized as the foundation upon which all other physical health is built.

3. The Metabolic Crisis – Lifestyle Diseases

India's health data presents a sobering reality, with the country often labelled the "diabetes capital of the world" and witnessing a rising graph of cardiovascular diseases among young adults.

Root Causes – These are identified not merely as medical issues but as "lifestyle manifestations" resulting from the transition to sedentary desk jobs and the consumption of processed diets.

Cultural Pivot – The solution requires a cultural return to mindful living and nutritional wisdom. Key recommendations include –

1. Reintroducing nutrient-rich millets into daily diets.
2. Adopting simple habits like a short walk after meals.
3. Consciously reducing sugar intake and cutting out trans fats and heavily processed foods.

4. The Environmental Imperative – Urban Design

Wellness is described as an environmental imperative that cannot thrive in isolation.

The Concrete Jungle Effect – Rapid urbanization often expands infrastructure at the cost of the "commons"—parks, playgrounds, and open public spaces that serve as the lungs of a city.

Reconnecting with Nature – The shrinking of green pockets leads to a claustrophobic existence.

Integrating nature back into urban design is not just an aesthetic choice but a fundamental necessity for a healthy society, as the simple act of breathing should be a source of vitality, not a health concern due to poor air quality.

5. Conclusion – Wellness as Resilience

Ultimately, wellness is defined not by perfection (like a perfect yoga pose) but by resilience—the ability of a student to handle exam pressure, a worker to find balance, or an elderly person to access clean air. The editorial concludes that a nation's greatest asset is not its infrastructure or technology, but the collective vitality of its people.

2. Mainstreaming Ayush for Holistic Health Ecosystem

GS Paper II – Government Policies and Interventions for Development in various sectors (Health); Issues relating to development and management of Social Sector/Services relating to Health.

GS Paper III – Science and Technology– indigenization of technology (Traditional Knowledge).

1. Context – The Need for Transformation

India's healthcare landscape is undergoing a significant shift. The country faces a "triple burden" of disease, but a primary concern is the rising prevalence of Non-Communicable Diseases (NCDs), mental health issues, and lifestyle disorders. The epidemiological transition from infectious diseases to chronic conditions like diabetes, cardiovascular diseases, and stress-related disorders demands a long-term management strategy rather than episodic "sick-care".

2. Policy Foundation – Convergence and Pluralism

National Health Policy (NHP) 2017 – This policy provides the bedrock for integrating traditional systems by endorsing a "pluralistic" healthcare approach.

Ministry of Ayush (2014) – Its establishment marked a turning point, recognizing traditional medicine not as an alternative but as a strategic pillar of national healthcare.

Convergence Strategy – The core strategy is convergence—not just co-location but a synergy between Ayush and modern medicine to build a resilient health ecosystem. This aligns with the goal of Universal Health Coverage (UHC).

3. Implementation – From Policy to Practice

The integration is happening across multiple levels of healthcare delivery –

Primary Care – Ayushman Arogya Mandirs (AAM) –

Over 1.8 lakh AAMs have been operationalized as of November 2025. These centers act as the first point of contact, integrating Yoga and wellness services into daily care. 12,500 of these are specialized Ayush AAMs.

Secondary & Tertiary Care –

1. Co-location – Ayush facilities have been co-located in 482 District Hospitals, 3103 Community Health Centers (CHCs), and 6158 Primary Health Centers (PHCs).
2. Integrated Departments – Major central hospitals like Safdarjung Hospital and Lady Hardinge Medical College now have dedicated Departments of Integrated Medicine offering therapies like Panchakarma alongside modern treatments.
3. Specialized Care – Institutions like the National Cancer Institute (Jhajjar) and NIMHANS have established integrative centers for cancer care and mental health, respectively.

4. Standardization and Quality Assurance

To ensure credibility and safety, the government has focused on evidence-based practice –

1. Standard Treatment Guidelines (STGs) –The Directorate General of Health Services (Ayush Vertical) has developed STGs for common ailments, including six musculoskeletal and five metabolic disorders.
2. Education Reforms – Under NEP 2020, interdisciplinary learning is emphasized. Medical graduates now undergo a mandatory one-week Ayush internship to foster mutual respect and understanding.

5. Digital and Global Integration

1. Digital Health – Integration with the Ayushman Bharat Digital Mission (ABDM) and the creation of the Ayush Grid ensure that patient data is standardized and interoperable. Apps like *Y-Break* and *m-Yoga* extend wellness services digitally.
2. Global Leadership – The establishment of the WHO Global Traditional Medicine Centre (GTMC) in Jamnagar positions India as a global leader, enabling it to set international standards and export wellness services.

3. Naturopathy and Holistic Wellness

GS Paper II – Issues relating to development and management of Social Sector/Services relating to Health.

GS Paper III – Science and Technology—indigenization of technology and developing new technology (Traditional Knowledge Systems).

1. Core Philosophy – The Healing Power of Nature

Naturopathy is presented as a drugless, non-invasive system of medicine that focuses on enhancing the body's inherent ability to heal itself.

Fundamental Principles –

1. Healing Power of Nature – The body has an innate intelligence to restore health.
2. Root Cause Treatment – Unlike modern medicine, which often manages acute symptoms, Naturopathy seeks to identify and treat the underlying cause of disease.
3. Holistic Approach – It treats the individual as a whole—integrating physical, mental, social, and spiritual dimensions—rather than focusing on isolated organs or symptoms.
4. Prevention over Cure – Emphasis is placed on preventing disease through conscious living and self-discipline.

2. Indian Naturopathy – Roots and Institutionalization

1. Ancient Roots – The Indian model draws inspiration from ancient texts like the *Upanishads*, which describe human existence as a combination of *Sharira* (body), *Manas* (mind), *Buddhi* (intellect), and *Atman* (consciousness).
2. Gandhian Influence – Mahatma Gandhi was a strong advocate of nature cure, believing the body could heal itself through natural laws like proper diet, fresh air, and sunlight.
3. Institutional Framework – Post-independence, Naturopathy gained official recognition under the AYUSH system. The Ministry of Ayush has propelled its growth through initiatives like the National Naturopathy Mission.

3. Key Therapeutic Interventions

Naturopathy employs specific tools to restore balance and remove toxins (*Ama*) –

Therapeutic Fasting –

1. Concept – Fasting is not starvation but a conscious, supervised physiological rest for the digestive system.
2. Benefits – It eliminates accumulated toxins, improves digestive efficiency, and redirects energy toward repair and immunity.
3. Types – Includes water fasting, juice fasting, fruit fasting, and mono-diet fasting, tailored to individual needs.

Yoga as Medicine –

4. Role – Yoga is inseparable from Indian Naturopathy. It is prescribed for conditions like hypertension, diabetes, and anxiety.
5. Mechanisms – *Asanas* improve circulation; *Pranayama* regulates the nervous system; and *Dhyana* (meditation) reduces stress.

Diet Therapy (Food as Medicine) –

6. Philosophy – Food is viewed as "information" that influences bodily functions, not just fuel.
7. Satvik Ahara – Emphasizes a natural, plant-based diet of fresh fruits, vegetables, whole grains, and sprouts while avoiding processed foods.

Natural Therapies –

8. Hydrotherapy – Uses water (hot/cold/steam) to stimulate circulation and detoxify.
9. Mud Therapy – Mud packs absorb toxins and reduce inflammation.
10. Sun Therapy – Enhances Vitamin D synthesis and boosts immunity.

4. Mental and Emotional Healing

A unique strength of this system is its focus on mental health. It recognizes stress and suppressed emotions as major contributors to disease.

1. Interventions – Through counseling, meditation, and lifestyle education, patients are guided toward emotional awareness and stress management.
2. Digital Detox – In modern urban contexts, Naturopathy incorporates digital detox protocols to address issues like burnout and digital overload.

5. Scientific Validation & Modern Integration

Contrary to the perception of being unscientific, emerging research validates these practices. Studies from the National Institute of Naturopathy (NIN), Pune, have demonstrated that naturopathic interventions can reduce inflammation markers and improve quality of life in patients with metabolic syndrome.

4. Millets in the Right Context

GS Paper III – Major crops-cropping patterns in various parts of the country; Food processing and related industries in India- scope' and significance.

1. The "New Maida" Trap – Context Matters

The author warns against the mindless adoption of millets as merely a "healthier" substitute for refined flour (maida) in processed foods.

1. The Trend – There is a growing trend of replacing maida with millets in products like biscuits, cakes, breads, and noodles to position them as healthy for profit.
2. The Problem – Good health isn't about simply replacing one ingredient with another (x with y). Without the traditional context of preparation (like fermentation or soaking) and consumption (seasonal timing), millets can become just another fad without delivering their full nutritional promise.
3. Processing vs. Health – Consuming processed millet chips or noodles often strips away the "baggage" (labor, traditional fats, pulses) that actually aids digestion and nutrient assimilation.

2. Traditional Wisdom – The "Glocal" Approach

The article advocates for a "glocal" approach—adapting global health goals to local realities and traditions.

1. Seasonal Consumption – Winter – Bajra (Pearl Millet) is traditionally consumed in winter due to its warming properties. Dishes include *Bajra Khichdi*, *Bhakri*, and *Laddoos* with garlic.

Summer – Jowar (Sorghum) is preferred in summer. It is eaten as *Bhakri* or *Thalipeeth*. Ragi (Finger Millet) is also consumed, often as *Sattva* (porridge) or *Dosa*.

2. Cultural Practices – The traditional method of eating involve specific combinations dictated by culture and climate. For example, hard-to-digest millets like Bajra are traditionally eaten with a dollop of *makhan* (butter), ghee, or jaggery to aid digestion.

3. Food Synergy and Preparation

1. Combination – Millets should not be eaten in isolation. Combining them with pulses, spices, and fats compensates for limiting amino acids and improves protein digestibility.
2. Preparation Techniques – Traditional methods like germination (for *sattva*), fermentation (for *dosa*), soaking, and heating (for *khichdi*) are crucial. These processes ensure there is no "taste fatigue" and that the body can effectively assimilate nutrients.

4. Sustainability and Balance

1. Not a Replacement – Millets are not meant to completely replace rice and wheat. A sustainable diet involves continuing with rice/wheat for regular consumption while integrating millets strategically—such as a weekly *Bhakri* or seasonal *Ladoo*.

2. Diverse Consumption – The diversity in consumption methods (porridge, rotis, snacks) ensures nutritional benefits without boredom.

5. Nutritional Highlights (Little Millet)

The chapter highlights specific benefits of Little Millet –

Heart Health – Good for the heart.

Weight Management – Helps in weight loss.

Metabolic Health – Balances blood pressure and serves as an antioxidant powerhouse

Digestion – Boosts digestion due to high fiber content.

5. Yoga and Wellness – Bhartiya Wisdom

GS Paper I – Indian Culture – Salient aspects of Art Forms, Literature and Architecture from ancient to modern times (Yoga as ancient science).

GS Paper II – Issues relating to development and management of Social Sector/Services relating to Health.

GS Paper IV – Ethics, Integrity, and Aptitude (Values rooted in Yama and Niyama).

1. Yoga – The Science of Life

The chapter defines Yoga not merely as physical exercise or gymnastics, but as a "science of breath and movement" and a practical way of living.

1. Connectivity – Yoga is described as the harmonization of body, mind, and soul. It is a means to achieve positive health and wellness through self-discipline.
2. Prana (Vital Force) – The concept of *Prana* is central—it is the vital energy that regulates the mind, heart, and diaphragm. Yogic practice strengthens this energy, which is the source of all mental functions and autoimmune resilience.
3. Empowerment – Yoga empowers the individual by shaping core values such as purity, love, peace, and will power. It encourages an attitude of humility, similar to the philosophy of *Karmayoga*.

2. Holistic Wellness Framework

Wellness is defined as a state of high-level health, influenced by daily decisions. The article references the 7 Dimensions of Holistic Wellbeing (7DHW) –

1. Physical – Diet, sleep, exercise.
2. Mental/Emotional – Self-awareness, resilience, and emotional regulation.
3. Intellectual – Creativity, critical thinking, and cognitive therapies.
4. Spiritual – Finding meaning, purpose, and connection to something larger.
5. Occupational – Wellness through work.
6. Social – Connection with community and loved ones.
7. Environmental – Awareness and respect for surroundings.

3. Ashtanga Yoga – The Eight Limbs

Sage Patanjali's *Ashtanga Yoga* is presented as a holistic model moving from external conduct to internal consciousness.

1. Yama (Social Discipline) – Ethical restraints including Non-violence (*Ahimsa*), Truthfulness (*Satya*), Non-stealing (*Asteya*), Moderation (*Brahmacharya*), and Non-possessiveness (*Aparigraha*).
2. Niyama (Personal Discipline) – Inner observances including Purity (*Saucha*), Contentment (*Santosha*), Discipline (*Tapas*), Self-study (*Svadhyaya*), and Surrender (*Ishvara Pranidhana*).
3. Asana (Postures) – Defined as *Sthirasukhamasanam* (stable and comfortable posture). It nurtures the body while preparing the mind for alignment with infinity.
4. Pranayama (Breath Regulation) – Breath awareness helps detoxify, repair, and reduce stress by strengthening the autonomic nervous system.
5. Pratyahara (Withdrawal of Senses) – Detaching from external sensory distractions to draw attention inward.

6. Dharana (Concentration) – Mental discipline involving focus and regularity (*Abhyaas*).
7. Dhyana (Meditation) – Absorption in the object of focus, such as mindfulness meditation which strengthens the parasympathetic nervous system.
8. Samadhi (Illumination) – The ultimate state of bliss and unity with the universe.

4. Health Impacts

The physiological benefits of Yoga are well-documented –

1. Regulation – It regulates heart rate, blood pressure, and breathing rate.
2. Metabolic Health – Improves digestion and maintains normal blood sugar levels.
3. Stress Reduction – Reduces the activity of stress hormones (which have an anti-insulin effect) and induces relaxation.

5. Conclusion

The chapter concludes that wellness is not a destination but a continuous practice of conscious choices. Future wellness lies not in external cures but in the inner capacity to live with awareness and harmony.

6. Next-Gen Nutrition Strategy for Child Wellness

GS Paper II – Issues relating to poverty and hunger; Government policies and interventions for development in various sectors and issues arising out of their design and implementation.

1. The Triple Burden of Malnutrition

India is grappling with a complex nutritional challenge that goes beyond simple undernutrition. The "triple burden" includes –

1. Undernutrition – High prevalence of stunting (35.5%), wasting (19.3%), and underweight (32.1%) children under five, as per NFHS-5.
2. Micronutrient Deficiencies – "Hidden hunger" affecting a vast population due to poor dietary diversity.
3. Rising Obesity – About 3% of children are now overweight, signaling the early emergence of overnutrition alongside deprivation.

2. Strategic Shift – The RMNCAH+N Framework

The national strategy has shifted from isolated food schemes to a holistic RMNCAH+N (Reproductive, Maternal, Newborn, Child, Adolescent Health plus Nutrition) framework.

1. Life-Cycle Approach – Interventions span the entire continuum of care—from preconception and pregnancy to the first 1,000 days (conception to two years), which are critical for survival and cognitive development.
2. Preconception Care – Poor nutrition before pregnancy increases the risk of low birth weight. Initiatives like Rajput and WINGS have shown that targeted maternal nutrition can reduce low birth weight by approximately 20%.

3. Newborn and Home-Based Care

Recognizing that over 70% of infant deaths are linked to low birth weight and prematurity, the strategy emphasizes care starting at birth.

1. Home-Based Newborn Care (HBNC) – ASHAs conduct scheduled home visits up to 42 days after birth to counsel on breastfeeding and identify danger signs.
2. Home-Based Care for Young Child (HBYC) – Launched in 2018, this extends support to children aged 3–15 months. It includes five scheduled visits to monitor growth, promote complementary feeding, and ensure early identification of developmental delays.

4. Community and Digital Integration

1. Community Management – The strategy moves beyond facility-based care to treating uncomplicated malnutrition within the community through Anganwadi and primary health systems

2. Digital Enablement – The Poshan Tracker and Reproductive and Child Health (RCH) portal act as the backbone of this strategy. They enable real-time monitoring of service delivery, longitudinal tracking of children, and automated alerts for at-risk cases, replacing cumbersome paper-based reporting.

5. Conclusion

Child Wellness as National Progress The chapter concludes that child wellness is a development priority central to building a productive and equitable nation. Success requires sustained political commitment, adequate financing, and the convergence of health, sanitation, and education sectors to break the intergenerational cycle of malnutrition.

7. Leveraging Grassroots Innovations for Public Health

GS Paper II – Issues relating to development and management of Social Sector/Services relating to Health.

GS Paper III – Science and Technology—indigenization of technology; Intellectual Property Rights (IPR); Conservation.

1. The Foundation – Traditional Knowledge Systems

India possesses a rich heritage of plant-based remedies that form the backbone of primary healthcare in rural areas.

1. Usage – The World Health Organization (WHO) notes that approximately 65% of India's rural population uses Ayurveda and herbal remedies for primary care. Globally, 65–80% of healthcare practice involves traditional medicines.
2. Bio-resources – About 17% of Indian plant species are considered to have pharmacological properties.
3. Scientific Validation – Traditional knowledge often precedes formal research. For instance, *Catharanthus roseus* (Sadbahaar), documented in India for lowering blood sugar, later yielded critical anti-cancer alkaloids like vinblastine and vincristine.

2. International Protection – The WIPO Treaty (2024)

A significant milestone for the Global South was the WIPO treaty on 'Intellectual Property, Genetic Resources, and Traditional Knowledge' announced in May 2024.

1. Mandatory Disclosure – The treaty mandates that patent applications involving genetic resources must disclose their origins.
2. Impact – This binding international standard holds 193 member countries accountable, reducing legal loopholes used for biopiracy and misappropriation of traditional knowledge.

3. Grassroots Innovations – The "Living Pharmacy"

Local healers and farmers continuously innovate using native plants. Key examples include –

1. *Tinospora cordifolia* (Giloy) – Used for fever, asthma, diabetes, and jaundice.
2. *Moringa oleifera* (Sahijan) – Treats joint pain, sprains, and snakebite.
3. *Ocimum sanctum* (Tulsi) – Applied for respiratory and circulatory health.
4. *Adhatoda vasica* (Vasa) – Effective for cough and asthma.

4. Institutional Support – National Innovation Foundation (NIF)

The National Innovation Foundation (NIF) acts as critical infrastructure to protect and scale these innovations through Intellectual Property Rights (IPR).

Patented Innovations –

1. Epilepsy – A herbal composition by Mila Ram Medhi (Assam) using *Lasia spinosa* and *Curcuma longa*.
2. Filariasis – A remedy by Sonia Devi (Bihar) using *Sansevieria roxburghiana*.
3. Nerve Disorders – A medication by Baidhar Biswal (Odisha) using *Capparis sepiaria*.
4. Liver Disorders – A multi-plant composition by Lalmuanzova (Mizoram).

Statistics -

NIF has filed over 279 patents for human health, with 131 patents granted for conditions ranging from tuberculosis to neurological disorders.

5. Challenges - Erosion and Extinction

1. Knowledge Erosion - Socio-economic changes are disrupting the intergenerational transfer of knowledge as younger generations migrate to cities.
2. Biodiversity Loss - Climate change and habitat destruction threaten medicinal plants. A global report notes that 106 out of 367 medicinal species studied have lost habitat area, and 33 face extinction. High-altitude Himalayan herbs are becoming increasingly scarce.

6. National Initiatives for Integration The government has launched several initiatives to document, protect, and commercialize this knowledge -

1. Traditional Knowledge Digital Library (TKDL) - Has documented over 5.15 lakh formulations (Ayurveda, Unani, Siddha, Yoga) to prevent biopiracy by making this knowledge visible to patent examiners globally. Access was recently widened to researchers to promote drug discovery.
2. National One Health Mission (2022) - Coordinates across sectors (human, animal, environment), recognizing the interconnectedness of medicinal plant ecosystems and health.
3. Ayushman Arogya Mandirs - Over 1.8 lakh centers operationalized, integrating herbal medicine management and cultivation awareness into primary care.
4. Pharmacopoeia Commission (PCIM&H) - Sets standards for the quality, identity, and purity of traditional medicines, which is essential for safe commercialization. Recently, 48 grassroots medicinal plants were included in the Indian Pharmacopoeia.

7. Conclusion - The Way Forward

The future requires sustaining resilient value chains through regional processing hubs and batch-level traceability. Certification programs for traditional healers could formalize their role in public health. Integrating ethnobotany into school curricula ensures that knowledge of native medicinal plants is passed on to the next generation.

8. Mental Health in the Digital Age

GS Paper II - Issues relating to development and management of Social Sector/Services relating to Health.

GS Paper IV - Ethics, Integrity, and Aptitude (Emotional Intelligence - concepts, their utilities and application in administration and governance; Cyber-ethics).

1. The Context - Digital Chaos and Attention Economy

The modern world offers unlimited access to information, which has created a chaotic internal environment for individuals.

1. The Problem - The current digital landscape is characterized by poor attention spans, information overload, and a lack of filtration boundaries.
2. Youth Impact - Young people face constant pressure due to risk-taking behaviors, a need for immediate gratification, and perpetual comparison with others' curated lives on social media. This erosion of value-based decision-making adds to their internal chaos.

2. Framework for Resilience - The 7 Cs of Mental Health

To navigate this chaos, the article proposes the "7 C's" framework to build resilience and positive mental health -

1. Competence - Feeling capable in one's actions and abilities.
2. Confidence - Maintaining a positive self-image and belief in oneself.
3. Connection - Establishing meaningful relationships with others.
4. Coping - Developing healthy mechanisms to manage stress effectively.
5. Compassion - Practicing kindness towards oneself and others.

6. Community – Feeling like part of a larger, supportive group.
7. Care/Calmness – Prioritizing self-care and finding inner peace.

3. The Digital Paradox – Impact of social media

social media is a double-edged sword, evoking conflicting feelings from isolation to excitement.

1. Negative Impacts – It is linked to increased anxiety, depression, cyberbullying, sleep disturbances, and "social comparison" where users feel inadequate compared to others.
2. Positive Impacts – It offers education, enhanced social connections, and access to support communities for those who might otherwise feel isolated.
3. Vulnerability – People with pre-existing vulnerabilities face higher risks of addiction and mental illness due to excessive device use.

4. Strategies for Digital Wellbeing

The chapter outlines practical strategies to make the online experience positive –

1. Set Boundaries –Track Time – Use apps with built-in timers to monitor usage.
Turn off Notifications – Disabling push notifications reduces the urge to constantly check the phone.
No Phone Zones – Establish rules like no phones in the bedroom or at the dinner table.
2. Curate the Feed –Unfollow Triggers – Users should unfollow accounts that make them feel inadequate or disturbed.
Follow Positivity – Fill feeds with nature photography, motivational quotes, educational content, and accounts that share realistic "ups and downs" rather than just highlights.
3. Focus on Facts – Remind oneself that social media is not real life. Algorithms control feeds, influencers are paid to look a certain way, and filters distort reality.

5. Guidance for Parents and Guardians

1. Empowerment over Restriction – Instead of banning technology, parents should empower children to be "responsible online participants".
2. Open Communication – Adopt an approach that fits the child's age and interests, maximizing protection without restricting learning opportunities.
3. Digital Literacy for Adults – Parents must develop their own digital confidence to model balanced habits.
4. Early Intervention – It is imperative to intervene early if a child shows signs of mental illness, utilizing adolescent mental health services for acute needs.

6. Conclusion

Mental health in the digital age requires a balanced approach. By setting limits, prioritizing real-life connections, and "cleaning up" digital feeds, individuals can leverage the benefits of technology while protecting their mental well-being.

9. Digital Tools that Simplify Wellness

GS Paper II – e-Governance– applications, models, successes, limitations, and potential; Issues relating to development and management of Social Sector/Services relating to Health.

GS Paper III – Science and Technology– developments and their applications and effects in everyday life.

1. Context – The Digital Wellness Revolution

With over 1 billion phones in India, the government has leveraged digital penetration to democratize wellness. These tools address critical gaps such as the shortage of doctors in rural areas (where 70% of the population lives but only 30% of doctors practice) and the high cost of private healthcare.

2. Key Digital Public Goods for Health

The chapter highlights several free, government-backed apps that are transforming healthcare delivery –

1. Fit India App (Gamifying Fitness) –
Purpose – Combats sedentary lifestyles by turning exercise into a fun, interactive game.

Features – Tracks steps and calories like a video game score. It features celebrity-led workout videos (e.g., Virat Kohli teaching Surya Namaskar) that require no gym equipment.

elegance – Crucial for managing India's diet-heavy festival culture by encouraging daily movement.

2. Ayushman Bharat Digital Mission (ABDM) & ABHA –

ABHA ID – A 14-digit unique health ID (Ayushman Bharat Health Account) that acts like an "Aadhaar for health".

Function – Stores all medical history—doctor visits, lab reports, vaccine records—digitally in one secure place.

Impact – Eliminates the need to carry physical papers and ensures records (like lost vaccination cards) are preserved for life. By 2026, over 35 crore people are projected to have an ABHA ID.

3. Sanjivani (Telemedicine) –

The Problem Solver – Bridges the urban-rural divide by connecting patients in remote villages to doctors in cities via video call.

Scale – Has facilitated over 28 crore consultations, saving millions of rural citizens the cost and effort of travel.

Usability – Free and accessible from home, treating ailments ranging from skin rashes to mental stress.

4. POSHAN Tracker –

Target Audience – Mothers, pregnant women, and children aged 0–6 years.

Functionality – Acts as a smart coach, analysing daily food intake to track protein and vitamin consumption. It monitors growth (height/weight) to detect stunting early and sends reminders for vaccinations and deworming.

5. AYUSH Sanjivani & Other Apps –

Tradition Meets Tech – Combines ancient wisdom with modern technology. It assesses a user's *dosh*a (body type) to suggest personalized diets and routines.

Home Remedies – Provides science-backed kitchen remedies (e.g., sandalwood for headaches).

- Access – Helps users locate the nearest AYUSH wellness centre and book appointments.

3. Citizen Engagement – MyGov Challenges

The government uses the MyGov platform to run wellness challenges, shifting from boring lectures to participatory events. Examples include –

1. 30-Day No Sugar Challenge – Encouraging sugar reduction.
2. Millet Recipe Contest – Promoting traditional grains through cooking competitions.
3. Family Fitness Challenge – Encouraging families to exercise together.

10. Athletic Resilience

GS Paper IV – Ethics, Integrity and Aptitude (Emotional intelligence-concepts, and their utilities and application in administration and governance).

1. The Unseen Game – Mental Psychology

While spectators applaud physical feats like a perfect shot or a cricket six, the complex psychological processes behind them often go unrecognized.

1. The Reality – Behind sporting brilliance lies a mental state that is as trained and fragile as physical skill. Athletes often battle anxiety, self-doubt, and burnout despite appearing composed on the outside.
2. Prominent Examples – Elite athletes like Virat Kohli, Simone Biles, and Naomi Osaka have openly discussed their mental health struggles, normalizing the conversation around pressure and depression in sports.

2. Redefining Mental Toughness

The chapter challenges the notion that "mental toughness" is an innate trait.

1. Skill, Not Talent – It is defined as a trainable skill set involving focus, confidence, and emotional regulation. It is not about suppressing emotions or being relentlessly positive, but about facing challenges with awareness and adaptability.
2. Vulnerability – True strength involves acknowledging vulnerability and managing difficult thoughts rather than eliminating them.

3. The Need for Systematic Training

Psychological preparation cannot be left to trial and error. It requires a systematic approach similar to physical conditioning.

1. Tools – Techniques include attentional control, emotional regulation, self-talk, imagery, and pressure management.
2. The Coach's Role – While coaches care, they often lack formal training in psychology. The article highlights the structural gap in the sporting system where mental support is often ad-hoc rather than evidence-based.

4. Holistic Support Systems

Athletes are humans first. Their mental well-being is heavily influenced by their environment outside the sport.

1. Detachment – Recovery often comes from disconnecting from the sport—engaging in simple routines, shared meals, or spending time with pets.
2. The "Pet Effect" – The author shares personal experiences of how pets (like cats) provide unconditional support unrelated to performance, a sentiment echoed by Olympians like Abhinav Bindra.

5. Conclusion

The real measure of sporting excellence is the mind's ability to stay present and breathe when everything is on the line.

11. Interview – Peepal Baba

GS Paper III – Conservation, environmental pollution and degradation, environmental impact assessment.

1. Early Influences – Nature as Teacher

Peepal Baba (Swami Prem Parivartan) attributes his journey not to a planned decision but to natural evolution shaped by early influences.

1. Education – His teacher, Mrs. Williams, used storytelling and *National Geographic* imagery to instill a love for geography and nature, moving beyond textbook learning.
2. Army Cantonments – Growing up in army cantonments taught him that development and nature can coexist. These areas serve as models of "balanced living" with space for trees, birds, and pedestrians, unlike the crowded vertical growth of modern cities.

2. Urban Planning Lessons

Drawing from international travels, he critiques current urban development and offers alternatives –

1. Singapore – Cited as a prime example of a "garden city" where greenery is central to planning, ensuring open spaces even with high density.
2. Dubai – Demonstrates that natural limitations (like a desert) are not excuses; vision and confidence can create green infrastructure anywhere.
3. Takeaway for India – Urban planning must prioritize environmental well-being to make cities liveable, preventing footpaths from turning into markets and preserving "lungs" for the city.

3. Action-Oriented Philosophy

1. Power of Action – People respond to visible action (planting trees) more than speeches. Consistent fieldwork encourages others to join, creating shared responsibility.

2. Individual Power – Social change begins with small, consistent individual acts like saving water or reducing waste. He emphasizes that "social change is nothing but the result of consistent individual action".

4. Practical Steps for Citizens

He suggests three simple steps for every citizen to combat pollution and stress –

1. Plants – Surround homes with plants to improve local air quality and calm the mind.
2. Grow Food – Growing even a little food changes one's relationship with what they eat and fosters responsibility.
3. Reduce Stress – Curate information intake to avoid constant negativity.

5. Agriculture and Ecology

He advocates for a return to natural farming, noting that chemical dependence weakens the foundation of agriculture. Food must be respected as "life," not just a product, to build a sustainable system.

12. Tribute — Bappi Lahiri

GS Paper I – Indian Culture will cover the salient aspects of Art Forms, Literature and Architecture from ancient to modern times.

1. The "Different" Maestro

Bappi Lahiri (Alokesh Aparesh Lahiri) is celebrated as a composer who was distinct in every way—from his music to his persona.

1. Prodigy – Born into a family of classical musicians, he began playing the tabla at age three and recorded his first Bengali song at 14.
2. Classical Roots – Despite his "disco" image, his training was purely in Indian classical music, which allowed him to create deep melodies alongside rhythmic hits.

2. The Disco Revolution

Bappi Lahiri is credited with establishing the disco genre in Hindi cinema.

1. Pioneering Sound – With the film *Suraksha* (1979), he introduced a new rhythmic identity to Bollywood.
2. The Mithun Collaboration – The 1982 hit *Disco Dancer* cemented his legacy. Songs like "I Am a Disco Dancer" became cult hits globally, especially in Russia and China, winning him the China Gold Award.

3. Innovation and Versatility

1. Synthesis – He defended his inspiration from Western music (e.g., *One Way Ticket*, *Lambada*) by arguing that he adapted them for Indian audiences, while his original compositions were equally popular.
2. Global Collaborations – He collaborated with international artists like Samantha Fox and Boy George and even dubbed for Elton John in Hollywood films.
3. Guinness Record – He entered the Guinness Book of World Records in 1985 for recording over 180 songs for 33 films in a single year.

4. Legacy

Bappi Lahiri proved that music transcends borders and genres. He remained relevant across decades, adapting to changing trends while maintaining his unique "Gold Man" persona inspired by Elvis Presley. His contribution bridged the gap between traditional Indian melody and the synthesized sounds of modern pop culture.

1. Rural Sports Powering India@2047

GS Paper II – Government Policies and Interventions for Development in various sectors.

GS Paper II – Issues relating to development and management of Social Sector/Services relating to Human Resources.

Vision 2047 & Strategic Shift –

The chapter positions rural sports not merely as recreational but as a strategic driver for the "Viksit Bharat" (Developed India) 2047 vision. The government has shifted the policy approach to be athlete-centric, prioritizing transparency, nutrition, and scientific training over the earlier ad-hoc methods.

Institutional Framework –

1. National Sports Governance Act & Khelo Bharat Niti 2025 – These are the twin pillars designed to institutionalize sports governance, ensuring transparency and enabling youth to balance academics with sports.
2. Khelo India Scheme – Acts as the grassroots powerhouse connecting village participation to elite performance. It includes components like the Khelo India Centres (KICs) (upgrading rural schools/panchayat grounds into training hubs) and State Centres of Excellence (KISCEs) for elite training.

Talent Identification (KIRTI) –

The Khelo India Rising Talent Identification (KIRTI) programme introduces a scientific method to spot talent in children aged 9–18 years in rural and tribal areas, moving away from chance-based discovery to data-driven selection.

Infrastructure & Governance –

1. PYKKA (Panchayat Yuva Krida aur Khel Abhiyan) – Focuses on block and village-level infrastructure and operational costs for competitions.
2. Accountability – National Sports Federations have been mandated to prepare short (1-year), medium (5-year), and long-term (10-year) roadmaps targeting the 2036 Olympics and 2030 Commonwealth Games.

2. Rural Talent – The Bedrock of Indian Sports

GS Paper II – Social Justice (Issues relating to youth and human resource development).

GS Paper I – Social Empowerment (Role of sports in rural upliftment).

1. Demographic Dividend –

Approximately 80% of India's sportspersons originate from rural areas, proving that villages are the backbone of the sporting ecosystem.

- *Examples* – Neeraj Chopra (Khandra village, Haryana), Lovlina Borgohain (Baromukhiya village, Assam), and Dilip Tirkey (Saunamara village, Odisha).

Target Olympic Podium Scheme (TOPS) –

1. Launched to professionalize elite athlete management. It provides a dedicated technical support team, foreign training exposure, and a monthly stipend of ₹50,000 to core group athletes.
2. Currently supports 98 core group athletes and 165 development group athletes.

2. Cricket's Rural Shift –

The article notes a shift in cricket recruitment. Unlike the urban dominance of the past (Gavaskar, Tendulkar), modern leagues like the IPL are heavily investing in rural talent (e.g., Vaibhav Suryavanshi from Bihar, Kartik Sharma from Rajasthan).

3. Challenges –

Despite the talent pool, the lack of modern coaching standards remains a bottleneck.

Dependence on foreign coaches for disciplines like hockey and shooting persists, necessitating an upgrade in domestic coaching capabilities.

3. Rural Women Redefining India's Sporting Glory

GS Paper I – Role of Women and Women's Organization; Social Empowerment.

GS Paper II – Welfare schemes for vulnerable sections (Women).

1. The Paradigm Shift –

Rural women are moving from social conservatism to global podiums. Sports is now viewed by rural families as a pathway to employment, education (scholarships), and social mobility, rather than a distraction.

ASMITA League –

1. Standing for "Achieving Sports Milestone by Inspiring Women Through Action," this is a nationwide women-only competitive ecosystem.
2. It normalizes women's participation in sports within conservative rural settings by engaging schools and local institutions. In 2024-25, over 53,000 women participated.

Socio-Economic Impact –

1. Delayed Marriage – Participation in organized sports is linked to delayed marriages and higher school retention rates for rural girls.
2. Financial Independence – Earnings from scholarships and government jobs provide economic agency to rural women.

2. Regional Powerhouses –

Specific rural belts have specialized –

3. Sundergarh (Odisha) – Nursery of Indian Hockey.
4. Rohtak-Sonapat (Haryana) – Wrestling and Boxing.
5. Manipur – Weightlifting and Football.

4. Rural India's Para Athlete Champions

GS Paper II – Social Justice (Mechanisms, laws, institutions and Bodies constituted for the protection and betterment of vulnerable sections – Disabled/Divyangs).

1. Resilience amidst Adversity –

The article highlights how rural athletes with disabilities (Divyangs) face a "double burden" of rural lack of infrastructure and social stigma but have emerged as global champions.

1. Case Studies – Sheetal Devi (armless archer from J&K), Sumit Antil (Javelin gold medalist from Haryana), and Arunima Sinha (first female amputee to climb Mt. Everest).

2. Shift in Perspective –

Prime Minister Modi's terminology "Divyang" (divinely empowered) marked a shift from sympathy to empowerment.

Policy Gaps & Needs –

2. Cost of Equipment – Advanced prosthetics and sports gear remain prohibitively expensive for rural families.
3. Early Identification – There is a need for early screening of special needs children in village schools to direct them toward para-sports.
4. Digital Mapping – A call for a platform to link rural para-athletes with schemes and training centers.

5. Khelo Bharat Niti 2025 (National Sports Policy)

GS Paper II – Government Policies and Interventions.

1. Overview –

Approved on July 1, 2025, this policy supersedes the 2001 policy. It adopts a "Whole-of-Government" approach, integrating sports into the schemes of all ministries.

The Five Pillars –

1. Global Excellence – Targeting top 10 in 2036 Olympics.
2. Economic Development – Promoting sports tourism, manufacturing (Make in India for sports gear), and the "Fan Economy".
3. Social Inclusion – Targeted support for tribals, women, and Divyangs.
4. Mass Participation – Establishing a "fitness index" for schools and workplaces to make fitness a daily habit.
5. Education Integration – Aligning with NEP 2020 to make sports a formal subject, not co-curricular, and providing academic credits for sporting excellence.

2. Implementation –

Utilization of CSR funds and Public-Private Partnerships (PPP) to finance infrastructure gaps.

6. Revolutionising Sports Training with Technology

GS Paper III – Science and Technology (Indigenization of technology and developing new technology).

Democratization of Tech –

High-end sports science is moving from elite labs to village grounds via smartphones.

1. AI & Video Analysis – Rural athletes can upload training videos to platforms like *Kreedon* or *StepOut*, where AI analyzes biomechanics (stride length, foot strike) without a physical coach.

Data-Driven Ecosystem –

1. Wearables – Use of GPS vests in hockey/football and bat sensors (e.g., *Str8bat*) to monitor metabolic power and fatigue.
2. Injury Prevention – Predictive modeling identifies "red zones" (overtraining), reducing stress fractures and ACL injuries by ~30% compared to 2020 levels.

Digital Twin Technology –

Used at elite levels to create virtual physiological models of athletes to test training loads before physical implementation.

7. The Sports Economy – Rural Youth, Real Jobs

GS Paper III – Indian Economy (Employment) & Industrial Policy.

Sports as Livelihood –

Sports is no longer just recreation but a structured employment ecosystem.

1. Government Recruitment – 43 sports disciplines are eligible for Sports Quota jobs in Railways, Army, and PSUs (ONGC, IOCL).
2. Structured Pay – Jobs are categorized by grade pay based on achievement (e.g., Olympic medalists get higher grade pay than state-level winners).

Allied Employment –

3. Manufacturing – Clusters in Meerut and Jalandhar employ rural artisans for making cricket bats, balls, and wrestling gear.
4. Sports Tech – A booming sector expected to reach \$130 billion by 2030, creating jobs in data analytics, grounds management, and physiotherapy.
5. Indigenous Sports – Revival of Mallakhamb and Gatka creates demand for specialized coaches.

8. Rural Sports for Community Well-Being

GS Paper I – Social Issues (Substance Abuse).

GS Paper II – Health (Preventive Healthcare).

Drug De-addiction Tool -

In regions plagued by substance abuse (often due to unemployment), organized sports provide structure, discipline, and dopamine alternatives. It is used as a preventive and rehabilitative tool.

Cluster-Based Infrastructure -

Proposes a model where one well-equipped complex serves a cluster of villages to ensure cost-efficiency and maintenance.

Convergence with MGNREGA -

Suggests using rural employment guarantee schemes (like the new VB-GRAM G Act) to build sports assets (leveling grounds, boundary walls) to reduce costs and generate local employment.

9. Sports, Rural Youth, and Economic Development

GS Paper III - Inclusive Growth & Economics of Animal-Rearing (Wait, not animal rearing, strictly Sports economy here).

Economic Framing -

The chapter argues for reframing girls' sports from "empowerment" to "economic intervention."

1. Health Costs - Low physical activity could add ₹55 trillion to healthcare costs by 2047; sports acts as preventive health infrastructure.

Women Coaches as Anchors -

Training rural women as certified coaches creates local employment and makes sports participation safer and more acceptable for adolescent girls.

Infrastructure Design Failure -

Highlights that "gender-neutral" often means "male-centric." Lack of toilets, safe access routes, and lighting are structural barriers that exclude girls.

Significant Policy Feature - Viksit Bharat-G RAM G Act, 2025

GS Paper II - Welfare Schemes for Vulnerable Sections; Governance.

Replacement of MGNREGA -

The *Viksit Bharat-Guarantee for Rozgar and Aajeevika Mission (Gramin) Act, 2025* replaces the 2005 MGNREGA.

Key Reforms -

1. Guaranteed Days - Increased from 100 to 125 days of wage employment.
2. Agriculture Support - Introduces a 60-day "pause" during peak sowing/harvesting seasons to ensure labor availability for farmers.
3. Asset Focus - Works strictly categorized into 4 verticals - Water Security, Core Rural Infra, Livelihood Infra, and Climate Resilience.
4. Funding - Shifts to a Centrally Sponsored Scheme (60 -40 split generally) with normative allocations to ensure state accountability.

Short Notes - Indigenous Games

GS Paper I - Indian Culture (Intangible Heritage).

1. Kabaddi - Globalized via the Pro Kabaddi League; played in 50+ countries.
2. Kho-Kho - First World Cup held in 2025 in New Delhi; modernized with new rules for TV audiences.
3. Mallakhamb - Traditional pole gymnastics from Maharashtra; emphasizes core strength and is now a structured sport with a federation.
4. Kalaripayattu - Ancient martial art from Kerala; rooted in "Kalari" arenas, emphasizes mental and physical discipline.

DOWN TO EARTH

1. Uncertainty, Public Distrust, & Global Insularity Become New Normal

Context

A series of influential global surveys released in early 2026, notably the World Economic Forum's Global Risks Report 2026 and the Edelman Trust Barometer 2026 revealed a sharp rise in uncertainty, public distrust, and global insularity.

A World Defined by Uncertainty

1. The World Economic Forum has identified uncertainty as the defining theme of 2026. Its Global Risks Perception Survey, which synthesised responses from over 1,300 global leaders and experts, paints a bleak picture of the near and long-term future.
2. 50% of respondents expect a turbulent or stormy global outlook over the next two years.
3. This rises to 57% when looking a decade ahead.
4. Only 1% anticipate a calm future in either timeframe.
5. For the first time in many years, environmental risks have been displaced in the short term by geopolitical and economic threats, signalling a shift in global anxieties.

Geo-economic Confrontation Takes Centre Stage

1. Nearly one in five respondents identified geo-economic confrontation as the most significant risk capable of triggering a global crisis in 2026.
2. Trade, finance, and technology are increasingly being used as tools of influence rather than cooperation.
3. According to the report, 'rules and institutions that have long underpinned stability are under siege', as the world fractures into multiple power centres marked by isolationism and strategic rivalry.
4. It has left many societies in a state of shock, struggling to adjust to a rapidly polarising global order.

Polarisation and the Crisis of Governance

1. Extremism in social, political, and cultural has intensified distrust in governance structures.
2. The surveys point to a growing 'streets versus elites' narrative, reflecting widespread disillusionment with traditional political systems.
3. Many citizens feel excluded from decision-making processes and sceptical that public policy can meaningfully improve livelihoods.
4. This erosion of trust is not limited to governments but extends to leaders and institutions more broadly.

Retreat Into Insularity

1. The Edelman Trust Barometer reinforces these concerns, warning of 'a world retreating towards insularity'. Key findings include –
2. 70% of respondents across 28 countries are hesitant or unwilling to trust people with different values, backgrounds, or information sources.
3. Only 33% say they trust 'most people'."
4. 45% describe insularity as a large or crisis-level problem.
5. In one of the most troubling conclusions, a majority believe societal distrust has become so deep that people actively try to make things worse for those they see as different.

Losing Faith in Institutions and the Future

1. Recent societal and geopolitical events have accelerated this loss of trust.
2. About 95% of respondents said such events contributed to declining confidence in institutions, with 40% reporting reduced trust in their national governments.

3. When asked whether the next generation would be better off than today, only 32% globally answered yes.
4. India stood out, with 53% responding positively, a 13-point increase from 2025, offering a rare note of relative optimism.

2. EU–Mercosur Trade Pact & Impacts on India

Context

Recently, the EU–Mercosur Trade Pact was signed with aims to create one of the world’s largest free trade zones, covering nearly 700 million consumers.

About EU–Mercosur Trade Pact

1. It is a major proposed trade agreement between the European Union and Mercosur (Argentina, Brazil, Paraguay, and Uruguay).
2. If fully ratified, it would create one of the world’s largest free-trade areas.

What Is Mercosur?

1. Mercosur, short for Mercado Común del Sur (Southern Common Market), is a regional economic and political bloc in South America.
2. It was established in 1991 with the goal of promoting free trade, economic integration, and political cooperation among its member states.

Member Countries

1. Full Members – Argentina, Brazil, Paraguay, Uruguay, Bolivia (joined formally in 2023; integration ongoing).
2. Associated States – Chile, Peru, Colombia, Ecuador, Guyana, and Suriname.
3. Associated states participate in trade agreements with Mercosur but are not part of the customs union.

Objectives of Mercosur

1. Eliminate tariffs and trade barriers within the bloc;
2. Establish a common external tariff for non-member countries;
3. Encourage free movement of goods, services, and factors of production;
4. Coordinate macroeconomic and sectoral policies;

What does the pact aim to do?

1. Reduce tariffs & open markets – The EU would remove most tariffs on Mercosur agricultural exports (beef, poultry, sugar, ethanol).
2. Mercosur would lower tariffs on EU industrial goods (cars, machinery, chemicals, pharmaceuticals).
3. Boost trade & investment – Covers a combined market of ~450 million people.
4. Intended to make EU companies more competitive in South America and give Mercosur exporters easier access to Europe.
5. Rules beyond tariffs – The agreement goes further than classic trade deals by including –
6. Services & public procurement (EU firms bidding for South American public contracts)
7. Intellectual property protection;
8. Sanitary and phytosanitary rules (food safety standards);
9. Sustainable development commitments (labor rights, environmental protection);

Why Does the Deal Matters for India?

1. Impact on Indian Agriculture – Increased Competition in Global Markets;
2. Mercosur countries are among the world’s largest exporters of Soybeans; Beef and poultry; Sugar; Maize and ethanol;

3. Mercosur agricultural exports could become more competitive globally with preferential access to EU markets. It may –
4. Put downward pressure on global commodity prices;
5. Affect Indian farmers exporting sugar, oilseeds, rice and processed foods to third markets;
6. Indian agricultural exports to the EU may face stiffer competition from cheaper South American produce.
7. Impact on Indian Manufacturing and Exports – As tariffs fall under the EU–Mercosur deal –
8. European firms may source raw materials more cheaply from South America;
9. Indian exporters of engineering goods, chemicals and automobiles could face tougher competition in the EU market;
10. Pressure on India–EU FTA Talks – India and the EU are already negotiating a long-pending India–EU Free Trade Agreement. The Mercosur pact –
11. Raises EU expectations on market access;
12. May push Brussels to demand deeper tariff cuts from India;
13. Strengthens the EU’s leverage in negotiations;

Strategic and Geopolitical Implications for India

1. Competition for Critical Minerals – One of the strategic pillars of the EU–Mercosur pact is access to critical raw materials –
2. Brazil – graphite, rare earths, niobium;
3. Argentina – lithium (key for EV batteries);
4. India, which is expanding its electric vehicle and renewable energy sectors, may now face –
5. Greater competition for lithium and rare earth supplies;
6. Higher costs or reduced bargaining power in global mineral markets;
7. It underscores India’s need to accelerate overseas mineral partnerships and domestic exploration.
8. Shifting Global Trade Alliances – The pact reflects a broader reordering of global trade, as the EU seeks to reduce dependence on China. For India, this presents –
9. A challenge, as South America gains strategic importance;
10. An opportunity, if India positions itself as a complementary, not competing, partner in global supply chains.

3. Forest Law Amendment – A Green Push or a Paper Industry

Context

An amendment to the Van (San Rakshan Evam Samvardhan) Adhi Niyam, 1980 has triggered intense debate by opening large tracts of forestland to commercial exploitation by the paper industry.

Why the Paper Industry Wanted Forest Access?

1. India’s paper industry faces a persistent fibre shortage. Domestic wood availability is estimated at 9 million tonnes per annum (TPA), while demand stands at around 11 million TPA.
2. At the same time, paper demand is growing at 6–7% annually, driven by rising literacy, packaging needs, and economic growth.
3. Although India is the third-largest paper producer globally, it remains fibre-deficient.
4. Nearly 76% of raw material comes from recycled paper, while wood and bamboo contribute about 20%.
5. Most wood is sourced from agroforestry and farm forestry, leaving little room for expansion without additional land.

What the Amendment Changes

1. Earlier Rules (2023 Guidelines) – Under the consolidated guidelines issued in 2023 –

2. Commercial plantations on forestland were treated as non-forest activities;
3. Industries had to pay Net Present Value (NPV), a charge reflecting lost ecosystem services;
4. Compensatory afforestation was mandatory for diverted forestland;
5. These provisions were designed to discourage forest diversion and offset ecological loss.
6. New Amendment (January 2024) – The revised notification reclassifies assisted natural regeneration; afforestation; commercial plantations, as ‘forestry activities’, even when undertaken by private or non-government entities.

Forest Health Hazard

1. ‘Greenwashing’ Forest Diversion – Former Forest officials warn that leasing forestland to industries is, in effect, forest diversion, regardless of whether trees are planted.
2. When private lessees profit from plantations, exempting them from ecological compensation amounts to greenwashing.
3. Plantation activities, critics argue, are core functions of forest departments, not commercial enterprises and cannot be equated with natural forest conservation.
4. Threat of Monoculture – Environmental groups caution that industries will prioritise monoculture plantations, such as eucalyptus and acacia—to maximise profits. These species deplete groundwater, reduce soil fertility, and suppress biodiversity.
5. Such plantations may increase tree numbers but degrade forest ecosystems, especially in grasslands, savannas, and floodplains that are not traditionally forested.

Reviving a Struggling Sector

1. Paper manufacturers say the amendment offers a lifeline to an industry grappling with rising imports and underutilised domestic capacity. Imports of paper and paperboard from ASEAN countries alone have grown at over 25% annually over the past decade.
2. Industry leaders argue that unlike mining, paper plantations increase tree cover rather than destroy it.
3. The short-rotation plantations can contribute to India’s climate goals, including –
4. Creating an additional 2.5–3 billion tonnes of carbon sinks by 2030;
5. Restoring 26 million hectares of degraded land under global commitments such as the Bonn Challenge;
6. From the above perspective, applying NPV and compensatory afforestation to plantation-based industries is seen as counterproductive.

4. India’s Urban Water Crisis

Context

1. The deaths caused by contaminated drinking water in Indore are not an isolated failure but a symptom of a deeper, systemic problem in India’s urban water-supply model.
2. It exposes how poor regulation, outdated infrastructure, weak data systems and a chronic neglect of sewage management continue to endanger public health across the country.

About India’s Urban Water Crisis

1. India’s urban water crisis is increasingly about safety, infrastructure failure and public health.
2. Repeated outbreaks of waterborne diseases across cities reveal deep flaws in how drinking water and sewage systems are planned, built and managed.

What Is the Crisis About?

1. At its core, India’s urban water crisis has three interconnected dimensions –
2. Contaminated drinking water;
3. Inadequate sewage and sanitation systems;

4. Ageing and poorly maintained infrastructure;
5. Sewage frequently leaks into drinking-water pipelines, exposing millions to diseases such as diarrhoea, typhoid, cholera and hepatitis.

Why Contamination Is So Common

1. Ageing Infrastructure – Many Indian cities rely on pipelines that are 30–100 years old. Cracks, corrosion and leaks are common, allowing sewage to enter water lines, especially when pressure drops.
2. Poor Separation of Sewage and Water Pipes – Engineering rules require water pipelines to be laid above and away from sewer lines.
3. In practice, pipes often crisscross or run side by side due to space constraints and unplanned urban growth.
4. Intermittent Water Supply – Most cities do not supply water round the clock. When supply stops, negative pressure forms inside pipes, sucking in contaminated water through leaks.
5. Lack of Reliable Underground Maps – Many cities lack updated digital maps of underground utilities. Without accurate data, authorities unknowingly damage pipelines while laying roads, drains or toilets.

Why Government Schemes Haven't Solved It?

1. India runs major urban programmes such as the Atal Mission for Rejuvenation and Urban Transformation and the Smart Cities Mission. However –
2. Most funding prioritises water supply, not sewage treatment;
3. Large non-sewered areas still depend on septic tanks and open drains;
4. Wastewater reuse and sludge management remain weak
5. Without fixing sewage systems, expanding water supply only increases the risk of contamination.

Why Is Sewage the Missing Link?

1. India needs to adopt a sewage-first approach –
2. Safely collect and treat all human waste;
3. Prevent faecal contamination of groundwater, rivers and pipelines;
4. Promote reuse of treated wastewater for industry and agriculture;
5. Without proper sewage management, clean drinking water cannot be guaranteed, no matter how many new pipelines are laid.

Way Forward

1. To address India's urban water crisis, cities need to –
2. Enforce pipeline safety standards strictly;
3. Digitally map underground infrastructure using GIS;
4. Shift investment priorities toward sewerage and septage management;
5. Ensure continuous, pressurised water supply where possible;
6. Protect and rejuvenate local water sources;

5. Odisha – A Model for Urban Water Safety in India

Context

Across urban India, safe piped drinking water remains elusive. Ageing pipelines, intermittent supply and poor maintenance frequently lead to contamination, forcing households to rely on boiling, filtration or bottled water. Against this backdrop, Odisha has emerged as a notable exception.

Drink-from-Tap Initiative of Odisha (2017)

1. Odisha's Drink from Tap mission aims to provide safe, potable water directly from household taps on a continuous, 24-hour basis, implemented by the Water Corporation of Odisha (WATCO).

2. It currently covers 11 cities of state ie Puri, Gopalpur, Nimapada, Brahmapur, Champua, Rajgangpur, Birmiritrapur, Rairangpur, Sundargarh, Hinjilicut and Anandpur, reaching about 3.2 million people through nearly 600,000 connections.

Why Continuous Supply Matters?

1. The central principle behind the programme is constant pressurisation of pipelines. In most Indian cities, water is supplied intermittently.
2. When supply stops, pressure drops, creating a vacuum that can draw contaminated water into pipelines through cracks, loose joints or illegal connections.
3. A continuous, 24-hour supply keeps pipelines pressurised at all times, significantly reducing the risk of external pollutants entering the system—even when leakages exist.

Fixing the Underground Problem

1. Pressurisation alone is not enough if water and sewer pipelines are poorly aligned. A common cause of contamination in Indian cities is the close proximity, or overlap of water supply lines and sewerage networks.
2. National guidelines mandate a minimum horizontal separation of 3 metres and a vertical separation of 1–1.5 metres between the two.
3. Odisha made detailed asset mapping mandatory before introducing round-the-clock supply in any city. Where required, pipelines were realigned or relocated to ensure safe distances.

Changing Household Practices

1. The programme also addresses contamination risks within homes. Underground sumps and overhead storage tanks, common in Indian households, can become breeding grounds for bacteria.
2. Under the Odisha model, households are encouraged to remove these storage systems and rely directly on the continuous tap supply.
3. In Puri alone, around 85% of households voluntarily dismantled storage tanks.
4. As a result, many residents now drink water straight from the tap—at home and even in public spaces.

Community Engagement Through 'Jalasathis'

1. A distinctive feature of the programme is the involvement of jalasathis (water friends). These local workers read meters, collect user charges, facilitate new connections and conduct basic field-level water quality tests.
2. Their presence has helped build trust, improve compliance and change water-use behaviour at the community level.

Strengthening Water Quality Monitoring

1. Odisha has also overhauled its water quality surveillance system by setting up an independent Water Quality Assurance Cell under the Department of Housing and Urban Development.
2. Water samples are tested at city, regional and state laboratories, with third-party verification by the Indian Institute of Technology Bhubaneswar.
3. Testing covers up to 69 parameters, including microbiological and chemical indicators, with around 50 routinely monitored based on city-specific risks such as heavy metal contamination.

A Model for the Rest of India

1. Under the AMRUT 2.0 (Atal Mission for Rejuvenation and Urban Transformation), the Centre is encouraging other states to adopt Odisha's approach.
2. In the long run, a 24-hour pressurised supply is the only structural solution to prevent contamination and avert recurring urban water crises.

6. Growing Water Crisis & Warming of Earth

Context

New global climate assessments and scientific reports confirmed multiple record-breaking milestones at once, highlighting an escalating climate emergency with direct human impacts.

Key Reasons

1. Record heat confirmed – Scientists reported that 2023–2025 is the hottest three-year period in at least 100,000 years, with global temperatures temporarily crossing the 1.5°C warming limit set by the Paris Agreement.
2. Freshwater crisis warnings – Major studies and UN-backed reports linked this extreme heat to rapidly shrinking freshwater supplies, drawing attention to worsening droughts and expanding ‘mega-dry’ regions.
3. Water demand outpacing supply – Research showed that human water use now exceeds natural replenishment, prompting experts to describe the situation as global ‘water bankruptcy’.
4. Policy urgency – These findings intensified debates ahead of climate summits, pushing governments to confront water security, climate adaptation, and sustainable resource management.

Path to Recovery

1. Reversing water bankruptcy requires urgent recognition of the crisis and coordinated global action.
2. Conserving water, managing groundwater sustainably, and restoring balance to the planet’s hydrological cycle are essential steps to securing freshwater for the future.

7. Iran’s Deepening Water Crisis

Context

1. Recently, thousands gathered at four shrines in Tehran to offer salat al-istisqa—a communal prayer seeking rain amid a historic drought. It underscored the severity of Iran’s water emergency, now stretching into its sixth year.

Current Status

1. With autumn rainfall nearly 90% below long-term averages, reservoirs depleted and Lake Urmia dried up, the crisis has moved from environmental distress to a national emergency.
2. Iran’s drought began in 2020 and intensified sharply after 2024, when rains largely failed.
3. By 2025, the country recorded a 42% rainfall deficit; 19 dams fell to about 5% capacity, and those supplying Tehran dropped below 10%.
4. Scientific assessments suggest the five-year drought, once expected once in 50–100 years without global warming, now has a return period of about a decade due to climate change and rising regional temperatures.
5. With land degradation and desertification accelerating, average rainfall may no longer restore water security.
6. The outlook points to continued scarcity, heightened social stress and more frequent ‘day zero’ risks for major cities.

Concerns

1. The drought has exposed multiple fault lines.
2. Environmentally, shrinking lakes and salt storms threaten health and agriculture.
3. Economically, water scarcity undermines farming and industry, compounding hardship amid sanctions and isolation.
4. Socially, unrest, reportedly severe though hard to verify due to internet shutdowns, has raised fears of instability.

5. While some analysts dispute water scarcity as the direct trigger for protests, there is broad agreement that chronic mismanagement, poor institutional coordination and unsustainable consumption patterns have worsened the crisis.

Way ahead

1. Iran's response must extend beyond emergency measures like cloud seeding. Long-term solutions include reforming water governance, improving coordination among institutions, curbing over-extraction, and promoting water-efficient agriculture.
2. Projects such as the Hope Transfer Line, designed to move desalinated water across regions require transparency and rigorous assessment to ensure they are viable and equitable.
3. Equally crucial is building public awareness and changing consumption behaviour.
4. Without structural reforms and climate-adaptive planning, Iran's water crisis risks becoming a recurring driver of environmental, economic and social upheaval.

8. Global Water Bankruptcy Report

Context

The United Nations University Institute for Water, Environment and Health released the Global Water Bankruptcy Report, which introduces the concept of 'water bankruptcy' to describe the world's deepening and systemic water failure, going beyond the commonly used terms like water stress or water crisis.

Understanding 'Water Bankruptcy'

1. Beyond Water Stress and Crisis – Water bankruptcy refers to a state of failure, not a temporary shock.
2. Water scarcity may arise naturally, from overuse, or due to poor infrastructure.
3. A water crisis is a deviation from normal conditions, where mitigation is still possible.
4. Water bankruptcy, however, occurs after prolonged overuse, when ecosystems are already damaged and recovery becomes extremely difficult or impossible.
5. It is explained by using a financial analogy –
6. Surface water (rivers, lakes) is like a checking account, now largely empty.
7. Groundwater is the savings account, already overdrawn.
8. Climate change is shrinking 'income' by reducing and disrupting rainfall.
9. But, water demand from agriculture, cities, power plants and data centres continues unabated.

Drivers of Global Water Bankruptcy

1. Climate Change and Mismanagement – The report argues that water bankruptcy is caused by a combination of climate change and human decisions.
2. Climate change has altered precipitation patterns, melted glaciers, and disrupted the hydrological cycle.
3. However, human choices, such as water-intensive agriculture, poorly planned cities, and outdated dams and treaties have magnified the problem.
4. Blaming climate change alone, allows policymakers to avoid accountability, even though land use decisions and consumption patterns are largely human-driven.

Visible Signs of Collapse

1. Environmental and Social Impacts – As water systems fail, cascading effects become visible i.e. shrinking and polluted rivers, drying lakes and wetlands, groundwater depletion, land subsidence and sinkholes, desertification, sand and dust storms, wildfires, biodiversity loss, and flood risks from glacial melt.

2. Cities such as Chennai, Cape Town, Tehran, São Paulo and Mexico City have already experienced 'Day Zero' scenarios, highlighting how close many regions are to complete system failure.

Insolvency vs Irreversibility

1. Not All Failures Are the Same – The report distinguishes between –
2. Insolvency – when water demand exceeds supply but recovery may still be possible.
3. Irreversibility – when prolonged insolvency causes permanent damage, such as land subsidence, which cannot be undone.
4. Examples include dried lakes in Central Asia, Iran, and Africa, and geological damage seen recently in Türkiye.

Rethinking the 'New Water Normal'

1. A Call for a New Agenda – The world must accept the new water normal. Some regions may never return to historical conditions, and recovery may be physically impossible in others. Key takeaways include –
2. Recognising regional diversity in water stress and vulnerability;
3. Updating outdated definitions and metrics;
4. Redefining development, agriculture, and urban planning within new ecological limits;
5. Understanding water bankruptcy, the report concludes, is essential not only to prevent further damage, but also to adapt responsibly to a future with less water.

9. World's Freshwater Is Disappearing with Megadroughts and Sinking Cities

Context

1. The A series of recent scientific studies and global reports have warned that the world is entering an era of megadroughts, large-scale groundwater depletion, and sinking cities, leading to a rapid disappearance of freshwater.
2. Research published in science, along with the United Nations University's report The Global Water Bankruptcy, highlights that freshwater loss is now so severe that it is contributing more to global sea-level rise than melting ice sheets in Greenland or Antarctica.

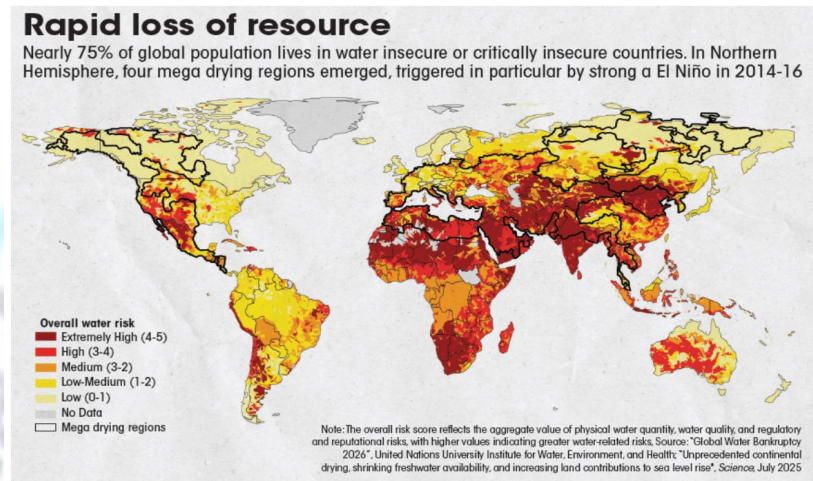
Rise of Megadroughts

1. Megadroughts are prolonged droughts spanning large regions and lasting for years or even decades. Unlike short dry spells, they permanently damage ecosystems, water sources, and livelihoods.
2. West Asia (Iran, Iraq, Syria) continues to face severe, long-term drought.
3. Chile has experienced a megadrought since at least 2007. Rainfall in central Chile has declined by 20–60%, while mountain lakes, key freshwater sources—have shrunk by up to 25%.
4. Emergency measures such as excessive groundwater extraction worsened the crisis. Chile's groundwater use rose by 383% between 1997 and 2022, forcing water rationing in Santiago.

Cascading Impacts – Fires, Ecosystems & Economies

1. Megadroughts trigger chain reactions –
2. In Australia and California, prolonged drying combined with extreme heat fuelled catastrophic wildfires.
3. California's 2025 wildfires caused losses of up to US \$60 billion, among the costliest climate disasters on record.

4. Scientists link these events to 'hydro-climatic whiplash', where wet years are abruptly followed by extremely hot and dry ones.
5. A 2025 Science study analysing 500 multiyear droughts found –
6. Droughts are becoming hotter, drier, and more damaging.
7. The land area affected by such droughts expanded by 49,000 sq km every year.
8. Vegetation loss was most severe in temperate grasslands, including Mongolia, eastern Australia and the western United States.



Overall Drying Planet

1. Another Science study revealed a troubling trend – dry regions are drying faster than wet regions are getting wetter, leading to net global drying.
2. Drying zones expanded annually by an area twice the size of California.
3. Previously isolated drought hotspots are now merging into vast 'mega-drying regions' stretching from western Europe through West and South Asia to East Asia.
4. New drying regions are emerging in northern Canada, northern Russia, and Central America.

Why is freshwater disappearing?

1. Climate warming and glacier loss – Rising temperatures are accelerating glacier melt, especially in the Himalayas, while reducing precipitation in many regions.
2. Natural climate variability – Phenomena such as El Niño, the Arctic Oscillation, and the Pacific Decadal Oscillation intensify dry years and increase drought persistence.
3. Groundwater overextraction – Groundwater depletion accounts for 68% of terrestrial water storage loss in non-glaciated regions.
4. The Indus basin is losing 1.23 cm of water storage per year.
5. The Ganga–Brahmaputra basin loses about 1.09 cm annually.

Freshwater Loss & Rising Seas

1. A striking finding is that continental drying now contributes 44% to global sea-level rise, more than –
2. Greenland ice melt (37%)
3. Antarctic ice melt (19%)
4. Nearly 6 billion people, about 75% of the global population, live in countries that have been losing freshwater over the past two decades.

Water Bankruptcy – A Global Crisis

1. The UN University describes the situation as 'water bankruptcy' where water use exceeds natural recharge.
2. Key findings include –
3. Three-quarters of the world's population live in water-insecure or critically water-insecure countries.

4. 410 million hectares of wetlands have disappeared in the last 50 years, costing ecosystems services worth US \$5.1 trillion.
5. Excessive groundwater extraction has caused land subsidence across 6 million sq km, with some cities sinking by up to 25 cm per year.

Agriculture and livelihoods at risk

1. Agriculture consumes 70% of global freshwater and is increasingly threatened by shrinking supplies and pollution.
2. At the same time, the loss of glaciers and snowpacks endangers communities dependent on meltwater-fed rivers.
3. Scientists warn that both 'blue water' (surface and groundwater) and 'green water' (soil moisture) have crossed safe planetary limits, alongside climate and biodiversity boundaries.

10. India's Deepening Dry Spell – From Climate Signals to Water Bankruptcy

Context

1. India has come under renewed focus due to a series of recent scientific studies and global reports warning that large parts of the country are entering an era of accelerating drying and 'water bankruptcy'.
2. The global assessments caution that mismanaged water systems could trigger long-term ecological, economic and political instability.

India's drying trend – What the science shows?

1. Early warning signs from the Indo-Gangetic Plain – The Indo-Gangetic Plain (IGP), India's agricultural heartland, has been identified as a drying hotspot since as early as 2009.
1. A study published in Climate Change (December 2025) analysed drought patterns across six regions of India i.e. western, central, Himalayan, IGP, peninsular and northeast India between 1971 and 2020.
2. It found that drying is accelerating fastest in the IGP and northeast India using multiple climate indicators such as the Standardised Precipitation Evapotranspiration Index (SPEI).
3. Monsoon weakening and rising heat – The findings point to a dangerous combination –
4. Weaker monsoon rainfall, leading to rainfall deficits during the monsoon season;
5. Rising daytime and nighttime temperatures, increasing evaporation before and after the monsoon;
6. The IGP and northeast India show the strongest negative SPEI trends, indicating rapidly intensifying moisture stress.
7. In contrast, central and Himalayan regions show weaker but still concerning drying signals.
8. Human pressures worsen natural stress – Climate stress is compounded by intensive groundwater extraction, water-intensive cropping, and high evapotranspiration from agriculture.
9. In the northeast, once known for abundant rainfall, weakening monsoonal circulation and warming temperatures are steadily eroding water availability.

Historic Low for Ganga Basin

1. Another study published in PNAS Earth, Atmospheric and Planetary Sciences places current drying in a long-term context.
2. Using tree-ring data to reconstruct river flows from the year 700 onward, researchers found that the Ganga river basin experienced its driest three-decade phase (1991–2020) in the last 1,300 years. This drying was –
3. 76% more intense than 16th-century droughts;
4. Beyond the range of natural climate variability;
5. The evidence strongly points to human-driven climate change as a key driver.

Water Bankruptcy – More Than A Hydrological Crisis

1. The concept of 'water bankruptcy' refers to a state where water demand consistently exceeds sustainable supply, pushing systems toward irreversible collapse.
2. According to the Global Water Bankruptcy Report released in January 2026, water scarcity is as much a political and economic challenge as a climatic one.
3. Poor water management can threaten food security, political stability, biodiversity and ecosystems, climate and desertification mitigation efforts.

Can Technology Solve the Crisis?

1. Promise and limits of technical fixes – Technologies such as efficient irrigation, desalination, recycling, dams and water transfers can help, but each comes with trade-offs –
2. Efficient irrigation often leads farmers to expand cultivation or switch to thirstier crops;
3. Desalination creates brine that harms marine ecosystems;
4. Large reservoirs disrupt river systems and local livelihoods;
5. Technology alone, without safeguards, can worsen the problem.

Data Gap – Why Models Are Not Enough

1. Observations still matter – Despite advanced satellites and climate models, ground observations remain critically inadequate, especially in India.
2. Groundwater levels can vary dramatically even between nearby wells due to geological heterogeneity.
3. Many monitoring wells are not automated, measured only once a year, and do not align with satellite paths.
4. Without frequent, shared and reliable data, climate and hydrological models remain poorly calibrated, effectively 'blind' to local realities.

Agriculture At the Centre of The Solution

1. Agriculture accounts for over 85% of water use in many Indian regions, making it the most urgent sector for intervention. Key priorities include –
2. Shifting away from water-intensive crops in stressed regions;
3. Scaling up drip irrigation and solar-powered pumping;
4. Reforming power subsidies to curb indiscriminate groundwater extraction;
5. Promoting practices such as direct-seeded cultivation and soil moisture conservation;

Beyond Technology – Lessons from Global Examples

1. Successful water management systems combine technology with institutional and economic reforms.
2. Countries like Israel and regions such as California have invested not only in infrastructure, but also in diversifying their economies so that drought does not destabilise national security or employment.
3. In contrast, many countries in the Global South cannot rapidly industrialise or withdraw water from agriculture without risking social unrest.
4. Delaying reform, however, risks permanent water loss. Balancing these pressures is the central challenge.

Indigenous knowledge and adaptation

1. Traditional water systems such as Iran's ancient underground qanats offer valuable lessons in efficiency and cooperation, but cannot meet modern-scale demand on their own.
2. Indigenous practices are most effective when adapted to local contexts and supplemented with modern methods.
3. Earlier systems relied heavily on community cooperation. Over time, competition driven by technology has weakened collective water governance, something that future reforms must address.

11. India's AI Awakening – A Late Realisation in a Changing Tech Order

Context

India's technology ecosystem made headlines after the significant rise of China's DeepSeek AI chatbot, a large language model whose capabilities rival those of the world's leading AI systems.

A Year of Reckoning for India's Tech Sector

1. 2025 became a year of reckoning for India's technology sector. For years, innovation existed in a comfort zone, more services-led than science-driven.
2. The rapid advances in AI, advanced avionics, and deep technologies exposed this fragility.
3. Instead of investing steadily in future-facing technologies, precious time had been spent glorifying a mythical past, claiming ancient mastery over all sciences.
4. The rise of China's AI ecosystem showed, starkly, where India truly stood in the global hierarchy.

DeepSeek Shock & Government Response

1. The debut of DeepSeek and its performance shook the Ministry of Electronics and Information Technology (Ministry of Electronics and Information Technology) into action. Within weeks, the government –
2. Invited proposals to develop foundation AI models (large base models that can be adapted for many tasks).
3. Asked private companies to earmark GPUs (graphic processing units) for government-led AI research.
4. It was significant because India faces a severe shortage of GPUs, the computing backbone of modern AI.
5. The response yielded access to nearly 19,000 GPUs at subsidised rates, spurring early, but still limited, interest from private players.

India vs China – Two Startup Philosophies

1. China's dominance is the result of long-term investment in science, engineering education, and deep integration between academia and industry.
2. Chinese startups lead in AI, semiconductors, robotics, electric vehicles, and advanced manufacturing.
3. India's contrast was publicly highlighted by Union commerce minister Piyush Goyal at the 'StartUp Maha Kumbh'.
4. Indian startups focus largely on food delivery, grocery apps, betting, and fantasy sports.
5. Chinese startups prioritise electric vehicles, batteries, AI, robotics, renewable energy, space, and high-speed rail.

China's Long-term AI Strategy

1. As early as 2017, it unveiled the 'New Generation Artificial Intelligence Development Plan', a national blueprint to become the world leader in AI by 2030.
2. It aligned funding, research institutions, talent development, and industry goals.
3. During the same period, India was grappling with internal disruptions such as demonetisation, with little focus on AI strategy.

India's Delayed But Crucial AI Push

1. India's first serious step came only in 2024 with the launch of the IndiaAI Mission, a \$1.25 billion programme aimed at building core AI infrastructure.
2. Managed by MeitY, the mission supports startups like Sarvam, which are developing foundation models in Indian languages and targeting sectors such as agriculture, education, and healthcare.
3. It remains nascent compared to China's scale and maturity.

India-AI Impact Summit – Symbolism vs Substance

1. AI is now firmly in public discourse, helped by the upcoming India–AI Impact Summit 2026 in New Delhi. India has even invited China, signalling a readiness to learn from the leader.
2. China arrives with credibility, having integrated AI into healthcare, manufacturing, transport, infrastructure, and governance under its AI+ Initiative.
3. India, by contrast, is still hoping to showcase a handful of foundation model prototypes.
4. Despite this, official rhetoric remains heavy on symbolism, invoking ancient sutras and chakras as guiding principles, ideas unlikely to impress leading AI nations focused on execution and scale.

Lessons From China's Resilience

1. Chinese AI firms adapted through architectural innovation, efficiency, and open-source collaboration when faced with US export controls on advanced chips.
2. This resilience translated into real self-reliance—far beyond slogans.
3. India, meanwhile –
4. Continues to lose top talent to the US tech ecosystem. Suffers from chronic computing shortages.
5. Seeks global cooperation to compensate for internal deficiencies, as noted by analysts at the AI Insight Think Tank.

Takeaway For India

1. China's rise in AI underscores a simple lesson – technology leadership demands patience, deep investment, and coherence between policy, talent, and infrastructure.
2. India's recent moves suggest awareness, but awareness alone is not enough.
3. For Indian startups and policymakers, the message is clear, stop chasing short-term convenience models and start building technologies that shape the future.
4. The world has already chosen its AI leaders. India needs to decide how seriously it wants to compete.

12. Pampadum Shola National Park

Context

Restoration of grasslands of Kerala's Pampadum Shola National Park, once dominated by invasive Australian wattles, see a return of streams and native species.

About Pampadum Shola National Park

1. It is a high-altitude protected area located near Munnar in Kerala's Idukki district, within the Western Ghats.
2. It lies at elevations between 1,900 and 2,300 metres and is characterised by a distinctive shola–grassland ecosystem, where evergreen forests occupy sheltered valleys and rolling montane grasslands cover the hilltops.

Grassland Ecosystem (Shola)

1. Sholas are ancient, climate-regulating forests that act like natural sponges.
2. They absorb rainfall, release water slowly into streams and rivers, and help maintain groundwater levels in surrounding regions.
3. The grasslands between these forest patches are equally important, supporting grazing species and pollinators and preventing soil erosion.

Biodiversity and Endemism

1. The park is home to endemic and threatened species such as the Nilgiri marten, Nilgiri tahr, sambar, and a rich diversity of birds, butterflies, and moths.
2. Rare plants, orchids, grasses, and medicinal herbs thrive in its cool, moist climate, making the park ecologically significant within the Western Ghats landscape.

Human Impact and Conservation Challenges

1. During the mid-20th century, large parts of Pampadum Shola were converted into plantations of exotic species like Australian wattle (*Acacia mearnsii*), eucalyptus, and pine.
2. These fast-growing trees disrupted native vegetation, reduced water retention in soils, and affected wildlife habitats.
3. Over time, forest managers recognised that these 'green' plantations were ecologically damaging.

13. Biodiversity Beyond National Jurisdiction (BBNJ) Treaty

Context

Recently, the UN's Biodiversity Beyond National Jurisdiction (BBNJ) treaty came into force, providing countries with a legally binding framework to tackle threats such as overfishing and meet a target to protect 30% of the ocean environment by 2030.

About the BBNJ Treaty

1. It is formally titled the Agreement under the United Nations Convention on the Law of the Sea (UNCLOS) on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction, adopted in June 2023.
2. It is the first global, legally binding framework dedicated to protecting biodiversity on the high seas and deep seabed, areas that lie outside any country's control and cover nearly two-thirds of the ocean.

Why does the BBNJ Treaty matter?

1. Fragmented governance of the high seas across fisheries, shipping, mining, and conservation bodies.
2. Overexploitation and biodiversity loss, especially from fishing and emerging activities.
3. Unregulated access to marine genetic resources (MGRs) and inequitable benefit-sharing.
4. Lack of global tools to create and enforce high seas marine protected areas (MPAs).

Four Core pillars of the BBNJ Treaty

1. Marine Genetic Resources (MGRs) & Benefit-Sharing - Establishes rules for access to genetic material from high seas organisms;
2. Introduces non-monetary and potential monetary benefit-sharing, particularly for developing states;
3. Aims to balance scientific freedom with equity;
4. Area-Based Management Tools (ABMTs), including MPAs - Enables the designation of Marine Protected Areas on the high seas;
5. Requires cooperation with existing bodies (e.g., RFMOs, IMO);
6. Seen as essential for achieving the '30x30' global biodiversity target;
7. Environmental Impact Assessments (EIAs) - Mandates EIAs for activities likely to harm biodiversity in areas beyond national jurisdiction;
8. Introduces minimum global standards and transparency obligations;
9. Capacity-Building & Transfer of Marine Technology - Supports developing countries through training, data sharing, and technology access;
10. Central to equity and effective implementation;
11. Legal and governance significance - Operates under UNCLOS, not as a replacement;
12. Reinforces principles like the common heritage of mankind and due regard;
13. Creates new institutional bodies, including a Conference of the Parties (COP) and scientific/technical committees;

14. Emissions Trading System (ETS)

Context

Recently, Slovakian Prime Minister called for the suspension of the Emissions Trading System (ETS) due to rising carbon prices and burden on domestic manufacturers.

About the Emissions Trading System (ETS)

1. An ETS is a market-based climate policy in which regulators –
2. Set a cap on total emissions from covered sectors (power, industry, aviation, shipping in some systems).
3. Distribute or auction allowances, each permitting the emission of one tonne of CO₂-equivalent.
4. Allow firms to trade allowances, so reductions occur where they are cheapest.
5. Tighten the cap over time, ensuring declining total emissions.

Why is ETS economically attractive?

1. Cost efficiency – Firms with low abatement costs reduce more and sell allowances; high-cost firms buy allowances.
2. Dynamic incentives – A carbon price encourages innovation and cleaner investment.
3. Revenue recycling – Auction revenues can fund climate action or offset household impacts.

EU ETS

1. Launched in 2005, covering ~40% of EU emissions.
2. Early phases (I–II) faced over-allocation and low prices.
3. Later reforms introduced auctioning, stricter caps, and the Market Stability Reserve (MSR).
4. Empirical studies find significant emissions reductions, especially in the power sector, with limited evidence of carbon leakage when complementary policies are in place.

Current Trends

1. Expansion to new sectors (maritime transport, buildings in some jurisdictions);
2. Linking ETSs across regions;
3. Stronger price-stability tools;
4. Integration into broader policy mixes alongside carbon taxes and standards;

Key challenges identified

1. Price volatility and uncertainty for investors;
2. Carbon leakage risks in trade-exposed sectors;
3. Policy interaction issues with renewable subsidies and efficiency standards;
4. Distributional effects on households and regions;

15. Nipah Virus

Context

Recently, West Bengal has confirmed the presence of Nipah virus after 19 years, as two nurses in North 24 Parganas district are believed to have contracted the infection.

About Nipah Virus (NiV)

1. It is a highly pathogenic, zoonotic RNA virus belonging to the genus Henipavirus (family Paramyxoviridae).
2. It was first recognized in Malaysia in 1998–1999, and has caused recurrent outbreaks in South and Southeast Asia, especially Bangladesh and India, with high case-fatality rates (40–75%).

3. Fruit bats (*Pteropus* species) are the natural reservoir, and transmission occurs via animal intermediates (notably pigs), contaminated food (e.g., raw date palm sap), and human-to-human spread in healthcare and household settings.
4. Clinically, NiV causes acute febrile illness that can progress to fatal encephalitis and respiratory disease.
5. There is no licensed vaccine or specific antiviral therapy for humans; management relies on supportive care and public-health prevention.

Diagnosis, Treatment & Prevention

1. Diagnosis - RT-PCR, serology (ELISA), virus isolation (BSL-4).
2. Treatment - Supportive; investigational antivirals and monoclonal antibodies under study.

16. Kumbhalgarh Wildlife Sanctuary

Context

Recently, the Union government declared the Kumbhalgarh Wildlife Sanctuary, part of the Aravalli hills, as an eco-sensitive zone and banned activities such as mining and stone quarrying in 243 sq km.

About Kumbhalgarh Wildlife Sanctuary

It is a protected forest area in the Rajsamand District of Rajasthan, India, situated in the Aravalli Range, forming an ecological buffer around the historic Kumbhalgarh Fort (a UNESCO World Heritage Site).

1. It acts as a natural green corridor between Udaipur and Jodhpur regions.

Fauna (Wildlife)

1. The sanctuary is best known for its Indian wolf habitat, which is rare in India.
2. Major mammals include - Indian Wolf (*Canis lupus pallipes*), Indian Leopard (apex predator), Sloth Bear, Striped Hyena, Golden Jackal, Jungle Cat, Sambar Deer, Nilgai, Chinkara (Indian Gazelle), and Chausingha (Four-horned Antelope).
3. Avifauna (Birdlife) - Grey Junglefowl, Indian Eagle-Owl, Parakeets, doves, woodpeckers, and raptors;
4. Reptiles - Monitor lizards, snakes, and other dry-forest species;

Flora & Vegetation

1. Dominated by tropical dry deciduous forests;
2. Common species - Dhok (*Anogeissus pendula*); Khair (*Acacia catechu*); Salar (*Boswellia serrata*); Bamboo patches in valleys;
3. Important for soil conservation and watershed protection;

Cultural & Historical Importance

1. Encloses Kumbhalgarh Fort, built by Rana Kumbha (15th century);
2. Birthplace of Maharana Pratap;
3. Forest historically served as a natural defense shield for the fort;
4. Represents a rare blend of natural and cultural heritage;

17. African Swine Fever (ASF)

Context

Recently, Mizoram Forest officials said that 20 wild boars in Serchhip district were found to have died after contracting African Swine Fever (ASF).

About African Swine Fever (ASF)

1. It is a viral disease of domestic pigs and wild suids, characterized by very high mortality, severe economic losses, and major challenges for global animal health.
2. It is caused by African swine fever virus (ASFV), the only known member of the family Asfarviridae.
3. Its transmission is driven by a combination of direct contact, contaminated pork products, wild boar ecology, and soft ticks.
4. It affects domestic pigs and wild boar; it does not infect humans.
5. There is still no widely available commercial vaccine; and effective control relies primarily on biosecurity, surveillance, and rapid response.

18. Sundarbans

Context

The Sundarbans' low-lying geography makes it extremely vulnerable to floods and natural disasters, whose frequency is increasing with climate change.

About the Sundarbans

1. It is the world's largest contiguous mangrove ecosystem, spread across nearly 19,000 square kilometres of India and Bangladesh.
2. It lies at the delta of the Ganga, Brahmaputra and Meghna rivers, where land and sea constantly interact.
3. It is recognised as a UNESCO World Heritage Site owing to its unique biodiversity and ecological value.

Rich Biodiversity and Wildlife

1. The Sundarbans is globally famous as the habitat of the Royal Bengal tiger, adapted to survive in a saline, swampy environment.
2. It supports estuarine crocodiles, fishing cats, spotted deer, dolphins, snakes, birds and countless species of fish and crustaceans.
3. Its mangroves act as a natural shield against cyclones and storm surges.

Climate Change Hotspot

1. The Sundarbans' low-lying geography makes it extremely vulnerable to climate change.
2. Rising sea levels, salinity intrusion, cyclones, floods and erosion are occurring more frequently and with greater intensity.
3. These hazards have led to loss of land, damaged homes, declining crop yields and forced migration.

19. Periyar Tiger Reserve

Context

Recently, the Periyar Tiger Reserve marked its 75th anniversary, a milestone that coincides with a remarkable conservation record – zero officially recorded poaching cases for several consecutive years.

About the Periyar Tiger Reserve

1. It is located in the Idukki district of Kerala, within the biologically rich Western Ghats.
2. It is one of India's oldest and best-managed protected forest landscapes.

Historical Background

1. Late 19th Century – The construction of the Mullaperiyar dam led to the creation of a large reservoir that submerged forest valleys and altered animal movement patterns.
2. 1930s – The Travancore princely state declared surrounding forests as reserved areas to curb unchecked plantation expansion and timber extraction.

3. After Independence – The region was notified as a Wildlife Sanctuary in 1950, brought under Project Tiger in 1978, and partially declared a National Park in 1982.

From Forest Crime to Conservation Model

1. For decades, Periyar lay along a porous Kerala–Tamil Nadu border, making it vulnerable to poaching, sandalwood smuggling, illegal timber felling, and extraction of forest produce.
2. By the 1990s, authorities realised that enforcement alone could not control forest crime.
3. It led to two landmark initiatives –
4. The Periyar Foundation, enabling flexible use of tourism revenue and donations for conservation and community welfare.
5. Eco Development Committees (EDCs), which brought local and tribal communities into forest protection, ecotourism, and surveillance roles.
6. Former poachers and smugglers were rehabilitated as forest guards, trackers, and guides, transforming threats into protectors.

Biodiversity and Habitat

Periyar is part of one of the largest contiguous evergreen and semi-evergreen forest blocks in southern India. Its rich biodiversity includes 40–45 tigers, nearly 1,000 elephants, Gaur, sambar, barking deer, wild pig, and leopards, around 2,000 species of flowering plants, and nearly 300 bird species, along with diverse reptiles and amphibians.



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YOJANA

1. The Four Pillars of Viksit Bharat

GS Paper: GS Paper III (Economic Development).

Subject: Indian Economy and issues relating to planning, mobilization of resources, growth, development, and employment.

Topic: Government Budgeting; Infrastructure (Energy, Ports, Roads, Airports, Railways).

Sub-Topic: Inclusive growth; E-technology in the aid of farmers; Gender Budgeting.

The Budget is built upon a "structural quartet" designed to anchor social and economic development:

1. The Youth (Demographic Dividend)

New University Townships: Creation of five new townships near industrial corridors to align academic curricula with market needs.

Orange Economy: Setting up AVGC (Animation, Visual Effects, Gaming, and Comics) labs in 15,000 secondary schools and 500 colleges.

Corporate Mitras: A new initiative to train youth to provide affordable GST and compliance support to MSMEs.

New-Age Skills: Strong emphasis on training in Artificial Intelligence (AI), cloud computing, and digital services.

2. Women (Women-Led Development)

SHE Marts: Launch of Self-Help Entrepreneur (SHE) Marts as community-owned retail hubs for products made by rural women.

STEM Support: Establishment of dedicated girls' hostels in every district within higher education STEM institutions.

Care Economy: Training 1.5 lakh multi-skilled caregivers to create large-scale employment for women in elderly and childcare.

Gender Budgeting: Allocation of Rs 5.00 lakh crore for the welfare of women and girls, representing 9.37% of the total budget.

3. Farmers (Agrarian Modernization)

Bharat-VISTAAR: A multilingual, AI-driven platform providing customized advisory support by integrating Agri Stack and ICAR data.

High-Value Agriculture: Incentivizing the cultivation of coconut, cocoa, cashew, and sandalwood, especially in the North-East.

Blue Economy: Integrated development of 500 reservoirs and Amrit Sarovars to transform water bodies into aquaculture hubs.

Natural Farming: Resurrection of sustainable practices using cow-based formulations like Jeevamrit and Beejamrit.

4. The Poor (Inclusive Welfare)

VB-GRAM G: The Viksit Bharat Guarantee for Rozgar and Aajeevika Mission promises up to 125 days of guaranteed rural employment.

Food Security: Continued support for PMGKAY, providing 5 kg of free foodgrains per person monthly to 80 crore citizens.

Housing: Massive funding boost for affordable housing, with urban housing seeing a 179% increase in allocation.

2. Infrastructure as an Economic Multiplier

GS Paper: GS Paper III (Socio-Economic Development).

Subject: Indian Economy and issues relating to planning, mobilization of resources, growth, development, and employment.

Topic: Infrastructure: Energy, Ports, Roads, Airports, Railways, etc.

Sub-Topic: Government Budgeting and Investment Models (PPP, Capex-led growth).

This chapter explores the strategic shift in India's developmental narrative, where infrastructure is viewed not just as physical assets but as a force multiplier that enhances human capability and transforms individual progress into collective national advancement.

1. The Macro-Economic Strategy

Capex-led Growth: The Union Budget 2026-27 has increased capital expenditure (Capex) by 8.9% to ₹12.2 lakh crore.

Growth Multiplier: Public expenditure on infrastructure is estimated to have a multiplier effect of 2.5 to 3.5 times the GDP over the medium term.

Fiscal Prudence: The government aims to sustain this growth while maintaining a fiscal deficit target of 4.3% for FY 2026-27.

Investment Roadmap: India aims to spend approximately \$1.723 trillion (₹143 trillion) on infrastructure between FY24 and FY30.

2. PM Gati Shakti: Integrated Planning

Unified Framework: Launched to unify efforts across 58 Central Ministries and 36 States/UTs for integrated infrastructure development.

Logistics Efficiency: The goal is to reduce logistics costs from the current 13-14% of GDP to 8% by 2030, bringing India on par with global competitors.

Data-Driven Planning: The platform has integrated over 1,700 data layers to assess major projects worth ₹13.59 lakh crore.

3. Sector-Specific Milestones & Targets

Railways: Budgeted outlay of ₹2.92 trillion for 2026-27, a 10% increase.

1. Proposal for 7 High-Speed Rail corridors acting as "growth connectors" (e.g., Mumbai-Pune, Delhi-Varanasi).
2. 68 Vande Bharat trains are currently operational across 333 districts.

Roads & Highways:

1. Budgeted outlay of ₹3.09 trillion for 2026-27.
2. National Highway network grew by 60% since 2014, reaching 1,46,572 km.

Civil Aviation (UDAN): 88 airports operationalised under the regional connectivity scheme.

1. Introduction of the Seaplane VGF (Viability Gap Funding) Scheme to support specialized operations.

Ports & Waterways: Port capacity has doubled to 2,762 MMTPA.

1. Plan to develop 20 new National Waterways over the next five years.

4. Urban Infrastructure & Sustainable Growth

City Economic Regions (CER): * Cities are identified as engines of growth; CERs will be mapped based on specific growth drivers.

An allocation of ₹5,000 crore per CER over five years has been proposed.

Energy Security: ₹20,000 crore allocated for Carbon Capture, Utilisation, and Storage (CCUS) technologies to align industrial growth with climate goals.

Solar Power: Outlay for the solar sector increased by 32% to reach ₹30,539 crore.

5. Financial and Institutional Reforms

Risk Mitigation: Proposal to set up an Infrastructure Risk Guarantee Fund to provide credit guarantees and encourage private sector participation.

Asset Monetisation: Continued focus on asset recycling via REITs to unlock capital for new projects.

Capacity Building: Establishment of Regional Centres of Excellence to train the required manpower for managing high-tech infrastructure

3. Personal Finance and Middle-Class Empowerment

This chapter details the budgetary measures designed to empower the middle class by focusing on "Ease of Living" through simplified compliance, lower tax incidences in specific sectors, and improved cash flow management.

GS Paper: GS Paper III (Economic Development).

Subject: Indian Economy and issues relating to planning, mobilization of resources, growth, and development.

Topic: Government Budgeting; Effects of liberalization on the economy.

Sub-Topic: Direct and Indirect Tax Reforms; Mobilization of Small Savings; Financial Inclusion.

1. Stability in Direct Taxation

Dual Regime Continuity: The Budget proposes the continuation of existing rates, slabs, and exemptions.

Old Tax Regime: There is no change or "sunset date" for the old Income Tax regime, allowing middle-class individuals to continue using tax-free savings and investment instruments.

New Tax Regime Relief: Provides lower tax incidence for those opting for simplicity, with previous changes making income up to ₹12 lakh effectively tax-free (provided there is no capital gain).

NPS Benefits: While employee contributions to the National Pension System (NPS) are not deductible in the new regime, employer contributions up to 14% of basic salary remain fully exempt under Section 80CCD (2).

2. Ease of Compliance and Procedural Reforms

Extended Filing Window: The time available for filing revised Income Tax returns is extended from 31 December to 31 March of the next fiscal year, subject to a nominal fee (₹1,000–₹5,000).

Simplified Declarations: Investors can now file a single declaration (Form 15G/15H) with a depository for mutual fund income, interest, and dividends, rather than filing separately with multiple entities.

Electronic Lower TDS Certificates: Small taxpayers can apply electronically for certificates for lower or nil Tax Deduction at Source (TDS), reducing administrative friction.

Foreign Asset Disclosure: A one-time opportunity is provided for taxpayers (such as tech employees with ESOPs or former students with dormant foreign accounts) to disclose misreported foreign assets with immunity from prosecution.

3. Relief via Indirect Taxes and Duties

Cancer & Rare Diseases: Basic customs duty is exempted for 17 cancer drugs. Additionally, 7 more rare diseases are added to the list for duty-free import of medicines and special medical foods (FSMP).

Personal Imports: The tariff rate on all dutiable goods imported for personal use is halved from 20% to 10%.

Duty-Free Allowances: The duty-free allowance for items brought from abroad is revised up to ₹75,000.

Consumer Electronics: Customs duty is exempted on critical components of microwave ovens to make them more affordable.

4. Capital Gains and Investment Protection

Share Buybacks: The tax treatment for buybacks is changed to capital gains instead of being taxed as dividends. This allows small shareholders to set off losses, with tax rates set at 12.5% for long-term and 20% for short-term listed gains.

MACT Compensation: Interest awarded by the Motor Accident Claims Tribunal (MACT) to a natural person is now exempt from Income Tax and will not face TDS, regardless of the amount.

5. Liberalised Remittance Scheme (LRS) Reforms

Education and Medical Care: The Tax Collected at Source (TCS) rate for remittances exceeding ₹10 lakh for education or medical purposes is reduced from 5% to 2%.

Overseas Travel: The TCS rate on overseas tour program packages is slashed to 2% from the previous levels of 5% and 20%, significantly reducing cash-flow blockage for travelers

4. India's Orange Economy & The Role of IICT

This chapter focuses on the emergence of the "Orange Economy"—a sector where creativity, heritage, and culture intersect with technology to drive economic growth, innovation, and global cultural presence.

GS Paper: GS Paper III (Economic Development) & GS Paper II (Social Justice/Education).

Subject: Indian Economy; Skill Development; Role of IT in various sectors.

Topic: Issues relating to intellectual property rights; Investment models; Management of social sector/Services relating to Education and Human Resources.

Sub-Topic: Creative Economy; Digital India; AVGC-XR Sector; Startup Ecosystem.

1. Defining the Orange Economy

Creative Engines: The sector encompasses industries such as animation, gaming, digital storytelling, visual effects (VFX), and design innovation.

Economic Impact: Globally, the creative economy contributes trillions of dollars in revenue. In India, the AVGC segment is one of the fastest-growing components of the media and entertainment ecosystem.

Workforce Demand: Industry estimates suggest that India's AVGC industry will require approximately 2 million professionals by 2030.

2. The Indian Institute of Creative Technologies (IICT)

Institutional Vision: IICT is envisioned as a premier national institution (on par with IITs and IIMs) where art, storytelling, and computer science intersect.

Mumbai Campus: The first campus launched in July 2025 at the NFDC premises in Mumbai, featuring state-of-the-art animation labs and XR (Extended Reality) studios.

Curriculum: The institute offers 18 industry-aligned courses, including short-term programs that integrate Artificial Intelligence (AI) into creative workflows.

Incubation: IICT provides an incubation ecosystem to mentor early-stage ventures in gaming, digital art, and interactive media.

3. Nationwide Educational Integration

School Labs: The Union Budget 2026-27 supports IICT in establishing AVGC Content Creator Labs in 15,000 secondary schools.

College Expansion: The initiative extends to 500 colleges, transforming them into regional innovation engines for intellectual property (IP) creation.

Democratizing Talent: By placing labs in schools, the government aims to bridge the access gap, allowing students in small towns to translate local folklore into global digital content.

4. Strategic Objectives and Future Growth

From Service to Leadership: The goal is to shift India from being a "back-end support" provider to a global leader in original content creation and IP ownership.

Interdisciplinary Cross-Pollination: Encouraging collaboration between computer science, fine arts, and literature students to prototype solutions for sectors like healthcare and education using XR.

Research and Development (R&D): Positioning India as an innovation contributor in areas like AI-assisted animation, motion capture optimization, and virtual production.

Cultural Confidence: Using the Orange Economy to represent India's diverse artistic traditions and mythological narratives in global media landscapes.

5. Key Budgetary Support (2026–27)

Institutional Support: Direct budgetary provisions to scale IICT operations and its nationwide lab initiative.

SME Integration: Linking creative startups to the ₹10,000 crore SME Growth Fund to encourage entrepreneurial innovation in the AVGC–XR domain.

5. AI Governance—Innovation for Public Good

This chapter examines India's strategic "middle path" regarding Artificial Intelligence (AI), moving away from global hype toward practical, capacity-building frameworks that prioritize last-mile delivery, ethical safeguards, and institutional accountability.

GS Paper: GS Paper III (Science and Technology; Economic Development).

Subject: Developments and their applications and effects in everyday life; Awareness in the fields of IT and Space.

Topic: Science and Technology—developments and their applications and effects in everyday life; Government Budgeting.

Sub-Topic: AI Governance and Ethics; Digital Public Infrastructure (DPI); Fourth Agricultural Revolution.

1. The "Middle Path" Strategy

Capacity over Hype: The Union Budget 2026–27 avoids "moonshots" in favor of building core computing muscle and data infrastructure.

Three Pillars of AI Approach:

1. Infrastructure: Ramping up computing power and deep-tech ecosystems.
2. Human Capital: Skilling and re-skilling workforce, including specific AI/ML training for government statistical officers.
3. Practical Domains: Steering AI toward testable sectors like agriculture to ensure clear, fast results.

2. AI in Agriculture: Bharat–VISTAAR

Integrated Advisory: Bharat–VISTAAR (Vision for Innovative Solutions and Technology for Agriculture Advancement and Reach) serves as a multilingual AI tool.

Data Fusion: It synthesizes massive datasets from "Agri Stack" portals and ICAR packages to provide tailored advisory systems directly to farmers.

Risk Management: The tool aims to turn information into a primary input, helping farmers manage pests, improve yields, and connect to markets.

3. AI for Social Inclusion

Divyang Sahara Yojana: Plans to scale assistive devices for the specially-abled using AI and R&D.

Assistive Tech Marts: Developing new distribution channels to ensure AI-driven support reaches the last mile.

Job Matching: Using AI to match workers to evolving job pipelines and training programs.

4. Governance and Institutional Backbone

Standing Committee: Finance Minister Nirmala Sitharaman introduced a committee to track how emerging tech affects jobs, skills, and the education-to-employment chain.

Institutional Strength: A focus on building institutions that can question tech defaults and push back against "silent dependencies" on foreign data standards.

Infrastructure Gaps: Recognition that AI success is contingent upon clean data, solid connectivity, and functional grievance redressal systems.

5. Ethics and Accountability

Baked-in Ethics: Emphasis on integrating consent protocols, privacy guards, bias audits, and human oversight from system inception.

Redressal Mechanisms: Critical need for appeal mechanisms to prevent vulnerable citizens from being "locked out" of welfare due to algorithmic errors.

Accountability: The modernizing state is judged not by automation speed, but by how well it protects its people during the process.

6. Strategic Evolution Toward a TB-Mukt Bharat

This chapter details India's ambitious public health mission to eliminate Tuberculosis (TB), highlighting a shift from standardized case management to a patient-centric, technology-driven, and community-led response.

GS Paper: GS Paper II (Governance; Social Justice).

Subject: Issues relating to development and management of Social Sector/Services relating to Health.

Topic: Welfare schemes for vulnerable sections of the population by the Centre and States; Issues relating to poverty and hunger.

Sub-Topic: Public Health Policy; TB-Mukt Bharat Abhiyaan; Jan Bhagidari; Ni-kshay Digital Platform.

1. A Global Leadership Role in Health

Outperforming Global Averages: India recorded a 21% decline in TB incidence between 2015 and 2024, nearly double the global decline of 12%.

Mortality Reduction: TB mortality fell by 25% over the same period, dropping from 28 to 21 per lakh population.

Treatment Success: India achieved a 90% treatment success rate, surpassing the global average of 88%.

Increased Funding: These gains were supported by a ten-fold increase in financial allocations to the TB program between 2015-16 and 2025-26.

2. Innovation and Technology at Scale

Ni-kshay Platform: A comprehensive digital backbone operational since 2012 that enables real-time patient tracking and programmatic analytics.

Advanced Diagnostics: India operates the world's largest TB laboratory network, featuring over 9,800 rapid molecular testing facilities.

AI-Enabled Screening: Deployment of nearly 2,000 AI-enabled handheld X-ray machines to bring diagnostics to the most remote and vulnerable communities.

Private Sector Engagement: Structured incentives led to a 24-fold increase in private sector TB notifications since 2013, ensuring standardized quality care.

3. Patient-Centric Care and New Regimens

BPaLM Regimen: In 2024, India adopted the safer and shorter WHO-recommended BPaLM regimen for Drug-Resistant TB (DR-TB), significantly improving survival and adherence.

Differentiated TB Care: A strategic approach where high-risk patients are identified based on clinical parameters and provided individualised, tailored support.

Subclinical Detection: During the 100-Day TB Mukt Bharat Abhiyaan in 2025, over 20 crore individuals were screened, detecting 9 lakh asymptomatic patients who would have otherwise fueled silent transmission.

4. Addressing Social Determinants (Nutrition & Protection)

Ni-kshay Poshan Yojana: Provides direct benefit transfers for nutritional needs; the monthly amount was increased from ₹500 to ₹1,000 in 2024.

Financial Outreach: As of November 2025, over ₹4,538 crore has been disbursed to 1.39 crore beneficiaries.

Household Protection: Evaluation and preventive treatment are extended to household contacts to stop the development of the disease.

5. Jan Bhagidari: The People's Movement

Ni-kshay Mitras: Over 7 lakh donors (individuals, corporates, and NGOs) have distributed more than 49 lakh nutritional baskets since 2022.

TB Mukh Panchayat: Shifts ownership of TB outcomes to local self-governments, with over 30,000 elected leaders championing the cause in 2025.

Volunteer Mobilization: Over 2 lakh MY Bharat volunteers provide psychosocial support and adherence counselling to patients.

7. Women-Led Development & Budgetary Provisions

This chapter emphasizes the paradigm shift from viewing women merely as beneficiaries to recognizing them as active, leading participants in India's economic structure and nation-building process.

GS Paper: GS Paper II (Social Justice) & GS Paper III (Economic Development).

Subject: Welfare schemes for vulnerable sections; Indian Economy and issues relating to development and employment.

Topic: Government policies and interventions for development; Gender Budgeting; Human Resource Development.

Sub-Topic: Economic Empowerment of Women; Self-Help Groups (SHGs); Maternal and Child Health.

1. Gender-Responsive Budgeting

Increased Allocation: The Gender Budget allocation has risen to ₹5.00 lakh crore for FY 2026-27, an 11.36% increase from the previous year.

Budget Share: The share of the Gender Budget in the total Union Budget increased from 8.86% in FY 2025-26 to 9.37% in FY 2026-27.

Economic Rationale: Policy is grounded in the understanding that women's economic empowerment leads to higher productivity and inclusive growth.

2. Economic Empowerment & Entrepreneurship

DAY-NRLM Boost: The Deendayal Antyodaya Yojana-National Rural Livelihoods Mission received a 20% increase in its program component, reaching ₹17,280 crore.

SHE Marts: Establishment of Self-Help Entrepreneur (SHE) Marts to provide consistent market access for products made by women-led SHGs.

Lakhpati Didi Success: The budget builds on the success of the Lakhpati Didi program, which has mobilized 10.05 crore rural households into 90.9 lakh SHGs.

Financial Inclusion: Deployment of 47,952 Bank Sakhis has strengthened rural access to credit and financial services.

3. Support for Traditional & Allied Sectors

Krishonnati Yojana: A 65% increase in funding (to ₹3,360 crore) to support women farmers, who play a crucial role in the agricultural system.

Handloom & Handicrafts: Focused support through the National Handloom and Handicraft Programme and the Mahatma Gandhi Gram Swaraj initiative for female-intensive traditional sectors.

Blue Economy: Strengthening market connections for women-led organizations in fisheries and coastal livelihoods.

4. Enabling Infrastructure & Safety

Jal Jeevan Mission (JJM): Funding increased nearly threefold to ₹33,022.96 crore, significantly reducing the time women spend collecting water.

Mission Shakti: An integrated program for women's safety, security, and empowerment, with an increased allocation of ₹3,200 crore.

STEM Hostels: Proposal to establish dedicated girls' hostels in every district within higher education STEM institutions to improve female enrollment.

Safety Schemes: A proposed increase in funding for women's safety programs to ₹1,014.05 crore to improve mobility and labor participation.

5. Health & Social Security

National Health Mission: Renewed commitment to women's health with an investment of ₹19,835.88 crore in flexible pools for Reproductive and Child Health (RCH).

Inclusive Care: Continued focus on maternal and child health through schemes like RMNCAH+N, JSY, and JSSK.

Employment Incentives: The Pradhan Mantri Viksit Bharat Rojgar Yojana (PMVBRY) 2025 targets formal employment and skill development, directly benefiting women in the labour market.

8. Innovation for Public Good—Reimagining Agricultural Transformation

This chapter explores the transition of Indian agriculture from the Green Revolution's focus on calorie sufficiency to a modern era of "Nutritional and Prosperity Security," driven by technological intervention and grassroots innovation.

GS Paper: GS Paper III (Economic Development; Agriculture).

Subject: Indian Economy and issues relating to planning, mobilization of resources, growth, development, and employment.

Topic: E-technology in the aid of farmers; Issues related to direct and indirect farm subsidies and minimum support prices.

Sub-Topic: Agricultural Innovation (Agri-tech); Grassroots Innovation; Self-reliance (Aatmanirbharta) in Food Production.

1. The Paradigm Shift: From Yield to Prosperity

Historical Context: While the Green Revolution increased foodgrain production from 108.42 million tonnes (1970-71) to 357.73 million tonnes (2024-25), it created ecological burdens like soil degradation and groundwater depletion.

Prosperity Security: The current focus has shifted to a holistic scorecard including soil health, water-use efficiency, and net farm income.

Jai Anusandhan: Innovation is now recognized as a decentralized, democratic phenomenon where farmers are active knowledge producers rather than passive recipients.

2. Global and National Agri-Tech Landscape

Precision Farming: Utilization of GPS, remote sensing, and IoT sensors to judiciously apply water and pesticides.

Kisan Drones: Integration of drones for planting, weeding, and aerial spraying, aligning with global smart-farming trends.

Digital Infrastructure: The e-NAM platform breaks market barriers, allowing remote farmers to access price information and buyers across state boundaries.

3. Strategic National Missions

Shree Anna (Millets): India is the world's largest millet producer (180.15 lakh tonnes in 2024-25), promoting these as climate-resilient and nutrient-dense "Marvel Grains".

Aatmanirbharta in Pulses and Oilseeds: Target to expand oilseed cultivation by 40 lakh hectares and pulses by 35 lakh hectares to reduce the import gap.

Natural Farming: Resurrection of indigenous wisdom through cow-based formulations like Jeevamrit and Beejamrit.

4. Grassroots Innovation and Drudgery Reduction

Institutional Support: The National Innovation Foundation (NIF) - India documents and validates affordable solutions developed by farmers themselves.

Paddy Transplanters: Low-cost manual transplanters developed by grassroots innovators (e.g., Sadasibo Majhi) reduce the physical drudgery typically faced by women farmers.

Multipurpose Processing: Dharambir Kamboj's machine can process over 100 types of fruits and herbs, extracting oils and gels, and is now used by women's SHGs across 15 countries.

5. Farmer-Led Crop Improvements

HRMN-99 Apple: Developed by Hariman Sharma, this variety thrives in tropical regions with temperatures of 40–45°C, eliminating the need for high-altitude chilling hours.

Riyawan Silver Garlic: An improved variety with large compact bulbs and high yield potential (120 quintal/ha), perfected through disciplined selection by Ishvarlal Dhakad.

Sadabahar Mango: A round-the-year, dwarf mango variety developed by Shrikishan Suman, suitable for high-density plantations and kitchen gardening.

9. Sai Paranjpye—A Storyteller Across Mediums

This chapter features an in-depth conversation with acclaimed filmmaker and writer Sai Paranjpye, exploring her creative journey and the philosophy behind her timeless narratives that capture human relationships and social realities.

GS Paper: GS Paper I (Indian Heritage and Culture).

Subject: Indian Culture.

Topic: Salient aspects of Art Forms, Literature, and Architecture from ancient to modern times.

Sub-Topic: Modern Indian Cinema and Theatre; Contribution of women to Indian Art and Literature; The role of media and creative industries in social reflection.

1. Formative Influences and Discipline

Maternal Impact: Her mother, Shakuntala Paranjpye—a Cambridge-educated writer and linguist—was the primary force in shaping her career through strict discipline.

Early Literacy: Her first book was published at the age of eight, a result of a mandatory daily writing routine imposed by her mother.

Visual Storytelling: Family friend and director Achyuth Ranade taught her to visualize cinema in camera movements long before she understood technical terms.

Self-Taught Cinema: While a teacher at the Film and Television Institute of India (FTII), she educated herself on filmmaking by studying great screenplays and biographies in the library.

2. Mastery Over Multiple Mediums

Writing as the Core: Paranjpye identifies primarily as a writer, believing that a strong literary foundation allowed her to navigate diverse creative forms.

Television (Intimacy): Described as an informal and intimate medium that enters homes and focuses on personal human relationships.

Cinema (Freedom): Viewed as a fluid and expansive medium that allows for movement across time and space through tools like flashbacks.

Theatre (Magic): Considered a "living" medium where the storyteller can feel the immediate, physical response and breath of the audience.

Radio (First Love): Her initial step into the creative world, characterized by the thrill of the live studio lights.

3. Portrayal of Cities and Social Reality

Cities as Characters: Her films often turn urban spaces into living entities, such as Delhi in *Chashme Buddoor* (described as a "love letter" to the city) and the Bombay chawls in *Katha*.

Plagiarizing Life: She admits to drawing "great dialogue" from real-life observations, such as the living conditions of mill workers in dormitories (galas) for her film *Disha*.

Humor in Seriousness: Even in serious works, she maintains a positive attitude, finding lighter moments to keep the narrative grounded.

4. Universal Themes and Timelessness

Enduring Emotions: Her work remains fresh because it focuses on fundamental human feelings—love, jealousy, excitement, and contentment—which do not change with technology.

Thematic Relevance: Films like *Sparsh* (dealing with physical and emotional handicaps) or *Chashme Buddoor* (youthful mischief) are considered timeless because the situations occur across generations.

Subtle Messaging: She abhors "preaching" or "heavy-handed" morals, preferring that meaning arises naturally and subtly from the story itself.

5. Creative Use of Music and Environment

Music as Narrative: Songs are used to advance the story rather than pause it; for example, in *Katha*, a single song was used to establish the protagonist's simultaneous relationships with three different women.

Environmental Awareness: Her film *Chaka Chak* was born out of personal frustration with public spitting and littering, illustrating how the environment dictates her subject matter.

10. Fiscal Consolidation and Expenditure Profile

This chapter provides the macroeconomic backbone of the Union Budget 2026-27, outlining the government's strategy to balance aggressive infrastructure spending with fiscal responsibility and administrative reform.

GS Paper: GS Paper III (Economic Development).

Subject: Indian Economy and issues relating to planning, mobilization of resources, growth, and development.

Topic: Government Budgeting; Fiscal Policy; Resource Mobilization.

Sub-Topic: Fiscal Deficit management; Capital Expenditure (Capex); Taxation Reforms; Allocation across sectors.

1. Macro-Fiscal Indicators (2026-27 BE)

The budget reflects a calibrated balance between sustained capital formation and macroeconomic prudence.

Total Expenditure: Estimated at ₹53,47,315 crore (approx. ₹53.5 lakh crore).

Non-Debt Receipts: Pegged at ₹36.5 lakh crore.

Fiscal Deficit: Target set at 4.3% of GDP, a reduction from the 4.4% estimated for 2025-26.

Debt-to-GDP Ratio: Projected to moderate to 55.6% (down from 56.1% in RE 2025-26).

Net Tax Receipts: Estimated at ₹28.7 lakh crore.

2. Central Government Expenditure Profile

The allocation of funds highlights the government's priorities toward debt servicing, infrastructure, and social welfare.

Major Allocations (in Crore):

1. Interest Payments: ₹14,03,972
2. Transport: ₹5,98,520
3. Defence: ₹5,94,585
4. Major Subsidies: ₹4,10,495
5. Rural Development: ₹2,73,108
6. Agriculture and Allied Activities: ₹1,62,671
7. Education: ₹1,39,289
8. Energy: ₹1,09,029
9. Health: ₹1,04,599

3. Taxation and Administrative Reforms

A significant focus is placed on making the tax system more competitive and citizen-friendly.

New Income Tax Act: Effective from April 2026, featuring simplified rules and forms.

Corporate Incentives: Unified safe harbour regime for the IT sector with faster Advance Pricing Agreements (APAs).

Tax holidays for data centres and MAT exemptions for non-residents to attract global investment.

Customs Rationalization: Exemptions for critical minerals, electronics manufacturing, and nuclear power components to promote energy transition.

Removal of courier export caps to empower small exporters.

4. Strategic Investment & Market Unlocking

Asset Recycling: Unlocking capital via REITs (Real Estate Investment Trusts) to fund new projects.

Crowding-in Private Capital: Use of the Infrastructure Risk Guarantee Fund to mitigate risks for private developers and lenders.

Trade Facilitation: Implementation of digital single windows and risk-based scanning to improve the speed of cross-border trade.

5. The Philosophy of "Kartavya"

The First Budget in Kartavya Bhawan: The budget is anchored in three guiding duties: accelerating growth, fulfilling aspirations, and ensuring inclusive access to resources.

Structural Transformation: Beyond an annual financial statement, it serves as a strategic blueprint linking industrial policy with social development.

KURUKSHETRA

1. Accelerating Rural Transformation

GS Paper III: Economic Development & Agriculture

Topic: Indian Economy and issues relating to planning, mobilization of resources, growth, development, and employment.

Sub-Topic: Rural Infrastructure, Agriculture and Allied Sectors, and Government Budgeting.

1. Introduction

India's rural landscape is undergoing a paradigm shift from a state of subsistence to becoming a vibrant engine of national growth. Aligned with the vision of Viksit Bharat 2047, the current policy framework emphasizes creating self-reliant and dignified village communities. By bridging the rural-urban divide through massive investments in physical and social infrastructure, the government aims to ensure that "aspiration meets opportunity" in the heartlands of India.

2. Rationale for Rural Transformation

Demographic Significance: With 54.6% of the workforce residing in 6.62 lakh villages, rural India is the backbone of the national economy.

Administrative Scale: Development is managed across 2.57 lakh Gram Panchayats, requiring massive decentralized coordination.

Resource Constraints vs. Support: Despite possessing only 2.4% of global land and 4% of water, rural India supports 17% of the global population and 15% of global livestock.

Imperatives for Growth: Overcoming low per capita income, human development gaps, and regional disparities is essential for "inclusive growth."

3. Key Drivers of Transformation

A. Physical Infrastructure

Rural Connectivity (PMGSY): * 99.7% of habitations is now connected.

1. PMGSY-IV targets an additional 62,500 km of roads with an outlay of ₹70,125 crore.

Housing for All (PMAY-G): Aims to provide 4.95 crore pucca houses to ensure dignity and security.

Energy Security (Saubhagya): Connected 2.86 crore households.

1. Led to a 39% increase in power supply, facilitating small-scale rural industries and better study environments.

B. Social Infrastructure

Water Security (Jal Jeevan Mission): Tap water coverage skyrocketed from 17% (2019) to 81.31% (15.74 crore households).

1. Impact: WHO estimates savings of 5.5 crore hours (primarily for women) and the prevention of 4 lakh deaths due to water-borne diseases.

Human Capital: Integrated focus on sanitation, healthcare, and education to strengthen the foundational health of women and children.

C. Digital and Emerging Infrastructure

Bharat Net: 2.14 lakh villages are now service-ready, moving toward a goal of 2.64 lakh Gram Panchayats.

Connectivity: Tele-density stands at 86.76%, with 5G present in 99.9% of districts, integrating farmers into the global digital economy.

Logistics: Expansion of national waterways and coastal shipping to lower transport costs for rural produce.

4. Agriculture and Allied Sectors

Productivity Gains: Shift from subsistence to market-oriented farming; India is now the largest rice producer and second-largest fish producer.

Diversification: Significant growth in fisheries, livestock, and non-farm rural industries to reduce over-reliance on traditional crops.

Value Chains: Improvements in irrigation and market linkages are enhancing the "income-earning" capacity of rural households.

5. Budgetary Commitment (2026–27)

MoRD Allocation: ₹1.97 lakh crore (a 21% increase), signalling a massive push for asset creation.

Total Rural Focus: Combined allocation for Agriculture and Rural Development exceeds ₹4.35 lakh crore.

6. Viksit Bharat Gram Rozgar Mission (VB-GRM)

This mission represents an evolution of rural employment strategies, transitioning from basic labour to durable asset creation.

Evolution from MGNREGA: Builds on a foundation of 8.5 crore existing assets.

Enhanced Provisions: * Work days increased from 100 to 125 days.

1. Introduction of unemployment allowance and wage delay compensation.

Financials: Total allocation of ₹1.51 lakh crore (includes ₹30,000 crore for the MGNREGA transition).

Decentralization: 50% of implementation is handled via Gram Panchayats to ensure local relevance.

7. Challenges and Way Forward

Key Challenges

Regional Disparities: Uneven growth across different states and topographies.

Maintenance: Ensuring the long-term sustainability of the 8.5 crore+ assets created.

Climate Change: High vulnerability of rural livelihoods to erratic weather patterns.

Implementation Gaps: Overcoming "last-mile" delivery deficits in remote areas.

The Way Forward

Climate Resilience: Designing infrastructure that can withstand environmental shocks.

Livelihood Diversification: Promoting non-farm employment and high-value allied sectors.

Empowered Governance: Strengthening the fiscal and administrative powers of Gram Panchayats.

Digital Literacy: Ensuring that digital infrastructure translates into digital "capability" for the rural population.

8. Conclusion

The transformation of rural India is not merely a social welfare project but a strategic economic necessity. By turning villages into economic growth centres, India is laying the groundwork for a balanced, sustainable, and inclusive path toward becoming a developed nation (Viksit Bharat) by 2047.

2. Driving Growth in Agriculture and Allied Sectors

GS Paper III: Economic Development & Agriculture

Topic: Issues related to direct and indirect farm subsidies and minimum support prices; Public Distribution System; Technology missions; Economics of animal-rearing.

Sub-Topic: Agricultural Productivity, Allied Sectors, Digital Agriculture, and Climate Resilience.

1. Introduction

The Union Budget 2026–27 marks a strategic pivot in India's agrarian policy. It transitions from a traditional subsidy-driven model to an investment-led growth model. By prioritizing productivity, infrastructure, and climate resilience, the government aims to move beyond mere "distress protection" toward long-term income stabilization and structural empowerment of the rural workforce.

2. Structural Context of Indian Agriculture

Economic Paradox: Agriculture employs 43–45% of the workforce but contributes only 15–16% to the national GDP.

The Problem: High levels of disguised unemployment and low productivity per worker.

The Goal: Rectify this imbalance through value addition, diversification into allied sectors, and enhanced efficiency to achieve Viksit Bharat goals.

3. Budgetary Trends & Fiscal Realities

Nominal Growth: The Ministry of Agriculture's budget rose to ₹1.41 lakh crore (up from ₹1.25 lakh crore in 2024–25).

Inflation Adjustment: With inflation at approximately 5%, the real fiscal expansion is modest, signaling a shift toward better targeting and digital verification rather than just increasing spending.

Critical Concern: A reduction in funding for the Department of Agricultural Research and Education (DARE) to ₹9,967 crore, which may challenge long-term climate adaptation and innovation.

4. Flagship Schemes: From Protection to Enablement

The Budget reorients existing schemes to serve as "structural enablers":

Direct Support: PM-KISAN (₹60,000 crore) provides a liquidity floor for farmers.

Risk Mitigation: PMFBY (₹18,500 crore) addresses rising climate uncertainties.

Infrastructure & Irrigation: RKVY (₹12,000 crore) and PMKSY (₹11,500 crore) focus on creating physical assets.

Post-Harvest Management: Agriculture Infrastructure Fund (₹10,000 crore) aims to reduce waste and improve market access.

5. Productivity and Investment-Led Growth

Targeted Growth: Aiming to increase annual productivity growth from the historical 2–2.5% to 3–3.5%.

Output Projection: This shift is expected to add 12–15 million tonnes of foodgrain by 2028.

The Multiplier Effect: Every 7% increase in capital investment is estimated to yield a 1.9% additional output growth.

Key Interventions: Focus on climate-resilient seeds, soil health, and precision agriculture.

6. Diversification and Horticulture

High-Value Contribution: Horticulture accounts for 33% of Agricultural GVA and 38% of total output value.

Loss Reduction: Current post-harvest losses stand at 15–20%. Reducing this through cold chains could save ₹8,000–10,000 crore annually.

Specialized Focus: ₹350 crore allocated for high-value crops (e.g., Sandalwood, Cocoa, Agarwood) and ₹700 crore under Krishonnati Yojana.

7. Allied Sectors: The New Growth Engines

Allied sectors offer regular cash flow and act as a hedge against crop failure:

Fisheries: Growing at 8–9%; targets 8 lakh new jobs and exports worth ₹75,000 crore by 2028.

Dairy: Expected productivity growth of 4–5%.

Financial Inclusion: Extension of Kisan Credit Cards (KCC) to fisheries and dairy sectors ensures institutional credit access.

8. Irrigation and Water Management

The Gap: Only 52% of net sown area is currently irrigated.

Expansion: PMKSY aims to add 2–3 million hectares, raising cropping intensity from 142% to 148%.

Efficiency: Micro-irrigation can boost water-use efficiency by 30–40% and increase yields by 15–20%.

9. Digital Agriculture & The Startup Ecosystem

Infrastructure: Digital farmer databases and e-NAM integration aim to reduce transaction costs by 10–12%.

Agri-Tech Growth: The startup ecosystem is projected to expand from 2,500 to 4,000 enterprises by 2028.

AI Integration: Platforms like Bharat-VISTAAR offer real-time, location-specific advisory services to farmers.

10. Sustainability and Climate Resilience

Risk Mitigation: Climate-resilient seeds and insurance are projected to reduce crop loss variability by 1.5–2 percentage points.

Natural Farming: Aims for an 8–10% reduction in chemical fertilizer usage, focusing on soil health and export-standard produce.

11. Regional Focus: North-Eastern Region (NER)

Economic Potential: Targeted infrastructure can boost regional GSDP by 1%.

GI Opportunities: Focus on niche exports like Tripura's Queen Pineapple.

Constraints: High need for better processing facilities and localized research despite the DARE funding cuts.

12. Growth Outlook & Conclusion

Multiplier Potential: Agricultural investment has a multiplier of 1.6–1.8. An investment of ₹15,000 crore can generate up to ₹27,000 crore in GDP gains.

Projected GVA: Growth is expected to stabilize at 3.5% (normal) to 5% (favourable conditions).

Conclusion:

The 2026–27 strategy moves India toward "Smart Farming." By balancing direct income support with aggressive structural reforms in digitalization and allied sectors, the policy framework builds a resilient agricultural foundation capable of sustaining India's journey toward 2047.

3. Building a Stronger and More Inclusive Healthcare System

GS Paper: General Studies II & III

Subject: Social Justice (GS II) / Economic Development (GS III)

Topic: Issues relating to development and management of Social Sector/Services relating to Health.

Sub-Topic: Public Health Infrastructure, Universal Health Coverage, Human Resources in Health, and Biopharmaceutical Innovation.

1. Introduction

The Union Budget 2026–27 elevates healthcare from a welfare service to a strategic national priority. With an allocation of ₹1,06,530.42 crore (a 10% increase), the policy signals a shift toward a system-oriented approach. It integrates primary care, financial protection, and cutting-edge innovation to build a resilient healthcare foundation for Viksit Bharat 2047.

2. The Paradigm Shift: Integrated Health Systems

From Fragmented to Integrated: Moves away from isolated schemes to a system that acknowledges the link between health, nutrition, environment, and technology.

Life-Cycle Approach: Addresses health needs at every stage—from maternal-child care and communicable diseases to the rising burden of Non-Communicable Diseases (NCDs) and geriatric care.

Budgetary Growth: Public health expenditure has risen by 194% since 2014–15, emphasizing long-term capacity building over short-term fixes.

3. Key Pillars of Healthcare Strengthening

A. Infrastructure & Primary Care

National Health Mission (NHM): Allocated ₹39,390 crore (↑6.17%). Focuses on the "equitable model" of primary health, immunization, and ASHA worker support.

PM-ABHIM: A massive 67.66% increase (₹4,770 crore) to build critical care blocks and district-level labs for pandemic readiness.

Tertiary Expansion (PMSSY): ₹11,307 crore for new AIIMS and upgrading existing medical colleges.

B. Financial Protection & UHC

PM-JAY (Ayushman Bharat): Provides a safety net against "catastrophic out-of-pocket expenditure," ensuring the poor aren't bankrupted by hospital bills.

C. Human Resources & Allied Health

Medical Education: Focus on increasing MBBS/PG seats and faculty development (₹1,725 crore).

Allied Workforce: A ₹980 crore plan to train 1 lakh professionals and 1.5 lakh geriatric caregivers, moving toward "team-based" healthcare delivery.

D. Nutrition & Preventive Health

Foundational Health: Integration of Saksham Anganwadi & POSHAN 2.0 with PM POSHAN (Mid-day meals) to link nutrition with educational and immunity outcomes.

Food Security: PMGKAY acts as a preventive health measure by ensuring basic caloric intake for the vulnerable.

4. Technology and Innovation

A. Digital Health

Ayushman Bharat Digital Mission (ABDM): Allocated ₹350 crore (↑7.94%) to create interoperable digital health records and expand telemedicine.

B. Bio-Pharma Shakti Initiative

Industrial Integration: A ₹10,000 crore push to make India a biologics hub.

Clinical Research: Establishment of 1,000 clinical trial sites and strengthening National Institutes of Pharmaceutical Education and Research (NIPERs).

5. Specialized Care and Affordability

Cost Reduction: Custom duty exemptions on 17 life-saving drugs to lower treatment costs.

Disease Control: NACO (₹3,477 crore) focus on HIV/AIDS and blood safety.

Holistic Health: Increased support for AYUSH for preventive and integrative medicine.

Environment-Health Nexus: Inclusion of pollution control as a health measure to combat respiratory and cardiovascular ailments.

6. Governance: Cooperative Federalism

State Support: Recognition that health is a State Subject; increased financial assistance allows states to design context-specific health solutions.

7. Challenges and The Way Forward

Key Challenges

Regional Imbalances: Significant gap in healthcare quality between different states.

NCD Burden: Rising pressure on health financing due to lifestyle-related diseases (Diabetes, Hypertension).

Implementation Deficits: Ensuring quality of care and regulatory oversight in a rapidly expanding system.

The Way Forward

Efficiency: Improving the "utilization ratio" of public health funds through digital tracking.

Data Governance: Strengthening health data privacy while using AI for better diagnostics.

Workforce Resilience: Constant upskilling of doctors, nurses, and paramedics to meet 21st-century health challenges.

8. Conclusion

The 2026-27 Health Budget transitions India from incremental spending to holistic strengthening. By merging infrastructure with digital tools and biopharma innovation, the government is treating healthcare as a central pillar of human capital, essential for long-term economic resilience and social equity.

4. Empowering Youth and Enterprise for Viksit Bharat

GS Paper: General Studies II & III

Subject: Social Justice (GS II) / Economic Development (GS III)

Topic: Issues relating to development and management of Social Sector/Services relating to Education, Human Resources (GS II); Inclusive growth and issues arising from it, MSMEs, and Employment (GS III).

Sub-Topic: Skill Development, Startup Ecosystem, MSME Reforms, and Digital Economy.

1. Introduction

The Union Budget 2026–27 identifies Yuva Shakti (Youth Power) and Enterprise as the twin engines to drive India toward a Viksit Bharat 2047. The policy shifts from merely providing "access" to ensuring "quality and employability." By integrating education, skills, and technology, the government aims to transform the youth from job-seekers into job-creators.

2. Education and Human Capital Development

Fiscal Commitment: Allocated ₹1.39 lakh crore, aligned with the National Education Policy (NEP) 2020.

Innovation at School Level: Proposes expanding Atal Tinkering Labs from 10,000 to 50,000 to instill design thinking early.

Higher Education & Research: Establishment of Centres of Excellence in AI and PM Research Chairs.

1. "One Nation One Subscription" to provide universal access to academic journals.

Industry-Academia Linkage: Developing 5 university townships near industrial corridors to ensure the curriculum meets real-world industrial needs.

3. Skill Development and New-Age Employment

Integrated Approach: Focuses on the "Education to Employment to Enterprise" pipeline.

The Creative (Orange) Economy: Establishment of AVGC (Animation, Visual Effects, Gaming, and Comics) labs in 15,000 schools/500 colleges; aiming for 2 million jobs by 2030.

Sector-Specific Skills: * **Healthcare:** Training 1 lakh allied professionals.

1. **Tourism:** Training 10,000 specialized guides for cultural and circuit tourism.

Digital Drivers: Focus on AI, IT services, and content creation as the primary future employers.

4. MSMEs: The Engine of Growth

Financial Support: Allocated ₹24,566 crore, including a new ₹10,000 crore SME Development Fund to create "Champion MSMEs."

Ease of Doing Business: * **Corporate Mitra Initiative:** Provides affordable compliance and legal advisory in Tier-2 and Tier-3 cities.

1. Self-Reliance: Strengthening the Atmanirbhar Bharat Fund (₹2,000 crore).

Market Access: Integration with Gem (Government e-Marketplace) and digital platforms to help small businesses scale.

Heritage & Rural Industry: Revival of 200 heritage industrial clusters and promotion of One District One Product (ODOP) to curb rural-to-urban migration.

5. Innovation and the Digital Economy

National Missions: Implementation of the AI Mission, Quantum Mission, and the Anusandhan National Research Foundation (NRF).

Technology Self-Reliance: * **India Semiconductor Mission (ISM 2.0):** Building a domestic chip ecosystem.

1. Bio-Pharma Shakti (₹10,000 crore): Promoting biologics and innovation.

Global Competitiveness: Reforms in Safe Harbour norms for IT services to attract global investment and increase export potential.

6. Inclusive and Regional Development

- **Women-Led Development:** Expansion of the Lakhpati Didi scheme and strengthening Self-Help Group (SHG) enterprise models.

- **Agricultural Tech: Bharat VISTAAR**, an AI-based tool, to provide real-time advisory to rural youth engaged in farming.
- **Geographic Focus:** Special emphasis on Purvodaya (Eastern India) and the North-East through industrial corridors and the Buddhist Tourism Circuit.

7. Conclusion

The 2026–27 framework moves beyond incremental changes to create a holistic ecosystem where education leads to high-value skills, and skills lead to thriving enterprises. By focusing on outcome-oriented learning and MSME resilience, India is positioning its youth to be the global leaders of the fourth industrial revolution, ensuring that the path to 2047 is both innovative and inclusive.

5. Women in India: Policy, Power, and Possibility

GS Paper: General Studies I & II

Subject: Indian Society (GS I) / Social Justice & Governance (GS II)

Topic: Role of women and women's organization; Population and associated issues; Welfare schemes for vulnerable sections of the population.

Sub-Topic: Gender Budgeting, Women-led Development, Female Labour Force Participation (FLFP), and Institutional Safety Frameworks.

1. Introduction

The Union Budget 2026–27 signifies a historic transition from "women-centric development" to "women-led development." By placing women at the heart of the national fiscal policy, the government aims to transform them from passive beneficiaries into active economic agents, essential for achieving the Viksit Bharat 2047 vision.

2. Fiscal Commitment: The Gender Budget

Record Allocation: The Gender Budget has reached ₹5.01 lakh crore, a significant 11.55% increase from the previous year.

Fiscal Weight: This allocation now constitutes 9.37% of the total national expenditure.

Mainstreaming: Participation has expanded to 53 ministries, ensuring that gender sensitivity is not restricted to one department but is embedded across all sectors (Health, Transport, Energy, etc.).

3. Gender-Responsive Governance

Structural Transformation: Shift from isolated schemes to a systemic integration of gender priorities in infrastructure, sanitation, and rural leadership.

Mission Shakti (₹3,605 crore): Focuses on the "Safety and Empowerment" cycle through:

1. One Stop Centres (OSCs): For integrated support to women affected by violence.
2. Safety Mechanisms: Enhancing public infrastructure safety and institutional support.

Architecture of the State: Policy design now mandates looking at every public investment through a "gender lens."

4. Economic Empowerment and Market Access

From Micro to Macro: Focus on scaling women-owned businesses rather than keeping them limited to subsistence-level micro-enterprises.

SHE-Marts: A new initiative providing branding, market access, and value-chain integration for women entrepreneurs.

SHG & Enterprise: Leveraging the Self-Help Group (SHG) network and One District One Product (ODOP) to create formal employment and consistent income streams.

5. Education Access and Mobility

District-Level Hostels: The Budget proposes building girls' hostels in every district to remove the biggest barrier to higher education: safe housing and mobility.

STEM Focus: Targeted efforts to increase female participation in Science, Technology, Engineering, and Mathematics (STEM) and other professional courses.

Capability Approach: Shifting focus from just "enrolling girls" to ensuring "career-oriented outcomes."

6. Women as Drivers of Inclusive Growth

Paradigm Shift: Move from a welfare-based approach (giving aid) to a productivity-based approach (enhancing skill and capability).

Key Pillars:

1. Leadership: Increasing women's presence in decision-making roles within rural and urban local bodies.
2. Financial Inclusion: Ensuring women have direct access to credit, insurance, and digital banking tools.
3. FLFP: Strategic aim to improve the Female Labour Force Participation rate to boost national GDP.

7. Conclusion

The 2026–27 policy framework recognizes that India cannot become a developed nation by leaving 50% of its population behind. By combining massive fiscal investment with institutional reforms like SHE-Marts and district hostels, the government is creating an ecosystem where women have the power and possibility to lead India's economic and social transformation toward 2047.

6. Seed Act 2026

GS Paper: General Studies III

Subject: Agriculture and Economy

Topic: Issues related to direct and indirect farm subsidies and minimum support prices; PDS; Technology missions.

Sub-Topic: Agricultural inputs, Seed Industry Reforms, Intellectual Property Rights (IPR) in Agriculture, and Regulatory Governance.

1. Introduction

The Seed Act 2026 is a landmark reform designed to modernize India's agricultural input ecosystem. By replacing the outdated Seeds Act of 1966, this new legislation addresses the modern challenges of private market expansion and hybrid technology. Its core mission is to eliminate fake and substandard seeds, ensuring that the "first link" in the agricultural chain—the seed—is reliable and high-quality.

2. Regulatory Reforms: Transparency and Deterrence

The Act shifts the seed sector from an opaque system to a highly regulated and traceable market through three main pillars:

QR-Based Traceability: Every seed packet will feature a QR code. Farmers can scan it to verify the origin, quality, and seller credentials, while authorities can instantly track and recall defective batches.

Mandatory Registration: All producers, dealers, and sellers must be registered, bringing informal seed players into a formal and accountable network.

Heavy Penalties: Seed fraud is now a serious economic offense. Penalties include:

1. Fines up to ₹30 lakh.
2. Imprisonment for up to 3 years.

3. Quality Assurance and Institutional Oversight

The Act bridges the gap between lab research and field reality by involving national scientific bodies:

Role of Institutions: ICAR (Indian Council of Agricultural Research), agricultural universities, and KVKs (Krishi Vigyan Kendras) are tasked with validating seed performance across different agro-climatic zones.

Scientific Validation: Ensuring seeds are not only high-yielding but also adapted to specific local environments (drought-resistant, flood-tolerant, etc.).

4. Farmer Empowerment and Rights

A unique feature of the Act is its balance between modern regulation and traditional farming values:

Protection of Traditional Rights: The Act explicitly protects the rights of farmers to save, use, exchange, and share seeds, ensuring that the law does not favor large corporations over smallholders.

Grievance Redressal: Established formal channels for farmers to report substandard seeds and seek compensation.

Awareness Programs: Extension services are focused on teaching farmers how to use digital verification tools (QR codes) and understand technical quality parameters.

5. Significance for the Rural Economy

The successful implementation of the Seed Act 2026 acts as a catalyst for broader rural growth:

Risk Reduction: Minimizes the massive income losses caused by crop failure due to "spurious" seeds.

Yield Stability: Reliable inputs lead to predictable harvests, which is essential for national food security.

Market Trust: Encourages responsible private sector participation and innovation by protecting genuine brands from counterfeiters.

Climate Resilience: Streamlines the distribution of climate-resilient seed varieties to diverse regions.

6. Conclusion

The Seed Act 2026 represents a structural shift in agricultural governance by combining digital technology with stringent enforcement. It recognizes that agricultural productivity begins with a quality seed. By securing the integrity of the seed market, India is taking a major step toward protecting farmer livelihoods and achieving a resilient, sustainable agricultural sector for Viksit Bharat 2047.

DOWN TO EARTH

1. IPBES Business and Biodiversity Assessment

Context

The IPBES Business and Biodiversity Assessment (2025) highlights the growing systemic risks created when businesses undermine the ecosystems, they depend on, making corporate participation crucial in reversing biodiversity loss.

About

1. Biodiversity underpins economic activities by providing essential ecosystem services such as pollination, soil fertility, water regulation, and climate stability.
2. However, recent global assessments show that business activities are simultaneously degrading these very natural systems.

Example: Cocoa Production and Deforestation

1. The global chocolate industry illustrates the link between business and biodiversity loss.
2. Ivory Coast, the world's largest cocoa producer, has experienced significant deforestation due to rising global demand.
3. Around 70% of illegal deforestation in the country is linked to cocoa cultivation.
4. The country has lost nearly 45% of its tropical forests in the last two decades.

Key Findings of the IPBES Business and Biodiversity Assessment

1. Decline of Natural Capital: The report reveals a significant imbalance between economic growth and environmental sustainability.
2. Since 1992, human-produced capital (buildings, machinery) has doubled per person.
3. Meanwhile, natural capital i.e. forests, soils, water, and biodiversity has declined by nearly 40%.
4. Finance Flows that Harm Nature: In 2023, about \$7.3 trillion in public and private finance directly harmed nature.
5. \$4.9 trillion from private finance; and \$2.4 trillion from harmful public subsidies; In comparison, only \$220 billion was invested in biodiversity conservation and restoration.
6. Thus, for every \$1 spent protecting nature, nearly \$33 finances activities that damage it.
7. Business Drivers of Biodiversity Loss: The assessment finds that businesses contribute to all five main drivers of biodiversity loss:
8. Land- and sea-use change (e.g., deforestation, urban expansion);

9. Overexploitation of species (overfishing, wildlife trade);
10. Climate change;
11. Pollution;
12. Invasive alien species;
13. High-impact sectors include agriculture, fisheries, forestry, mining, infrastructure, energy, and transport.

Risks for Businesses and the Economy

1. Physical Risks: Degradation of ecosystems can disrupt supply chains, reduce crop yields, and increase production costs.
2. Transition Risks: New environmental regulations and sustainability standards may increase compliance costs for businesses.
3. Systemic Risks: Large-scale ecosystem collapse could threaten financial stability and economic growth, affecting markets and investments.

Indigenous Lands and Biodiversity Protection

1. Indigenous territories play a critical role in biodiversity conservation.
2. Around 60% of Indigenous lands globally face industrial development pressure.
3. Nearly 25% face high pressure from resource extraction.
4. However, Indigenous knowledge is often excluded from business and financial decision-making.
5. The importance of Free, Prior and Informed Consent (FPIC) when development projects affect Indigenous territories.

Policy Challenges and Global Negotiations

1. The IPBES report highlights disagreements between developed and developing countries regarding biodiversity finance and subsidies.
2. Developed countries, including the EU, preferred softer language on harmful subsidies.
3. Developing countries such as India, Brazil, and South Africa pushed for stronger commitments.
4. For many developing countries, balancing economic development and environmental protection remains a major challenge.

Relevance to India

1. India faces similar tensions between development and ecological protection.
2. For example, increasing hydropower projects in Himalayan states such as Uttarakhand and Himachal Pradesh have weakened fragile mountain ecosystems.
3. Events such as the 2021 Chamoli flash flood demonstrate the risks of infrastructure development in ecologically sensitive regions.

Enabling Solutions for Nature-Positive Business

1. Strong Policies and Regulations: Governments must enforce environmental laws and remove harmful subsidies.
2. Reforming Financial Systems: Financial institutions should redirect investments toward sustainable activities.
3. Changes in Corporate Culture: Companies must shift from short-term profits to long-term sustainability.
4. Improved Technology and Data: Better monitoring systems can track biodiversity impacts across supply chains.
5. Capacity Building and Knowledge Sharing: Collaboration among governments, businesses, scientists, and Indigenous communities is essential.

Emerging Global Frameworks

1. Initiatives like the Taskforce on Nature-related Financial Disclosures (TNFD) help companies identify and report their dependence on nature.
2. Over 730 organisations worldwide have voluntarily adopted TNFD recommendations, signalling increasing pressure on corporations to address biodiversity risks.

2. Breast Milk and Environmental Contaminants: First Food Under Threat

Context

Recent scientific studies suggest that environmental contaminants present in water, soil, and food may also enter the human body and appear in breast milk, raising concerns about early-life exposure to pollutants.

Importance of Breast Milk for Infant Health

1. Breast milk is a biologically active fluid that evolves according to an infant's nutritional and developmental needs.
2. It contains essential nutrients, antibodies, hormones, enzymes, and bioactive compounds that support growth and immunity.
3. The World Health Organization (WHO) considers breastfeeding a crucial intervention for improving child survival, immunity, and long-term health.
4. Key benefits include:
5. Strengthening immune defence and reducing infections;
6. Supporting neurological development and cognitive growth;
7. Regulating inflammation and shaping the gut microbiome;
8. Reducing risks of allergies, autoimmune diseases, obesity, and respiratory infections;
9. A study published in *The Lancet Global Health* (2015) found that longer breastfeeding duration is associated with higher intelligence, increased years of schooling, and improved adult income levels.

Detection of Environmental Contaminants in Breast Milk

1. Uranium in Breast Milk: A 2025 study published in *Scientific Reports* investigated uranium exposure in the Gangetic plains of six districts of Bihar.
2. Key findings:
3. Uranium was detected in all 40 breast milk samples.
4. Concentrations ranged from trace amounts to 5.25 µg/L.
5. The highest levels were recorded in Katihar district.
6. Model-based risk assessments suggested that about 70% of infants could face potential non-carcinogenic health risks, including kidney damage and neurological effects.

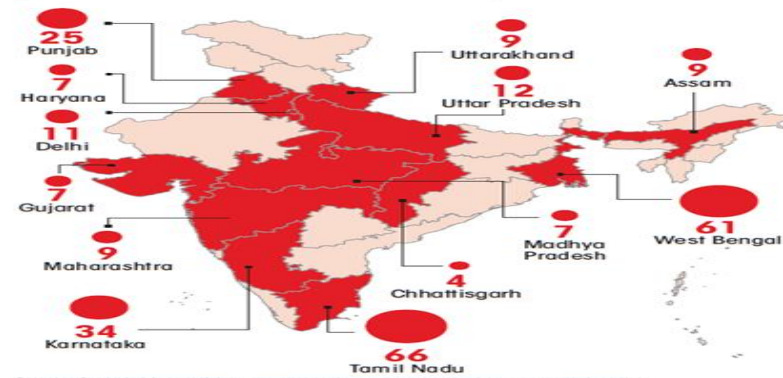
Other Contaminants Detected

1. Uranium is not the only contaminant identified in breast milk samples in India.
2. Heavy Metals: Studies in Bihar's Gangetic belt have detected Arsenic, Mercury, and Lead. In some samples, lead concentrations were extremely high, exceeding safe limits.
3. Chronic exposure to these metals may lead to developmental delays, reduced growth, and cognitive impairment in children.
4. Persistent Organic Pollutants (POPs): Research from rural Karnataka has also found trace levels of organochlorine pesticides, including DDT and its metabolites (DDE).
5. These chemicals persist in the environment for decades and accumulate in human tissues, including breast milk.

Quite a threat

Studies have detected at least 101 contaminants in breast milk samples from across India. Several of the contaminants are potential carcinogens, endocrine disruptors and neurotoxins

● No. of contaminants found in breast milk samples studied



Source: ExHuMId Database, accessible online at: <https://cb.iimsc.res.in/exhumid/>

Key Observations of Exposome of Human Milk Across India (ExHuMId) Database

1. Over 100 environmental pollutants have been detected in breast milk.
2. These include heavy metals, pesticides, dioxins, furans, and polychlorinated biphenyls (PCBs).
3. Many of these chemicals are carcinogens, endocrine disruptors, or neurotoxins.

Sources of Contamination

1. Contaminated Groundwater: Groundwater polluted with heavy metals or radioactive elements may enter drinking water supplies and irrigation systems.
2. Agricultural Inputs: Phosphate fertilisers may contain uranium impurities, which gradually accumulate in soil and groundwater through long-term agricultural use.
3. Industrial and Energy Activities: Coal combustion in thermal power plants can enhance naturally occurring radioactive elements, contributing to groundwater contamination.
4. Persistent Environmental Chemicals: Old pesticides such as DDT remain in soils and ecosystems for decades, entering the food chain and eventually accumulating in human tissues.

Key Concerns for Public Health

1. The detection of contaminants in breast milk highlights several challenges:
2. Early-life exposure to environmental pollutants;
3. Possible long-term health risks such as neurological disorders and kidney damage;
4. Lack of regulatory standards for many contaminants in breast milk;
5. Limited nationwide biomonitoring data;
6. Despite these concerns, scientists emphasize that breastfeeding remains far safer and more beneficial than alternatives.

Way Forward

1. Addressing the issue requires coordinated environmental and public health interventions:
2. Strengthening groundwater monitoring and pollution control;
3. Regulating fertiliser and pesticide use;
4. Expanding biomonitoring programmes for contaminants in human tissues;
5. Improving safe drinking water access in rural areas;
6. Supporting interdisciplinary research on environmental health;

3. India's Ai Challenge: Innovation Deficit and The Data Centre Strategy

Context

1. Despite hosting high-profile events like the AI Impact Summit, the country continues to struggle with limited innovation capacity, shortage of AI talent, and inadequate infrastructure.
2. In response, the government has promoted a strategy to turn India into a global hub for data centres, but this approach raises economic, technological, and environmental concerns.

India's Vision for Human-Centric AI

1. At the summit, the Prime Minister proposed the MANAV framework for AI governance.

2. MANAV Framework: MANAV stands for:
3. M: Moral and ethical systems;
4. A: Accountable governance;
5. N: National sovereignty;
6. A: Accessible and inclusive;
7. V: Valid and legitimate principles;
8. The framework aims to ensure human-centric AI development, prioritising welfare, accountability, and inclusivity.
9. Similar global initiatives already exist, such as the UN's 'AI for Good' programme, which promotes AI for sustainable development and societal benefit.

AI Disruption and Employment Risks in India

1. India's technology services sector, the backbone of its digital economy, is highly vulnerable to AI-driven automation.
2. Key Employment Concerns:
3. 2.7 million jobs could be lost by 2031 due to AI disruption.
4. Tech services employment may decline from 7.5–8 million to around 6 million.
5. Customer service jobs may fall from 2–2.5 million to about 1.8 million.
6. Studies suggest over 60% of formal sector jobs in India could be vulnerable to AI automation by 2030.
7. This is particularly concerning because the tech sector:
8. Employs around 13% of India's workforce.
9. Accounts for over 30% of white-collar employment.
10. Automation and AI will transform labour markets, requiring large-scale reskilling and policy adaptation to avoid structural unemployment.

India's Weak Position in Global AI Innovation

1. India lags behind global leaders in AI research and innovation, despite a large digital workforce.
2. Indicators of Innovation Gap:
3. India's share of AI patents declined from about 8–10% in 2010 to under 5% in 2023.
4. Low presence in AI publications, citations, and foundational model development.
5. Shortage of advanced AI researchers and specialised computing infrastructure.
6. India lacks domestic large language models (LLMs) and access to advanced AI chips, which are essential for AI sovereignty.

NITI Aayog's Proposed Solution: India AI Talent Mission

To address these challenges, policy experts propose a national AI skill development programme.

1. Key Recommendations:
2. Establish an India AI Talent Mission to coordinate skilling efforts.
3. Reform education curricula to incorporate AI and data science.
4. Expand public-private partnerships for workforce reskilling.
5. Increase investment in AI research and innovation ecosystems.
6. AI is evolving faster than policy and education systems, leaving only a short window for corrective action.

Government's Data Centre Strategy

1. In parallel, India has invited global technology companies to build large-scale data centres in the country.
2. Expected Investments: Major technology companies such as Google, Amazon, and Microsoft have pledged investments that could reach \$200 billion in data infrastructure.
3. The government views this as an opportunity to:
4. Position India as a global digital infrastructure hub;
5. Strengthen the AI ecosystem; and
6. Attract foreign investment.

Limitations of the Data Centre Approach

1. Limited technology transfer: Global firms rarely share proprietary data or AI models.
2. Low employment generation: Data centres require relatively few workers.
3. No direct contribution to AI innovation: They primarily store and process data rather than develop AI systems.
4. Therefore, data centres do not automatically lead to AI sovereignty or technological leadership.

Environmental Concerns

1. Resource Consumption: A 100 MW data centre can consume over 2 million litres of water per day.
2. Massive projects such as the 1 GW Google data centre in Visakhapatnam illustrate the scale.
3. Energy and Climate Impacts: Data centres may require 2.5 GW power capacity in the near future.
4. India's electricity still relies heavily on coal-based power, increasing carbon emissions.
5. Extreme heat conditions in many districts increase cooling demands, further raising energy consumption.
6. International organisations, including the UN Environment Programme, warn that the rapid expansion of digital infrastructure can create significant environmental stress if not properly regulated.

Way Forward: Policy Priorities

1. Invest in AI research and domestic innovation;
2. Develop foundational AI models and semiconductor capabilities;
3. Expand AI education and reskilling programmes;
4. Promote sustainable digital infrastructure powered by renewable energy;
5. Encourage public-private collaboration in AI development;

4. China's Energy Transition And Lessons For India

Context

China's moves to transition to clean energy offer critical lessons to India

Declining Emissions Amid Rising Power Demand

1. China, the world's largest greenhouse gas emitter, recorded a 1.6% year-on-year decline in CO₂ emissions in the first quarter of 2025, and 1% decline over the past year.
2. It occurred despite rising electricity demand, indicating a structural shift in China's power sector.
3. Clean energy is increasingly replacing coal as the primary source of electricity generation.
4. China now has 1,494 GW of clean power capacity, which contributes over 50% of the country's electricity generation.
5. It demonstrates that rapid expansion of renewable and non-fossil energy capacity is translating into actual decarbonisation outcomes.

India's Capacity-Generation Gap

1. India presents a more complex transition pathway. Although non-fossil sources account for more than half of installed capacity, they contribute only around one-third of total electricity generation.
2. It highlights a critical issue: capacity expansion does not automatically translate into dominant energy generation, especially due to intermittency and grid integration challenges.

Changing Role of Coal in China

1. China remains the largest coal consumer globally, with 1,189 GW of installed coal-fired power capacity. However, the role of coal is evolving:
2. Coal plants are shifting from baseload power providers to peaker and balancing sources that operate during periods of high demand.
3. Plant Load Factors (PLF) have declined from around 45–50%, reflecting reduced utilisation.
4. Retrofit programmes are enabling coal plants to operate flexibly at lower loads, supporting integration of renewable energy.
5. China's policy framework now emphasises quality over quantity, promoting:
6. Deep peak-shaving (reducing generation during low demand);

7. Lower minimum stable load levels (below 30%);
8. Improved operational flexibility;
9. This flexibility is essential for supporting China's emerging "new-type power system", where renewables form the backbone of electricity supply.

Coal Flexibility Reforms

1. Under the 14th Five-Year Plan (2021–2025), China targeted the retrofit of 200 GW of coal capacity for flexible operation, representing 16.8% of the coal fleet.
2. The aim is to transform coal plants into low-load, flexible units that complement renewable energy rather than compete with it.

Capacity Payment Mechanism

1. Declining utilisation rates threaten the economic viability of coal plants. To address this, China introduced a capacity payment mechanism in January 2024.
2. Key Features:
3. Provides monthly standby payments to eligible coal plants.
4. Covers fixed costs during periods of low utilisation due to high renewable output.
5. Payments are based on 30–50% of a fixed cost benchmark of 330 yuan/kW.
6. Reliable Capacity Compensation (2026 Policy Update): In January 2026, China revised the mechanism under the 'Reliable Capacity Compensation Mechanism'. Key changes include:
7. Minimum payment increased to 50%, with higher levels depending on provincial market conditions.
8. Expanded coverage beyond coal plants to include Battery storage systems, and Gas-based thermal power plants.
9. The policy aims to reward generators that ensure grid reliability, particularly during peak demand periods outside solar generation hours.

Key Lessons for India

1. Move Beyond Capacity Expansion: China's experience shows that simply adding power capacity is insufficient. Effective transition requires operational flexibility and grid management mechanisms.
2. Accelerate Coal Flexibility: India is still in the pilot phase of coal flexibilisation, aiming for 40% minimum technical load. The target of retrofitting 200 GW by 2030 remains challenging under current progress.
3. Develop Market-Based Reliability Mechanisms: India requires structured financial mechanisms, such as capacity payments, to ensure the economic viability of plants providing grid stability and balancing power.
4. Integrate Storage and Flexible Resources: A balanced ecosystem should include flexible coal plants, energy storage systems, and reliable market mechanisms.

5. Climate Anxiety, Youth Behaviour, And Community Conservation

Context

Climate change is increasingly recognised not only as an environmental crisis but also as a psychological and social challenge. Rising awareness of environmental degradation has triggered eco-anxiety and ecological grief among young people, which can sometimes manifest as frustration or aggressive behaviour.

Climate Change and Youth Mental Health

1. Eco-Anxiety and Solastalgia: Young people across the world are experiencing new climate-related emotional states:
2. Eco-anxiety: Persistent worry about climate change and the planet's future.
3. Solastalgia: Emotional distress caused by environmental changes in one's home environment.
4. Adolescents are particularly vulnerable because their cognitive and emotional systems are still developing, making them more sensitive to uncertainty and long-term threats.

Why Are Teenagers More Vulnerable?

1. Developmental Sensitivity: Adolescence is marked by rapid psychological change. Climate-related stress adds additional pressure through:
2. Incomplete emotional regulation mechanisms in the developing brain;
3. Heightened peer influence and social awareness;
4. Limited decision-making power regarding global environmental issues;
5. As a result, teenagers often worry more about climate change than adults but feel less capable of influencing outcomes, which intensifies stress.

Pathways Linking Climate Stress to Aggressive Behaviour

1. Direct Environmental Impacts: These arise from extreme climate events such as floods, droughts, or heatwaves.
2. Effects include disrupted schooling, family financial instability, and displacement and trauma.
3. Such stress can impair attention, memory, and emotional control, increasing the likelihood of irritability or aggression.
4. Indirect Social and Psychological Impacts: Climate change can also weaken social systems like food and water insecurity, displacement and migration, and breakdown of community support systems.
5. These pressures create feelings of helplessness and betrayal, which sometimes manifest as anger or confrontational behaviour.

Mechanisms Behind Climate-Induced Aggression

1. Cognitive Stress: Environmental stressors such as heat and pollution reduce concentration and decision-making ability.
2. Emotional Overload: Persistent feelings of helplessness associated with eco-anxiety can translate into frustration.
3. Loss of Support Systems: Climate disruption weakens families, schools, and community networks that normally protect adolescents.
4. Developmental Vulnerability: Teenagers have higher emotional reactivity, making them more susceptible to environmental stress.

Research Gaps

1. Limited research on climate stress and aggression (most studies focus on anxiety or depression).
2. Lack of standardised eco-anxiety measurement tools for adolescents.
3. Underrepresentation of Global South populations in climate psychology studies.
4. These gaps are important for policymaking in countries like India where climate vulnerability is high.

Transforming Eco-Anxiety into Positive Action

1. Studies indicate that constructive engagement in climate action improves youth mental health.
2. Examples include environmental restoration activities, community climate initiatives, and youth participation in sustainability projects.
3. Active participation builds agency, hope, and resilience, reducing frustration and aggressive tendencies.

6. Measuring Poverty: Challenges And A New Approach

Context

Measuring poverty is essential for designing and implementing effective development programmes. Accurate poverty measurement helps governments identify vulnerable populations and allocate resources efficiently. However, the process is complex and often contested due to methodological limitations.

Traditional Methods of Measuring Poverty

1. Income Surveys: In many advanced economies, poverty is measured through direct income surveys, which estimate the earnings of individuals or households.
2. Those whose income falls below a defined poverty line are categorized as poor.

3. Expenditure Surveys: In countries like India, poverty measurement relies largely on consumption expenditure surveys, which use household spending as a proxy for income.
4. Based on this data, a poverty line is drawn and individuals below this threshold are considered poor.

Limitations of the Poverty Line Approach

1. Exclusion of the Near-Poor: The poverty line creates a rigid classification of poor vs. non-poor. Individuals earning slightly above the poverty line are excluded from welfare schemes despite facing similar hardships as those below the line.
2. In India, the poverty line has often been criticized as a 'deprivation line' or 'starvation line' because it is set very low.
3. Seasonal Bias in Surveys: Consumption surveys capture spending only at the time of the survey, which may not represent the household's annual economic condition.
4. Surveys conducted post-harvest may show higher consumption due to increased income and produce availability.
5. Surveys during the monsoon or lean season may reflect lower consumption levels.
6. Since surveys are usually conducted once, they may not capture these seasonal fluctuations accurately.

A New Measure: 'Average Poverty'

1. Concept by Olivier Sterck: Olivier Sterck proposes a new approach that does not rely on a poverty line.
2. Instead of classifying people as poor or non-poor, the method measures poverty across the entire income distribution.
3. Methodology: Sterck suggests measuring poverty as the reciprocal of income, focusing on the time required to earn a unit of money.
4. If income is measured in dollars per day (\$/day), poverty is measured in days per dollar (days/\$).
5. For example: If person A earns half as much as person B, A is twice as poor.
6. Definition: Sterck calls this measure 'Average Poverty', defined as: The average time it takes for people in a population to earn one dollar.

Advantages of the Average Poverty Measure

1. Distribution-Sensitive Measurement: The method considers variations across the entire income distribution, rather than focusing only on those below a fixed poverty line.
2. Better Policy Targeting: It highlights the severity of poverty, enabling governments to design better-targeted anti-poverty programmes.
3. Greater Impact for the Poorest: A small income increase for the poorest individuals reduces poverty more significantly than the same increase for relatively richer individuals.

Conclusion

Traditional poverty measures based on the poverty line provide useful but limited insights into economic deprivation. The Average Poverty approach proposed by Olivier Sterck offers a more inclusive and distribution-sensitive method by considering the entire income spectrum. Such innovative measures could improve poverty assessment and enhance the effectiveness of development policies.

7. India Joins Pax Silica Coalition (2026)

Context

India formally joined Pax Silica, a US-led coalition that sought to build a common supply chain for electronics and critical minerals during the AI Impact Summit held in New Delhi.

What is Pax Silica?

1. Pax Silica is an emerging strategic technology and resource partnership focused on:
2. Building secure and resilient supply chains for semiconductors and electronics;
3. Ensuring reliable access to critical minerals such as lithium, cobalt, rare earth elements, and silicon;
4. Reducing dependence on geopolitically concentrated mineral supply chains;

5. Strengthening technological cooperation among partner countries;
6. The initiative reflects the growing importance of technology security and supply-chain resilience in global geopolitics.

Significance for India

1. Strengthening Semiconductor and Electronics Ecosystem: Access to technology partnerships and manufacturing networks.
2. Support for India's Semiconductor Mission and electronics manufacturing sector.
3. Secure Access to Critical Minerals: Helps India obtain lithium, cobalt, rare earth elements, and silicon needed for semiconductors, batteries, renewable technologies, and electronics manufacturing.
4. Strategic Technology Partnerships: Collaboration with EU, Japan and the US enhances research cooperation, supply-chain diversification, and advanced manufacturing capabilities.
5. Reduced Supply Chain Vulnerabilities: Global supply chains for many critical minerals are highly concentrated geographically, creating risks of disruption.

Relevance for Global Geopolitics

1. The Pax Silica initiative reflects a broader trend of technology alliances among democracies to secure strategic resources and manufacturing capacity.
2. Critical minerals and electronics manufacturing are becoming central to national security and technological leadership.

Implications for India's Strategic Policy

1. Joining Pax Silica could support India in semiconductor manufacturing expansion, energy transition technologies, AI hardware development, and supply chain diversification.
2. It aligns with initiatives such as Make in India, India Semiconductor Mission, and National Critical Minerals Mission.

Conclusion

1. India's entry into Pax Silica marks an important step toward technological self-reliance and resilient supply chains.
2. By partnering with advanced economies, India can strengthen its electronics manufacturing, semiconductor ecosystem, and access to critical minerals, all of which are crucial for future AI, digital infrastructure, and clean energy technologies.

8. Repeal Of the Us 'Endangerment Finding': Implications for Climate Policy and Global Energy Transition

Context

The United States has recently overturned the 'Endangerment Finding', a key legal basis for regulating greenhouse gas emissions under the Clean Air Act (CAA) since 2009.

What is the Endangerment Finding?

1. The Endangerment Finding (2009) concluded that greenhouse gases such as carbon dioxide, methane, and nitrous oxide pose a threat to public health and welfare.
2. This finding legally empowered the EPA to regulate emissions under the Clean Air Act.

Key Significance

1. Provided the legal basis for US climate regulation.
2. Enabled emission standards for vehicles, power plants, and industrial sources.
3. Formed a cornerstone of US climate policy for over a decade.

Reasons Given for the Repeal

1. The US administration argues that overturning the finding will bring economic benefits.
2. Claimed Advantages:
3. Savings of over \$1.3 trillion for taxpayers.

4. Lower vehicle prices for consumers.
5. Reduced trucking costs and overall cost of living.
6. Restoration of consumer choice in vehicle technologies.
7. However, these claims overlook the rapid decline in renewable energy costs and broader environmental consequences.

A Broader Shift in US Climate Policy

1. Policy Changes: Reduced support for renewable energy, electric vehicles, and battery technologies.
2. Expanded backing for fossil fuels, including new drilling licenses.
3. Promotion of oil, gas, and coal exports.
4. Legal challenges and resistance against state-level climate initiatives.
5. It reflects a deliberate shift toward fossil fuel expansion while weakening federal climate regulation.

Economic Debate: Fossil Fuels vs Renewables

1. Market Trends: In many regions, renewables are already cheaper than fossil fuels.
2. States like Texas are rapidly expanding wind and solar energy because of their economic advantages.
3. Renewable energy involves higher upfront investment, but long-term operating costs are lower.
4. Therefore, analysts argue that fossil fuels are not necessarily the cheaper option in the long run.

Impact on International Climate Cooperation

1. The US stepping back from climate commitments could weaken global momentum.
2. Key Concerns:
3. Reduced leadership in international climate negotiations.
4. Other countries may use US withdrawal as justification for delaying climate action.
5. Potential weakening of commitments under the Paris Agreement.

Role of Courts and States

1. Domestic Divisions: Several environmental and health groups have challenged the repeal in court.
2. Many states, especially California and other progressive states continue pursuing ambitious climate policies.
3. These states represent nearly half of the US GDP, indicating significant internal policy divergence.

Strategic Choices for Countries

1. Two Possible Paths:
2. Continue reliance on imported fossil fuels.
3. Accelerate the transition to domestic renewable energy.
4. Countries like India and members of the European Union import large quantities of fossil fuels, leading to capital outflows. Expanding domestic renewable energy can:
5. Improve energy security.
6. Create jobs and technological innovation.
7. Strengthen export-oriented industries, such as solar photovoltaic manufacturing.

Emerging Climate Alliances

1. New global partnerships could accelerate the clean energy transition.
2. Possible Cooperation:
3. Stronger India–EU collaboration on technology and supply chains.
4. Alliances among fossil-fuel-importing countries to reduce dependence on volatile energy markets.
5. Such partnerships could support faster adoption of renewable energy while enhancing economic resilience.

9. Coal Mining Proposal Near Bandhavgarh–Achanakmar Corridor: Implications for Tiger Conservation

Context

1. A proposal to start coal mining in Umaria district, Madhya Pradesh, is awaiting final environmental clearance from the MoEFCC.
2. It lies only about a few metres from the Bandhavgarh–Achanakmar tiger corridor, a critical wildlife corridor that enables movement of tigers between protected areas in central India's tiger landscape.

Importance of the Bandhavgarh–Achanakmar Corridor

1. Wildlife corridors are ecological linkages that allow animals to move between fragmented habitats.
2. The Bandhavgarh–Achanakmar corridor connects several important tiger reserves such as Bandhavgarh, Kanha, Sanjay–Dubri, Pench, Panna, and Achanakmar.
3. According to the 'Status of Tigers in India, 2022' report by the National Tiger Conservation Authority (NTCA), these six reserves together hold around 342 tigers, with Bandhavgarh alone hosting about 134 tigers.
4. The corridor enables genetic exchange between tiger populations, which is essential to prevent inbreeding and population decline.
5. Connectivity also helps tigers disperse to new territories, reducing pressure on core habitats and limiting human–wildlife conflict.
6. Landscape connectivity is crucial for long-term tiger survival in fragmented habitats like central India.
7. Loss of corridors can isolate populations and increase extinction risk.

Details of the Marwatola VII Coal Mining Project

1. The proposed Marwatola VII coal block spans approximately 12 sq km in the Sohagpur coalfield. Key features of the project include:
2. Open-cast and partial underground mining;
3. 10.59 sq km of forest land likely to be disturbed;
4. 6.52 sq km to be mined through open-cast method;
5. Over 152,000 trees expected to be cut;
6. Nearly 88% of the mining area lies within forest land, most of which is classified as Reserved Forest under the Indian Forest Act, 1927, offering the highest level of protection.
7. Open-cast mining is proposed because it allows extraction of about 82 million tonnes of coal from a total geological reserve of 188.7 million tonnes, making it economically viable.

Environmental and Ecological Concerns

1. Habitat Fragmentation: Mining infrastructure such as roads, trucks, and waste dumps can fragment forest landscapes.
2. Anthropogenic infrastructure significantly disrupts wildlife corridors and movement patterns.
3. Impact on Tiger Connectivity: Research using landscape genetics and connectivity modelling indicates that the central Indian landscape depends on functional corridors between tiger reserves.
4. Fragmentation of such corridors may reduce gene flow and threaten the viability of tiger meta-populations.
5. Biodiversity Loss: The forest in the proposed mining area supports several species including Leopard, Sloth bear, Jackal, Chital and deer species, Macaques, reptiles and vultures.
6. It also contains ecologically important flora such as sal (*Shorea robusta*), teak (*Tectona grandis*), mahua (*Madhuca indica*), palash (*Butea monosperma*), and tendu.
7. Impact on Local Livelihoods: Forest produce like mahua and tendu leaves supports local tribal livelihoods. Mining may also affect five local streams (nallas) and disrupt hydrological flows.

Policy and Legal Issues

1. 'No-Go' Forest Area: The Marwatola VII block was earlier included in the 2010 'No-Go' list, which identified dense forest areas unsuitable for coal mining.
2. Wildlife Clearance Debate: The National Tiger Conservation Authority (NTCA) recommended that wildlife clearance should be obtained due to proximity to a tiger corridor.

3. Supreme Court Directive: The Supreme Court, in 2025, ordered a complete ban on mining within 1 km of critical tiger habitats, raising further questions about the project's legality.

Institutional Review Process

1. To assess the ecological impact, MoEFCC formed a six-member expert committee including representatives from NTCA, Bandhavgarh Tiger Reserve, MoEFCC regional offices, and Madhya Pradesh forest department.
2. The committee conducted a site inspection in December 2025, and its report is awaited.

Way Forward

1. Avoid open-cast mining near critical wildlife corridors;
2. Consider underground mining with strict safeguards;
3. Strengthen scientific mapping and legal protection of wildlife corridors;
4. Ensure community consultation and rehabilitation planning;
5. Balancing energy security and biodiversity conservation remains a key challenge. Protecting critical corridors is vital to sustain India's globally significant tiger populations.

10. Guggul (*Commiphora Wightii*)

Context

1. The Chambal ravines of Madhya Pradesh, characterised by steep slopes, severe soil erosion, and barren terrain, are largely unsuitable for conventional agriculture, limiting livelihood opportunities for local communities.
2. The cultivation of Guggul (*Commiphora Wightii*) can address environmental degradation and rural poverty.

About Guggul (*Commiphora Wightii*)

1. It is a medicinal shrub belonging to the Burseraceae family, widely known for producing an aromatic oleo-gum resin called 'guggul gum'.
2. It has been used for centuries in Ayurvedic medicine to treat various ailments such as high cholesterol, arthritis, and obesity.
3. The plant is commonly called Indian bdellium tree, guggul, or guggulu.

Distribution and Habitat

1. Guggul is primarily found in arid and semi-arid regions of South Asia.
2. Major regions:
3. India: Rajasthan, Gujarat, Madhya Pradesh, and parts of the Deccan plateau;
4. Pakistan: Sindh and Balochistan;
5. Bangladesh: limited distribution;
6. In India, the plant naturally occurs in rocky tracts, dry forests, and desert ecosystems, particularly in the Thar Desert and Chambal ravines.

Economic and Medicinal Importance

1. Medicinal Uses: The resin contains guggulsterones, biologically active compounds with pharmacological effects.
2. Major therapeutic uses:
3. Reducing cholesterol and triglycerides;
4. Anti-inflammatory properties for arthritis;
5. Supporting weight loss and metabolism;
6. Treating skin diseases and digestive disorders;
7. Several Ayurvedic formulations include guggul resin, such as Yograj Guggulu, Kishore Guggulu, and Laksha Guggulu.
8. Other Uses: Perfumes and incense due to its aromatic resin; Traditional religious rituals; and Herbal pharmaceutical industries.

Ecological Importance

1. Guggul is highly suitable for dryland ecosystems. Key ecological benefits:
2. The Drought-tolerant plant that survives with minimal water;
3. The Helps stabilize fragile desert and ravine soils;
4. The Supports biodiversity in arid ecosystems;
5. The Because of these features, it is recommended for ravine reclamation and dryland afforestation projects.

Threats

1. Overharvesting of resin using destructive tapping techniques;
2. Habitat degradation in arid regions;
3. Low natural regeneration;
4. Grazing and land-use changes;

Conservation Status

1. Listed as Critically Endangered in India
2. Included in the IUCN Red List of Threatened Species.
3. Conservation strategies include:
4. In-situ conservation in natural habitats;
5. Cultivation by farmers;
6. Biotechnological propagation techniques;
7. Government medicinal plant conservation programmes;

11. China's Zero-Tariff Policy for African Nations

Context

1. Recently, China announced that it will implement zero tariffs on imports from 53 African countries (except Eswatini) with which it maintains diplomatic relations.
2. Eswatini maintains diplomatic relations with Taiwan instead of China.

Key Features of the Policy

1. Expansion of Duty-Free Access: China's policy extends zero-tariff treatment to all African partners with diplomatic ties.
2. Earlier, the benefit was mainly limited to least developed African countries.
3. The new move also benefits middle-income economies such as Nigeria and Kenya.
4. Exclusion of Eswatini: Eswatini remains excluded because it recognizes Taiwan diplomatically rather than China.
5. Beijing follows the 'One China Policy', which discourages diplomatic relations with Taiwan.
6. Continued Economic Partnerships: China plans to deepen economic cooperation through:
7. Joint economic partnership agreements with African countries.
8. Expanding market access mechanisms such as the 'Green Channel', which ensures fast-track administrative approvals and streamlined trade procedures.

Potential Benefits for Africa

1. Increased Market Access: Duty-free access to the world's second-largest economy can boost African exports such as agricultural products; minerals and raw materials; and manufactured goods;
2. China has become one of Africa's largest trading partners, facilitating infrastructure development and trade expansion across the continent.
3. Support for Economic Growth: Trade liberalisation can enhance export revenues, promote industrialisation, and support Africa's integration into global value chains.
4. Alignment with South-South Cooperation: China's policy reflects a broader strategy of strengthening South-South cooperation and development partnerships, especially through frameworks such as the Forum on China-Africa Cooperation (FOCAC).

Challenges and Limitations

1. Regulatory Standards: Despite tariff removal, China's strict regulatory and quality standards could create barriers, particularly for agricultural exports.
2. Structural Trade Imbalances: Africa's trade with China often remains resource-heavy and manufacturing-light, which may limit long-term industrial gains unless diversification occurs.
3. Non-Tariff Barriers: Even with zero tariffs, logistical, technical, and sanitary standards can restrict export growth for African producers.

12. Amazon Rainforest Turning into A Carbon Source: Key Findings from the 2023 Drought

Context

A recent study published in AGU Advances found that extreme drought and prolonged heatwaves in 2023 temporarily turned parts of the Amazon into a carbon source. It highlights growing concerns about the stability of the Amazon's climate-regulating role.

Key Findings of the Study

1. The Amazon rainforest is traditionally known as a global carbon sink, meaning it absorbs more carbon dioxide (CO₂) than it emits.
2. Estimated CO₂ released: 10–170 million tonnes into the atmosphere.
3. The study concluded that the Amazon acted as a net carbon source for about three months.
4. The phenomenon was primarily linked to extreme drought and heatwaves associated with the 2023 El Niño event.

Main Cause: Reduced Vegetation Uptake

1. Researchers found that the carbon release was mainly due to reduced photosynthesis, not forest fires.
2. Mechanism:
3. Severe drought leads to reduced soil moisture;
4. Heat stress on vegetation;
5. Weaker photosynthesis during the dry season;
6. Reduced carbon absorption by plants;
7. Thus, the decline in vegetation carbon uptake rather than increased emissions caused the shift.

Role of Early-Year Vegetation Uptake

1. From January to April 2023, the Amazon experienced unusually strong vegetation growth and carbon absorption.
2. This early uptake partially offset the later carbon loss.
3. Without this earlier absorption, the annual net carbon loss would have been much larger.

Role of El Niño and Ocean Warming

1. El Niño (2023 Event): Causes warmer and drier conditions in the Amazon basin. Intensifies drought and heatwaves.
2. Widespread Ocean Warming: Beyond the Pacific Ocean, global ocean warming may also influence Amazon rainfall patterns. This may increase the frequency of extreme drought events.

Implications for the Global Climate System

1. If such extreme events become more frequent:
2. The Amazon could transition from a carbon sink to a permanent carbon source.
3. This would accelerate global warming.
4. It may push the ecosystem toward a tipping point, leading to forest degradation or savannization.

Conclusion

- The 2023 Amazon drought demonstrates how climate extremes can weaken the planet's largest rainforest's capacity to absorb carbon.
- Continued warming and frequent El Niño events could push the Amazon toward a long-term transition into a carbon source, posing serious risks for global climate stability.

13. Us Supreme Court Strikes Down Trump's Global Reciprocal Tariffs (2025)

Context

Recently, the US Supreme Court struck down the global reciprocal tariffs, ruling that the president had exceeded the powers granted under existing trade laws.

Background: Reciprocal Tariffs

1. In February 2025, the administration of the US President introduced global reciprocal tariffs, imposing duties on imports from multiple countries.
2. It was aimed to counter what the U.S. perceived as unfair trade practices and trade imbalances.

Supreme Court Ruling

1. The Court held that Congress retains primary authority over tariffs and foreign commerce under the US Constitution.
2. The Court found that the blanket global tariffs went beyond these delegated powers, while Congress has delegated limited tariff powers to the executive through legislation.
3. The decision reaffirmed the principle of checks and balances between the executive and legislative branches in trade policy.

Financial Implications

1. The US government may need to refund more than \$100 billion collected as tariff revenue.
2. The refunds would primarily go to American importers who paid the duties under the invalidated tariff policy.
3. This could create a significant budgetary impact and administrative challenge for the US government.
4. Tariffs often function as a tax on domestic consumers and firms, because importers usually bear the cost.

Significance for Global Trade

1. Reassertion of Congressional Authority: The decision reinforces that trade policy ultimately falls under Congress's constitutional powers over foreign commerce.
2. Limits on Presidential Trade Powers: It clarifies the limits of executive authority under laws such as emergency economic powers or trade statutes.
3. Impact on Global Trade Relations: The rollback of sweeping tariffs could reduce tensions with trading partners and affect ongoing trade negotiations.
4. Legal Precedent: The judgment may influence future challenges to unilateral trade actions by US presidents.

14. Kashiwazaki-Kariwa Nuclear Power Plant: Japan

Context

Recently, Japan restarted the Kashiwazaki-Kariwa Nuclear Power Plant located in Niigata Prefecture, marking a major step in reviving its nuclear energy sector.

About Kashiwazaki-Kariwa Nuclear Power Plant

1. It is the largest nuclear power station in the world by installed capacity (around 7.9 GW), operated by the Tokyo Electric Power Company (TEPCO).
2. It had remained offline since the 2011 Fukushima Daiichi nuclear disaster, which triggered nationwide shutdowns of nuclear reactors and stricter safety regulations.
3. Location: Niigata Prefecture, Japan
4. Technology: Advanced Boiling Water Reactors (ABWR) and Boiling Water Reactors (BWR)

Reasons for Restart

1. Energy Security: Japan imports most of its fossil fuels. Restarting nuclear plants reduces dependence on imported coal, oil, and LNG.

2. **Climate Commitments:** Nuclear energy is a low-carbon source that helps Japan meet its carbon neutrality target by 2050.
3. **Rising Energy Costs:** Fossil fuel imports surged after the Fukushima shutdown, increasing electricity prices.
4. **Energy Transition:** Nuclear power is considered part of Japan's balanced energy mix alongside renewables.

Safety and Regulatory Measures

1. After Fukushima, Japan introduced one of the strictest nuclear safety regimes in the world. Key steps before restart include:
2. Approval from the Nuclear Regulation Authority (NRA);
3. Enhanced seismic and tsunami safety measures;
4. Improved emergency response systems;
5. Strengthened cybersecurity and security protocols;
6. These measures aim to rebuild public trust and ensure operational safety.

Significance for Japan's Energy Policy

1. The restart reflects a broader shift in Japan's energy strategy:
2. Reintegrating nuclear power into the national energy mix;
3. Supporting decarbonization and climate goals;
4. Stabilizing electricity supply amid global energy uncertainties;
5. The move signals that nuclear power will remain a key component of Japan's long-term energy transition strategy.

15. Measles Outbreak in Mexico: Threat to Measles-Free Status

Context

Mexico has reported around 9,000 measles cases by mid-February, marking a major resurgence of the disease since an outbreak began in early 2024.

About Measles

1. Measles is a highly contagious viral disease caused by the Measles morbillivirus.
2. It spreads through respiratory droplets and close contact.
3. Symptoms include fever, cough, conjunctivitis, and a characteristic skin rash.
4. Severe cases may lead to pneumonia, encephalitis, and death, especially among children.

Measles Elimination Efforts in the Americas

1. The PAHO-led measles elimination programme significantly reduced cases across the Americas in the 1990s through mass immunization and surveillance.
2. By the mid-1990s, several countries, including Mexico, achieved interruption of endemic measles transmission.
3. The Region of the Americas was declared measles-free in 2016, becoming the first WHO region to achieve this milestone.

Implications

1. Loss of measles-free status could indicate re-establishment of endemic transmission.
2. It may require intensified immunization campaigns and surveillance measures.
3. The situation highlights the importance of maintaining herd immunity (~95% vaccination coverage).

16. Tightening Industrial Emission Standards in Delhi-NCR

Context

Recently, the Commission for Air Quality Management (CAQM) in Delhi-NCR tightened particulate matter emission standards for 17 highly polluting industries that operate boilers, thermic fluid heaters and furnaces.

Background

1. Air pollution in the Delhi–National Capital Region (NCR) is significantly influenced by industrial emissions, vehicular pollution, and construction activities.
2. Industrial units operating boilers, thermic fluid heaters, and furnaces release substantial amounts of particulate matter (PM), which contributes to poor air quality and adverse health impacts.

New Norms by the CAQM

1. CAQM introduced stricter particulate matter emission standards for 17 highly polluting industries operating in Delhi-NCR.
2. Key Provisions:
3. Revised emission limit: 50 mg/Nm³ for particulate matter.
4. Earlier standard: 150 mg/Nm³.
5. Implementation deadline: October (same year).
6. Industries covered: Units operating boilers, thermic fluid heaters, and furnaces.
7. It represents a threefold tightening of permissible emissions, aligning industrial operations with more stringent pollution control measures.

Rationale Behind the Decision

1. Control of Particulate Pollution: Industrial combustion processes are a major source of PM₁₀ and PM_{2.5}, which significantly degrade urban air quality.
2. Public Health Concerns: High particulate concentrations are associated with respiratory illnesses, cardiovascular diseases, and premature mortality.
3. Technological Feasibility: Pollution-control technologies such as electrostatic precipitators (ESPs), bag filters, and scrubbers can significantly reduce particulate emissions to below 50 mg/Nm³.
4. Regional Air Quality Management: The measure supports broader strategies to mitigate severe pollution episodes in Delhi-NCR identified in air-quality modelling studies.

Expected Impact

1. Improved air quality in the Delhi-NCR region.
2. Technological upgrades in industrial pollution-control systems.
3. Better compliance monitoring through stricter emission norms.
4. Reduction in health risks associated with particulate pollution.

Way Forward

1. Adoption of advanced pollution-control equipment in industries.
2. Strengthening monitoring systems such as Continuous Emission Monitoring Systems (CEMS).
3. Integration with broader initiatives like National Clean Air Programme (NCAP) to achieve sustainable air-quality improvements.

17. Suspected Water Contamination and Illness Outbreak

Context

Recently, Chhainsa village in Palwal district of Haryana witnessed a serious public health incident where at least a dozen people died after experiencing symptoms such as fever, cough, body ache, and vomiting.

Background of the Incident

1. The sudden cluster of illnesses raised concerns about a possible localised disease outbreak, prompting health authorities to investigate the cause.

Suspected Cause: Contaminated Drinking Water

1. Initial investigations suggested that the contamination of drinking water might have been the primary cause of the illness.
2. Rural water supply systems often face risks such as sewage mixing, poor sanitation infrastructure, and inadequate water treatment, which can lead to outbreaks of waterborne diseases.
3. Unsafe drinking water remains a major public health concern in developing regions and can trigger outbreaks of infectious diseases affecting large populations.

Detection of Hepatitis B and C

1. Health officials reported that some patients tested positive for Hepatitis B and Hepatitis C infections.
2. These viruses primarily affect the liver and can lead to severe health complications if untreated.
3. The presence of such infections during an outbreak may indicate pre-existing infections or co-morbidities among affected individuals, while Hepatitis B and C are usually transmitted through infected blood or bodily fluids, requiring further epidemiological investigation.

Public Health Significance

1. The incident highlights broader public health challenges in rural India, including:
2. Poor water quality and sanitation;
3. Weak disease surveillance systems;
4. Limited healthcare access in villages;
5. Research indicates that microbial contamination of drinking water is a major driver of disease outbreaks, especially in regions with inadequate sanitation infrastructure.
6. Such events emphasize the need for robust water quality monitoring and rapid outbreak response mechanisms.

Way Forward

1. To prevent similar incidents, the following measures are essential:
2. Strengthening rural drinking water infrastructure;
3. Regular water quality testing and monitoring;
4. Improving sanitation and sewage management;
5. Community awareness about safe water practices;
6. Enhanced disease surveillance and rapid response teams;
7. Ensuring safe drinking water and effective public health surveillance is crucial to preventing outbreaks and safeguarding rural populations.

18. India–WFP Rice Supply Agreement (2026)

Context

Recently, the Food Corporation of India (FCI) signed a five-year Memorandum of Understanding (MoU) with the United Nations World Food Programme (WFP), aiming to support global humanitarian food assistance programmes by supplying rice from India's public food grain stocks.

Key Provisions of the Agreement

1. Quantity: India will supply 200,000 tonnes of rice to the WFP.
2. Duration: The agreement is valid for five years.
3. Price: The rice price is fixed at ₹2,800 per quintal until March 31, 2026, after which it will be reviewed annually.
4. Implementing Agency: The Food Corporation of India (FCI) will handle procurement and supply.

Significance for Global Food Security

1. The supply will support humanitarian relief operations in food-insecure regions across the world.
2. It strengthens international cooperation in addressing global hunger.
3. The initiative demonstrates India's role as a reliable supplier of food grains due to its large public buffer stocks.

Importance for India

1. Enhances India's global humanitarian role in combating hunger.
2. Supports food diplomacy and soft power.
3. Utilizes surplus buffer stocks maintained by FCI under India's food security system.

About the World Food Programme (WFP)

1. Established: 1961 by the United Nations and FAO.
2. Headquarters: Rome, Italy.
3. Mandate: Provides emergency food assistance and works to eliminate hunger globally.

4. Recognition: Awarded the Nobel Peace Prize in 2020 for efforts to combat hunger.

About the Food Corporation of India (FCI)

1. Established: 1965 under the Food Corporations Act, 1964.
2. Functions:
3. Procurement of food grains at Minimum Support Price (MSP)
4. Maintenance of buffer stocks
5. Distribution of grains under the Public Distribution System (PDS).

19. Solar Expansion and The Threat to Khejri Trees and Orans in Rajasthan

Context

Rapid expansion of solar infrastructure has raised environmental and socio-ecological concerns like indiscriminate felling of Khejri trees and encroachment on Orans, which are integral to the ecology and livelihoods of the Thar Desert communities.

Khejri Tree

1. The Khejri tree (*Prosopis cineraria*), the state tree of Rajasthan, is a keystone species in the arid ecosystems of the Thar Desert.
2. It plays a vital role in sustaining desert biodiversity and supporting local agriculture.
3. Key ecological functions:
4. Soil fertility improvement: Being a nitrogen-fixing species, it enriches soil quality and supports crop growth.
5. Drought resilience: Its deep root system helps stabilize sandy soils and withstand extreme arid conditions.
6. Habitat for biodiversity: It provides shelter and food for birds, insects, and small mammals.
7. Agroforestry support: Crops such as millets and pulses often grow better under Khejri-based agroforestry systems.
8. The tree holds strong cultural value, particularly among the Bishnoi community, known for their historical sacrifice during the 1730 Khejarli movement to protect Khejri trees.

Orans: Community-Conserved Sacred Groves

1. Orans are traditional sacred groves protected by local communities in Rajasthan.
2. These landscapes are dedicated to local deities and function as community-managed ecosystems.
3. Importance of Orans:
4. Biodiversity conservation: They preserve native desert flora and fauna.
5. Grazing grounds: Local pastoral communities depend on them for livestock grazing.
6. Water sources: Orans often include ponds or catchments that help recharge groundwater.
7. Cultural heritage: Community norms and religious beliefs protect these landscapes from exploitation.
8. Thus, Orans act as community forests and rangelands, contributing to ecological stability in the fragile desert environment.

Solar Power Expansion and Emerging Concerns

1. Encroachment on Orans: In recent years, large tracts of land traditionally classified as Orans or common grazing lands have been allocated to solar companies. This has led to:
2. Loss of grazing land for pastoral communities;
3. Disruption of local livelihoods;
4. Weakening of community-based conservation systems;
5. Felling of Khejri Trees: The installation of solar panels often requires clearing vegetation. As a result:
6. Large numbers of Khejri trees are being cut down.
7. This disrupts the fragile desert ecosystem and agroforestry systems.
8. It may also reduce habitat for desert wildlife.

9. This paradox highlights a key policy challenge: renewable energy expansion should not undermine local ecosystems and community rights.

Way Forward

1. Legal recognition of Orans as community forests or protected areas.
2. Mandatory ecological impact assessments before allocating land for renewable energy projects.
3. Integrating solar projects with agroforestry systems instead of clear-felling vegetation.
4. Community participation in land-use decisions to safeguard livelihoods.
5. Protection of keystone species like Khejri through strict conservation policies.

20. Conservation Of Ruddy Shelduck in Mudh Valley, Ladakh

Context

For over two decades, residents of Mudh village in eastern Ladakh have been actively protecting the ruddy shelduck (*Tadorna ferruginea*) through a community initiative called Cha Tsogspa (Bird Association).

About Ruddy Shelduck (*Tadorna Ferruginea*)

1. It is also known as the Brahminy duck, is a migratory waterbird found across Europe and Central Asia and wintering in South Asia.
2. Ladakh hosts one of the important breeding habitats in India, especially in high-altitude wetlands and river valleys.
3. IUCN Status: Least Concern
4. Breeding in India: Primarily in eastern Ladakh wetlands and river valleys
5. Local Name in Ladakh: Cha muru

Cha Tsogspa: Community Conservation Initiative

1. Origin of the Initiative: The conservation effort began in 2003 after the Dalai Lama's visit to Ladakh.
2. Conservation Activities:
3. Monitoring breeding sites during the breeding season;
4. Escorting fledglings safely from valley nesting areas to the Indus River;
5. Protecting birds from predators such as stray dogs;
6. Using binoculars and cameras for monitoring and documentation;
7. Over the past two decades, the community has helped protect around 200–300 ruddy shelduck fledglings.

Challenges in Conservation

1. Stray Dogs: Increased army deployment in eastern Ladakh has led to food waste that attracts stray dogs, posing a threat to fledglings.
2. Habitat Pressure: Infrastructure expansion and human activities in Trans-Himalayan landscapes affect breeding habitats.
3. Lack of Scientific Data: There is limited systematic research on population trends of ruddy shelduck in Ladakh, making conservation planning difficult.

Other Important Migratory Bird: Bar-headed Goose

1. The Mudh community also monitors the bar-headed goose (*Anser indicus*), locally known as Cha nangpa.
2. Key Characteristics:
3. Known as the world's highest-flying migratory bird;
4. Often observed crossing the Himalayas and even Mount Everest;
5. Breeds in wetlands such as Tso Moriri and Tso Kar, both Ramsar sites;
6. The species is considered an important indicator of high-altitude wetland ecosystems.

Importance of Ladakh Wetlands

1. Eastern Ladakh contains several crucial breeding habitats for migratory birds, including Tso Moriri, Tso Kar, Puga, Chushul, and Hanle.
2. These wetlands support multiple waterbird species and are part of the Central Asian Flyway.

Significance for Conservation and Policy

1. Community-based conservation models in remote regions;
2. Integration of traditional ecological knowledge with wildlife protection;
3. The need for regulated development in fragile Himalayan ecosystems;
4. Importance of protecting high-altitude wetlands and migratory bird habitats
5. Such grassroots initiatives complement formal conservation programs and help maintain biodiversity in ecologically sensitive regions.



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GS Paper: General Studies III (GS-3)

Subject: Science and Technology; Economic Development; Environment; Disaster Management

Topic & Sub-Topics:

1. IT & Computers: Artificial Intelligence (AI) and Digital Public Infrastructure (DPI).
2. Cyber Security: Cyber threats, data privacy, and digital trust architectures.
3. Space & Deep-Tech: Indigenous technology, private sector participation, and frontier computing.
4. Disaster Management: Disaster Risk Reduction (DRR), institutional frameworks, and climate resilience.
5. Environment & Infrastructure: Green technology, renewable energy transition, and circular economy.

1. Artificial Intelligence at Population Scale

Introduction

Artificial Intelligence (AI) is evolving into India's next frontier of Digital Public Infrastructure (DPI), building upon the foundational triumphs of Aadhaar, UPI, and Digi Locker. By unifying data ecosystems, compute infrastructure, and public governance, India is pioneering a unique model of population-scale digital innovation engineered to drive economic growth, maximize social inclusion, and uplift human development.

AI as a Tool for Public Good (Sectoral Transformation): India's focus centers strictly on real-world deployment across foundational sectors rather than restricted, experimental research labs:

Agriculture: Deploying AI-enabled voice-based assistants to help farmers effortlessly navigate welfare schemes, carry out automated crop surveys, and receive localized weather advisories in regional languages, eliminating critical information asymmetry.

Healthcare: Scaling AI-powered diagnostic tools to assist frontline healthcare workers in early, rapid detection of critical diseases like tuberculosis and diabetic retinopathy, substantially boosting public health outcomes.

Fintech: Integrating AI with UPI systems to enable voice-activated digital payments, driving financial inclusion deep into low-literacy and rural demographics.

Governance & Judiciary: Deploying AI-driven, real-time translation and transcription systems to enhance administrative efficiency and streamline access to justice across a linguistically diverse country.

India AI Impact Summit 2026 & Global Leadership: This landmark event shifted the international narrative away from basic AI risk and regulation toward harnessing AI for development and public good. The globally endorsed New Delhi Declaration (signed by 90+ nations) focused heavily on:

1. Democratizing universal access to AI infrastructure.
2. Promoting inclusive, ethical, and human-centric AI ecosystems.
3. Developing highly secure, trusted architectures while building AI-ready human capital and resilient infrastructure.
4. Positioning India as a primary architect for Global South-centric AI governance frameworks.

The IndiaAI Mission (Foundational Infrastructure): An initiative aimed at completely democratizing core AI resources through a three-tiered structural framework:

1. **Compute Infrastructure:** Setting up shared Graphic Processing Unit (GPU) clusters available to startups, researchers, and public labs at heavily subsidized rates (\$ \approx ₹65 to ₹100 per hour).
2. **Data Ecosystem (AIKosh Platform):** Constructing a central repository hosting over 10,000+ distinct datasets and 286+ pre-trained AI models tailored specifically to solve Indian socio-economic challenges.

3. **Application Layer (Governance Integration):** Actively applying a whole-of-government approach to deploy AI for direct public utility, including crop monitoring, real-time disaster prediction (floods, landslides), beneficiary verification, and healthcare diagnostics.

Building an Inclusive AI Innovation Ecosystem: Focuses on shifting innovation away from Tier-1 metros by setting up dedicated AI labs and training centers in Tier-2 and Tier-3 cities.

1. Massive literacy drives like YUVA AI for ALL are integrated across public platforms like DIKSHA and iGOT Karmayogi.
2. Comprehensive startup support is provided through strategic funding, mentorship, and international collaborations.
3. Ensuring data safety and transparency by introducing robust deepfake detection, digital AI watermarking, and model evaluation frameworks.

Significance: Extends the standard DPI philosophy to AI-driven governance, improves service delivery, minimizes linguistic barriers, bridges the digital divide, and functions as an affordable, scalable blueprint for developing countries.

Challenges: Stubborn digital divides regarding infrastructure access; pervasive concerns surrounding data privacy, system security, and ethical deployment; a prominent skill gap in the workforce; and a pressing need for stronger inter-institutional coordination.

Way Forward:

Expand inclusive digital networks, deepen AI literacy, establish robust data governance and ethical AI regulations, and actively champion public-private partnerships (PPPs) alongside global tech collaborations.

2. Cyber Security and Digital Trust

Introduction

In an era shaped by hyper-digital transformation, cybersecurity has transitioned from a backend technical requirement to the ultimate cornerstone of digital trust, national sovereignty, and economic stability. As the massive convergence of Biotechnology, Robotics, Artificial Intelligence, and Nanotechnology (BRAIN) accelerates, modern systems—ranging from smart vehicles to national governance networks—are becoming deeply interconnected, rapidly expanding the cyberattack surface. Consequently, future cyber readiness relies heavily on systemic resilience and trust-based ecosystems.

Evolving Cyber Threat Landscape: Operating within a highly volatile, uncertain, complex, and ambiguous (VUCA) environment, modern systems integrate physical machinery, digital software (AI networks), and unpredictable human interfaces. This cross-convergence exposes vulnerabilities across multiple vectors:

1. Supply Chain Risks: Compromised or malicious hardware components.
2. Network Threats: GPS spoofing, satellite disruptions, or attacks on critical undersea cables.
3. Software Flaws: Malicious software updates and crippling ransomware.
4. Application Vulnerabilities: Data theft and illicit remote control of critical infrastructure.
5. Human Elements: Sophisticated social engineering and phishing campaigns.

Key Cyber Frauds Active in the Ecosystem:

As highlighted by the Enforcement Directorate, prominent frauds target various vulnerable points:

Pig Butchering: Scammers lure victims into fake romantic relationships or job offers, build emotional trust, and subsequently defraud them via fake investment schemes.

Phantom Hacking: Fraudsters masquerade as government officials or tech support, falsely claim the victim's bank account or device is compromised, and trick them into transferring funds to a "safe account" controlled by the attacker.

Online Betting and Gambling: Illicit, unauthorized platforms draw users into rigging games with false promises of massive financial returns.

Instant Loan Apps: Rogue apps offer quick, document-free micro-loans, exploit personal user data from devices, and blackmail victims for exorbitant repayments through threats without ever disbursing the actual loan amounts.

The Multi-Layered Cybersecurity Architecture: Effective defense requires enforcing rigorous security standards across six distinct, interconnected layers simultaneously:

1. Material & Communication Layer: Securing hardware supply chains, satellite uplinks, and physical telecom networks.
2. Hardware & Systems Layer: Countering dangerous backdoor implants and the manipulation of core control systems.
3. Operating System & Network Layer: Mitigating unpatched OS update bugs, broken network protocols, and ransomware.
4. Application Layer: Securing vulnerable APIs, untrusted applications, and cloud storage breaches.
5. Task/Functional Layer: Defending against algorithmic manipulation and malicious system operation overrides.
6. Human Layer: Addressing the weakest link by building behavioural resilience against social engineering.

Digital Trust & Cyber Resilience: Moving beyond mere threat prevention, current policies champion **cyber resilience**. This focuses on real-time threat detection, rapid recovery mechanisms, and maintaining continuous operational workflows even during an active attack. Digital trust is reinforced by deploying **Public Key Infrastructure (PKI)** to manage bulletproof authentication, data encryption, and systemic integrity.

Stakeholder Responsibilities:

1. Government: Standardizing robust regulatory legal frameworks, investing heavily in dedicated cyber-talent, and sharing real-time global threat intelligence.
2. Industry: Practicing "security-by-design" product development, continuous network auditing, and responsible data management.
3. Citizens: Practicing basic everyday cyber hygiene and upgrading general digital awareness.

Challenges & Vulnerabilities: The rapidly increasing sophistication of attacks, an acute domestic shortage of skilled cybersecurity professionals, complex data privacy governance issues, and systemic dependence on foreign digital assets (like satellites and undersea fiber paths).

3. India's Space and Deep-Tech Ecosystem

Introduction

In the contemporary global dynamic, national power is measured by technological depth and sovereignty rather than basic industrial manufacturing capacity. India's space and deep-tech ecosystem reflect a strategic transformation from a basic technology service provider to a pioneering frontier technology creator, directly feeding into the national vision of Viksit Bharat @2047.

Evolutionary Context: Rooted originally in pure socio-economic development under Dr. Vikram Sarabhai, ISRO successfully established core capabilities across satellite communications, remote sensing, indigenous planetary navigation (NavIC), and deep space exploration. Highly cost-effective landmark triumphs—including the Mars Orbiter Mission (MOM), the Chandrayaan Programme, and the Aditya-L1 solar probe—have permanently secured India's position among elite spacefaring powers.

The Paradigm Shift to a Public-Private Ecosystem: Recent reforms have broken the traditional state-driven monopoly, introducing an expansive commercial startup environment. The regulatory body IN-SPACe has successfully enabled this change by:

1. Opening the space sector to direct private capital and independent corporate participation.
2. Empowering private firms to build proprietary satellites, operate custom launch vehicles, and market downstream space services.
3. Transforming domestic industry players from simple component sub-contractors into independent end-to-end aerospace market leaders.
4. Private Space Sector Innovations: High-tech startups are capturing critical points across the aerospace value chain:

5. **Launch Systems:** Ventures like Sky root Aerospace and Agnikul Cosmos are actively engineering customized, highly flexible small satellite launch vehicles to satisfy the global demand for immediate small-satellite constellations.
6. **Satellite & Data Economy:** Enterprises like Pixel are putting advanced hyperspectral satellites into orbit to harvest rich data analytics for precision agriculture monitoring, urban development, and global climate analysis.
7. **Deep-Tech as a Strategic Stack Enabler:** The space ecosystem is heavily reinforced by a cluster of foundational, sovereign deep technologies:
 1. **AI & Analytics:** Automating the processing of massive satellite telemetry and climate tracking maps.
 2. **Semiconductors:** Domestic fabrication of specialized, radiation-hardened microchips designed to survive extreme cosmic rays.
 3. **Quantum Tech:** Engineering un-hackable, quantum-encrypted secure satellite communication links.
 4. **Robotics & Automation:** Optimizing high-precision automated spacecraft assembly and surface exploration rovers.
 5. **Policy Pillars:** This tech stack is driven by government initiatives like the National Quantum Mission, the India Semiconductor Mission, and the proposed National Deep Tech Startup Policy.

Societal Applications for Public Welfare: India's advanced tech remains dedicated to grassroots development. For instance, the Bharat-VISTAAR platform seamlessly merges real-time satellite imagery, AI models, and weather data to provide hyper-local agricultural advisories, optimize crop productivity, assess environmental risks, and handle regional disaster mitigation.

Strategic Autonomy & Future Trajectory: Cultivating an indigenous semiconductor system and scaling NavIC significantly limits reliance on unpredictable foreign frameworks, reinforcing national security. Simultaneously, India is acting as a reliable technology partner by supplying cost-effective space solutions across the Global South. The road to 2047 remains defined by the Gaganyaan human spaceflight mission, plans for a permanent indigenous space station, deep lunar surface exploration, and expanding deep-tech research labs.

4. From Relief to Resilience (Disaster Risk Reduction)

Introduction

India's current developmental path dictates that economic expansion cannot be sustained without building safe, resilient infrastructure. With the intensifying frequencies of multi-hazard heatwaves, urban deluges, and acute health emergencies, disasters are treated as complex, systemic risks rather than isolated incidents. Thus, public policy has engineered a major structural shift from old-school, reactive, relief-centric compensation to proactive, risk-informed, asset-resilient governance.

The Changing Risk Landscape: Driven heavily by three key structural shifts:

1. **Climate-Induced Intensification:** Pervasive, severe weather extremes like sudden cloudbursts, high-intensity cyclones, and extended heatwaves.
2. **Cascading and Interconnected Risks:** A singular hazard now triggers systemic failures across multiple overlapping sectors simultaneously (e.g., paralyzing transport, grids, health centers, and supply lines).
3. **Rising Urban Vulnerabilities:** Rapid, unplanned urbanization sprawling directly over hazard-prone zones, requiring future-projection planning over historical data.

Institutional Architecture: Mainstreaming Disaster Risk Reduction (DRR) directly into standard urban planning via the legal mandate of the Disaster Management Act, 2005 (establishing 3-tier national, state, and district networks), the policy execution of the NDMA, and the National Disaster Management Plan (NDMP), which is aligned with the global Sendai Framework.

The Aswal Model (Risk-Informed Governance): This model integrates rigid quality-assurance metrics into civic governance, emphasizing that resilience must be engineered into public infrastructure during the design phase rather than added after a failure. It functions via 4 interlinked stages:

1. Risk Knowledge: Mapping scientific vulnerability utilizing geospatial software, AI models, and real-time data.
2. Decision Support: Translating raw data maps into strict localized building codes and zoning laws.
3. Implementation: Ensuring institutional execution, active bureaucratic regulation, and local training.
4. Learning & Adaptation: Conducting analytical post-disaster audits to upgrade future defensive systems.

Empirical Analysis of the Indian Experience:

Risk Area / Hazard	What Science & Data Provide	What Governance Does	Visible Outcome
Cyclones (East Coast)	Accurate tracking, storm surge modelling.	Automated early warning, mass evacuations, cyclone shelters.	Sharp, historic reductions in the loss of human lives.
Heat Waves	Precise temperature forecasts, health risk analytics.	Executing localized Heat Action Plans, hospital preparedness.	Minimizing heat-related public mortality rates.
Urban Floods	Rainfall modelling, drainage mapping.	Flash alerts, traffic redirections, stormwater upgrades.	Accelerated post-flood recovery (though execution gaps persist).
Earthquakes	Seismic zoning maps, structural design standards.	Implementing building codes, structural retrofitting.	Reduced building collapses where codes are enforced.
Landslides	Rainfall threshold markers, remote sensing terrain maps.	Safe route planning, slope protection infrastructure.	Reduced vulnerability across hill highways and settlements.
Industrial Risks	Exposure analysis, rigorous safety audits.	Strict safety inspections, emergency management plans.	Noticeable improvements in industrial crisis prevention.

Systemic Gaps & Challenges: Persistent weaknesses in integrating scientific risk data into everyday municipal planning; weak enforcement of localized structural codes; severe resource and capacity constraints across local urban bodies (ULBs); and poor inter-agency data sharing.

Way Forward: Mandate risk-informed structural engineering across all public infrastructure, deploy AI-backed district risk dashboards, upgrade local municipal funding, and foster community-led participatory disaster response networks.

5. Green Technologies for India's Sustainable Future

Introduction

India's developmental blueprint toward Viksit Bharat @2047 balances economic growth with environmental stewardship by transitioning toward a low-carbon, highly resource-efficient circular economy. This green transformation combines traditional ecological values with cutting-edge modern clean technology.

Conceptual Distinctions in Sustainable Tech:

Green Tech: Employs science and technology to safeguard the planet's natural resources and limit human environmental degradation (e.g., sustainable farming, eco-friendly goods).

Clean Tech: Specifically optimizes performance and operational efficiency while reducing waste and negative environmental impacts (e.g., solar panels, wind turbines, wastewater treatment).

Climate Tech: Focuses directly on mitigating greenhouse gas emissions and countering human-induced climate change (e.g., carbon capture systems, electric vehicles).

Energy Transition and Renewable Growth Metrics:

India is the 4th largest producer of renewable energy globally. As of January 2026, the energy architecture stands as follows:

1. Total Non-Fossil Capacity: \$ \approx \$ 272 GW, making up roughly 51.5% of India's total installed power capacity.
2. Solar Leadership: Dominating with 107+ GW from ground-mounted commercial stations and 24+ GW from rooftop setups.
3. The Storage Target: To sustain grid stability during peak variations, India requires 16.13 GW / 82.37 GWh of energy storage by 2026–27, driven by pumped hydro and Battery Energy Storage Systems (BESS) funded via Viability Gap Funding (VGF).

Power Capacity Share Analysis (As of October 2025 Data):

1. Coal: 218.3 GW (43.2%)
2. Solar: 129.9 GW (25.7%)
3. Hydro: 55.5 GW (11.0%)
4. Wind: 53.6 GW (10.6%)
5. Gas: 20.1 GW (4.0%)
6. Biomass: 10.8 GW (2.1%)
7. Nuclear: 8.8 GW (1.7%)
8. Lignite & Diesel: 7.2 GW (1.4%)
9. Waste to Energy: 0.0 GW (0.2%)

Green Mobility Framework: Accelerating mass EV adoption across public transit, two-wheelers, and three-wheelers via fiscal schemes like FAME-II and PM E-DRIVE. Long-term success relies heavily on cleanly generated charging electricity, closed-loop lithium battery recycling, and a highly skilled mechanical workforce.

Circular Economy & Waste-to-Wealth: Transitioning away from linear models by enforcing strict Extended Producer Responsibility (EPR) under the E-Waste Management Rules 2022 and Battery Waste Management Rules. Notably, 60% of **legacy urban waste has been processed as of 2026**. Furthermore, the Gobardhan initiative converts rustic organic waste into Compressed Biogas (CBG) and organic manure.

Sustainable Agriculture & Water Management: Integrating climate resilience with resource optimization:

1. Micro-Irrigation: "Per Drop More Crop" protocols now span 95+ lakh hectares.
2. PM-KUSUM: Targeting 34,800 MW of solar capacity dedicated entirely to agricultural water pumping.
3. Water Security: Driven by the Jal Jeevan Mission (rural tap access), AMRUT (urban wastewater treatment), and the Atal Bhujal Yojana (groundwater table replenishment).

Industrial Decarbonization and Green Hydrogen: Targeting hard-to-abate core industrial sectors (steel, cement, chemicals) via market-driven instruments:

1. Perform Achieve and Trade (PAT): Generated 27.07 MTOE in direct energy savings.
2. Carbon Credit Trading Scheme (CCTS): Introducing market-driven compliance mechanisms for carbon reduction.
3. National Green Hydrogen Mission: Displacing fossil fuels in heavy manufacturing.

Nuclear Energy Paradigm Shift: The SHANTI Act 2025 marks a regulatory transformation by opening the historically state-controlled nuclear energy sector to private corporate participation and Foreign Direct Investment (FDI up to 49%), repositioning nuclear power as a clean, reliable baseline source to achieve Net-Zero targets.

Challenges: High capital financing constraints for urban/rural green grids; lack of large-scale energy storage capacity; implementation gaps at the local municipality level; and keeping green technologies affordable and inclusive for lower-income groups.

Way Forward: Classify battery storage as critical national grid infrastructure, strengthen financing avenues for Urban Local Bodies (ULBs), enforce energy-efficient green building codes, and integrate grassroots MSMEs into the clean-tech manufacturing supply chain.

KURUKSHETRA

1. Digital Transformation — Digital Pathways for Rural India

Introduction

Digital empowerment stands as the structural anchor for inclusive growth in rural India. Over the last decade, the expansion of broadband networks, unified public digital data architectures, and frontier conversational Artificial Intelligence (AI) has fundamentally transformed rural socio-economic institutions. By narrowing the urban-rural technological divide, the state is pulling isolated village economies into the formalized, mainstream digital economy.

Drivers and Scale of the Rural Digital Footprint:

Macro Scale Optimization: India's digital ecosystem encompasses nearly 958 million active internet users, with projections firmly on track to hit 1.03 billion by 2026.

Rural-Led Expansion: Rural pockets account for approximately 548 million users (57% of the national aggregate). Notably, rural data adoption is growing four times faster than urban equivalents.

Telecom Infrastructure Cover: Deep penetration is driven by widespread 4G networks covering 95% of the population, a progressive nationwide 5G rollout, and intuitive voice-search AI tools used by 44% of rural internet users to bypass text-literacy barriers.

Policy Framework: This shift is anchored by the Digital India Programme, aimed at transitioning the nation into a digitally empowered knowledge economy.

Digital Infrastructure & Last-Mile Delivery Networks:

Bharat Net Architecture: Serving as the core optical fiber backhaul, it connects over 2.15 lakh Gram Panchayats across the nation, with more than 2.18 lakh Panchayats verified as fully service-ready.

Common Service Centres (CSCs): A distributed retail delivery network of nearly 6 lakh CSC nodes is operational, with 79% explicitly situated in rural landscapes.

Village Level Entrepreneurs (VLEs): Operated locally by VLEs, CSCs function as single-window service hubs providing friction-free access to e-governance, micro-banking, health platforms, and digital literacy portals directly to the grassroots.

Digital Governance, Financial Inclusion, and Leakage-Free Welfare Infrastructure:

Direct Benefit Transfer (DBT) Efficiency: Linking biometric Aadhaar verification with state welfare distribution has minimized structural leakages. By 2025, the framework securely routed over ₹34 lakh crore across 370+ union and state welfare programs, directly benefiting more than 50 crore citizens.

Universal Welfare Linkages: Flagship agrarian and rural job schemes have achieved near-universal Aadhaar integration, explicitly led by PM-KISAN (disbursing funds to \$ \approx \\$ 11.65\$ crore farmers) and MGNREGA.

The JAM Trinity Effect: The synergy between Jan Dhan bank accounts, Aadhaar validation, and Mobile connectivity cut's identity duplication, reducing the incidence of fake or ghost beneficiaries by 20% to 30% across core programs.

UPI Financial Formalization: The Unified Payments Interface (UPI) has restructured everyday rural commerce. Approximately 86.7% of rural youth use UPI platforms daily. Furthermore, 55% of all national UPI transactions originate from rural and semi-urban territories, driving the rapid formalization of the rural economy.

Digital Agriculture and Intelligent Agronomic Technology Stack:

Agri Stack Core Foundation: Digital integration is anchored by Agri Stack alongside the unified Kisan ID network (targeting 20 crore farmers). This infrastructure links farmer identities, land registries, and crop data to support targeted state subsidies and direct credit appraisal.

Precision Farming Applications: Integrating AI algorithms, IoT field sensors, and satellite remote imaging enables precision input application, predictive pest tracking, and crop health mapping. This data-driven model has triggered a 10% to 30% reduction in farmer input costs while optimizing crop yields.

Intermediary-Free Market Access: Platforms like the e-NAM digital marketplace provide transparent price discovery and direct market access, minimizing farmer dependence on exploitative local intermediaries.

Socio-Economic Development and Structural Diversification:

Telemedicine Delivery: The Ayushman Bharat Digital Mission (ABDM) enables portable digital health records and direct telemedicine consultations, bringing healthcare to remote areas.

Grassroots E-Education: Open-access portals like DIKSHA and e-Vidya distribute interactive digital learning resources to compensate for local school infrastructure gaps.

E-Commerce Market Integration: The ONDC (Open Network for Digital Commerce) allows rural artisans, small-scale producers, and micro-enterprises to sell directly to national consumer markets, boosting rural entrepreneurship.

Systemic Challenges & Constraints: Pervasive connectivity gaps across remote and tribal areas; low digital literacy levels among elderly and marginalized populations; and rising cybersecurity vulnerabilities alongside data privacy risks.

Way Forward: Expand broadband fiber and 5G cellular infrastructure to underserved areas; strengthen targeted digital capacity-building drives; increase public-private partnerships (PPPs) in Agri-tech; and implement robust data governance and cybersecurity frameworks.

2. Food Safety in the Digital India Era

Introduction

Food safety constitutes an uncompromisable pillar of public health, consumer protection, and macro-economic development. Managing food safety in India is an immensely complex challenge, given its large population, highly diverse food sub-cultures, and a massive network of over 6 million Food Business Operators (FBOs). Fast-paced urbanization, an expanding food processing sector, the growth of food delivery apps, and rising consumer awareness necessitate a highly modern regulatory model. Under the Digital India framework, technology-driven governance has modernized the national food safety regulatory architecture.

Structural Shift in Governance (Traditional vs. Digital Ecosystem): The Food Safety and Standards Authority of India (FSSAI), operating under the Food Safety and Standards Act, 2006, has transitioned national food safety from a slow, reactive mechanism into a preventive, data-backed model:

Regulatory Metric	Traditional Food Safety Framework	Modern Digital Food Safety Framework
Licensing & Registration	Slow, paper-based physical applications.	Unified online tracking via FoSCOS .
Enforcement Inspection	Subjective, manual physical inspections.	Mobile-based, real-time digital inspections.
Data Management	Fragmented, isolated paper records.	Centralized national databases.
Market Monitoring	Reactive, post-incident approach.	Real-time tracking and predictive monitoring.
Grievance Redressal	Opaque, limited consumer grievance options.	Transparent, direct online grievance platforms.
Ecosystem Transparency	Low structural transparency.	High transparency with trackable workflows.
Response Velocity	Slow, bureaucratic delayed responses.	Fast, immediate data-backed mitigation.

FSSAI's Core Integrated Digital Initiatives:

FoSCOS (Food Safety Compliance System): A single-window cloud architecture that enables online licensing, registration, and compliance tracking. It maintains a centralized national database of food businesses, enhancing regulatory oversight and supporting the Ease of Doing Business.

InFoLNet (Indian Food Laboratory Network): This platform fully digitizes sample testing, lab reporting, and inter-lab data sharing. It seamlessly connects national, state, and private labs into a single network, providing empirical data to support evidence-based policymaking.

Food Import Clearance System (FICS): An online platform providing risk-based, real-time clearance for imported food shipments. Integrated with the customs network ICEGATE-SWIFT, it ensures strict quality control on all food imports without bottlenecking trade velocity.

FoSTaC (Food Safety Training & Certification): A digital portal focused on large-scale capacity building for food handlers. It has trained over 16 lakh food safety supervisors and nearly 3 lakh street food vendors, embedding a culture of food hygiene across the country.

Food Safety Connect App & Eat Right India: Consumer-facing digital applications designed for immediate grievance redressal, food violation reporting, and promoting public awareness regarding nutrition, labelling, and safe practices.

The Role of Frontier Technologies in Predictive Governance:

Artificial Intelligence (AI): Machine learning models parse historical compliance records to identify high-risk food establishments and predict potential sanitation violations before they occur.

Internet of Things (IoT): Smart, connected cold-chain sensors log real-time temperature, humidity, and storage variations during transit, eliminating food spoilage.

Blockchain Traceability: Distributed ledgers secure end-to-end "farm-to-fork" traceability, enabling near-instantaneous tracking and isolation of contamination sources during public health recalls.

Significance & Regulatory Impact: This digital ecosystem strengthens public health outcomes by reducing food-borne diseases, boosts export competitiveness by aligning with global quality benchmarks, enhances the ease of doing business for food firms, and fosters consumer trust.

Systemic Challenges: A persistent digital divide affecting small-scale rural vendors; low digital literacy levels among informal street food handlers; and rising concerns regarding data privacy and cybersecurity.

Way Forward: Expand basic digital infrastructure and last-mile connectivity for vendors; strengthen localized training and capacity-building programs; promote deep integration of AI-IoT-Blockchain architectures; and implement robust data protection frameworks.

3. Digitising Cooperatives – PACS In Transition & Rural Governance Reform

Introduction

The digital transformation of rural institutions serves as a vital pathway for inclusive governance in modern India. Among these, Primary Agricultural Credit Cooperative Societies (PACS)—which historically relied on manual accounting and paper ledgers—are undergoing a massive structural reorganization through centralized computerization. This transition extends beyond simple administrative reform; it modernizes the entire rural financial landscape to build a transparent, highly efficient, and accountable cooperative ecosystem.

The Macro Context of Rural Governance Re-Engineering:

1. Driven by expanded internet connectivity (over 100 crore subscribers) and deep mobile penetration, rural governance has experienced rapid digitization.
2. Modern systems like e-Gram Swaraj, SVAMITVA, Bharat Net, and the digitized Public Distribution System (PDS) have collectively improved service delivery, transparency, and accountability at the grassroots level.
3. Aadhaar-based authentication and online tracking platforms have addressed historical administrative challenges—such as delays, poor record-keeping, and leakages—while cutting the incidence of fake beneficiaries by establishing targeted service delivery channels.
4. This foundational digital shift has paved the way for the modernization of cooperative institutions, including PACS, cooperative banks, and dairy cooperatives.

The Strategic Role and Vulnerabilities of Manual PACS:

Credit Backbone: PACS form the baseline of the national rural cooperative credit structure, accounting for nearly 14% of all institutional agricultural credit.

Farmer-Centric Operations: As member-driven institutions, they provide short- and medium-term agricultural credit, supply critical inputs (seeds, fertilizers, pesticides), and offer accessible financial services directly at the village level.

The Manual Bottleneck: Despite their local accessibility and high community trust, their traditional reliance on manual accounting led to operational inefficiencies, loan processing delays, and risks of financial irregularities or lack of transparency.

The PACS Computerization Project (Features & Technical Objectives):

Institutional Mandate: Launched following the creation of the dedicated Union Ministry of Cooperation (2021), the landmark PACS Computerization Project is designed to fully digitize roughly 63,000 functional PACS over a five-year timeline.

ERP Cloud Integration: The project introduces a unified Enterprise Resource Planning (ERP) software platform, linking local PACS with District Central Cooperative Banks (DCCBs), State Cooperative Banks (StCBs), and NABARD.

Hardware Support: The software transition is reinforced by the nationwide deployment of physical computers, biometric authentication devices, and handheld printers.

End-to-End Functional Digitization: The platform automates:

1. Core membership registries and loan portfolio management.
2. Deposit accounts, input procurement, and warehouse inventory tracking.
3. Local PDS operations and seamless Direct Benefit Transfer (DBT) routing.
4. Direct Kisan Credit Card (KCC) integration and RuPay card linkages.
5. Standardized cybersecurity protocols and data management.

Multi-Dimensional Structural Impacts:

Credit Velocity Optimization: Digital records of landholdings and loan histories enable accurate credit appraisal and faster loan disbursement, aligning with agricultural cycles. Automated calculations reduce errors and delays.

Governance Transparency: A common national accounting platform reduces malpractices such as duplicate or fraudulent loans, ensures real-time transaction visibility, and strengthens audit mechanisms. This builds trust among farmers in cooperative institutions.

Multi-Service Transition: Digitization allows PACS to function as multi-functional service nodes. They can operate Common Service Centres (CSCs), Fair Price Shops, and Kisan Samridhi Kendras, generating employment and improving village service delivery.

Democratic Deepening: Real-time record updates improve the accountability of management committees, reinforcing the cooperative ethos.

Systemic Challenges: Significant digital literacy gaps persist among older cooperative society members and local staff; rural power and connectivity issues challenge remote regions; and data security concerns complicate large-scale system integration.

Way Forward: Establish continuous capacity-building and digital training bootcamps for PACS personnel; expand localized connectivity infrastructure; implement strict data protection standards to ensure interoperability across the cooperative banking sector.

4. Smart Panchayats — Grassroots Digital Governance

Introduction

The emergence of Smart Panchayats reflects the modernization of grassroots rural governance through digital technology. Managing over 2.68 lakh Gram Panchayats, Panchayati Raj Institutions (PRIs) constitute the foundational backbone of democratic decentralization in India. Long constrained by manual workflows, poor record keeping, and opaque fund tracking, PRIs are adopting integrated digital architectures. This shift is transitioning local self-governance from a slow bureaucratic structure into a highly transparent, accountable, and citizen-centric democratic model.

Key Digital Initiatives Driving the Smart Panchayat Architecture:

eGramSwaraj & PFMS Integration: A single unified interface combining the eGramSwaraj planning portal with the Public Financial Management System (PFMS). It enables end-to-end digital planning,

standardized accounting, and continuous monitoring of local development works alongside real-time bank transfers, minimizing administrative delays and fiscal leakages.

Meri Panchayat App & Panchayat NIRNAY: Mobile-first user applications that provide citizens direct access to local financial files, allocated budgets, ongoing asset spending, and historical minutes of council decisions, driving participatory democracy.

SabhaSaar (AI-powered Tool): An advanced Artificial Intelligence tool that records local Gram Sabha proceedings via automatic speech-to-text, generating instant bilingual summaries and official transcripts. By 2026, 1.15 lakh Panchayats (approx 43%) have deployed SabhaSaar, with states like Tamil Nadu and Odisha achieving near-universal implementation.

SVAMITVA Scheme: A landmark initiative utilizing high-resolution drone mapping to survey rural inhabited land parcels. It generates legal property ownership cards, reducing property disputes, streamlining local tax planning, and unlocking asset-backed credit access for rural homeowners.

Gram Manchitra (GIS Platform): A comprehensive Geo-Spatial Information System (GIS) application that allows Panchayats to practice scientific spatial planning for infrastructure projects (roads, schools, clinics) using precise satellite layers.

AuditOnline Platform: A system designed for digital financial auditing of Panchayat accounts. It minimizes the misuse of public funds by enforcing strict financial discipline and ensuring public accountability.

BharatNet & PM-WANI: High-speed broadband fiber backhauls coupled with PM-WANI public Wi-Fi access points provide the essential telecom infrastructure needed to run digital governance services across rural communities.

Core Functional Modules of Panchayat Digitization: As standardized by the Ministry of Panchayati Raj, digitization transforms six core functional areas:

1. Finance and Accounting: Automatically organizes and displays all Panchayat income streams and asset expenditures in a clear, standardized format.
2. Panchayat Profiling: Electronically records and stores local election data, elected representative details, and active planning committees in a single profile.
3. Geo-Tagging of Assets: Mandates the use of mobile GPS applications to map and photograph local infrastructure works, verifying project implementation.
4. Action Plan Creation: Employs automated budgeting systems to help draft realistic annual village action plans based on available funds.
5. Progress Tracking and Reporting: Provides live dashboard updates on whether an approved public project is actively running, completed, or halted.
6. Activity Output Integration: Links transaction data across distinct functional modules to ensure continuous progress tracking.

Systemic Challenges: Persistent connectivity gaps disrupt operations across remote and tribal borderlands; a gender digital divide limits the active participation of women representatives; and language barriers on portals restrict accessibility for marginalized groups.

Way Forward: Ensure reliable broadband up-time to all villages; promote regional language user interfaces; implement gender-inclusive digital policies to empower women within PRIs; and improve the accessibility of devices.

5. AgriTech and The Data-Driven Rural Economy

Introduction

Agriculture remains the core economic driver of rural India, directly supporting nearly half of the national workforce. However, traditional agricultural systems face structural challenges, including fragmented landholdings, climate volatility, and limited market access, which suppress crop yields and lead to unstable farm incomes. Powered by expanding digital infrastructure, the rapid rise of the Agri Tech sector is driving a structural transition toward a modern, data-driven rural economy.

Agri Tech as a Driver of Macro Rural Transformation:

1. Agri Tech integrates Artificial Intelligence, specialized drone hardware, satellite remote sensing, IoT arrays, and open digital marketplaces to support data-backed farming decisions.
2. These systems bridge traditional information gaps between isolated farmers, buyers, banks, and agronomic research centers.
3. Widespread adoption has shown the potential to increase average farmer net incomes by 25% to 35%, contributing directly to UN Sustainable Development Goals.

Core Technological Vectors and Their Direct Impact:

AI-Backed Agrometeorological Advisory Systems: Machine learning models analyse real-time soil data, short-range weather patterns, satellite indexes, and historical pest migrations to deliver location-specific crop advisories.

Kisan e-Mitra: A multilingual, voice-enabled AI chatbot that handles thousands of daily complex queries regarding agricultural schemes and troubleshooting.

National Pest Surveillance System (NPSS): An automated imaging system that enables early pest detection and automated treatment advisories across 65+ crops and 400+ pest species, reducing information asymmetry.

Drones and Precision Farming Infrastructure: Replaces uniform, wasteful farming methods with targeted input application. Drones provide detailed multispectral crop monitoring and precision chemical spraying, cutting input use and lowering labor costs.

Namo Drone Didi Scheme: Backed by an allocation of ₹1,261 crore, this initiative provides specialized agricultural drones directly to women Self-Help Groups (SHGs), driving rural employment opportunities for youth and women.

Sovereign Digital Ecosystems (Agri Stack): A unified national data architecture that integrates verified farmer databases, digitized land records, and crop maps. It supports targeted subsidy delivery, index-based crop insurance, and fast-tracked access to institutional credit while minimizing financial inclusion bottlenecks.

The AgriTech Value Chain (Key Interlocking Components): The shift toward smart agriculture relies on eight technical nodes:

1. GPS & GIS: Maps exact plot boundaries and soil type variations.
2. Auto-Steer Machinery: Automates tractor pathways to prevent overlapping rows and save fuel.
3. Variable Rate Technology (VRT): Automatically alters fertilizer and water discharge rates based on localized soil needs.
4. Remote Sensing: Utilizes satellite bands to track localized chlorophyll levels and water stress.
5. Yield Monitors: Measures crop volume in real time during harvest to pinpoint underperforming plot sections.
6. Wireless Telematics: Connects field equipment with central farm management databases.
7. Artificial Intelligence: Diagnoses crop diseases instantly from smartphone images.
8. Data Collection & Analysis: Aggregates multi-year statistics to support evidence-based policymaking.

Policy and Institutional Backing:

Digital Agriculture Mission: Backed by an allocation of ₹32,817 crore, this mission funds the foundational development of Agri Stack and the complete digitization of land registries.

State Initiatives: Tailored regional networks—such as Karnataka’s Krishi Sanjeevani mobile testing laboratories and Kerala’s K-FON fiber highway—deliver digital governance directly to the field.

Systemic Challenges: High upfront procurement costs for drones and sensors challenge smallholder farmers; highly fragmented landholdings limit the scalability of heavy mechanical technologies; and data ownership and privacy concerns complicate large-scale data integration.

Way Forward: Leverage Farmer Producer Organizations (FPOs) to support the collective adoption of high-cost drone services; design clear data governance frameworks that safeguard individual farmer

privacy rights; expand broadband connectivity; and increase public-private partnerships to scale agrotech innovation across rural India.

DOWN-TO-EARTH APRIL 2026

1. Food In the Age of Climate Change

Context

1. Food systems today are at the intersection of climate change, livelihoods, nutrition, and ecology.
2. As modern agriculture contributes significantly to greenhouse gas emissions, the emerging paradigm is climate-smart agriculture, which integrates livelihood security, nutritional outcomes, and ecological sustainability.

About Food System & Climate Change

1. Food systems today are both victims and drivers of climate change. Agriculture contributes significantly to greenhouse gas emissions, while climate change threatens crop productivity, water availability, and farmer livelihoods.
2. Thus, the challenge is to redesign agriculture to ensure livelihood security, nutritional adequacy, and ecological sustainability simultaneously.

Low-Input and Climate-Resilient Agriculture

Reduce dependence on costly external inputs (fertilisers, pesticides). Key rationale are:

1. High-input agriculture increases costs and farmer vulnerability.
2. Smallholders lack economies of scale.
3. Low-input systems can maintain productivity via soil and water management.

Water and Soil as Core Inputs

Shift focus from chemical inputs to natural resource management. Key measures include:

1. Rainwater harvesting (traditional Indian practices)
2. Improving irrigation efficiency
3. Enhancing soil organic matter

Risk Minimisation through Diversification

The key idea is to adopt multi-cropping and mixed farming systems. It benefits:

1. Reduces climate risk (pests, droughts)
2. Ensures multiple income streams
3. Enhances biodiversity

Climate-Smart Crop Choices (Millets Focus)

Promote crops suited to local ecology and nutrition needs.

Why Millets?

1. Drought-resistant, climate-resilient
2. High nutritional value (iron, fibre)
3. Suitable for marginal soils

Food, Nutrition, and Gut Health

Key Idea: Food choices influence human health via gut microbiome.

1. Soil Health → Crop Diversity → Dietary Diversity → Gut Health
2. Gut hosts trillions of microbes that are critical for immunity and metabolism
3. Diverse, fibre-rich diets support healthy microbiota

Conclusion: Towards Sustainable Food Systems

Food must be reimaged as a system that supports farmers' livelihoods, ensures nutritional security, and protects ecological balance. The future lies in climate-resilient, low-input, biodiversity-based agriculture, supported by policy reforms and conscious consumption. As research shows, crops like millets can act as a bridge between climate adaptation, nutrition, and sustainability, making them central to India's agricultural transformation.

2. Sanitary Waste Management in India

Context

1. Women in rural areas of Himalayan states adopt reusable menstrual hygiene products, reducing sanitary waste.

About Sanitary Waste

1. It comprises used menstrual pads and diapers that remains an under-recognized component of India's solid waste management system.
2. Its environmental, financial, and social impacts are disproportionately high, making it a critical governance and public health issue, despite forming a small fraction of total waste.

Case Study: Dehradun

Key Issues: Mixed with dry waste or concealed in packaging.

1. Disposal methods: Open dumping, burial, and flushing in toilets.
2. Handled manually by sanitation workers, exposing them to health risks (infection, odour), social stigma and indignity.

Economic Burden:

3. Incineration cost: ₹1.75 lakh/month for 10 tonnes
4. Estimated cost for Dehradun city: ₹1.86 crore/month

Environmental and Public Health Concerns

Non-biodegradability: Over 90% of sanitary pads contain plastic.

Pollution: Improper disposal contaminates soil and water.

Health risks: Pathogen exposure for waste workers.

Infrastructure gaps: Lack of disposal systems in India.

Poor menstrual waste management is now recognized as a global environmental and public health challenge.

Emerging Solution: Reusable Menstrual Products

Waste Warriors Initiative: Active since 2022 in Uttarakhand & Himachal Pradesh.

Strategy includes awareness workshops, demonstrations of reusable pads & menstrual cups; community engagement via SHGs, schools, Anganwadi's.

Adoption Trends:

1. Cloth pads: Higher acceptance (cultural familiarity)
2. Menstrual cups: Adopted more by younger women

Long-term benefits:

3. Cost-effective (cup lasts ~5 years)
4. Eliminates disposal challenges

Why Reusables Matter

Reusable products significantly reduce waste burden.

1. Cloth pads are less polluting and sustainable.
2. Promote circular economy in waste management.
3. Reduce pressure on municipal systems.

Challenges in Sanitary Waste Management

Behavioural Issues: Social stigma around menstruation; and concealment of waste.

Policy Gaps: Limited implementation of Solid Waste Management Rules, 2016; and lack of segregation at source.

Technological Constraints: Incineration is costly and polluting; and limited eco-friendly alternatives.

Equity Concerns: Burden falls on informal sanitation workers.

Way Forward

Promote Sustainable Alternatives: Scale up reusable pads and menstrual cups; and encourage biodegradable sanitary products.

Strengthen Waste Segregation: Mandatory separate collection of sanitary waste; and provide labelled disposal bags/bins.

Behavioural Change: Awareness campaigns under Swachh Bharat Mission; and menstrual hygiene education in schools.

Protect Sanitation Workers: Mechanization of waste sorting, and provide PPE and dignified working conditions.

Policy Integration: Include sanitary waste in Extended Producer Responsibility (EPR); and incentivize eco-friendly product innovation.

3. E20 Ethanol Blending in India

Context

1. From April 2026, India has mandated 20% ethanol blending (E20) in petrol to reduce crude oil imports, enhance energy security, and lower carbon emissions.
2. However, emerging evidence suggests that E20 is a transitional solution with mixed outcomes, raising concerns about its long-term sustainability.

About Ethanol Blending

1. It is the process of mixing ethanol (a biofuel made from crops like sugarcane or corn) with petrol to be used as fuel in vehicles.
2. **Example:**
 1. E10: 10% ethanol & 90% petrol
 2. E20: 20% ethanol & 80% petrol
3. It is mainly done to reduce dependence on crude oil, lower pollution and emissions, and promote renewable energy sources.

Rationale Behind Ethanol Blending

India imports ~85% of its crude oil. Ethanol blending helps save foreign exchange, support farm incomes, and reduce GHG emissions (partially).

Impact on Vehicles and Fuel Economy

Lower Energy Efficiency: Ethanol has lower calorific value, leading to higher fuel consumption, and reduced mileage.

Compatibility Issues: Older vehicles (pre-2023) are not designed for E20, that face corrosion risks, and material degradation.

Fuel System Concerns: Ethanol is hygroscopic (absorbs water), and corrosive in nature, that can damage fuel lines, and rubber seals.

Environmental Implications

Positive Effects: Better combustion due to oxygen content, that reduces carbon monoxide (CO), hydrocarbons (HC), and particulate emissions.

Negative Effects:

Increase in NOx Emissions: E20 can increase nitrogen oxides (NOx)

Toxic Aldehyde Emissions: Higher emissions of acetaldehyde, and formaldehyde.

Higher Evaporative Emissions: Ethanol increases fuel volatility leads to VOC emissions, and contributes to ground-level ozone.

Regulatory Gap: India lacks adequate monitoring of aldehydes, and strong evaporative emission norms, compared to US, EU, Brazil.

Economic and Agricultural Concerns

Food vs Fuel Debate: Rising ethanol demand increases demand for corn and sugarcane. It leads to food inflation, and stress on the livestock sector.

Import Paradox: India is importing industrial ethanol, and corn that undermines the goal of self-reliance.

Water Stress: Sugarcane-based ethanol highly water-intensive impacting groundwater levels.

Policy Paradox: Transitional vs Long-Term Solution

1. E20 is a transitional fuel, not a clean end-state. It risks diverting focus from Electric Vehicles (EVs), and hydrogen-based mobility.

Global trend:

1. EU: Focus on electrification (90% CO₂ reduction target)
2. US: Limits blending to ~10–15%

Need for Strategic Reorientation

Promote 2G Ethanol: From crop residues, and municipal waste. It reduces food-fuel conflict.

Shift Towards Industrial Use: Ethanol as chemical feedstock, green solvent, bio-plastic input.

Global examples: USA, Germany, EU

Strengthen Regulations: Introduce aldehyde emission norms, and evaporative emission standards.

Accelerate Clean Mobility: Focus on electric mobility, and renewable energy integration.

4. A Warmer, Shorter Winter in India

Context

1. India's winter of 2026 stands out as an anomaly, marked by a near absence of cold extremes and a premature transition to summer-like conditions.
2. Analysis of IMD data reveals it as part of a broader climatological shift, characterised by declining cold waves, rising temperatures, and increasing variability in seasonal patterns.

IMD Classification

Cold Day: Maximum temperature 4.5°C–6.4°C below normal

Severe Cold Day: >6.4°C below normal

Cold Wave: Minimum temperature 4.5°C–6.4°C below normal

Severe Cold Wave: >6.4°C below normal

Decline of Cold Waves: Key Trends

February 2026: No cold day or cold wave recorded; first such February in five years.

1. Comparison: 6 cold-wave days in 2022; 1 in 2023; 7 in 2024 and 5 in 2025.
2. It indicates a sharp weakening of winter intensity.

Seasonal Trend (Jan–Feb Combined)

3. 24 events in 2026 (second lowest in 5 years); 21 in 2023 (lowest); 38 in 2024 (peak).
4. It suggests high inter-annual variability, but overall declining severity.

Changing Geography of Cold Waves

Core Pattern: Concentrated in North, Northwest, Central India

Emerging Shifts: Limited southern penetration

1. 2023: Telangana & Karnataka affected
2. 2025: Only Telangana (1 day)
3. 2026: Only Karnataka

Spatial Variability:

4. 2023: Widest spread (17 states)
5. 2025: Narrowest (9 states)
6. 2026: Expanded again (15 states)

It reflects unstable spatial behaviour of cold extremes.

Warming Trend Across Cities

Major Observations: 34 cities analysed:

1. 23 cities: Above-normal maximum temperatures
2. 30 cities: Above-normal minimum temperatures

Key Pattern: "Normal" temperatures becoming rare

3. Pan-India trend: From Himalayas (Shimla, Srinagar) to coastal regions (Panjim)

Himalayan Anomalies: Warmer nights than days (relative to normal)

4. Extreme spikes:

1. Shimla: Up to 10°C above normal
2. Itanagar: Night temp ~8°C above normal
5. It suggests elevation-dependent warming, a critical climate signal

Scientific Evidence: Long-Term Climate Trends

The observed 2026 anomalies align with broader research findings:

1. Declining cold waves and increasing heatwaves across India
2. Rising minimum temperatures (warmer nights)
3. Increasing temperature anomalies and variability

Conclusion

India's winter of 2026 reflects a clear climatic transition i.e. weaker winters, earlier summers, and erratic spatial spread of cold events.

These trends align with long-term scientific evidence pointing to climate change-driven restructuring of seasonal cycles, rather than isolated anomalies.

5. Energy Warfare in The Strait of Hormuz: Implications for India and The World

Context

1. The recent naval escort of Indian LPG tankers through the Strait of Hormuz signals a structural shift in global energy trade.
2. What was once largely commercial is now deeply geopolitical, resembling a zero-sum strategic contest.
3. Control over energy flows has become a tool of coercion, reflecting the growing weaponisation of trade and supply chains.

Strategic Importance of the Strait of Hormuz

1. A critical maritime chokepoint, only ~33 km wide.
2. It handles a significant share of global energy flows:
 1. ~35% of seaborne crude oil
 2. ~29% of LPG
 3. ~19% of LNG and refined products
3. Nearly 20% of global oil trade passes through it.
4. Around 100 ships transit daily under normal conditions.
5. Maritime chokepoints like Hormuz are 'systemic vulnerabilities' where disruptions can trigger global economic shocks and energy insecurity.

From Conflict to Energy War (2026 Crisis)

1. Conflict triggered by US-Israel strikes on Iran, and Iran's retaliation led to closure of the Strait, causing 97% drop in shipping traffic, and ~3,000 ships stranded.
2. Escalation: Israeli strike on South Pars gas field; and Iranian strike on Qatar's Ras Laffan LNG hub.
3. It resulted in a full-fledged energy war, targeting production and transit infrastructure.

Global Economic Impact

1. Oil prices surged:
 1. Touched \$120/barrel, stabilizing above \$100
 2. Possible rise to \$150 if disruption continues
2. LNG, LPG, fertilisers, helium prices increased
3. IEA released 400 million barrels (record reserve release)
4. Energy shocks from chokepoint disruptions resemble 1970s oil crises, with cascading effects across sectors.

Impact on Asia: Maximum Vulnerability

1. Asia consumes ~80% of Hormuz oil flows; Major dependents are China, India, Japan, South Korea.
2. Severe impacts on developing nations:
 1. Nepal: LPG rationing

2. Sri Lanka: Weekly shutdowns
3. Pakistan: LNG crisis leads to school closures.
3. It highlights energy inequality and vulnerability of import-dependent economies.

India's Energy Vulnerability

High Import Dependence:

1. Crude oil: 88–90% imported, in which ~50% via Hormuz.
2. LPG: 60% imported (90% via Hormuz)
3. LNG: 68% from Gulf.

India's Response

1. Invoked Essential Commodities Act, 1955
2. **4-tier rationing system:**
 1. Priority: households, CNG
 2. Cuts: industry (50%), fertilisers (70%)
3. Increased domestic LPG production by 38%
4. Diversified imports: US, Russia, Norway, Algeria
5. Push for PNG (piped natural gas) expansion

Broader Geopolitical Lessons

Energy Security & National Security: Naval escorts and diplomacy show militarisation of trade routes

Chokepoint Vulnerability: Hormuz exemplifies how geography shapes geopolitics

Weaponisation of Energy: States increasingly using energy supply as leverage.

Control over chokepoints gives states outsized geopolitical power, making global trade fragile.

Way Forward for India

1. Diversification of energy sources (Africa, Americas)
2. Strategic petroleum reserves expansion
3. Accelerate renewables & green hydrogen
4. Strengthen naval presence in IOR
5. Promote regional energy cooperation

OIL SHOCKS

1973 Crisis (First Oil Shock): It was triggered by the Yom Kippur War (1973) between Israel and a coalition of Arab states.

1. OPEC, particularly Arab members, imposed an oil embargo on countries supporting Israel (primarily the US, Western Europe and Japan).
2. Oil prices quadrupled from US \$3 per barrel to \$12.
3. Global economic recession and inflation followed ('stagflation').

1979 Crisis: Triggered by Iranian Revolution that toppled the Shah of Iran.

4. Production in Iran collapsed and exports fell sharply.
5. Oil prices doubled from \$15 per barrel to \$39, renewed global inflation and economic slowdown.

1990 Oil Price Spike: Caused by Iraq invasion of Kuwait or Gulf War in 1990.

6. Oil prices jumped from \$20 per barrel to over \$40 temporarily and stabilised after coalition forces liberated Kuwait in early 1991.

2008 Oil Price Spike: Caused by strong global demand, especially from China and emerging economies.

7. Geopolitical tensions (West Asia) and limited spare capacity resulted in tight supply.
8. Oil prices hit a record high of \$147 per barrel in July 2008.

2020 Oil Price Collapse: Triggered by global demand collapse due to COVID-19 lockdowns and price war between Russia and Saudi Arabia in early 2020 exacerbated oversupply.

9. West Texas Intermediate (WTI) crude futures briefly went negative in 2020.

2026 Oil Price Spike: The US–Iran tensions have driven Brent crude prices up from \$80 per barrel to \$120 within a week.

6. India's Fertiliser Dependence

Context

Recent conflicts in West Asia and past disruptions (Russia–Ukraine war, China's export restrictions) highlight how fertilizer security is directly linked to food security, fiscal stability, and geopolitical strategy.

Scale of India's Fertiliser Dependence

High Import Dependence: India is the 2nd largest fertiliser importer globally (FAO data).

Demand vs Production (2024–25):

1. Demand: ~64.9 million tonnes
2. Production: ~46.5 million tonnes
3. Imports: ~16 million tonnes

Import Concentration Risks:

4. Urea imports: ~70% from Gulf (Oman, Qatar, Saudi Arabia, UAE)
5. DAP imports: More than 40% from Saudi Arabia
6. Heavy reliance on Strait of Hormuz (critical chokepoint)

Hidden Dependence (Raw Materials):

7. 85% natural gas (urea feedstock) imported
8. 90–95% rock phosphate imported
9. ~50% phosphoric acid imported

Effective dependence rises to ~68–70%, making India structurally vulnerable.

Link Between Fertiliser and Food Security

1. Fertilisers are essential for high crop yields and Green Revolution sustainability.
2. Supply disruptions leading to lower yields, inflation, food insecurity.

Recent Geopolitical Shocks

West Asia Conflict (2025–26): Disruption in Gulf supply routes;

1. Gas supply restrictions → fertiliser plants running below capacity;
2. Likely price rise and subsidy burden increase;

Past Examples:

3. Russia–Ukraine War (2022): Fertiliser prices doubled
4. China export restrictions (2025): Forced costly imports

Every disruption leads to reactive scrambling rather than strategic planning.

Key Challenges

Supply Chain Concentration: Overdependence on a few regions (Gulf, China, Russia)

Fiscal Burden:

1. Fertiliser subsidy: ₹1.77 lakh crore (2024–25)
2. Urea heavily subsidised leading to market distortion.

Imbalanced Usage: Excessive urea use leading to soil degradation & environmental damage.

Domestic Constraints: Limited reserves of potash and phosphate; and high dependence on imported feedstock.

Strategies to Reduce Dependence

Diversification of Imports: Shift sourcing to Southeast Asia (Indonesia, Malaysia, Vietnam); Africa, Central Asia, Latin America

1. Reduce geopolitical concentration risks

Overseas Investments: Expand models like Oman India Fertiliser Company (OMIFCO)

2. Invest in rock phosphate (Morocco – 70% reserves); and potash mines abroad

Boost Domestic Production: Improve plant efficiency; use low-grade domestic resources; and integrate with the energy sector (green ammonia).

Strategic Fertiliser Reserve: Maintain buffer stocks for crisis situations

Reforming Fertiliser Subsidy

Current Issues: Urea price fixed since 2018 leading to overuse; and government bears 85–90% of cost.

Suggested Reforms:

1. Direct income transfers to farmers (per acre basis)
2. Rationalise urea pricing
3. Promote balanced nutrient use (NPK mix)

Way Forward

Treat fertiliser as a strategic sector like energy security; and build resilient and diversified supply chains.

Biofertilisers & Organic Inputs: Compost from agricultural waste; and microbial nitrogen fixation

Government Initiatives: PM-PRANAM scheme

7. Ecocide: Environmental Harm in Warfare

Context

1. Recent geopolitical conflicts in West Asia highlight a growing but under-recognised dimension of warfare i.e. environmental destruction.
2. Incidents involving incendiary weapons, toxic chemicals, and attacks on energy infrastructure demonstrate that ecological damage is no longer incidental but increasingly systemic and strategic.

Recent Evidence of Environmental Damage in Conflict

Use of Hazardous Substances: Reports indicate use of white phosphorus over civilian areas in southern Lebanon, and alleged aerial spraying of glyphosate.

1. **White phosphorus** Is highly incendiary; causes severe burns, fires, and long-term soil contamination.
2. **Glyphosate** is an herbicide that can contaminate soil, crops, and water systems at high concentrations.

According to environmental monitoring groups, over 120 incidents of ecological harm have been recorded in the ongoing conflict.

Destruction of Energy Infrastructure

1. Airstrikes on oil depots and refineries triggered massive fires releasing soot, hydrocarbons, sulphur and nitrogen compounds.
2. Reports of 'black rain' (acid precipitation) affecting human health and agriculture.

Climate Impact of War

Initial weeks of bombardment were estimated to emit ~5 million tonnes CO₂ equivalent, exceeding annual emissions of some countries (e.g., Iceland).

Emissions drivers: Burning oil facilities, military mobilization, and weapon production and deployment

When Does Environmental Harm Become a War Crime?

Traditionally, environmental damage in war is treated as collateral, not primary harm. However, current conflicts challenge this assumption.

Historical Precedent:

Agent Orange (Vietnam War): Long-term ecological and human health damage, and triggered global debate on environmental protection in warfare.

Existing Legal Frameworks

Additional Protocol I (1977): Prohibits warfare causing 'widespread, long-term, and severe' environmental damage.

Rio Declaration (1992): Warfare is inherently destructive to sustainable development (Principle 24).

Rome Statute, 1998 (ICC): Environmental damage is a war crime if it is intentional, causes widespread, long-term, severe harm, and is disproportionate to military advantage.

Concept of Ecocide

It was proposed in 2021 as 'Unlawful or wanton acts committed with knowledge of causing severe and widespread or long-term environmental damage'.

Recent Developments: 2024 proposal by Vanuatu, Fiji, Samoa to include ecocide as the 5th international crime under the Rome Statute.

Ecology as a Tool of Conflict

Slow Environmental Transformation: Afforestation policies replacing native ecosystems:

1. Example: Replacement of Mediterranean vegetation with European pines
2. Impacts: Biodiversity loss; Soil degradation; Altered fire regimes

War–Environment Nexus: Environmental damage is now a by-product of conflict.

A strategic instrument (e.g., targeting infrastructure, altering landscapes)

Way Forward

1. Codify Ecocide as an international crime with clearer thresholds
2. Strengthen monitoring mechanisms (e.g., satellite-based environmental tracking)
3. Integrate environmental norms into military doctrines
4. Promote universal participation in ICC frameworks
5. Enhance role of non-state actors and civil society in documentation and advocacy

8. West Asia War: Impact On India's Pharmaceuticals Sector

Context

1. Recent geopolitical conflicts have exposed the fragility of global pharmaceutical supply chains.
2. Disruptions in the supply of critical raw materials and rising input costs pose a serious threat to global public health, especially for developing nations dependent on affordable medicines from India.

About Geopolitics and the Changing Nature of 'Collateral Damage'

1. Modern conflicts increasingly extend beyond battlefields to disrupt essential civilian infrastructure, including healthcare systems.
2. Geopolitical tensions and wars significantly affect pharmaceutical supply chains by interrupting logistics, increasing trade barriers, and creating uncertainty in global markets.
3. Such disruptions disproportionately affect vulnerable populations, especially children, by limiting access to essential medicines and vaccines.

India as the 'Pharmacy of the World'

1. India plays a central role in global health:
 1. Supplies generic medicines to ~200 countries
 2. Major provider of vaccines (DPT, BCG, measles) to UNICEF and WHO
 3. Accounts for a significant share of low-cost drugs globally
2. India's pharmaceutical sector is deeply integrated into global health systems, particularly in developing regions.

Structural Weakness: Dependence on Imported Raw Materials

Heavy Import Dependence: 70–75% of APIs and intermediates sourced from China.

1. Dependence spans Key Starting Materials (KSMs), drug intermediates, and Active Pharmaceutical Ingredients (APIs).
2. India's dominance in generics is underpinned by reliance on Chinese raw materials, making it vulnerable to external shocks.

Impact of War on Pharma Supply Chains

Supply Chain Disruptions: Damage to air transit hubs and shipping routes, delays in temperature-sensitive drugs (e.g., cancer medicines) and increased logistics costs and rerouting.

1. Pharmaceutical supply chains are highly sensitive to geopolitical disruptions due to their complexity and just-in-time nature.

Rising Input Costs: Increased cost of APIs and intermediates; currency volatility and insurance costs; and impact on drug prices across the distribution chain.

2. Rising trade pressures and tariffs significantly increase pharmaceutical costs, especially for generic manufacturers.

Medicines at Risk: Shortages and price increases are expected in Paracetamol (fever management), antibiotics (routine infections), diabetes medicines, and cancer drugs (temperature-sensitive).

3. These medicines form the backbone of primary healthcare, amplifying the crisis.

Global Implications

Impact on Developing Countries: Africa and low-income countries rely heavily on Indian generics.

1. Disruptions may cripple public health programs

Vaccine Supply Risks: India supplies bulk vaccines globally;

2. ~70% of vaccine raw materials are imported → potential bottlenecks

Threat to Global Health Security: Disruptions in pharmaceutical supply chains can undermine global health systems and pandemic preparedness.

Policy Responses and Gaps

Government Measures: Production Linked Incentive (PLI) scheme to boost domestic API production; and increase in API exports.

Limitations:

1. Continued high import dependence;
2. Rising share of imports from China;
3. Insufficient domestic capacity in KSMs and intermediates;

Onshoring and diversification are necessary but require long-term investment and policy coherence.

Way Forward

Short-Term Measures: Strategic stockpiling of critical drugs and APIs; diversification of import sources; and strengthening logistics and cold-chain infrastructure.

Long-Term Measures: Promote domestic API and KSM manufacturing; invest in R&D and innovation; build resilient supply chains (multi-country sourcing); and enhance global cooperation in health security.

9. Fuelwood Resurgence Amid LPG Crisis: Energy Security Lessons For India

Context

Amid West Asia conflict, fuelwood has re-emerged as a critical fallback energy source, as it disrupted global energy supply chains, exposing India's dependence on imported liquefied petroleum gas (LPG).

Return to Fuelwood

Across India, reports indicate a sharp surge in fuelwood demand:

1. Chhattisgarh, Jharkhand, Odisha, Kerala: Households reverting to fuelwood despite earlier LPG adoption
2. Urban spillover: Even city dwellers are sourcing fuelwood from outskirts

Informal markets booming

3. Fuelwood bundles being sold near Raipur
4. Ranchi witnessing increased roadside trade
5. Balangir (Odisha) seeing LPG users shift to wood

It reflects a 'distress-driven reverse transition' in cooking energy use.

Historical Perspective: Echoes of the 1970s Oil Crisis

1. The 1974 oil crisis triggered LPG shortages in India
2. That decade marked the beginning of the transition from fuelwood to LPG
3. However, the transition remains incomplete even after five decades

Fuelwood continues to function as a parallel energy system.

Current Energy Mix

NSO (2021): ~33% households use fuelwood; and ~50% rural households depend on it

NFHS-5: ~41% population uses biomass fuels (fuelwood, dung cakes)

Urban India: 89% households use LPG

Regional disparity: 11 states have more than 50% households using solid fuels

These indicate energy inequality and rural-urban divide.

Fuelwood Economy

Fuelwood is not merely a traditional fuel—it is an organized informal economy:

1. Global market size: \$37.04 billion (2024) and further projected ~\$46 billion by 2030 (Grand View Research)
2. Livelihood dependence: Millions of rural households engaged in collection and trade.
3. Commercial circulation: ~18% of fuelwood collected is sold in towns and cities.

These demonstrate that fuelwood is a market-driven energy commodity, not just subsistence use.

Why Fuelwood Persists

Structural Reasons

1. Affordability: Minimal or zero monetary cost
2. Accessibility: Locally available
3. Supply reliability: Not dependent on imports or logistics
4. Cultural familiarity: Traditional cooking practices

The current LPG shortage reinforces these advantages.

Concerns and Challenges

Health Impacts: Indoor air pollution leads to respiratory diseases; and disproportionate burden on women and children.

Environmental Costs: Deforestation and forest degradation, and carbon emissions (though sometimes considered carbon-neutral locally).

Energy Poverty: Indicates lack of sustained access to clean energy; and reflects gaps in schemes like PM Ujjwala Yojana.

Policy Implications

Strengthen Clean Energy Access: Ensure continuous LPG supply chains; and improve refill affordability (subsidies, DBT efficiency).

Diversified Energy Basket: Promote alternatives like biogas, electric cooking, and solar-based solutions.

Sustainable Fuelwood Management: Agroforestry and community forestry, and efficient cookstoves to reduce emissions.

Focus on Energy Justice: Address rural-urban disparities, and target vulnerable populations.

10. Declining Camel Population in Rajasthan

Context

Recently, the Rajasthan High Court observed a sharp decline in camel population despite a protection law.

Trend in Camel Population

1. India's Camel population has declined by more than 75% since the 1970s, a decline driven by economic transitions, shrinking rangelands, legal constraints, and declining institutional support
~7.5 lakh in 2004, ~3.2 lakh (year of enactment of protection law) in 2015 and ~1.5 lakh in 2021.
2. It indicates a continuous and steep decline, even after legal protection.

Legal Framework

Rajasthan Camel Act, 2015: Rajasthan Camel (Prohibition of Slaughter and Regulation of Temporary Migration or Export) Act, 2015.

Key Provisions:

1. Ban on slaughter of camels
2. Restriction on transport/export outside the state
3. Regulation of migration of camels

Camel declared as the State Animal of Rajasthan.

About Camels

They are exceptionally suited to dryland ecosystems, and deeply embedded in the cultural lives of pastoral communities such as the Raika, Rabari, and Fakirani Jat.

Key Camel Breeds in India

Dromedary Camels (Rajasthan and Gujarat):

1. **Bikaneri (Rajasthan):** Commonly used for cart pulling and heavy draught work.
2. **Jaisalmeri (Rajasthan):** Primarily used for riding, camel safaris, and long-distance travel, especially in the Thar Desert.
3. **Mewari (Southern Rajasthan):** This is a dual-purpose breed, utilized for both milk production and draught.
4. **Kachchhi (Gujarat):** It is commonly used for ploughing and carting in the Rann of Kachchh and surrounding regions.
5. **Kharai (Gujarat):** Adapted to coastal and mangrove ecosystems. It is an excellent swimmer, capable of crossing creeks and feeding on mangroves.

Bactrian (Camelus bactrianus), Ladakh: The double-humped camel, or Bactrian camel, is found exclusively in the high-altitude cold desert of Ladakh.

6. Critically Endangered on the IUCN Red List of Threatened Species.
7. Gobi and Gashun Gobi deserts of northwest China and Mongolia.

11. Illegal Sand Mining in National Chambal Wildlife Sanctuary

Context

A Supreme Court-appointed Central Empowered Committee (CEC) has flagged rampant illegal sand mining in the National Chambal Wildlife Sanctuary (NCWS). The issue highlights governance failures across Rajasthan, Madhya Pradesh, and Uttar Pradesh.

About National Chambal Wildlife Sanctuary

1. It is a tri-state protected area (Rajasthan, Madhya Pradesh, Uttar Pradesh).
2. It is notified for conservation of critically endangered species like Gharial (*Gavialis gangeticus*); Gangetic River dolphin; and Indian skimmer.
3. It is recognized as an Important Bird Area (IBA).
4. It features a fragile riverine ecosystem with sandbanks crucial for breeding.

Key Findings of the CEC

Continuous illegal mining: Sand extraction, transportation, and storage ongoing inside sanctuary limits.

Weak coordination: Poor inter-state and inter-departmental cooperation.

Denotification concerns: States have denotified forest areas without central approval, facilitating mining.

Regulatory failure: Ineffective enforcement of environmental laws and court orders.

Environmental Impacts

Threat to Biodiversity: Destruction of nesting sites of gharials and turtles. Disturbance to river dolphins and bird habitats.

River Ecology Degradation: Alteration of river flow and sediment balance. Increased erosion and habitat fragmentation.

Pollution and Noise: Mining machinery leads to noise pollution, affecting aquatic fauna.

Legal and Governance Issues

1. Violations of Wildlife Protection Act, 1972; and Environment Protection Act, 1986
2. Weak implementation of Eco-Sensitive Zone (ESZ) norms.
3. Federal governance gap: lack of coordinated action among states.

CEC Recommendations

1. Immediate ban on mining, extraction, transportation, storage of sand in sanctuary and ESZ.
2. Strengthening inter-state coordination mechanisms.
3. Strict enforcement of forest and wildlife laws.

Way Forward

1. Establish a joint inter-state task force.
2. Use technology (drones, GIS) for monitoring.
3. Ensure community participation in conservation.
4. Strengthen accountability of state authorities.

12. Global Energy Crisis Amid Conflict in West Asia

Context

The ongoing geopolitical conflict involving the US, Israel, and Iran has triggered a global energy crisis.

About

1. Disruptions in critical supply routes, especially maritime chokepoints like the Strait of Hormuz have historically posed major risks to global oil flows, affecting nearly one-fifth of global petroleum trade.
2. It has led to acute shortages of fuel (petrol, diesel, LPG), rising inflation and trade deficits, and long queues and rationing in several countries.

The crisis is not merely economic but humanitarian, disproportionately affecting vulnerable populations.

Socio-Economic Impacts

Energy Poverty and Inequality: Over 700 million people lack reliable energy access, making them highly vulnerable.

1. Rising LPG and fuel prices strain household incomes, especially in developing countries.

Impact on Agriculture and Food Security: Fertilizer supply disruptions (linked to natural gas) threaten agricultural productivity.

2. Combined with climate change, this may intensify global food insecurity.

Macroeconomic Stress: Increased oil import bills worsen current account deficits.

3. Developing economies face currency depreciation and fiscal instability.

Pre-existing Energy Transition Trends

1. Even before the crisis, the world was transitioning toward clean energy: Renewables accounted for ~50% of installed electricity capacity by 2025.
2. Around 85% of new capacity additions were solar and wind.
3. This transition is driven not only by climate goals but also by cost-effectiveness and technological advancements.

Role of Developing Countries in Energy Transition

1. Low and middle-income countries are leading adoption:
 1. Countries like Namibia and Togo (solar);
 2. Jordan and Kyrgyzstan (battery systems);
 3. Nepal and Sri Lanka (electric vehicles)
2. These trends are supported by falling costs of solar panels and batteries, flexibility to bypass legacy fossil fuel infrastructure, dependence on energy imports, and pushing energy independence.

War-Induced Structural Shifts in Energy

Short-Term Responses: Diversification of suppliers: US, Russia, Nigeria, Guyana;

1. Increased reliance on domestic fossil fuels (coal, charcoal)

Long-Term Structural Changes: Possible end of cheap fossil fuel era; acceleration of energy nationalism and protectionism; and supply chain restructuring for energy technologies.

Energy systems are becoming more geopolitically fragmented.

Clean Energy: From Climate Imperative to Security Necessity

1. The crisis reframes renewable energy as a tool for energy security, a hedge against geopolitical shocks, and a pathway to economic resilience.
2. Crises often accelerate energy transitions, as seen in Europe post-Ukraine war.

Challenges Ahead

1. Infrastructure damage in conflict zones delays supply recovery; fragmented global cooperation weakens climate action; and risk of reverting to polluting fuels in the short term.
2. The global order governing energy and climate is increasingly unstable.

Way Forward

1. Diversification of energy mix: renewables, storage, and green hydrogen
2. Strengthening strategic reserves
3. Decentralized energy systems (mini-grids, rooftop solar)
4. International cooperation despite geopolitical tensions
5. Domestic manufacturing of clean technologies

13. Maternal Mortality in India and The World

Context

Recent findings from the Global Burden of Disease (GBD) 2023 Study highlight a significant decline in maternal mortality globally and in India. However, progress remains uneven, with major challenges persisting in high-burden countries.

About Maternal Mortality

1. It refers to the death of a woman during pregnancy, childbirth, or within 42 days after termination of pregnancy, from causes related to or aggravated by the pregnancy or its management (excluding accidental or incidental causes).
2. It is a critical indicator of women's health and healthcare delivery. It is included in SDG Goal 3 (Good Health and Well-being).
3. Maternal Mortality Ratio (MMR) is the key indicator used to measure maternal mortality.
4. It reflects the quality of the healthcare system, access to maternal services, and socio-economic conditions.

India's Progress

1. India has reduced its Maternal Mortality Ratio (MMR) by nearly 80%, from 508 (1990) to 116 (2023). It reflects improvements in institutional deliveries, access to antenatal care, and government schemes (e.g., JSY, JSSK).
2. Despite this progress:
 1. India recorded 24,700 maternal deaths in 2023, making it the second-highest globally after Nigeria.
 2. Indicates that absolute burden remains high due to population size and regional disparities.

Global Scenario

1. Total maternal deaths worldwide (2023): ~240,000
2. Global MMR: 190.5 per 100,000 live births
3. This is ~3 times higher than the SDG target (≤ 70 by 2030)
4. **High-Burden Countries:** Five countries account for 36% of global maternal deaths: Nigeria, India, Ethiopia, Pakistan, and Cameroon.
5. These countries face weak health systems, inequitable access, and socio-economic barriers.

Major Medical Causes of Maternal Deaths

Haemorrhage (Severe Bleeding): Leading cause globally; especially postpartum haemorrhage; and requires timely emergency obstetric care.

Hypertensive Disorders: Includes preeclampsia/eclampsia; share increased from 16.6% to 20.1%; and reflects rising non-communicable disease burden.

These two causes account for over 40% of maternal deaths globally.

Emerging Concern: Late Maternal Deaths

1. Defined as deaths 43 days to 1 year after childbirth
2. Increased from 1.3% (1990) to 3.2% (2023)
3. It indicates gaps in postnatal care, and need for continuum of care beyond delivery.

Key Challenges

Structural Issues: Regional disparities (e.g., BIMARU states); rural-urban divide; and shortage of skilled birth attendants.

Health System Gaps: Inadequate emergency obstetric care, weak referral systems, and poor postnatal follow-up.

Social Determinants: Early marriage and pregnancy, malnutrition and anemia, and gender inequality.

Way Forward

Policy Measures: Strengthen primary healthcare (Ayushman Bharat, HWCs); and improve maternal death surveillance systems

Clinical Interventions: Timely management of haemorrhage & hypertension, and scale up skilled birth attendance.

Social Interventions: Delay age of marriage, and improve female education and nutrition.

14. India's Updated Climate Commitments (NDCs) For 2035

Context

1. Recently, India has updated its Nationally Determined Contributions (NDCs) under the Paris Agreement (2015), marking its third submission to the UNFCCC.
2. These commitments reflect a balanced approach between development and decarbonisation, especially in a global context of geopolitical tensions and supply-chain disruptions.
3. The update follows the first Global Stocktake (2023), which highlighted that the world is off track to limit warming to 1.5°C.

Key Targets for 2035

Emissions Intensity Reduction: Reduce emissions intensity of GDP by 47% from 2005 levels

Clean Energy Transition: Achieve 60% of installed power capacity from non-fossil fuel sources

Carbon Sink Expansion: Create 3.5–4 billion tonnes CO₂ equivalent carbon sink through forests and tree cover.

Qualitative Targets

1. Climate-friendly economic pathways
2. Climate-resilient infrastructure
3. Mobilisation of low-cost finance (domestic & international)
4. Capacity building and R&D
5. Promotion of Lifestyle for Environment (LiFE)
6. These aim to embed sustainability into governance and ensure a just and inclusive transition.

Significance of the Updated NDCs

- Aligns with India's net-zero targets by 2070
- Reflects commitment to climate multilateralism
- India differs from developed nations by focusing on emissions intensity, not absolute cuts
- Positions India among 130+ countries submitting updated NDCs.

Analysis

Incremental but Cautious Approach: Targets represent a gradual increase, not a major leap

1. **Concerns:** Lack of sector-specific pathways; and weak integration of existing decarbonisation roadmaps.

Energy Transition Challenges (Installed Capacity vs Actual Generation): More than 50% installed capacity from non-fossil fuels (~283 GW), but only about 29% actual electricity generation is non-fossil.

2. **Key Issues:** Structural inefficiencies in the energy system; grid constraints and transmission bottlenecks; renewable energy curtailment (e.g., 2.3 TWh solar curtailed in 2025); coal plants not flexible enough.

Strategic Shift in Energy Policy: Renewables now seen as a climate necessity and energy security tool, and reduces dependence on imported fossil fuels.

3. However, risk of new dependency on Lithium, and solar components supply chains.

Role of Technology: Key sectors (cement, aluminium, MSMEs) rely on energy efficiency improvements, and Carbon Capture, Utilisation and Storage (CCUS)

4. **Concern:** Pace of technological scaling may be insufficient.

Climate Finance Challenge: Estimated \$8 trillion (2025–2050) required, and \$5 trillion for the power sector alone.

5. **Constraints:** Global climate finance inadequate; \$300 billion/year vs \$1.3 trillion demand (COP29); and heavy reliance on domestic funding, and debt financing.

15. Artemis II And the New Lunar Race

Context

Half a century after Apollo, NASA's Artemis II aims to open a new chapter in deep-space exploration.

About Artemis Programme

Return to the Moon: NASA's Artemis programme aims to return humans to the Moon after the Apollo missions (ended in 1972). Artemis II is a crewed lunar flyby mission, paving the way for Artemis III (planned landing mission).

Focus on Lunar South Pole: The south pole region is the primary target due to presence of Permanently Shadowed Regions (PSRs), high possibility of water ice deposits, and geological diversity useful for scientific study.

Gateway to Mars: The Moon is envisioned as a launch base for deep-space missions, especially Mars. Artemis aligns with NASA's long-term goal of interplanetary exploration.

Importance of Lunar Far Side Observation

1. The far side of the Moon is less explored due to lack of direct communication with Earth.
2. Artemis II observations under partial illumination enhance detection of crater rims, ridges, slopes, and understanding of lunar geology and evolution.

Global Lunar Competition

United States (NASA): Artemis missions aim for human landing, lunar base establishment, and sample return missions.

China:

1. Target: Crewed Moon landing by 2030
2. Achievements: First landing on far side (2019); and sample return missions (2020, 2024)
3. Plans: International Lunar Research Station (ILRS) with Russia by 2035, and possible landing sites near equatorial volcanic regions (e.g., Rima Bode)

India:

4. Chandrayaan-3 (2023): Successful south pole landing
5. Chandrayaan-4 (2027 planned): Sample collection and return; focus on south pole exploration

Strategic and Geopolitical Dimensions

Resource Competition: Key lunar resources like Helium-3 (potential fusion fuel), water ice raises concerns about resource control, and economic exploitation

Military Concerns vs Scientific Cooperation:

1. Moon could become a strategic control point (Earth-Moon gravity well concept) & risk of militarization of space.
2. Moon is too distant and costly for effective military use; and limited direct strategic advantage.

International Space Law: Governed by the Outer Space Treaty (1967), prohibits weapons of mass destruction in space, and promotes peaceful use of outer space.

16. Land Consolidation in India: Key to Agrarian Reform and Productivity

Context

1. Land consolidation has become more relevant than ever for sustainable agriculture and rural development with rising land fragmentation due to demographic and economic pressures.
2. Implementation of land consolidation in India remains uneven and incomplete, despite early adoption and proven benefits.

About Land Consolidation in India

It refers to the reorganization of fragmented agricultural landholdings into compact blocks to improve efficiency, reduce costs, and enhance productivity.

Two Approaches:

1. **Voluntary Approach:** Based on consent of all landowners; more democratic and sustainable
2. **Majority-Based Approach:** Implemented with majority approval; faster but may lead to disputes.

Historical Evolution in India

Pre-Independence: Introduced in Punjab (1920) on an experimental basis; supported by cooperative societies

Post-Independence: Became a key component of land reforms (Kumarappa Committee); Adopted alongside Zamindari abolition, Tenancy reforms, and Land ceiling laws.

Legal Provisions

Constitutional Position:

1. Land is a State Subject (Entry 18, State List)
2. States are responsible for enacting and implementing consolidation laws

Central Support:

3. Department of Land Resources (DoLR), Ministry of Rural Development
4. Provides policy guidance and promotes best practices
5. Supports Digital India Land Records Modernization Programme (DILRMP)

Major State Laws:

6. Uttar Pradesh Consolidation of Holdings Act, 1953

Uttar Pradesh Model: Initiated in 1954 (Muzaffarnagar, Sultanpur); expanded statewide in 1958; and covered over 100,000 villages (Phase I).

7. Punjab Consolidation of Holdings Act, 1948
8. Haryana Consolidation of Holdings Act, 1948 (adapted)
9. Madhya Pradesh Land Revenue Code, 1959 (Sections 205–221)
10. Himachal Pradesh Holdings (Consolidation and Prevention of Fragmentation) Act, 1971

Objectives of Land Consolidation | Process of Land Consolidation

1. Reduce fragmentation of holdings | Notification of Area by state government
2. Promote economies of scale | Updating Land Records
3. Enable mechanization and irrigation efficiency | Valuation of Land Parcels
4. Improve land records and tenure security | Preparation of Consolidation Scheme
5. Facilitate rural infrastructure development (roads, irrigation channels) | Reallocation of Land (Chakbandi) into contiguous plots | Provision for Compensation (if value differs) | Creation of New Land Records (Jamabandi)

Evidence of Effectiveness

Empirical Findings: Fragmentation reduces productivity significantly; even a 10% reduction in fragmentation can boost output per acre.

1. **Field Study (Rajasthan, 2025):** Cultivation cost reduced by more than 30%; Labour days reduced from 220 to 140; and tractor use reduced by almost 50%.

Regional Success: Punjab, Haryana, Western UP have better irrigation systems, higher mechanization, and strong foundation for Green Revolution

2. **Lagging States (e.g., Bihar, Odisha)** lack of consolidation linked to lower agricultural development.

Global Perspective

1. FAO (2020) identifies land consolidation as a key tool for rural development
2. Contributes to SDGs: SDG 1 (No Poverty); & SDG 2 (Zero Hunger)

Challenge of Land Fragmentation

Rising fragmentation: 86.2% of India's operational holdings are small and marginal (<2 ha) (Agriculture Census 2021–22).

1. Average landholding declined from 1.08 ha (2016–17) to 0.74 ha (2021–22) (NABARD).
2. **Causes:** Population growth, inheritance laws leading to subdivision, economic compulsions
3. **Impacts:** Increased cost of cultivation, reduced mechanization efficiency, higher labour and time costs, lower agricultural productivity and incomes

Administrative & Governance Issues: Corruption and lack of transparency, weak land records and mapping systems, and revenue department-led process lacks local accountability.

Social Resistance: Disputes over land valuation and allocation, and lack of consent (e.g., cases from Uttar Pradesh villages).

Legal and Policy Gaps: Excessive exemptions in laws, and irregular implementation across states.

Infrastructure Issues: Missing access roads; and loss of trees, wells without compensation.

Policy Innovations & Suggestions

Strengthen Institutional Mechanisms: Involve Gram Panchayats for transparency; digitize land records (SVAMITVA, DLRS initiatives).

Ensure Farmer Participation: Minimum 75% consent rule (as suggested in UP)

Periodic Consolidation: Repeat exercise every 10–15 years

Integrate with Rural Development: Align with irrigation, roads, and livestock policies.

Protect Common Lands: Ensure proper demarcation of grazing and community lands.

Way Forward

Land consolidation is not merely a technical reform but a structural transformation tool for Indian agriculture. It improves productivity, reduces costs, and enhances rural livelihoods. However, its success depends on transparent governance, community participation, and periodic updates.



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YOJANA

1. Looking Beyond High School: Today and Tomorrow

Mains GS Paper: GS Paper II

Subject: Social Justice & Governance

Topic: Issues relating to development and management of Social Sector/Services relating to Education, Human Resources

Sub-Topic: Structural analysis of secondary education, learning pathways, foundational deficits, and career aspirations of youth

Introduction

The new National Education Policy (NEP 2020) restructures the school lifecycle into clear developmental stages. While significant national policy focus and research have targeted the primary and foundational tiers, understanding the **transition patterns of** the secondary cohort (ages 14 to 18) is critical to planning for the future of work and life outcomes in India. Currently, this age bracket is trapped in a hyper-competitive, high-stakes examination culture that often prioritizes academic credentials over practical, life-long learning and applied skills.

NEP 2020 Schooling Tiers:

1. The policy defines the secondary stage as a distinct block covering the age group of 14 to 18 years, corresponding to Classes 9 to 12.
2. This follows three distinct preceding stages: Foundational (Ages 3–8; Anganwadi to Class 2), Preparatory (Ages 8–11; Classes 3–5), and Middle (Ages 11–14; Classes 6–8).

The Exam-Centric Environment:

3. Life for high school students from Class 9 onwards is dominated by intensive exam preparation and high-stakes college entrance tests.

4. This creates an anxious, high-octane environment fueled by widespread commercial advertisements for test-preparation materials, online coaching packages, and instructional applications.
5. Academic performance is heavily tied to the societal reputation and standing of individual families, schools, and teachers.

Demographic Shift and Scale:

6. India has roughly 25 million children in each age-group cohort, moving through a rapidly expanding educational pipeline.
7. Class 8 national enrollment expanded from approximately 11 million in 2005–2006 to nearly 22 million by 2020–2021.
8. This near-doubling means a significantly higher percentage of youth are moving through secondary education today than a decade ago, driving the intense competition.

Activities & Enrollment Realities (ASER 2023 Data):

9. At age 14, over 95% of youth are actively enrolled in an educational institution.
10. By age 18, enrollment drops to 67.4%, showing a notable exit from the formal schooling system.

The Double Burden of Education and Labor:

11. A significant portion of enrolled students also work outside the home (having worked at least 15 days in the month preceding the survey).
12. For students in Class 10 or below, 33.8% of males and 24.4% of females are working.
13. For higher secondary students (Classes 11 and 12), the working share rises to 39.2% for males and 26.1% for females.
14. Approximately 80% of these working youth are engaged in agricultural work, typically on their family farms.

The Vocational Deficit:

15. Only a minimal 5.6% of youth in the 14–18 age bracket are enrolled in any vocational training courses.
16. Of the small segment taking vocational courses, the majority are confined to short-term programs lasting six months or less.

Foundational Deficits & Assessment Alarms:

17. Data from school-based national initiatives like PARAKH 2024 and household surveys like ASER highlight an urgent need to improve foundational learning in middle and secondary schools.
18. Many students reach the secondary stage lacking the basic reading and math skills needed for daily tasks and basic calculations.
19. Strengthening foundational arithmetic generates large dividends for a student's future career path.

Skewed Career Aspirations:

20. The career expectations of rural youth and their families remain heavily skewed toward securing government jobs or entering traditional professions like teaching, military, medicine, and engineering.
21. Many rural students face information gaps, lacking clear knowledge about the exact requirements or paths needed to successfully navigate avenues beyond high school.

Digital Skills vs. Classroom Absence:

22. Data from ASER 2024 reveals that nearly 90% of rural students aged 14–16 have access to a smartphone at home.
23. Over three-quarters of these youth can successfully complete everyday digital tasks on their own, such as setting alarms, browsing for information, locating videos, and sharing digital content.
24. Most youth have acquired these basic digital skills independently or from peers, despite not being taught how to handle technology systematically in school.

Way Forward & Policy Recommendations

1. **Redefining High School Learning:** Education must move past the current narrow focus on individual exam preparation and academic credentials toward building applied, hands-on skills.
2. **Systemic Foundational Recovery:** Clear definitions of basic foundational learning for high school levels must be set, backed by targeted efforts to ensure all enrolled students achieve these core skills.
3. **Integrating School with Real-Work Contexts:** Since a large share of rural students work on family farms, curriculum designers must create clear links between school-based academic concepts and real-world "learning by doing".
4. **Shifting to Team-Based Pedagogy:** High school frameworks should incorporate group projects to teach students how to work in teams, cooperate with diverse peers, and manage project delivery together.
5. **Integrating Digital Tools into the Curriculum:** Schools must move beyond simple device access and integrate digital technology directly into classroom activities. This will help connect youth to the evolving workforce while strengthening their capacity to handle daily life challenges.
6. **Adulthood Preparation Framework:** Immediate institutional changes are needed to ensure youth transition into adulthood with the skills required to support a lifelong learning path across three pillars: "learning for school", "learning for work", and "learning for life".

2. From Scale to Skill – Powering Viksit Bharat's Workforce

Mains GS Paper: GS Paper III

Subject: Economic Development

Topic: Employment, Growth, and Resource Mobilization

Introduction

India's path to becoming a developed economy by 2047 depends directly on its workforce. Millions enter the labor market every year, yet employers report an acute shortage of job-ready talent. The challenge has shifted from providing job access alone to ensuring workplace readiness. Converting our time-bound demographic dividend into a lasting asset requires upgrading our massive labor scale into highly adaptable skills.

The Skill Gap & Employability:

1. Only 3.7% of the total Indian workforce had undergone formal vocational training in 2022–23.
2. Modern industries report that youth employability stands at just over 51%.
3. A large number of young graduates enter the market without the specific practical skills required by employers.

The Disruption of Old Jobs:

4. Rapid technological change is quickly erasing low-skill, repetitive positions.
5. Legacy roles like PCO booth operators, manual typists, and traditional travel agents have been replaced by digital systems.
6. Standard banking clerical roles and manual factory assembly line tasks are increasingly handled by automated systems.
7. Emerging jobs now strictly require digital familiarity, quick problem-solving, and continuous learning.

The Boom of the Gig and Platform Economy:

8. App-based sectors (delivery partners, ride-hailing, home services, digital freelancing) support millions outside traditional job structures.
9. Gig workers must master multi-app navigation, platform metrics, and digital customer interfaces simultaneously.
10. Specialized skilling pathways are necessary to help gig workers transition from low-value tasks to high-value roles over time.

Building Training Systems at Scale:

11. The Skill India Mission (launched in 2015) shifted national planning to place skill development at the center of economic growth.
12. Thousands of Industrial Training Institutes (ITIs) have been set up or modernized across the country.

13. The Pradhan Mantri Kaushal Vikas Yojana (PMKVY) focuses its latest training cycles on future industries like AI, robotics, and advanced manufacturing.
14. Structured apprenticeship programs offer direct, practical exposure to bridge the gap between training and final jobs.
15. The National Skills Qualification Framework (NSQF) standardizes training to strictly match industry standards.

Workforce Inclusion and Global Mobility:

16. Increasing female labor participation requires accessible training, childcare setups, and flexible hours.
17. Overcoming rural training deficits requires localized infrastructure and targeted awareness campaigns.
18. India is signing international deployment treaties to position its skilled domestic labor force as a vital global asset.

Way Forward

1. **Continuous Lifelong Process:** Skilling can no longer be treated as a one-time school phase; it must evolve into a lifelong process of learning, unlearning, and relearning.
2. **Support Gig Mobility:** National training networks must recognize gig workers as core pillars and design specific upward mobility programs for them.
3. **Three-Way Coordination:** Transforming our time-bound workforce scale into shared prosperity requires highly coordinated action across government, industry, and academia.

3. Skilling India for an Innovation-Driven Future

Mains GS Paper: GS Paper III

Subject: Science & Technology / Economic Development

Topic: Fourth Industrial Revolution (Industry 4.0), Technology Indigenization, and Strategic Sovereignty

Introduction

The Fourth Industrial Revolution (Industry 4.0) is rapidly changing the global economy by combining physical, digital, and biological production systems. For India, converting its vast youth cohort into high-productivity workers requires an innovation ecosystem that builds digital mastery, critical tech skills, and research capabilities.

The Demographic Window:

1. India has the world's largest youthful workforce, with 65% of its population below the age of 35 and a median age of 28.

2. This window is time-limited; India's working-age population share is projected to begin declining after 2030.

The Degree-Industry Mismatch:

3. Economic data shows a structural mismatch where over 53% of graduates and 36% of postgraduates are underemployed in roles below their qualifications.
4. Standard degrees are not aligned with industry requirements, leaving a major portion of the workforce stuck in low-competency jobs.

Breaking Institutional Silos:

5. Government policy is merging academic research with large-scale manufacturing via specific programs like SPARC, IMPRINT, NIDHI, and target-driven Production Linked Incentive (PLI) schemes.
6. These initiatives aim to connect institutions to ensure high-end research directly solves domestic engineering and corporate problems.

Policy Updates & The Credit System:

7. The National Education Policy (NEP 2020) removes the rigid divide between academic degrees and vocational paths, treating skill training as a prestigious career route.
8. The National Credit Framework (NCrF) enables portable credit systems across academic, vocational, and hands-on experiential learning.
9. The digital Skill India Digital Hub 2.0 (SIDH 2.0) centralizes course identification, maps employment trends, and tracks digital credentials to fix market information gaps.

Key Critical Technology Domains:

10. **Artificial Intelligence (AI):** India holds 16% of the global AI talent pool. The ₹10,372 crore IndiaAI Mission focuses on expanding GPU computing power to Tier-2 and Tier-3 hubs, aiming to train 1.25 million AI specialists by 2027.
11. **Semiconductor Fabrication:** Moving from back-office chip design to local physical manufacturing. Key physical setups include Micron's ATMP facility in Sanand, Tata Electronics' ₹91,000 crore Fab in Dholera, and the TSAT facility in Morigaon. The Chips to Startups (C2S) initiative equips 315 colleges with professional design tools.
12. **Green Hydrogen:** The National Green Hydrogen Mission aims to train 600,000 clean-tech professionals by 2030 in complex chemical handling and storage systems.
13. **The Creative Media Sector (AVGC):** Union Budget 2026-27 establishes content creator labs across 15,000 schools and 500 colleges to secure digital content sovereignty and target 2 million jobs by 2030.

Global Capital & Grassroots Knowledge:

14. India is signing international migration treaties with regions like the EU, UK, Germany, Italy, and Japan to position domestic skilled labor as a strategic global diplomatic asset.
15. Traditional botanical knowledge and grassroots innovations are being structurally indexed within the NCrf to generate certified intellectual property from local communities.

Way Forward

1. **Democratic Infrastructure Access:** High-tech tools (like advanced compute power and clean rooms) must be decentralized away from a few elite centers out to regional ITIs and rural skill hubs.
2. **Just Transition Strategies:** Skilling policies must incorporate NITI Aayog's dual-strategy models, using infrastructure and regional development to bridge spatial mismatches between where green jobs are located and where workers live.

4. India's Labour Codes – Transforming Work, Empowering Workers, Building Viksit Bharat

Mains GS Paper: GS Paper II

Subject: Governance & Polity

Topic: Statutory Reforms, Executive Regulations, and Labor Welfare

Introduction

India has simplified its complex, outdated labor legal framework by consolidating 29 central laws into 4 comprehensive Labour Codes. This major statutory change aims to balance three essential targets: expanding social security protections for workers, lowering administrative paperwork for companies, and building a modern formal economic market.

The Core Structural Consolidation:

1. **Code on Wages, 2019:** Combines 4 older laws relating to wages, bonuses, and equal pay parameters.
2. **Industrial Relations Code, 2020:** Merges 3 major laws dealing with labor disputes, standing orders, and trade unions.
3. **Code on Social Security, 2020:** Integrates 9 legacy laws concerning provident funds, maternity leaves, and gratuity.
4. **Occupational Safety, Health and Working Conditions (OSHC) Code, 2020:** Consolidates 13 sector-specific laws regarding workplace health and safety rules.

The Code on Wages, 2019:

5. Establishes a standard, single definition of "wages" across industries. This prevents companies from using excessive allowances to artificially reduce their contributions to employee retirement funds.

6. Empowers the Central Government to set a mandatory "National Floor Wage" based on minimum living standards, which state governments cannot go below.
7. Guarantees timely wage payments and strictly bans gender-based pay discrimination for equal work.

The Industrial Relations Code, 2020:

8. Formally recognizes a single "negotiating union" if a trade union wins 51% or more worker votes, simplifying corporate disputes.
9. Raises the employee threshold from 100 workers to 300 workers before a company must seek prior government permission for layoffs, retrenchments, or closures.
10. Formalizes "Fixed-Term Employment," granting temporary contract workers the same wage rates and benefits as permanent workers.
11. Introduces a mandatory notice period before declaring strikes or lockouts to encourage settlement talks first.

The Code on Social Security, 2020:

12. Introduces the first-ever statutory definition and recognition for gig workers and platform workers in Indian labor history.
13. Sets up a legal framework to build aggregator-funded welfare schemes for digital and app-based workforces.
14. Directs portable welfare coverage for unorganized and migrant workers, utilizing the e-Shram digital registration system.

The OSHWC Code, 2020:

15. Modernizes workplace hygiene by standardizing medical exams, regulated hours, and safety committees.
16. Grants women the legal right to work night shifts across all industries, provided that strict security safeguards and consent rules are met.
17. Simplifies state compliance burdens by raising employment thresholds for regulating third-party contract labor.

Key Implementation Challenges:

18. Because Labor falls under the Concurrent List of the Constitution, different states are drafting rules at an uneven pace, which threatens to create a disjointed national framework.
19. Shifting from strict enforcement inspectors to an "Inspector-cum-Facilitator" system risks lowering deterrence in vulnerable, informal sectors if state inspection capacity is weak.

Way Forward

1. **Careful Rulemaking Cohesion:** Transitioning from statutory text to real results requires consistent rule implementation across all state governments.
2. **Bridging Digital Gaps:** Platforms like e-Shram must be paired with local language resources and training to ensure that digital exclusion does not block vulnerable migrant workers from accessing their benefits.

5. From Forest to Fashion – Tribal India Enters Global Value Chains

Mains GS Paper: GS Paper I & II

Subject: Social Issues & Governance

Topic: Welfare Schemes for Vulnerable Sections, Tribal Integration, and Livelihoods

Introduction

India's tribal economies are shifting from local survival gathering to high-value global commerce. By matching unique hand-made skills with modern business models, state initiatives are turning raw forest goods into premium brands. This ensures sustainable income and independent growth for tribal artisans.

The Core Structural Shift:

1. Tribal artisans are changing from simple suppliers of cheap raw materials into proud owners of premium brands.
2. Modern buyers look for unique, eco-friendly items, meaning tribal crafts cannot be replaced by factory machines.
3. Programs use platforms like the *Bharat Tribes Fest 2026* to show off tribal art, food, and culture directly to urban markets.

The Van Dhan Vikas Kendras (VDVKs) Model:

4. VDKs are community-owned processing centers run by the Ministry of Tribal Affairs and TRIFED.
5. **The Setup:** Each large VDK cluster brings together 15 tribal Self-Help Groups (SHGs).
6. **The Scale:** Each individual SHG contains up to 20 tribal collectors, totaling nearly 300 beneficiaries per cluster.
7. **The Process:** Tribal members bring raw minor forest goods to these centers for quality grading, clean packaging, and official brand tracking.

The Tribes India Supply Chain:

8. The TRIFED network links remote tribal producers directly to city buyers, cutting out greedy middleman merchants.
9. Finished items travel through high-end retail stores at major airports, premium malls, and digital e-commerce channels.

10. TRIFED partners with the *National Institute of Fashion Technology (NIFT)* to update old designs for modern consumers while keeping their cultural roots alive.

RISA – The Premium Tribal Brand:

11. This flagship brand aims to position tribal work in high-end domestic and international markets.
12. It teams up professional designers with local artisans to build modern, market-ready clothing and art collections.
13. **Key Featured Crafts:** Eri & Muga Silk (Assam), Kotpad Cotton (Odisha), Changpa Pashmina (Ladakh), Toda Embroidery (Tamil Nadu), Longpi Pottery (Manipur), Turtuk Brass Cutlery (Ladakh), and Dokhra Art (Chhattisgarh).

Women Leading the Transition:

14. Women run the show as producers, cooperative managers, and quality controllers.
15. These women-led groups allow shared savings, safe micro-lending, and joint investments in raw materials.
16. The system provides women with their first official economic ID, turning unrecognized daily labor into formal income.

Way Forward

1. **Scale Up Digital Reach:** Expand Tribes India's e-commerce stores to help remote artisans trade worldwide on their own terms.
2. **Protect Cultural Roots:** Keep the balance between modifying goods for modern buyers and protecting the core heritage of tribal arts.

6. Smart and Sustainable Agriculture: A Synergy of Tradition and Technology

UPSC Syllabus Mapping

Mains GS Paper: GS Paper III

Subject: Economic Development / Agriculture

Topic: E-technology in the aid of farmers, Land reforms, and Precision Agriculture

Introduction

Indian agriculture is moving from basic family survival to high-tech, skill-based smart livelihoods. By combining ancient tribal ecological wisdom with modern tools like nanotechnology, artificial intelligence (AI), and drones, farms are turning into data centers. This integration increases rural incomes and builds environmentally safe, climate-resilient farming systems.

Core Agricultural Scale:

1. Around 54.6% of India's workforce depends directly or indirectly on agriculture and allied lines for their survival.
2. The agricultural sector contributes between 18% and 19% to India's Gross Value Added (GVA).
3. India is a global leader in staple crops like rice, wheat, sugarcane, and cotton, making it a critical link in global food security.

The Power of Tribal Botanical Knowledge:

4. India is home to over 700 distinct tribal communities who act as the protectors of ancient plant sciences.
5. More than 7,000 plant species are used across indigenous medical lines like Ayurveda, Siddha, and Unani.
6. Traditional botanical insights have provided vital ingredients for modern medicine, such as *reserpine* from *Sarpagandha* for blood pressure, and *quinine* from *Cinchona* bark for malaria.
7. Tribal communities preserve genetic seed diversity naturally, understanding exactly which seeds match specific soil types and erratic seasons.
8. Traditional practices like mixed farming, organic resource fertilizers, and natural clay grain-coatings are safer and more eco-friendly than modern chemical alternatives.

The Nanotechnology Leap:

9. **Higher Efficiency:** Only 30–40% of standard chemical urea is absorbed by plants, while the rest pollutes soil and groundwater. Liquid Nano Urea achieves an absorption rate of over 80%, drastically reducing chemical dependency and environmental harm.
10. **Targeted Delivery:** Nano-fertilizers deliver micro-nutrition directly to plant tissues, reducing input waste and lowering the state's heavy fertilizer subsidy burden.
11. **Crop Protection:** Elements like nano-zinc and nano-iron improve crop quality, nano-copper protects against pests, and nano-silica helps plants survive severe droughts.

The Digital Revolution on the Farm:

12. **Precision Tools:** AI, Internet of Things (IoT) tracking, and drone setups allow automated real-time soil checking, smart water use, and fast fertilizer spraying.
13. **Market Transparency:** Digital portals like e-NAM bypass local middlemen, connecting farmers directly to national market pricing via their smartphones.
14. **Blockchain Tracking:** Offers complete "farm-to-fork" supply visibility, boosting the economic value of traditional grains and millets (*Shree Anna*) in global organic markets.

15. **The AgriStack Database:** Built under the Digital Agriculture Mission to store land, soil, and crop data, offering customized, automated advice to individual farmers.

Emerging Carbon Credit Markets:

16. Farmers can now sell carbon credits on international markets by planting trees and storing carbon using traditional low-emission methods.
17. Forest-protecting tribal communities stand to be the biggest beneficiaries of this new eco-service economy.

Way Forward

1. **Establish Rural Service Hubs:** Set up Smart Agriculture Service Centres in every village to provide training on drones and nano-fertilizers.
2. **Strengthen Cooperatives:** Build up local Farmer Producer Organisations (FPOs) and expand digital literacy in local languages so small farmers can tap into global markets.

7. Women's Empowerment and Workforce Participation: Challenges and Possibilities

Mains GS Paper: GS Paper I & II

Subject: Social Issues & Governance

Topic: Role of Women, Women's Organizations, and Welfare Schemes for Vulnerable Sections

Introduction

Achieving true gender balance and economic freedom for women is essential to building a democratic, progressive society. As India works toward the goal of a developed nation (*Viksit Bharat @2047*), raising female workforce numbers to 50% is a critical requirement to power national economic growth and ensure fair opportunities for all.

Historical & Social Background:

1. Traditionally, women faced deep-rooted social constraints, including a patriarchal system, early child marriage, and lack of education.
2. Historic movements led by early Indian reformers (like Raja Ram Mohan Roy and Savitribai Phule) fought against social evils like Sati and child marriage, paving the way for women's education and basic rights.
3. After independence, constitutional protections and progressive laws helped women step into diverse roles, ranging from political leaders to fighter pilots.

Workforce Trends & Statistics:

4. **Significant Growth:** Driven by targeted government policies, India's Female Labour Force Participation Rate (LFPR) grew from 23.3% in 2017–18 to approximately 41.7% in 2023–24.
5. **Global Recognition:** World Bank data shows India achieved the highest increase in female workforce participation among all BRICS countries over the past decade.
6. **The Rural Lead:** According to the Periodic Labour Force Survey (PLFS), workforce growth is higher in rural areas (increasing by 12 percentage points) than in urban areas.
7. **Leadership Gaps:** Despite these workforce gains, deep gaps remain at senior levels; women hold board seats in only 6% of India's top 160 listed companies.
8. **Future Scale:** Women are expected to make up more than half of all new entrants into the national workforce by 2030.

Key Government Welfare Schemes:

9. **Mission Shakti Campaign:** Operates through two distinct sub-plans—*Sambal* (focusing on safety, security, and legal aid) and *Samarthya* (focusing on economic empowerment).
10. **Economic Support Policies:** Programs like the *Lakshpati Didi* initiative, *Namo Drone Didi* scheme, and Pradhan Mantri Mudra Yojana provide specialized business assets and direct financial loans to women.
11. **Supportive Workplace Laws:** The *Maternity Benefit Amendment Act of 2017* increased fully-paid maternity leave from 12 weeks to 26 weeks, making it easier for women to return to their jobs.

Major Hurdles to Workforce Growth:

12. Persistent challenges include social biases, domestic violence, workplace safety issues, and an unequal burden of household chores.
13. Structural issues like a lack of safe public transport, the gender pay gap, uneven childcare options, and an urban-rural divide continue to limit female employment.
14. Increasing machine automation in traditional fields like agriculture risks displacing rural female laborers if they are excluded from technical and STEM education.

Workforce Safety & Redressal Tools:

15. **The POSH Act 2013:** A vital legal framework that strictly prohibits, prevents, and punishes sexual harassment to ensure a safe, dignified workplace environment for women.
16. **The She-Box Digital Portal:** An online platform built by the Ministry of Women and Child Development that lets women in public and private sectors file safety complaints directly to secure timely justice.

Way Forward

1. **Value All Forms of Work:** Stop the rigid division between domestic and professional life by fully recognizing and valuing women's labor in both formal and informal sectors.

2. **Remove Barriers to Integration:** Provide reliable, safe public transportation and build widespread childcare centers to unlock the full potential of women as independent economic leaders.

8. From Queues to QR Codes – India's Payment Revolution

Mains GS Paper: GS Paper III

Subject: Economic Development / Science & Technology

Topic: Financial Inclusion, Digital Public Infrastructure (DPI), and E-technology

Introduction

India's financial system has completely transformed from a slow, cash-heavy economy into a fast, digital network. Long queues at banks and utility offices have been replaced by instant smartphone transactions. This payment revolution has bridged the divide between urban and rural populations, making secure financial services accessible to everyone.

The Core Structural Base (JAM Trinity):

1. The revolution stands on three key pillars: Jan Dhan zero-balance bank accounts, Aadhaar digital biometric identity, and Mobile connectivity.
2. Jan Dhan accounts brought millions of unbanked citizens into the formal financial folder.
3. Aadhaar provided a trusted digital identity, enabling the government to send welfare funds directly to people through Direct Benefit Transfer (DBT), which reduced corruption and built public trust in digital banking.

The UPI Breakthrough:

4. Launched by the National Payments Corporation of India (NPCI) in 2016, the Unified Payments Interface (UPI) completely simplified how money moves.
5. It replaces complex requirements like bank account numbers and IFSC codes with a simple Virtual Payment Address (UPI ID) or a mobile number.
6. Transactions occur instantly, work round-the-clock, and are free and interoperable across different banks and payment apps.

UPI by the Numbers (Scale & Global Lead as of January 2026):

7. **Massive Volume:** Processed 21.70 billion transactions in the single month of January 2026.
8. **High Value:** Processed ₹28.33 lakh crore in transaction value during that same month.
9. **Retail King:** Handles 81% of all retail digital transactions in India.
10. **Global Leader:** Accounts for 49% of all global real-time digital payment transactions, making it the world's largest real-time payment system by volume.
11. **Rapid Growth:** Expanded its network from 216 connected banks in 2021 to 691 banks by January 2026.

Deepening Financial Access:

12. UPI has eliminated the barrier between the rich and the poor; street vendors, auto drivers, and village markets now accept payments through simple QR codes.
13. Using digital payments creates a recorded financial history for informal workers, helping them access formal loans, credit lines, and insurance options.
14. Features like *UPI Lite* support fast, small-value payments, *UPI AutoPay* handles monthly recurring bills, and *Credit on UPI* links pre-approved credit lines to user profiles.

Enhanced Fraud Security:

15. To make digital tools safer, the Reserve Bank of India (RBI) introduced a mandatory two-factor authentication mechanism effective April 1, 2026.
16. This ensures all transactions are strictly protected by multiple security layers, such as PINs, biometrics, or secure tokens alongside standard OTPs.

Global Impact & Technology Diplomacy:

17. International bodies like the IMF and World Bank recognize India's digital infrastructure as a leading model for global inclusion.
18. UPI has expanded beyond national borders and is now linked with payment networks in countries like the UAE, Singapore, Bhutan, Nepal, Sri Lanka, France, Mauritius, and Qatar to allow seamless cross-border transactions and remittances.

Way Forward

1. **Go Green with Payments:** Promoting UPI helps the environment by completely eliminating paper receipts and cutting down the carbon footprint tied to physical cash logistics.
2. **Maintain Public Trust:** As the system scales to handle billions of monthly transactions, keeping networks secure with advanced tools like two-factor verification is essential to sustain user confidence.

9. Mother Nargis

Mains GS Paper: GS Paper I & II

Subject: Indian Culture / Social Justice

Topic: Cinema as a Reflection of Societal Values, Role of Civil Society, and Institutional Welfare

Introduction

The life of cinematic icon Nargis Dutt illustrates how personal stardom can be transformed into a powerful tool for social reform and public welfare. Beyond her historic achievements in Indian cinema, her pioneering work for children with disabilities and her subsequent legislative role established a lasting legacy of empathy and institutional care.

Cinematic Milestones & National Identity:

1. Born to Jaddan Bai—a pioneering singer, actor, and music director—Nargis entered filmdom as a child artist under the name Fatima Rashid.
2. She became the first actress to be conferred the Padmashri (1958) and the first to win the National Film Award for Best Actress (*Raat Aur Din*, 1967).
3. Her legendary role as Radha in *Mother India* (1957) won her an international award at Karlovy Vary and turned her into the iconic cinematic symbol of the resilient Indian mother.
4. She was also the first actor to have a National Film Award category (National Integration) named in her honor.

Pioneering Support for Cerebral Palsy:

5. In 1972, when public awareness of cerebral palsy was almost non-existent in India, Nargis became the very first patron of the Spastics Society of India.
6. Her extensive on-the-ground work successfully focused national attention on the developmental needs and impairments faced by affected children.
7. Today, the Society continues her mission by providing specialized education and hands-on vocational training to spastic individuals.

Parliamentary Service:

8. In recognition of her deep commitment to social work and her efforts to help marginalized children, she was nominated to the Rajya Sabha in 1980.

Border Welfare & Cultural Outreach:

9. Alongside her husband, actor Sunil Dutt, she co-founded the Ajanta Arts Cultural Troupe.
10. Long before the era of television or the internet, she traveled with actors and musicians to remote, high-altitude border areas to entertain and boost the morale of Indian soldiers facing harsh winters and hazardous terrain.

The Nargis Dutt Foundation:

11. Following her tragic passing from cancer on May 3, 1981, her husband Sunil Dutt established the Nargis Dutt Foundation.
12. The foundation works extensively with the Tata Memorial Centre to build cancer awareness, offer treatment counseling, and provide scholarships to students aspiring to become doctors or lawyers.

A Continuing Family Legacy of Public Service:

13. Her daughter, Priya Dutt, directed an hour-long documentary on her life (*Nargis*, 1991) and walked alongside her father during his historic *Sadbhavna Padayatra* in 1987 to promote communal harmony.

14. Priya later stepped into public service directly, serving twice as a Member of Parliament (2005 and 2009) and continuing to run the foundation's healthcare initiatives for the poorest citizens.

Way Forward

1. **Leveraging Influence for Public Good:** The legacy of the Dutt family proves that popular art and cinema can go hand-in-hand with social accountability, showing how cultural platforms can effectively drive public health awareness and civil society welfare.

KURUKSHETRA

1. Nurturing Young Minds for India's Future

UPSC: GS III | Environment | Environmental Education | Role of Youth, Schools, Families, and Communities in Green India

Introduction: Environmental challenges of the 21st century — climate change, biodiversity loss, pollution, and resource depletion — require urgent action. A key long-term strategy is fostering environmental awareness and responsibility among children and youth, aligned with Viksit Bharat.

Why Early Awareness Matters:

1. Environmental challenges directly affect daily life through extreme weather, water scarcity, soil erosion, and declining air quality.
2. Habits formed during childhood persist throughout life — a child who conserves water and minimises waste carries these values into adulthood.
3. National Environment Policy 2006, NAPCC, Swachh Bharat Mission (Gramin) Guidelines, and NEP 2020 all emphasise integrating environmental sustainability into education and governance.

Role of Environmental Education:

1. Builds knowledge, attitudes, and skills for sustainable living — goes beyond textbooks to develop critical thinking and problem-solving.
2. Samagra Shiksha Guidelines state: education is the most important tool for social, economic, and political transformation.
3. Key goals: building awareness early; developing responsible behaviour; fostering emotional connection with nature; encouraging community participation; integrating with Green India Mission; promoting eco-clubs.

Role of Schools:

1. First structured environment where environmental awareness can be systematically introduced, practised, and reinforced.

2. Curriculum integration — literature, science, social studies, and geography naturally connect to climate change, biodiversity, and conservation discussions.
3. Experiential learning — observing local ecosystems, maintaining gardens, conducting environmental projects builds real-life relevance.
4. Schools cultivate everyday habits — switching off lights, minimising paper waste, segregating waste; these habits persist throughout life.
5. Collective action platforms — eco-clubs, tree plantation drives, cleanliness campaigns provide students with opportunities to actively participate.
6. Green school environment — rainwater harvesting, solar energy, waste management, and green campuses make schools bridges between students, families, and communities.

Sustainable Practices for Green Minds:

1. Practising water conservation in daily life.
2. Reducing, reusing, and recycling waste (3Rs).
3. Using eco-friendly alternatives.
4. Planting and caring for trees and plants.
5. Saving energy at home and school.
6. Participating in cleanliness drives.
7. Promoting sustainable transportation.
8. Spreading environmental awareness.
9. Practising responsible consumption.
10. Engaging in school eco-clubs and green activities.

Role of Families:

1. Families are the earliest and most influential environment — children observe, imitate, and internalise habits practised at home.
2. Simple actions — conserving water, switching off appliances, reducing food waste, avoiding single-use plastics — serve as practical lessons in environmental responsibility.
3. Families shape attitudes toward consumption — encouraging mindful purchasing and reusing household items teaches children the importance of reducing waste.
4. Families bridge knowledge and practice — what children learn in school becomes meaningful when reinforced at home.
5. Activities like planting trees, maintaining home gardens, and visiting parks help children appreciate the natural world, fostering a stronger sense of responsibility.

Role of Communities:

1. Communities form the social fabric within which children and youth grow and learn beyond home and school.
2. When sustainability becomes a shared community value, it creates an ecosystem where green habits are practised, reinforced, and celebrated.
3. Community roles: fostering collective responsibility; organising cleanliness drives, tree plantation campaigns, and waste segregation programmes; integrating traditional knowledge with sustainability through cultural events.

Creative Approaches:

1. Connecting learning with real-life experiences of children and youth.
2. Promoting learning through play, activities, and gamification.
3. Using storytelling and creative expression.
4. Integrating technology with everyday life through digital platforms.
5. Promoting project-based learning linked to real-life experiences.
6. Encouraging peer learning and purposeful youth leadership.
7. Incorporating local contexts and cultural practices.
8. Linking sustainability with daily habits.

10 Youth-led Initiatives in India:

1. **Green Rising Initiative (India Alliance):** Global youth-led climate action platform with UNICEF and MoEF support — mobilises young people for afforestation, awareness campaigns, and sustainable practices.
2. **Natural Farming Fellows Programme:** Encourages young graduates to adopt natural farming, promoting eco-friendly agriculture and rural sustainability.
3. **Green Yatra — Green Youth Green India Campaign:** Engages college students in sustainability campaigns, tree plantation drives, recycling activities, and green campus programmes.
4. **Youth of India Foundation Environmental Programmes:** Empowers young individuals for climate action, community campaigns, and policy advocacy.
5. **Youth-Led Organic Farming in Maharashtra:** Young farmers in Ahmednagar adopted climate-smart and organic farming — reducing water usage, improving soil health, and enhancing productivity.
6. **Yuva Sansad for Environmental Policy Engagement:** Engaged hundreds of young participants in presenting ideas on sustainable development to local governance bodies.
7. **Student-Led Recycling Drives in Vijayawada:** Large-scale recycling campaigns collecting used books and paper — saving trees, water, and energy while reducing carbon emissions.

8. **Youth-Led Nature Clubs in Lucknow:** Efforts to establish nature clubs in higher educational institutions – promoting awareness campaigns and sustainability programmes.
9. **Fridays for Future India:** Students across India organise climate strikes, campaigns, and awareness drives, advocating for stronger climate policies.
10. **Enactus India (Sustainable Entrepreneurship):** Student-driven platform developing eco-friendly business solutions focused on waste management, sustainable livelihoods, and green innovation.

Conclusion:

1. Nurturing green minds is a collective responsibility requiring schools, families, communities, and young individuals.
2. National initiatives like Jal Jeevan Mission and LIFE Movement (Lifestyle for Environment, supported by NITI Aayog) contribute significantly to building a sustainable and resilient Green India.

2. Empowering SHGs for Green Action

UPSC: GS I & II | Social Issues & Governance | Women Empowerment, Rural Development, Climate Adaptation | SHGs and Climate-Resilient Livelihoods

Introduction: Climate change is a lived reality shaping rural livelihoods in India. In the discourse on women-led development as a core pillar of Viksit Bharat, reconsidering the role of Self-Help Groups (SHGs) becomes a crucial strategy – SHGs can address climate change, biodiversity loss, and advance inclusive and sustainable rural development.

SHGs – Scale and Significance:

1. Over **13.4 million SHGs** with nearly 100 million active members across India – mostly women from poor and marginalised communities.
2. SHGs have expanded beyond savings and microfinance to include micro-enterprise development, skill building, and livelihood generation.
3. Under NRLM, interventions implemented through: value chain development for farm and non-farm commodities; enterprise promotion; Lakhpati Didi; SVEP; Aajeevika Grameen Express Yojana (AGEY); and CRP-EP as local mentors.
4. Despite progress, a large proportion of SHGs continue to operate at subsistence level – unable to scale up economic activities.
5. SHG-based enterprises are highly vulnerable to climate change – limited awareness, inadequate skills related to resource efficiency, and weak infrastructure.

Key Issues:

1. Rural India facing shifting rainfall patterns, rising temperatures, and extreme weather events including floods, droughts, and cyclones.

2. Climate impacts affect SHG enterprises across multiple dimensions — physical infrastructure, production processes, supply and value chains, workforce stability, and access to markets and finance.
3. Many SHG enterprises lack capacity to assess, monitor, and adapt to climate-related risks.
4. Effects already visible — frequent energy (electricity) and water shortages during summer months.

Case Study — Waste to Wealth (Odisha):

1. Ms Kamala Moharana, 64 years old, Kendrapara district, Odisha — leads Ma Thanapati Self-Help Group (established 2016, around 30 women members).
2. Group converts plastic waste — milk pouches, polythene bags, food wrappers — into value-added products: hand fans, decorative items, baskets, pen stands, mobile stands, and flower pots.
3. Initiative was mentioned by the Prime Minister in Mann Ki Baat — received appreciation from various leaders; became a sustainable source of income while promoting cleanliness and environmental awareness.

Strategic Areas Where SHGs Can Contribute:

1. **Sustainable agriculture:** Organic and natural farming, use of bio-fertilisers, composting, reduction of chemical inputs — actively promoted under NRLM across states; promoting climate-resilient practices including IFS, kitchen gardens, climate-resilient seeds, and soil health cards.
2. **Water conservation and watershed management:** Constructing check dams, rainwater harvesting structures, and soil conservation measures — role of SHGs clearly recognised in PMKSY-WDC 2.0 guidelines.
3. **Waste management and circular economy:** Engaged in solid and liquid waste management, collection, segregation, and recycling — converting waste into useful products such as bags, mats, and handicrafts from water hyacinth.
4. **Renewable energy:** In several states, SHGs function as energy entrepreneurs by producing, distributing, or maintaining solar lanterns and lighting systems.
5. **Forest and tribal regions:** SHGs play a critical role in sustainable management of common resources, responsible utilisation of NTFPs, forest restoration, and preservation of indigenous knowledge.

SHG Best Practices Across Indian States:

Intervention	State	Key Features
Kudumbashree Model	Kerala	Women-led waste management; organic farming
Zero Budget Natural Farming (ZBNF)	Andhra Pradesh & Telangana	SHG-driven natural farming

"Palash" Branding Initiative	Jharkhand	SHG products — honey, pulses, handicrafts — marketed under a common brand
MAVIM Model	Maharashtra	Sustainable agriculture and nutrition gardens; SHGs linked with value chains
Waste to Wealth SHGs	Odisha	SHG women create products from textile waste and plastic waste
NTFPs / Forest-Based Livelihoods	North-eastern states	Bamboo crafts; products from water hyacinths; conservation + livelihood integration

Challenges:

1. Many rural communities lack access to reliable climate information, technical knowledge, and training.
2. Sensitising communities about climate change should be the first step — through Special Gram Sabhas facilitated by NGOs, government agencies, and FPOs.
3. Building capacity of SHG members to integrate climate concerns into VPRPs and GPDPs.
4. Providing regular capacity-building support on climate-resilient agriculture, water conservation, and clean energy adoption.

Way Forward:

1. SHG potential remains largely untapped in various micro-planning tools — GPDP, VDMP, MGNREGA, VB-GRAM G, PMKSY-WDC 2.0, and Pradhan Mantri Kisan Sinchayee Yojana.
2. India has a large cadre of CRPs — Krishi Sakhi, Pashu Sakhi, Doctor Didi, Matsya Sakhi, Udyog Sakhi, Bank Mitras, e-CRPs, Setu Didi, Tablet Didi, and Patrakar Didi — their capacities must be strengthened on climate change-related issues.
3. Panchayats should actively facilitate awareness among SHGs regarding schemes related to enterprise development.
4. Existing SHG network has significant potential to catalyse grassroots climate action through targeted capacity-building, improved access to financial resources, stronger institutional partnerships, and promotion of decentralised leadership.

3. Green Growth in Villages — Turning Policies into Realities

UPSC: GS III | Environment & Economy | Sustainable Development, Rural Development | Policy

Architecture for Green Growth — Key Schemes and State Experiences

Introduction: India's green transition strategy is increasingly anchored in rural transformation. This chapter examines how national policies across water, energy, agriculture, waste management, and local governance drive measurable outcomes at the village level.

What is Green Growth:

1. Green growth means fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies
— OECD, 2011.

India's NDC Commitments (Rural Dimensions):

1. Reduction of 45% in GHG emission intensity from Indian GDP by 2030 relative to 2005 levels.
2. 50% of India's electricity generation capacity to be from non-fossil fuel sources.
3. Additional carbon sink of 2.5–3.0 billion tonnes of CO₂ to be created through afforestation by 2030.

Key Policy Programmes:

Programme	Objective	Key Features	Budget
VB-GRAM G	Rural livelihoods through NRM	≥60% expenditure on agriculture; ~102 million tonnes CO ₂ sequestered (2017–18)	Rs 86,000 crore (BE 2025–26)
Jal Jeevan Mission (JJM)	Universal rural drinking water	Tap coverage from 17% (2019) to ~80% (2025); rainwater harvesting mandated	Rs 2,08,652 crore (2019–2028)
PKVY	Promote organic farming	End-to-end support for organic production, certification, market linkage	Part of National Food Security Mission
NMNF	Scale natural, chemical-free farming	Rs 2,481 crore outlay; targets 1 crore farmers; 7.5 lakh hectares by 2030; Jeevamrit; learning centres	Rs 2,481 crore (2024–25 to 2025–26)
PM-KUSUM	Decentralised renewable energy in agriculture	Target 34,800 MW by 2026; over 4.4 lakh solar pumps installed in 2024–25 (fourfold increase)	Rs 2,600 crore (BE 2025–26)
Gobar-Dhan (SBM-G Phase II)	Convert waste into energy and organic inputs	Functional biogas/CBG plants across 168 districts (2026); bio-slurry used in natural farming	Rs 10,000 crore (2023–24)
GPDP	Integrated, decentralised village planning	Framework with 9 themes including "Clean and Green Village"	State Finance Commission & devolution grants

State Experiences:

1. **Tamil Nadu — Green Fellowship Programme:**

- i. August 2023: CM launched the Chief Minister's Green Fellowship Programme — deployed 38 Green Fellows across 38 districts.
- ii. Green Fellows serve as a link for implementing climate change and environmental programmes — translating state-level aspirations into district-level plans.
- iii. Climate Resilient Villages programme (with WRI India) benefited 2.7 million people across 11 districts — installed solar photovoltaic systems, restored canals, installed water purification systems in schools, and offered jobs in local communities.

2. **Sikkim — Organic Transition:**

- i. First state in the world to be recognised as a fully organic state in January 2016.
- ii. Policy framework took 13 years (beginning 2003) — certified over 66,000 farming families on more than 76,000 hectares.
- iii. Invested in farmer field schools, state-funded certification, and strategic linkages between farmers and markets.
- iv. Awarded the United Nations' Future Policy Gold Award in 2018.
- v. Transition created a viable and sustainable tourism industry — combining ecological and economic goals.

3. **Gujarat — PM-KUSUM (Solar Energy for Agriculture):**

- i. Solar water pumps greatly decreased reliance on unreliable electricity from the grid.
- ii. Farmers in Banaskantha experienced significant economic benefits — reduced monthly agricultural electricity bills of more than Rs 10,000/month; generating new income through sale of surplus electricity.

4. **Madhya Pradesh, Chhattisgarh, Uttar Pradesh — Waste-to-Energy:**

- i. Village waste practically converted to biogas (energy) and organic fertiliser through Gobar-Dhan Initiative — reducing farmers' fuel costs and reliance on chemical fertilisers.
- ii. Chhattisgarh: significant progress in establishing community-based biogas plants.
- iii. Uttar Pradesh: community-based compressed biogas (CBG) plants — more consistent and sustained when Gram Panchayats assume responsibility for their operation.

Three Key Fundamentals for Strong Cooperation (Way Forward):

- 1. **Convergence must be institutionalised** — not relying upon individual administrator initiatives.
- 2. **Local capacity as key investment** — training representatives to develop capacity for Green Planning at the local panchayat level; providing trained technicians at the district level (as achieved in Tamil Nadu).
- 3. **Performance-based monitoring** — progress towards outcomes must be measured, monitored, and rewarded; incentives that demonstrate improvement in water supply, soil health, energy

transitioning, or waste management will help refocus local panchayats from merely utilising inputs to demonstrating positive impacts.

4. Harnessing Carbon Markets for Farmer's Prosperity in India

UPSC: GS III | Environment & Economy | Climate Change, Agriculture | Voluntary Carbon Markets, Carbon Credits, and Indian Farmer Integration

Introduction: The global Voluntary Carbon Market (VCM) has emerged as a significant mechanism for addressing climate change while creating new economic opportunities. This article examines the potential of VCM to benefit Indian farmers by incentivising sustainable agricultural practices.

Global Carbon Market — Size:

1. Global carbon credit market reached USD 887 billion in 2025 — projected to reach USD 6,130 billion by 2033 at CAGR of 25.9%.
2. India's carbon credit market was valued at USD 4,010 million in 2023 — projected to reach USD 49,448 million by 2030 at CAGR of 43.2%.

Agriculture's Role in Carbon Emissions:

1. Agriculture accounts for approximately 18% of global carbon emissions (FAO).
2. Five key sources:
 - i. Livestock digestion (enteric fermentation) — 53% of agricultural emissions.
 - ii. Use of chemical fertilisers — 21%.
 - iii. Rice cultivation — 17%.
 - iv. Mismanagement of manure and biomass — 6.5%.
 - v. Burning of agricultural residues — 2%.

What is a Carbon Credit?

1. A certification representing the removal, reduction, or avoidance of one metric tonne of CO₂ equivalent (tCO₂e) from the atmosphere.
2. Carbon Credits = 1 metric tonne of CO₂ equivalent (tCO₂e) reduced, avoided, or removed.

Voluntary Carbon Market (VCM):

1. Kyoto Protocol (1997) introduced the Clean Development Mechanism (CDM) — the beginning of compliance markets.
2. VCM emerged as developed countries and corporate entities began providing funding for clean and green projects in exchange for carbon credits.
3. VCMs can play a crucial role in linking climate action with agricultural communities in developing countries like India.

Government of India Initiatives:

1. Ministry of Environment, Forest and Climate Change has developed a framework for the Green Credit Programme – a market-based mechanism promoting activities such as tree plantation on degraded land, where "Green Credits" (GCs) are issued for environmentally positive actions.
2. Practices such as afforestation (including plantation of fruit-bearing trees), regenerative agriculture, and zero tillage contribute to carbon sequestration in soil.

Global Standards for Carbon Offset Projects:

1. **Verra (Verified Carbon Standard – VCS):** Largest voluntary carbon market standard; includes renewable energy, forestry (REDD+), biochar, and waste management projects; widely recognised at international level.
2. **Gold Standard:** Premium certification placing strong emphasis on climate impact AND sustainable development co-benefits (aligned with SDGs); Gold Standard-certified credits often command higher prices.

Agricultural Strategies to Reduce Carbon Emissions:

1. **Direct Seeded Rice (DSR):** Seeds sown directly into the field without nursery raising and transplanting – saves time, labour, and water; can reduce water usage by approximately 15–20%; reduces irrigation cycles from 25–27 to around 15–18.
2. **Alternate Wetting and Drying (AWD):** Advanced irrigation technique – fields not kept continuously flooded; irrigation applied only after water level has receded to a certain threshold; significantly reduces methane emissions from paddy fields; widely promoted across Asia, including Maharashtra.
3. **Agroforestry:** Integration of trees with agricultural crops – improves soil health, enhances biodiversity, conserves land resources; enhances carbon sequestration in soil; poplar-based agroforestry systems across seven districts in Punjab and Haryana stored approximately 9.946 million tonnes of CO₂ equivalent; models involving eucalyptus and poplar can generate additional income of up to Rs 25,000 per hectare per year for farmers.

Conclusion and Recommendations:

1. Farmers need to organise themselves collectively through FPOs, cooperatives, or government-supported institutions to participate in carbon markets.
2. Once registered, farmers can adopt sustainable agricultural practices including agroforestry, organic farming, DSR, AWD, improved livestock feed management, renewable energy sources, and efficient manure management.
3. Adoption of these practices will not only promote sustainable agriculture but also enable farmers to receive financial incentives in the form of carbon credits, aligned with international market standards.

5. Livelihoods, Green Economy and Rural Enterprises — Building the Foundations of Viksit Bharat

UPSC: GS III | Economy & Environment | Inclusive Growth, Rural Development, Green Economy | Green Livelihoods, DAY-NRLM, Circular Economy, Natural Farming, Gender and Green Economy

Introduction: Rural India lies at the heart of India's transition towards a green and inclusive development model. As the country advances towards Viksit Bharat, livelihoods are increasingly being reshaped through sustainable agriculture, renewable energy, circular economy practices, and rural entrepreneurship.

Green Economy — Definition:

1. As defined by UNEP: a green economy is "low carbon, resource efficient and socially inclusive" — designed to improve human well-being while reducing environmental risks and ecological scarcities.

Multi-sectoral Policy Convergence Driving India's Green Economy:

1. MoEFCC initiatives on climate action and circular economy.
2. MNRE programmes such as PM-KUSUM.
3. NITI Aayog strategies on resource efficiency and waste-to-wealth systems.
4. NABARD interventions in rural credit, FPOs, and green financing.

From Welfare Model to Enterprise Ecosystem:

1. A major structural shift underway in rural India is the transition from a welfare-based model to an enterprise-driven livelihood system.
2. **DAY-NRLM:** Represents one of the largest community institution-building programmes globally — SHG architecture has fundamentally reshaped rural financial inclusion; millions of rural women now access formal credit channels.
3. SHGs have evolved from savings groups into producer collectives, micro-enterprises, and service providers — engaging in dairy, food processing, tailoring, handicrafts, retail, and local services.
4. **SVEP under DAY-NRLM:** Focuses on business planning support, enterprise incubation, access to credit, mentoring, and capacity building — led to emergence of micro-enterprises in services, agro-processing, repair work, and small manufacturing, reducing distress migration.

Linking Economy with Ecology:

1. **Sustainable agriculture:** PKVY and NMNF promote reduced chemical inputs, organic farming clusters, and climate-resilient practices.

2. **Renewable Energy and Rural Energy Transition:** PM-KUSUM transforming rural energy systems through solar irrigation pumps, decentralised renewable generation, and enhancing farmer income through surplus electricity sales.
3. **Waste to Wealth and Circular Economy:** GOBARDhan under SBM-Grameen Phase II promotes biogas generation, organic fertiliser production, and circular waste systems.

Panchayati Raj Institutions — Backbone of Green Rural Transition:

1. Gram Panchayats occupy a central position in India's rural governance architecture — emerging as critical institutions for enabling the green economy at the grassroots level.
2. Functions: integrated planning and convergence of DAY-NRLM, MGNREGS, SBM-Grameen, PM-KUSUM, and GOBARDhan; local management of natural resources; supervision of waste and sanitation systems under circular economy models; facilitation of SHGs, FPOs, and village enterprises.
3. **Hiware Bazar Gram Panchayat (Maharashtra):** Participatory watershed management transformed a drought-prone village into a model of water sufficiency and rural prosperity.
4. **Piplantri Gram Panchayat (Rajasthan):** Integrating environmental conservation with social development through large-scale tree plantation linked to girl child welfare.

Natural Farming and Technological Convergence:

1. Natural farming focuses on: chemical-free cultivation, soil regeneration, biodiversity enhancement, and reduced input dependency.
2. Technological innovations such as drone-based agriculture enable: precision farming, crop monitoring, efficient input use, and new livelihood opportunities.
3. This convergence of traditional knowledge and modern technology creates sustainable productivity and new income avenues for rural youth and women.
4. "Drone Didi" initiative demonstrates how rural women are entering precision agriculture through drone technology.

Gender and Green Economy:

1. In rural India, SHGs are largely women-led — actively engaged in agro-processing and enterprise development.
2. Surya Mitra (MNRE) trains women in solar technology.
3. Despite progress, women still constitute a relatively small share of formal enterprises — the green economy is not only an environmental transition but also a gender inclusion opportunity of macro-economic scale.

Key Challenges:

1. Fragmented implementation across states.

2. Limited access to market linkages for green products.
3. Knowledge gaps at the grassroots level.
4. Weak integration between schemes.
5. Inadequate climate finance penetration in rural areas.

Three Structural Shifts Needed (Way Forward):

1. **Institutional convergence:** DAY-NRLM, MGNREGS, PM-KUSUM, and SBM must operate as an integrated ecosystem rather than isolated programmes.
2. **Capacity building:** Gram Panchayats must evolve into local climate and enterprise planning units, supported by technical training and digital tools.
3. **Market integration:** Without stable markets for organic produce, renewable energy, and circular products, rural green enterprises cannot scale sustainably.

6. Community-led Water Management

UPSC: GS III | Environment & Agriculture | Water Resource Management | Community-led Water Governance, PRIs, Water Users Associations, Water-Energy Nexus

Introduction: Water lies at the heart of India's journey towards sustainable and inclusive green growth. As pressures from climate change, rising demand, and ageing infrastructure intensify, conventional top-down approaches to water management are proving insufficient. Community-led water governance, rooted in PRIs and Water Users Associations, offers a more resilient and equitable alternative.

Green Growth and Water:

1. Water resource management is vital to achieving green growth — encompasses agriculture, industry, drinking, sanitation, energy generation, and recreation.
2. India has approximately six lakh inhabited villages accommodating around 95 to 100 crore people.
3. Subjects such as minor irrigation, water management, watershed development, and drinking water are included in the Eleventh Schedule of the Constitution — outlining the responsibilities of PRIs.

Finance Commission Support:

1. **13th Finance Commission (2010–15):** Observed that green growth promotes inclusivity — reducing quality of life degradation particularly for poor and vulnerable groups.
2. **15th Finance Commission (2021–26):** Earmarked 60% of total grants allocated to PRIs for national priorities such as drinking water supply, rainwater harvesting, and sanitation.
3. **16th Finance Commission (2026–31):** Recommended 50% of the basic component allocated to local bodies be directed towards 'Sanitation and Solid Waste Management' and/or 'Water Management'.

Water Infrastructure — Key Concerns:

1. There are **5,264 completed dams** in the country, with an additional 437 under construction.

2. **3,701 dams (approximately 73%)** were constructed before 1990; among the 65 dams of national importance, 31 are at least 45 years old.
3. Around 0.73% of reservoir storage capacity is lost annually due to silt accumulation – cumulative loss of nearly 30%.

Siltation and Watershed Management:

1. Major cause of reservoir sedimentation is uncontrolled soil erosion in catchment areas.
2. Micro-level watershed interventions offer an ideal solution that can be effectively planned, implemented, and maintained by local communities.
3. Measures: afforestation and reforestation of catchment areas; planting vegetative barriers; contour bunding of farmlands; gully plugs across drainage lines; selecting crops that minimise soil erosion.
4. **Mission Amrit Sarovar** has rejuvenated approximately 70,000 ponds – India has around 14.43 lakh ponds (Water Body Census, Ministry of Jal Shakti).

Water-Energy Nexus:

1. Subsidised electricity has played a crucial role in increasing groundwater abstraction.
2. 14.18% of groundwater assessment units fall into either the 'over-exploited' or 'critical' category (Central Ground Water Board).
3. Electricity consumption in the agricultural sector increased by 20.68% between 2019–20 and 2023–24.
4. PM-KUSUM supports solarisation of pumps for individual farmers and establishment of solar plants of up to 2 MW capacity by FPOs and Water Users Associations – farmers can also monetise surplus solar power by selling it to DISCOMs.

Minor Irrigation Schemes:

1. Schemes catering to irrigation requirements for areas up to 2,000 hectares are classified as Minor Irrigation (MI) Schemes.
2. **23.14 million MI schemes** across India, with an irrigation potential of 75.64 million hectares – nearly half of the country's total irrigation potential.
3. **94.7% of these schemes are groundwater-based** – there has been a significant increase in deep and medium tubewells.
4. MI schemes are particularly well-suited for community-based management.

Water Users Associations (WUAs):

1. WUAs can be established for every 40 to 50 hectares, supported by an advisory committee comprising representatives from WUAs, government officials, and elected representatives.

2. Such an institutional framework promotes harmony in water conservation by fostering a sense of ownership and enabling democratic decision-making.
3. **Kerala Irrigation and Water Conservation Act, 2003** authorises WUAs to levy and collect fees, and entrusts them with the responsibility of maintaining and managing designated parts of the water distribution system.

Managing Conflicting Demands:

1. Water resources are shared among multiple stakeholders with competing demands — a reservoir may serve rural farmers, supply urban drinking water, and support industrial use.
2. Community-level management can play a crucial role in building consensus — as opposed to relying solely on top-down administrative decisions.
3. Community-driven approaches better address the protection of riparian rights and maintenance of environmental flows in rivers.

Way Forward:

1. Community-led water management needs to be institutionalised and streamlined through sustained capacity building.
2. Women — as primary users, managers, and stewards of water at household level — should be adequately represented in leadership roles within water user communities.
3. Community collectives must be financially empowered to undertake regular operation and maintenance of water utility systems.

7. Green Technology Driving India's Renewable Revolution

UPSC: GS III | Infrastructure | Energy | Renewable Energy Transformation in India — Solar, Wind, Policy Support, and Rural Impact

Introduction: India's energy landscape has undergone a remarkable transformation over the past fifteen years, driven by rapid advancements in green technology and a strong push towards renewable energy — reducing carbon emissions while reshaping rural livelihoods and strengthening energy security.

Transformation in Energy — Key Data:

1. In 2010, India's renewable energy capacity stood at roughly 17 gigawatts — fossil fuels dominated the energy mix.
2. By 2026, renewable energy capacity has crossed approximately 270 gigawatts — more than a fifteen-fold increase.

India's Renewable Energy Transformation (Box):

1. India ranks 3rd globally in Renewable Energy Installed Capacity.

2. Total Non-Fossil Installed Capacity: 283.46 GW (as on 31.03.2026).
3. Non-Fossil Break-Up: Solar Power — 150.26 GW (53%); Wind Power — 56.09 GW (19.8%); Large Hydro — 51.41 GW (18.1%); Bio Energy — 11.75 GW (4.1%); Small Hydro — 5.17 GW (1.8%); Nuclear — 8.78 GW (3.1%).
4. Highest ever Annual Non-Fossil Capacity Addition: 55.29 GW in FY 2025–26.
5. Highest Renewable Share in Electricity Generation: 51.5% in July 2026.
6. 50% capacity from non-fossil sources achieved in June 2025 — 5 years ahead of the 2030 NDC target.
7. Our 2030 Target: 500 GW of installed electricity capacity from non-fossil sources.

Changing the Energy Mix:

1. Nearly 40% of installed power capacity now comes from non-fossil sources.
2. Renewable sources produce no direct carbon emissions — renewable growth has even contributed to a slowdown in fossil fuel-based power expansion.
3. India has achieved the milestone of 50% of its installed capacity from non-fossil sources ahead of its 2030 target.

Rural Impact:

1. Decentralised solutions — solar mini-grids, rooftop systems, and solar-powered irrigation — have brought reliable electricity to previously underserved regions.
2. **PM-KUSUM:** Enables farmers to use solar pumps for irrigation — reduces dependence on diesel, lowers costs, and allows farmers to generate additional income by selling surplus electricity.
3. **Saubhagya Scheme:** Expanded electricity access — renewable solutions played a crucial role in remote areas, improving education, healthcare, and rural entrepreneurship.

Economic and Strategic Dimensions:

1. Renewable energy sector has become a key driver of economic growth and energy security — falling costs have made clean energy competitive, attracting large-scale investments.
2. India is strengthening its domestic manufacturing ecosystem — solar module production and wind turbine manufacturing have expanded significantly, reducing reliance on imports.
3. This transition positions India as a potential global hub for renewable energy technology.

Key Policy Measures:

1. Reduction in GST on renewable energy equipment has lowered costs.
2. Efforts to promote domestic manufacturing including incentives for battery production.
3. Regulatory reforms from improved transmission access to simplified compliance frameworks.
4. Innovative mechanisms — Virtual Power Purchase Agreements and Contracts for Difference provide financial stability to developers.

5. Introduction of a National Policy on Geothermal Energy signals diversification beyond traditional renewable sources.
6. **Green Energy Corridor** has strengthened transmission networks, enabling efficient integration of renewable power into the grid.

National Green Hydrogen Mission:

1. Made notable progress — falling production costs and increasing industrial adoption are positioning India as a potential global leader in green hydrogen, particularly for sectors that are difficult to decarbonise.

8. Rural India Needs Plastic-Free Supply Chains for Green Growth

UPSC: GS III | Environment | Pollution, Circular Economy | Plastic Pollution in Rural India, Sustainable Alternatives, EPR, Circular Supply Chains

Introduction: Plastic pollution has emerged as a major environmental and developmental challenge in India, particularly in rural areas where consumption patterns are rapidly changing but waste management systems remain limited. India's vision of Viksit Bharat requires aligning economic development with environmental sustainability.

Scale of the Problem:

1. India is the world's second-largest manufacturer of plastic polymers.
2. India produces 9.46 million metric tonnes of plastic waste annually — equivalent to nearly one-fifth of global plastic waste.
3. Recycling initiatives handle only 25% of plastic waste — the rest ends up in uncontrolled landfills.
4. 2.7 Mt of microplastics seeped into the environment in 2020 — expected to double by 2040.
5. Global plastic production reached 436 million metric tons in 2023.
6. Key end-use sectors: packaging (43%), infrastructure (21%), automotive (16%), agriculture (2%), others (18%).
7. Only 17% of Indian households practise full waste segregation (NITI Aayog, "Waste Wise Cities" — 2023).
8. As of March 2025, 1,168 blocks had functional Plastic Waste Management Units.

Challenges in Rural Areas:

1. As per CPCB's 2023 report, India generated roughly 9.46 million tonnes of plastic waste annually — about 43% comprised single-use plastic items.
2. Only 43% of urban households currently practise source-level waste segregation — the infrastructure remains uneven across districts.

3. India produces over 160,000 tons per day of MSW — plastic waste is often mixed with organic, biomedical, or hazardous components, making it technically difficult to recycle.
4. Multi-layered plastic packaging for shampoos, biscuits, and chewing tobacco products adds to the growing plastic waste burden in rural areas.

Traditional Alternatives and Local Systems:

1. **Bamboo:** Highly promising sustainable alternative — renewable and biodegradable, maturing in three to four years and decomposing within six months; sequesters carbon for the product's lifespan; India is the second richest country in bamboo genetic resources after China; total bamboo-bearing area estimated at 13.96 million ha; total green weight of bamboo culms estimated at 169 million tonnes; can replace straws, cutlery, cups, bowls, and food packaging.
2. **Leaf-Based Packaging:** A long-standing practice in many regions — re-emerging as a bio-renewable and sustainable system of food packaging; banana and palm leaves offer great potential; most suitable for short shelf-life and low-risk foods.
3. **Jute and Cotton Bags:** Emerging as primary sustainable alternatives to plastic packaging — natural, biodegradable, and renewable; durable alternatives for transporting bulk goods and agricultural produce.
4. **Clay/Earthen Pots:** Sustainable, cost-effective, and scientifically sound practice — advantages include natural cooling through evaporation, enhanced food safety due to alkaline properties, and complete biodegradability.
5. **Crop Residues:** Agricultural residues like wheat and paddy straw (rice stubble) as sustainable packaging — startups transforming this waste into biodegradable, compostable, and renewable alternatives to petroleum-based plastics.
6. **Natural Fiber-based Packaging:** Cellulose is the most abundant natural and renewable polymer in the world; starch-based polymers from cassava, corn, and potatoes are becoming popular as eco-friendly substitutes.
7. **Biodegradable Plastic:** Polylactic acid (PLA) — one of the most widely used bio-based and biodegradable plastics; applied for disposable cups, bowls, and bottles.
8. **Fungal Mycelium:** Grows rapidly on low-cost agricultural waste substrates — forming dense, fibrous structures that can be moulded into various shapes; adopted by furniture, electronics, and cosmetics industries for biodegradability and low carbon footprint.

Policy Support:

1. MoEFCC has already prohibited identified single-use plastic items with low utility and high littering potential from 1 July 2022.

2. Plastic Waste Management Rules, 2016 (as amended) mandate the use of 30% recycled content in rigid plastic packaging effective from 2025–26, with a gradual increase of 10% every year until reaching 60% in 2028–29.
3. MoEFCC has issued guidelines mandating the use of 40% recycled content in food-grade PET packaging for fiscal year 2026–27 (notification issued 3 June 2025).
4. BIS published IS 18267:2023 — "Food Serving Utensils Made from Agri By-Products — Specification" — aimed at reducing plastic pollution and promoting sustainability.
5. FSSAI embarked on an initiative to combat the rising issue of microplastic contamination in Indian food supply — developing and standardising methods for detecting micro and nano-plastics.
6. **EU Packaging and Packaging Waste Regulation (PPWR):** As of 11 February 2025, it replaces the current Packaging Directive — aims to reduce packaging waste by 2030 through a functioning circular economy; in 2023, the EU banned the sale of loose plastic glitter.

Role of Panchayati Raj Institutions:

1. Plastic Waste Management Rules, 2016 (as amended in 2018) are applicable to rural local bodies — mandate specific responsibilities for Gram Panchayats and coordination regarding plastic waste management in rural areas.

Circular Supply Chain:

1. Circular economy strategies: refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, and recover.
2. A World Bank (2022) report found that India's recycling industry could grow to USD 6–8 billion by 2030 with the right segregation infrastructure and policy support.
3. By 2050, India's circular economy is expected to reach a market value of USD 2 trillion and create 10 million jobs.
4. Reducing dependency on virgin plastic through recycling could save more than 5 million tonnes of CO₂ annually.
5. United Nations suggests cutting plastic pollution by 80% globally by 2040 — implementing three market shifts: reuse, recycle, reorient, and diversify.

9. Smart Solutions for Cleaner Villages — Driving Green Growth through Rural Sanitation and Waste Management

UPSC: GS II & III | Governance & Environment | Rural Sanitation, Solid & Liquid Waste Management, Circular Economy | SBM-G, ODF Plus, Decentralised Innovations, Digital Monitoring

Introduction: India's rural sanitation has undergone a major transformation under the Swachh Bharat Mission-Gramin (SBM-G), achieving near-universal toilet access and widespread ODF status. SBM-G

Phase II (2020–26) shifts focus to sustainability through the ODF Plus framework, emphasising waste management and behavioural change.

Scale of Achievement Under SBM-G:

1. In 2014, only 39% of rural households had access to toilets — open defecation posed significant risks to public health, environmental quality, and women's safety.
2. The launch of SBM-G triggered an unprecedented national movement — combining financial incentives, mass awareness campaigns, and community participation.
3. By October 2019, over 10.6 crore toilets had been constructed, and more than 600,000 villages declared ODF.
4. As of 2026, over 95% of villages are progressing towards ODF Plus status — a paradigm shift from sanitation as infrastructure to sanitation as a circular, community-driven system.

SBM-G Phase II — Expanding the Sanitation Agenda:

1. Phase I revealed new challenges — faecal sludge accumulation, greywater stagnation, and improper solid waste disposal.
2. SBM-G Phase II was launched with a broader focus on sustainability.
3. By early 2026, approximately 5.68 lakh villages had achieved ODF Plus status, with significant progress in both solid and liquid waste management infrastructure.

Decentralised Innovations:

1. **Biogas-Linked Toilets (Maharashtra):** Toilet-linked biogas systems convert human and animal waste into cooking fuel and organic manure — a standard 2 cubic metre biogas plant can meet a household's cooking needs while reducing dependence on LPG and firewood.
2. **GOBARdhan Initiative:** Launched in 2018 — promotes conversion of cattle dung and organic waste into biogas and compressed biogas (CBG); as of 2024, over 2,700 biogas plants have been registered, contributing to renewable energy generation and rural livelihoods.
3. **Eco-Sanitation in Water-Scarce Regions:** In Ladakh and parts of the Northeast, urine-diverting dry toilets (UDDTs) offer efficient solutions — enable nutrient recovery while conserving scarce water resources; demonstrates relevance of traditional ecological knowledge.
4. **Zero-Waste Models:** Cities such as Ambikapur and villages such as Punsari illustrate how decentralised waste segregation and composting can create zero-waste ecosystems, generating employment and revenue for local communities.

Building a Circular Rural Economy:

1. Rural India generates approximately 0.2–0.3 kg of solid waste per capita per day, of which 60–70% is biodegradable — SBM-G Phase II leverages this resource potential through circular economy approaches.
2. Key interventions:
 - i. **Composting:** Vermicomposting and NADEP techniques convert organic waste into nutrient-rich fertiliser.
 - ii. **Biogas production:** Household and community digesters generate renewable energy and slurry manure.
 - iii. **Plastic waste utilisation:** Segregated plastic waste is used in road construction and recycling.
 - iv. **Greywater reuse:** Constructed wetlands and soak pits enable reuse for irrigation.
 - v. **Faecal sludge treatment (FSTPs):** Ensure safe treatment and reuse of sludge.
3. Estimates suggest households can save between Rs 500 and Rs 1,500 per month through reduced fuel and fertiliser costs.

Technology and Digital Monitoring:

1. **SBM-G Management Information System (MIS):** Enables real-time monitoring of sanitation infrastructure, including geo-tagging of toilets and waste management assets.
2. Mobile applications support desludging services, waste collection tracking, and grievance redressal.
3. In pilot areas, IoT-based sensors are being used to monitor system performance and detect leakages — enhancing transparency, accountability, and service delivery efficiency.

Convergence with Flagship Programmes:

1. **JJM:** Ensures water supply, which is essential for sustaining sanitation systems.
2. **MGNREGA:** Supports construction of soak pits, drainage systems, and compost units.
3. **NRLM:** Mobilises women's groups for waste management enterprises.
4. **Finance Commission Grants:** Provide funding for ODF sustainability.
5. Such convergence reduces costs, enhances efficiency, and strengthens institutional capacity.

Financing Sustainable Sanitation:

1. Rural sanitation financing has evolved from subsidy-driven models to more diversified approaches.
2. Key sources: Government incentives under SBM-G; Public–Private Partnerships (PPPs) for service delivery; Microfinance and SHG-based enterprises; Revenue from compost, biogas, and recyclables; Emerging carbon financing opportunities.

Impact on Health, Environment, and Livelihoods:

1. **Health:** Reduction in diarrhoeal diseases and child mortality — WHO estimates link improved sanitation to significant health gains.
2. **Environment:** Reduced groundwater contamination, improved soil health, and lower greenhouse gas emissions.
3. **Economy:** Employment generation and reduced healthcare expenditure.
4. **Gender empowerment:** Enhanced dignity, safety, and participation of women.
5. Outcomes align with SDG 6 (Clean Water and Sanitation) and SDG 13 (Climate Action).

Challenges and Gaps:

1. **Behavioural sustainability:** Studies indicate 5–10% of households may revert to open defecation in the absence of sustained awareness.
2. **Operation and maintenance:** Limited financial and technical capacity at the Panchayat level affects system sustainability.
3. **Faecal sludge management:** Inadequate desludging services and treatment infrastructure remain a concern.
4. **Plastic waste:** Increasing non-biodegradable waste poses new environmental challenges.
5. **Regional disparities:** Diverse climatic conditions require tailored technological solutions.

Way Forward:

1. **Short term:** Ensure universal coverage and functionality of SLWM systems; strengthen district-level faecal sludge management (FSM) infrastructure to safely handle waste streams.
2. **Medium term:** Develop cluster-based waste processing systems for greater efficiency; expand the role of SHGs in sanitation services, thereby creating local livelihoods and strengthening community ownership.
3. **Long term:** Rural sanitation must evolve into a circular and climate-resilient system by integrating bioenergy solutions such as biogas, leveraging carbon credit opportunities, and institutionalising digital monitoring for transparency and efficiency.

Conclusion:

1. India's transition to the ODF Plus framework signifies a major shift from infrastructure-led sanitation to sustainable, circular, and community-driven systems.
2. To ensure long-term success: strengthen behavioural change initiatives; institutionalise robust operation and maintenance mechanisms at the Panchayat level; scale decentralised and context-specific waste management solutions; enhance capacity and financing through PPPs and SHGs; and leverage digital monitoring and innovative financing mechanisms such as carbon credits.

10. India's Comprehensive Empowerment Model for Workers — Towards a Unified and Inclusive Workforce

UPSC: GS II & III | Social Justice & Economy | Labour Reforms, Social Security, Employment | Four Labour Codes, Gig Workers, PM Viksit Bharat Rozgar Yojana (PMVBRY), Unorganised Sector Welfare

Introduction: India's labour landscape is undergoing a historic transformation through the introduction of four Labour Codes and the Pradhan Mantri Viksit Bharat Rozgar Yojana (PMVBRY). These reforms aim to simplify compliance, expand social security, and bring informal and gig workers into the formal economic framework.

Reality of India's Unorganised Workforce:

1. Millions of people — street vendors, construction workers, domestic workers, gig workers — earn their livelihoods without formal employment contracts or job security.
2. India's unorganised and informal workforce: nearly 45 crore people — the living infrastructure on which the nation stands.
3. These workers build cities, sustain supply chains, support households, drive transport systems, and power the gig economy.
4. Despite being the backbone of India's economy, they remain among the most invisible and vulnerable — marked by low wages, unstable employment, lack of social security, poor living conditions, and weak legal protection.

From Welfare to Empowerment — A Paradigm Shift:

1. India possesses a wide spectrum of labour laws and protections — but rights often exist only on paper and workers frequently remain unaware of them.
2. Welfare boards are in place, yet registration levels remain low; digital portals have been created, but many workers lack digital literacy or access to identity-linked systems.
3. This implementation deficit is one of the most significant challenges confronting India's labour governance.
4. India must shift from a purely welfare-oriented approach to a comprehensive empowerment model — development must also be measured by how secure workers feel, how fair their wages are, and how accessible social protections are.

Labour Law Reforms — Unified Framework:

1. Government of India implemented comprehensive labour law reforms, effective from 21 November 2025, aimed at modernising the country's employment framework.
2. Four new Labour Codes consolidate 29 existing labour laws into a simplified and unified system.

3. These reforms apply to all categories of workers including full-time, part-time, contractual, and gig workers.
4. Designed to improve transparency, enhance employee benefits, and ensure timely payment of wages and access to social security.

Four New Labour Codes:

1. Code on Wages, 2019
2. Industrial Relations Code, 2020
3. Code on Social Security, 2020
4. Occupational Safety, Health and Working Conditions Code, 2020

Impact of Rationalisation — From 29 Laws to 4 Codes:

Parameter	Earlier	Now
Rules	1436	351
Returns	31	Single (Electronic)
Forms	181	73
Registers	84	08
Registration	8*	Single
Licence	4	Single
Compounding	—	Introduced
Improvement Notice	—	Introduced

Key Transformational Changes Under the New Labour Codes:

1. **Universal Minimum Wage:** All employees irrespective of sector or wage level entitled to a statutory minimum wage; a national floor wage established to ensure fair remuneration across both organised and unorganised sectors.
2. **Revised Definition of Wages:** Basic pay must constitute at least 50% of total salary — increases contributions to Provident Fund and gratuity, enhancing long-term retirement benefits.
3. **Social Security for Gig and Platform Workers:** For the first time in India, gig workers, freelancers, and platform-based professionals brought within the ambit of social security schemes; digital platform companies required to contribute a portion of their annual turnover to a dedicated fund covering life insurance, health, and disability benefits.
4. **Gratuity Reform:** Minimum service requirement for gratuity reduced from five years to one year for fixed-term employees — enabling quicker access to benefits.

5. **Mandatory Appointment Letters:** Employers now required to issue formal appointment letters to all workers, including those in informal and unorganised sectors – improving job documentation, wage transparency, and access to social security.
6. **Overtime Wages:** Employees working beyond scheduled hours entitled to overtime wages at twice the standard rate – strengthening labour rights and discouraging unpaid overwork.
7. **Revised Leave Eligibility:** Eligibility period for leave reduced from 240 days to 180 days – making it easier for workers to avail themselves of leave benefits.
8. **Women's Working Hours:** Women employees now permitted to work before 6 a.m. and after 7 p.m. across sectors, subject to their consent and provision of adequate safety measures; flexible working arrangements and work from home have received formal recognition.
9. **Free Annual Health Check-Ups:** Employers required to provide free annual health check-ups for employees above 40 years of age.
10. **Timely Wage Disbursement:** Wages must be disbursed within seven days of the end of the wage period, or within two working days in cases of resignation or termination.

Bridging the Gap – Inclusion of Gig Workers:

1. The Code on Social Security, 2020 marks a significant step towards recognising gig and platform workers.
2. However, gaps remain when compared to traditional employees.

Comparison of Labour Rights: Traditional Employees vs. Gig/Platform Workers:

Labour Right/Benefit	Traditional Employee	Gig/Platform Worker (CoSS 2020)
Statutory Minimum Wages	Mandated entitlement	Not mandated
Paid Leave	Mandated entitlement	Not mandated
Gratuity/Severance	Legal entitlement upon completion of service	Not mandated
Health Coverage	ESIC/employer-funded contributory insurance	Coverage through welfare schemes funded via non-wage levy
Formal Documentation	Mandatory appointment letters	Mandatory registration/Unique Identification (UAN)

PM Viksit Bharat Rozgar Yojana (PMVBRY) – Driving Employment:

1. Introduced by the Government of India in 2025 – aims to generate employment, enhance employability, and promote formalisation of the workforce.
2. **Two Components:**

- i. **Part A:** Incentivises youth entering the workforce for the first time.
 - ii. **Part B:** Provides incentives to employers for generating and sustaining employment.
3. **Outlay: Rs 1 lakh crore** — aims to support the creation of over 3.5 crore jobs within two years.
 4. Newly employed youth eligible for incentives of up to Rs 15,000 in two instalments.
 5. Employers can receive up to Rs 3,000 per month per new employee — in the manufacturing sector, incentives are extended to the third and fourth years as well.
 6. A portion of the incentive will be deposited in a fixed savings instrument, which can be withdrawn by the employee at a later stage.
 7. Benefits applicable to jobs created between 1 August 2025 and 31 July 2027.
 8. From the perspective of employees: promotes formalisation of jobs through expanded social security coverage; enhances employability by providing on-the-job training; fosters financial literacy.
 9. For employers: helps offset costs associated with job creation; enhances workforce stability and productivity; incentivises wider social security coverage.
 10. The scheme complements the National Manufacturing Mission by encouraging entry of new industries and expansion of existing ones, particularly in labour-intensive sectors.

Implementation Challenges:

1. **Wage definition ambiguity:** Ambiguities concerning variable or one-time payments and stock-based benefits may create compliance complexities — employers may need to reassess cost structures and recalculate benefits such as gratuity and leave encashment.
2. **Gratuity liabilities:** Changes in the definition of wages may increase gratuity liabilities — gratuity obligations for fixed-term employees including existing ones must also be accounted for.
3. **Workforce classification:** Organisations will need to undertake comprehensive classification of employees, workers, and gig workers based on roles and remuneration to ensure compliance.
4. **Harmonisation of Regulatory Frameworks:** A coherent strategy is required to reconcile varying state-level approaches such as turnover-based versus transaction-based levies.
5. **Preventing Cost-Shifting:** Strong enforcement mechanisms must be established to prevent aggregators from transferring the burden of contributions onto workers through reduced wages or incentives.
6. **Assessing Fund Adequacy:** Continuous actuarial assessment necessary to evaluate the sustainability of the 1–2% levy, particularly in view of the rapid expansion of the gig workforce.
7. **For PMVBRY specifically:** Complexity in determining baseline and threshold levels; risk of misuse and inflated employment data; compliance burden for smaller establishments; dependence on EPFO IT systems for timely disbursement of benefits.

Conclusion:

1. The introduction of the new Labour Codes and PMVBRY marks a transformative step in India's labour landscape.
2. These initiatives seek to balance worker welfare with enterprise efficiency — simplifying compliance, promoting workplace safety, and ensuring fairness in wages.
3. Collectively, these reforms lay the foundation for a more equitable, transparent, and growth-oriented economy.
4. Success will depend on effective stakeholder collaboration, strong enforcement mechanisms, and continuous alignment with global best practices.

DOWN TO EARTH

1. Food In the Age of Climate Change

Context

1. Food systems today are at the intersection of climate change, livelihoods, nutrition, and ecology.
2. As modern agriculture contributes significantly to greenhouse gas emissions, the emerging paradigm is climate-smart agriculture, which integrates livelihood security, nutritional outcomes, and ecological sustainability.

About Food System & Climate Change

1. Food systems today are both victims and drivers of climate change. Agriculture contributes significantly to greenhouse gas emissions, while climate change threatens crop productivity, water availability, and farmer livelihoods.
2. Thus, the challenge is to redesign agriculture to ensure livelihood security, nutritional adequacy, and ecological sustainability simultaneously.

Low-Input and Climate-Resilient Agriculture

1. Reduce dependence on costly external inputs (fertilisers, pesticides). Key rationale is:
 - i. High-input agriculture increases costs and farmer vulnerability.
 - ii. Smallholders lack economies of scale.
 - iii. Low-input systems can maintain productivity via soil and water management.

Water and Soil as Core Inputs

1. Shift focus from chemical inputs to natural resource management. Key measures include:
 - i. Rainwater harvesting (traditional Indian practices)
 - ii. Improving irrigation efficiency
 - iii. Enhancing soil organic matter

Risk Minimisation through Diversification

1. The key idea is to adopt multi-cropping and mixed farming systems. It benefits:
 - i. Reduces climate risk (pests, droughts)
 - ii. Ensures multiple income streams
 - iii. Enhances biodiversity

Climate-Smart Crop Choices (Millets Focus)

1. Promote crops suited to local ecology and nutrition needs.
2. Why Millets?
 - i. Drought-resistant, climate-resilient
 - ii. High nutritional value (iron, fibre)
 - iii. Suitable for marginal soils

Food, Nutrition, and Gut Health

1. Key Idea: Food choices influence human health via gut microbiome.
 - i. Soil Health → Crop Diversity → Dietary Diversity → Gut Health
 - ii. Gut hosts trillions of microbes that are critical for immunity and metabolism
 - iii. Diverse, fibre-rich diets support healthy microbiota

Conclusion: Towards Sustainable Food Systems

1. Food must be reimagined as a system that supports farmers' livelihoods, ensures nutritional security, and protects ecological balance.
2. The future lies in climate-resilient, low-input, biodiversity-based agriculture, supported by policy reforms and conscious consumption.
3. As research shows, crops like millets can act as a bridge between climate adaptation, nutrition, and sustainability, making them central to India's agricultural transformation.

2. Sanitary Waste Management in India

Context

1. Women in rural areas of Himalayan states adopt reusable menstrual hygiene products, reducing sanitary waste.

About Sanitary Waste

1. It comprises used menstrual pads and diapers that remains an under-recognized component of India's solid waste management system.
2. Its environmental, financial, and social impacts are disproportionately high, making it a critical governance and public health issue, despite forming a small fraction of total waste.

Case Study: Dehradun

1. **Key Issues:** Mixed with dry waste or concealed in packaging.
 - i. Disposal methods: Open dumping, burial, and flushing in toilets.
 - ii. Handled manually by sanitation workers, exposing them to health risks (infection, odour), social stigma and indignity.
2. **Economic Burden:**
 - i. Incineration cost: ₹1.75 lakh/month for 10 tonnes
 - ii. Estimated cost for Dehradun city: ₹1.86 crore/month

Environmental and Public Health Concerns

1. **Non-biodegradability:** Over 90% of sanitary pads contain plastic.
 2. **Pollution:** Improper disposal contaminates soil and water.
 3. **Health risks:** Pathogen exposure for waste workers.
 4. **Infrastructure gaps:** Lack of disposal systems in India.
- Poor menstrual waste management is now recognized as a global environmental and public health challenge.

Emerging Solution: Reusable Menstrual Products

1. **Waste Warriors Initiative:** Active since 2022 in Uttarakhand & Himachal Pradesh.
2. **Strategy** includes awareness workshops, demonstrations of reusable pads & menstrual cups; community engagement via SHGs, schools, Anganwadis.
3. **Adoption Trends:**
 - i. Cloth pads: Higher acceptance (cultural familiarity)
 - ii. Menstrual cups: Adopted more by younger women
4. **Long-term benefits:**
 - i. Cost-effective (cup lasts ~5 years)
 - ii. Eliminates disposal challenges

Why Reusables Matter

1. Reusable products significantly reduce waste burden.
2. Cloth pads are less polluting and sustainable.
3. Promote circular economy in waste management.
4. Reduce pressure on municipal systems.

Challenges in Sanitary Waste Management

1. **Behavioural Issues:** Social stigma around menstruation; and concealment of waste.

2. **Policy Gaps:** Limited implementation of Solid Waste Management Rules, 2016; and lack of segregation at source.
3. **Technological Constraints:** Incineration is costly and polluting; and limited eco-friendly alternatives.
4. **Equity Concerns:** Burden falls on informal sanitation workers.

Way Forward

1. **Promote Sustainable Alternatives:** Scale up reusable pads and menstrual cups; and encourage biodegradable sanitary products.
2. **Strengthen Waste Segregation:** Mandatory separate collection of sanitary waste; and provide labeled disposal bags/bins.
3. **Behavioural Change:** Awareness campaigns under Swachh Bharat Mission; and menstrual hygiene education in schools.
4. **Protect Sanitation Workers:** Mechanization of waste sorting, and provide PPE and dignified working conditions.
5. **Policy Integration:** Include sanitary waste in Extended Producer Responsibility (EPR); and incentivize eco-friendly product innovation.

3. E20 Ethanol Blending in India

Context

1. From April 2026, India has mandated 20% ethanol blending (E20) in petrol to reduce crude oil imports, enhance energy security, and lower carbon emissions.
2. However, emerging evidence suggests that E20 is a transitional solution with mixed outcomes, raising concerns about its long-term sustainability.

About Ethanol Blending

1. It is the process of mixing ethanol (a biofuel made from crops like sugarcane or corn) with petrol to be used as fuel in vehicles.
2. **Example:**
 - i. E10: 10% ethanol & 90% petrol
 - ii. E20: 20% ethanol & 80% petrol
3. It is mainly done to reduce dependence on crude oil, lower pollution and emissions, and promote renewable energy sources.

Rationale Behind Ethanol Blending

1. India imports ~85% of its crude oil. Ethanol blending helps save foreign exchange, support farm incomes, and reduce GHG emissions (partially).

Impact on Vehicles and Fuel Economy

1. **Lower Energy Efficiency:** Ethanol has lower calorific value, leading to higher fuel consumption, and reduced mileage.
2. **Compatibility Issues:** Older vehicles (pre-2023) are not designed for E20, that face corrosion risks, and material degradation.
3. **Fuel System Concerns:** Ethanol is hygroscopic (absorbs water), and corrosive in nature, that can damage fuel lines, and rubber seals.

Environmental Implications

1. **Positive Effects:** Better combustion due to oxygen content, that reduces carbon monoxide (CO), hydrocarbons (HC), and particulate emissions.
2. **Negative Effects:**
 - i. **Increase in NOx Emissions:** E20 can increase nitrogen oxides (NOx)
 - ii. **Toxic Aldehyde Emissions:** Higher emissions of acetaldehyde, and formaldehyde.
 - iii. **Higher Evaporative Emissions:** Ethanol increases fuel volatility leads to VOC emissions, and contributes to ground-level ozone.
3. **Regulatory Gap:** India lacks adequate monitoring of aldehydes, and strong evaporative emission norms, compared to US, EU, Brazil.

Economic and Agricultural Concerns

1. **Food vs Fuel Debate:** Rising ethanol demand increases demand for corn and sugarcane. It leads to food inflation, and stress on the livestock sector.
2. **Import Paradox:** India is importing industrial ethanol, and corn that undermines the goal of self-reliance.
3. **Water Stress:** Sugarcane-based ethanol highly water-intensive impacting groundwater levels.

Policy Paradox: Transitional vs Long-Term Solution

1. E20 is a transitional fuel, not a clean end-state. It risks diverting focus from Electric Vehicles (EVs), and hydrogen-based mobility.
2. **Global trend:**
 - i. EU: Focus on electrification (90% CO₂ reduction target)
 - ii. US: Limits blending to ~10–15%

Need for Strategic Reorientation

1. **Promote 2G Ethanol:** From crop residues, and municipal waste. It reduces food-fuel conflict.
2. **Shift Towards Industrial Use:** Ethanol as chemical feedstock, green solvent, bio-plastic input.
Global examples: USA, Germany, EU
3. **Strengthen Regulations:** Introduce aldehyde emission norms, and evaporative emission standards.

4. **Accelerate Clean Mobility:** Focus on electric mobility, and renewable energy integration.

4. A Warmer, Shorter Winter in India

Context

1. India's winter of 2026 stands out as an anomaly, marked by a near absence of cold extremes and a premature transition to summer-like conditions.
2. Analysis of IMD data reveals it as part of a broader climatological shift, characterised by declining cold waves, rising temperatures, and increasing variability in seasonal patterns.

IMD Classification

1. **Cold Day:** Maximum temperature 4.5°C–6.4°C below normal
2. **Severe Cold Day:** >6.4°C below normal
3. **Cold Wave:** Minimum temperature 4.5°C–6.4°C below normal
4. **Severe Cold Wave:** >6.4°C below normal

Decline of Cold Waves: Key Trends

1. **February 2026:** No cold day or cold wave recorded; first such February in five years.
 - i. Comparison: 6 cold-wave days in 2022; 1 in 2023; 7 in 2024 and 5 in 2025.
 - ii. It indicates a sharp weakening of winter intensity.
2. **Seasonal Trend (Jan–Feb Combined)**
 - i. 24 events in 2026 (second lowest in 5 years); 21 in 2023 (lowest); 38 in 2024 (peak).
 - ii. It suggests high inter-annual variability, but overall declining severity.

Changing Geography of Cold Waves

1. **Core Pattern:** Concentrated in North, Northwest, Central India
2. **Emerging Shifts:** Limited southern penetration
 - i. 2023: Telangana & Karnataka affected
 - ii. 2025: Only Telangana (1 day)
 - iii. 2026: Only Karnataka
3. **Spatial Variability:**
 - i. 2023: Widest spread (17 states)
 - ii. 2025: Narrowest (9 states)
 - iii. 2026: Expanded again (15 states)
4. It reflects unstable spatial behaviour of cold extremes.

Warming Trend Across Cities

1. **Major Observations:** 34 cities analysed:
 - i. 23 cities: Above-normal maximum temperatures

- ii. 30 cities: Above-normal minimum temperatures
- 2. **Key Pattern:** "Normal" temperatures becoming rare
 - i. Pan-India trend: From Himalayas (Shimla, Srinagar) to coastal regions (Panjim)
- 3. **Himalayan Anomalies:** Warmer nights than days (relative to normal)
 - i. Extreme spikes:
 - Shimla: Up to 10°C above normal
 - Itanagar: Night temp ~8°C above normal
 - ii. It suggests elevation-dependent warming, a critical climate signal

Scientific Evidence: Long-Term Climate Trends

- 1. The observed 2026 anomalies align with broader research findings:
 - i. Declining cold waves and increasing heatwaves across India
 - ii. Rising minimum temperatures (warmer nights)
 - iii. Increasing temperature anomalies and variability

Conclusion

- 1. India's winter of 2026 reflects a clear climatic transition i.e. weaker winters, earlier summers, and erratic spatial spread of cold events.
- 2. These trends align with long-term scientific evidence pointing to climate change-driven restructuring of seasonal cycles, rather than isolated anomalies.

5. Energy Warfare in The Strait of Hormuz: Implications for India and The World

Context

- 1. The recent naval escort of Indian LPG tankers through the Strait of Hormuz signals a structural shift in global energy trade.
- 2. What was once largely commercial is now deeply geopolitical, resembling a zero-sum strategic contest.
- 3. Control over energy flows has become a tool of coercion, reflecting the growing weaponisation of trade and supply chains.

Strategic Importance of the Strait of Hormuz

- 1. A critical maritime chokepoint, only ~33 km wide.
- 2. It handles a significant share of global energy flows:
 - i. ~35% of seaborne crude oil

- ii. ~29% of LPG
 - iii. ~19% of LNG and refined products
3. Nearly 20% of global oil trade passes through it.
 4. Around 100 ships transit daily under normal conditions.
 5. Maritime chokepoints like Hormuz are 'systemic vulnerabilities' where disruptions can trigger global economic shocks and energy insecurity.

From Conflict to Energy War (2026 Crisis)

1. Conflict triggered by US–Israel strikes on Iran, and Iran's retaliation led to closure of the Strait, causing 97% drop in shipping traffic, and ~3,000 ships stranded.
2. **Escalation:** Israeli strike on South Pars gas field; and Iranian strike on Qatar's Ras Laffan LNG hub.
3. It resulted in a full-fledged energy war, targeting production and transit infrastructure.

Global Economic Impact

1. **Oil prices surged:**
 - i. Touched \$120/barrel, stabilizing above \$100
 - ii. Possible rise to \$150 if disruption continues
2. LNG, LPG, fertilisers, helium prices increased
3. IEA released 400 million barrels (record reserve release)
4. Energy shocks from chokepoint disruptions resemble 1970s oil crises, with cascading effects across sectors.

Impact on Asia: Maximum Vulnerability

1. Asia consumes ~80% of Hormuz oil flows; Major dependents are China, India, Japan, South Korea.
2. **Severe impacts on developing nations:**
 - i. Nepal: LPG rationing
 - ii. Sri Lanka: Weekly shutdowns
 - iii. Pakistan: LNG crisis leads to school closures.
3. It highlights energy inequality and vulnerability of import-dependent economies.

India's Energy Vulnerability

1. **High Import Dependence:**
 - i. Crude oil: 88–90% imported, in which ~50% via Hormuz.
 - ii. LPG: 60% imported (90% via Hormuz)
 - iii. LNG: 68% from Gulf.

India's Response

1. Invoked Essential Commodities Act, 1955

2. **4-tier rationing system:**

- i. Priority: households, CNG
 - ii. Cuts: industry (50%), fertilisers (70%)
3. Increased domestic LPG production by 38%
 4. Diversified imports: US, Russia, Norway, Algeria
 5. Push for PNG (piped natural gas) expansion

Broader Geopolitical Lessons

1. **Energy Security & National Security:** Naval escorts and diplomacy show militarisation of trade routes
2. **Chokepoint Vulnerability:** Hormuz exemplifies how geography shapes geopolitics
3. **Weaponisation of Energy:** States increasingly using energy supply as leverage.
Control over chokepoints gives states outsized geopolitical power, making global trade fragile.

Way Forward for India

1. Diversification of energy sources (Africa, Americas)
2. Strategic petroleum reserves expansion
3. Accelerate renewables & green hydrogen
4. Strengthen naval presence in IOR
5. Promote regional energy cooperation

OIL SHOCKS

1. **1973 Crisis (First Oil Shock):** It was triggered by the Yom Kippur War (1973) between Israel and a coalition of Arab states.
 - i. OPEC, particularly Arab members, imposed an oil embargo on countries supporting Israel (primarily the US, Western Europe and Japan).
 - ii. Oil prices quadrupled from US \$3 per barrel to \$12.
 - iii. Global economic recession and inflation followed ('stagflation').
2. **1979 Crisis:** Triggered by Iranian Revolution that toppled the Shah of Iran.
 - i. Production in Iran collapsed and exports fell sharply.
 - ii. Oil prices doubled from \$15 per barrel to \$39, renewed global inflation and economic slowdown.
3. **1990 Oil Price Spike:** Caused by Iraq invasion of Kuwait or Gulf War in 1990.
 - i. Oil prices jumped from \$20 per barrel to over \$40 temporarily and stabilised after coalition forces liberated Kuwait in early 1991.

4. **2008 Oil Price Spike:** Caused by strong global demand, especially from China and emerging economies.
 - i. Geopolitical tensions (West Asia) and limited spare capacity resulted in tight supply.
 - ii. Oil prices hit a record high of \$147 per barrel in July 2008.
5. **2020 Oil Price Collapse:** Triggered by global demand collapse due to COVID-19 lockdowns and price war between Russia and Saudi Arabia in early 2020 exacerbated oversupply.
 - i. West Texas Intermediate (WTI) crude futures briefly went negative in 2020.
6. **2026 Oil Price Spike:** The US–Iran tensions have driven Brent crude prices up from \$80 per barrel to \$120 within a week.

6. India's Fertiliser Dependence

Context

1. Recent conflicts in West Asia and past disruptions (Russia–Ukraine war, China's export restrictions) highlight how fertilizer security is directly linked to food security, fiscal stability, and geopolitical strategy.

Scale of India's Fertiliser Dependence

1. **High Import Dependence:** India is the 2nd largest fertiliser importer globally (FAO data).
2. **Demand vs Production (2024–25):**
 - i. Demand: ~64.9 million tonnes
 - ii. Production: ~46.5 million tonnes
 - iii. Imports: ~16 million tonnes
3. **Import Concentration Risks:**
 - i. Urea imports: ~70% from Gulf (Oman, Qatar, Saudi Arabia, UAE)
 - ii. DAP imports: More than 40% from Saudi Arabia
 - iii. Heavy reliance on Strait of Hormuz (critical chokepoint)
4. **Hidden Dependence (Raw Materials):**
 - i. 85% natural gas (urea feedstock) imported
 - ii. 90–95% rock phosphate imported
 - iii. ~50% phosphoric acid imported
5. Effective dependence rises to ~68–70%, making India structurally vulnerable.

Link Between Fertiliser and Food Security

1. Fertilisers are essential for high crop yields and Green Revolution sustainability.
2. Supply disruptions leading to lower yields, inflation, food insecurity.

Recent Geopolitical Shocks

1. **West Asia Conflict (2025–26):** Disruption in Gulf supply routes;
 - i. Gas supply restrictions → fertiliser plants running below capacity;
 - ii. Likely price rise and subsidy burden increase;
2. **Past Examples:**
 - i. Russia–Ukraine War (2022): Fertiliser prices doubled
 - ii. China export restrictions (2025): Forced costly imports
3. Every disruption leads to reactive scrambling rather than strategic planning.

Key Challenges

1. **Supply Chain Concentration:** Overdependence on a few regions (Gulf, China, Russia)
2. **Fiscal Burden:**
 - i. Fertiliser subsidy: ₹1.77 lakh crore (2024–25)
 - ii. Urea heavily subsidised leading to market distortion.
3. **Imbalanced Usage:** Excessive urea use leading to soil degradation & environmental damage.
4. **Domestic Constraints:** Limited reserves of potash and phosphate; and high dependence on imported feedstock.

Strategies to Reduce Dependence

1. **Diversification of Imports:** Shift sourcing to Southeast Asia (Indonesia, Malaysia, Vietnam); Africa, Central Asia, Latin America
 - i. Reduce geopolitical concentration risks
2. **Overseas Investments:** Expand models like Oman India Fertiliser Company (OMIFCO)
 - i. Invest in rock phosphate (Morocco – 70% reserves); and potash mines abroad
3. **Boost Domestic Production:** Improve plant efficiency; use low-grade domestic resources; and integrate with the energy sector (green ammonia).
4. **Strategic Fertiliser Reserve:** Maintain buffer stocks for crisis situations

Reforming Fertiliser Subsidy

1. **Current Issues:** Urea price fixed since 2018 leading to overuse; and government bears 85–90% of cost.
2. **Suggested Reforms:**
 - i. Direct income transfers to farmers (per acre basis)
 - ii. Rationalise urea pricing
 - iii. Promote balanced nutrient use (NPK mix)

Way Forward

1. Treat fertiliser as a strategic sector like energy security; and build resilient and diversified supply chains.
2. **Biofertilisers & Organic Inputs:** Compost from agricultural waste; and microbial nitrogen fixation
3. **Government Initiatives:** PM-PRANAM scheme

7. Ecocide: Environmental Harm in Warfare

Context

1. Recent geopolitical conflicts in West Asia highlight a growing but under-recognised dimension of warfare i.e. environmental destruction.
2. Incidents involving incendiary weapons, toxic chemicals, and attacks on energy infrastructure demonstrate that ecological damage is no longer incidental but increasingly systemic and strategic.

Recent Evidence of Environmental Damage in Conflict

1. **Use of Hazardous Substances:** Reports indicate use of white phosphorus over civilian areas in southern Lebanon, and alleged aerial spraying of glyphosate.
 - i. **White phosphorus** Is highly incendiary; causes severe burns, fires, and long-term soil contamination.
 - ii. **Glyphosate** is a herbicide that can contaminate soil, crops, and water systems at high concentrations.
2. According to environmental monitoring groups, over 120 incidents of ecological harm have been recorded in the ongoing conflict.

Destruction of Energy Infrastructure

1. Airstrikes on oil depots and refineries triggered massive fires releasing soot, hydrocarbons, sulphur and nitrogen compounds.
2. Reports of 'black rain' (acid precipitation) affecting human health and agriculture.

Climate Impact of War

1. Initial weeks of bombardment were estimated to emit ~5 million tonnes CO₂ equivalent, exceeding annual emissions of some countries (e.g., Iceland).
2. **Emissions drivers:** Burning oil facilities, military mobilization, and weapon production and deployment

When Does Environmental Harm Become a War Crime?

1. Traditionally, environmental damage in war is treated as collateral, not primary harm. However, current conflicts challenge this assumption.
2. **Historical Precedent:**

Agent Orange (Vietnam War): Long-term ecological and human health damage, and triggered global debate on environmental protection in warfare.

Existing Legal Frameworks

1. **Additional Protocol I (1977):** Prohibits warfare causing 'widespread, long-term, and severe' environmental damage.
2. **Rio Declaration (1992):** Warfare is inherently destructive to sustainable development (Principle 24).
3. **Rome Statute, 1998 (ICC):** Environmental damage is a war crime if it is intentional, causes widespread, long-term, severe harm, and is disproportionate to military advantage.

Concept of Ecocide

1. It was proposed in 2021 as 'Unlawful or wanton acts committed with knowledge of causing severe and widespread or long-term environmental damage'.
2. **Recent Developments:** 2024 proposal by Vanuatu, Fiji, Samoa to include ecocide as the 5th international crime under the Rome Statute.

Ecology as a Tool of Conflict

1. **Slow Environmental Transformation:** Afforestation policies replacing native ecosystems:
 - i. Example: Replacement of Mediterranean vegetation with European pines
 - ii. Impacts: Biodiversity loss; Soil degradation; Altered fire regimes
2. **War-Environment Nexus:** Environmental damage is now a by-product of conflict.
 - i. A strategic instrument (e.g., targeting infrastructure, altering landscapes)

Way Forward

1. Codify Ecocide as an international crime with clearer thresholds
2. Strengthen monitoring mechanisms (e.g., satellite-based environmental tracking)
3. Integrate environmental norms into military doctrines
4. Promote universal participation in ICC frameworks
5. Enhance role of non-state actors and civil society in documentation and advocacy

8. West Asia War: Impact on India's Pharmaceuticals Sector

Context

1. Recent geopolitical conflicts have exposed the fragility of global pharmaceutical supply chains.
2. Disruptions in the supply of critical raw materials and rising input costs pose a serious threat to global public health, especially for developing nations dependent on affordable medicines from India.

About Geopolitics and the Changing Nature of 'Collateral Damage'

1. Modern conflicts increasingly extend beyond battlefields to disrupt essential civilian infrastructure, including healthcare systems.
2. Geopolitical tensions and wars significantly affect pharmaceutical supply chains by interrupting logistics, increasing trade barriers, and creating uncertainty in global markets.
3. Such disruptions disproportionately affect vulnerable populations, especially children, by limiting access to essential medicines and vaccines.

India as the 'Pharmacy of the World'

1. India plays a central role in global health:
 - i. Supplies generic medicines to ~200 countries
 - ii. Major provider of vaccines (DPT, BCG, measles) to UNICEF and WHO
 - iii. Accounts for a significant share of low-cost drugs globally
2. India's pharmaceutical sector is deeply integrated into global health systems, particularly in developing regions.

Structural Weakness: Dependence on Imported Raw Materials

1. **Heavy Import Dependence:** 70–75% of APIs and intermediates sourced from China.
 - i. Dependence spans Key Starting Materials (KSMs), drug intermediates, and Active Pharmaceutical Ingredients (APIs).
 - ii. India's dominance in generics is underpinned by reliance on Chinese raw materials, making it vulnerable to external shocks.

Impact of War on Pharma Supply Chains

1. **Supply Chain Disruptions:** Damage to air transit hubs and shipping routes, delays in temperature-sensitive drugs (e.g., cancer medicines) and increased logistics costs and rerouting.
 - i. Pharmaceutical supply chains are highly sensitive to geopolitical disruptions due to their complexity and just-in-time nature.
2. **Rising Input Costs:** Increased cost of APIs and intermediates; currency volatility and insurance costs; and impact on drug prices across the distribution chain.
 - i. Rising trade pressures and tariffs significantly increase pharmaceutical costs, especially for generic manufacturers.
3. **Medicines at Risk:** Shortages and price increases are expected in Paracetamol (fever management), antibiotics (routine infections), diabetes medicines, and cancer drugs (temperature-sensitive).
 - i. These medicines form the backbone of primary healthcare, amplifying the crisis.

Global Implications

1. **Impact on Developing Countries:** Africa and low-income countries rely heavily on Indian generics.
 - i. Disruptions may cripple public health programs
2. **Vaccine Supply Risks:** India supplies bulk vaccines globally;
 - i. ~70% of vaccine raw materials are imported → potential bottlenecks
3. **Threat to Global Health Security:** Disruptions in pharmaceutical supply chains can undermine global health systems and pandemic preparedness.

Policy Responses and Gaps

1. **Government Measures:** Production Linked Incentive (PLI) scheme to boost domestic API production; and increase in API exports.
2. **Limitations:**
 - i. Continued high import dependence;
 - ii. Rising share of imports from China;
 - iii. Insufficient domestic capacity in KSMs and intermediates;
3. Onshoring and diversification are necessary but require long-term investment and policy coherence.

Way Forward

1. **Short-Term Measures:** Strategic stockpiling of critical drugs and APIs; diversification of import sources; and strengthening logistics and cold-chain infrastructure.
2. **Long-Term Measures:** Promote domestic API and KSM manufacturing; invest in R&D and innovation; build resilient supply chains (multi-country sourcing); and enhance global cooperation in health security.

9. Fuelwood Resurgence Amid LPG Crisis: Energy Security Lessons for India

Context

1. Amid West Asia conflict, fuelwood has re-emerged as a critical fallback energy source, as it disrupted global energy supply chains, exposing India's dependence on imported liquefied petroleum gas (LPG).

Return to Fuelwood

1. Across India, reports indicate a sharp surge in fuelwood demand:
 - i. Chhattisgarh, Jharkhand, Odisha, Kerala: Households reverting to fuelwood despite earlier LPG adoption
 - ii. Urban spillover: Even city dwellers are sourcing fuelwood from outskirts
2. **Informal markets booming**
 - i. Fuelwood bundles being sold near Raipur
 - ii. Ranchi witnessing increased roadside trade

- iii. Balangir (Odisha) seeing LPG users shift to wood
- 3. It reflects a 'distress-driven reverse transition' in cooking energy use.

Historical Perspective: Echoes of the 1970s Oil Crisis

- 1. The 1974 oil crisis triggered LPG shortages in India
- 2. That decade marked the beginning of the transition from fuelwood to LPG
- 3. However, the transition remains incomplete even after five decades

Fuelwood continues to function as a parallel energy system.

Current Energy Mix

- 1. **NSO (2021):** ~33% households use fuelwood; and ~50% rural households depend on it
- 2. **NFHS-5:** ~41% population uses biomass fuels (fuelwood, dung cakes)
- 3. **Urban India:** 89% households use LPG
- 4. **Regional disparity:** 11 states have more than 50% households using solid fuels

These Indicate energy inequality and rural-urban divide.

Fuelwood Economy

- 1. Fuelwood is not merely a traditional fuel—it is an organized informal economy:
 - i. Global market size: \$37.04 billion (2024) and further projected ~\$46 billion by 2030 (Grand View Research)
 - ii. Livelihood dependence: Millions of rural households engaged in collection and trade.
 - iii. Commercial circulation: ~18% of fuelwood collected is sold in towns and cities.
- 2. These demonstrate that fuelwood is a market-driven energy commodity, not just subsistence use.

Why Fuelwood Persists

- 1. **Structural Reasons**
 - i. Affordability: Minimal or zero monetary cost
 - ii. Accessibility: Locally available
 - iii. Supply reliability: Not dependent on imports or logistics
 - iv. Cultural familiarity: Traditional cooking practices
- 2. The current LPG shortage reinforces these advantages.

Concerns and Challenges

- 1. **Health Impacts:** Indoor air pollution leads to respiratory diseases; and disproportionate burden on women and children.
- 2. **Environmental Costs:** Deforestation and forest degradation, and carbon emissions (though sometimes considered carbon-neutral locally).

3. **Energy Poverty:** Indicates lack of sustained access to clean energy; and reflects gaps in schemes like PM Ujjwala Yojana.

Policy Implications

1. **Strengthen Clean Energy Access:** Ensure continuous LPG supply chains; and improve refill affordability (subsidies, DBT efficiency).
2. **Diversified Energy Basket:** Promote alternatives like biogas, electric cooking, and solar-based solutions.
3. **Sustainable Fuelwood Management:** Agroforestry and community forestry, and efficient cookstoves to reduce emissions.
4. **Focus on Energy Justice:** Address rural-urban disparities, and target vulnerable populations.

10. Declining Camel Population in Rajasthan

Context

1. Recently, the Rajasthan High Court observed a sharp decline in camel population despite a protection law.

Trend in Camel Population

1. India's Camel population has declined by more than 75% since the 1970s, a decline driven by economic transitions, shrinking rangelands, legal constraints, and declining institutional support ~7.5 lakh in 2004, ~3.2 lakh (year of enactment of protection law) in 2015 and ~1.5 lakh in 2021.
2. It indicates a continuous and steep decline, even after legal protection.

Legal Framework

1. **Rajasthan Camel Act, 2015:** Rajasthan Camel (Prohibition of Slaughter and Regulation of Temporary Migration or Export) Act, 2015.
2. **Key Provisions:**
 - i. Ban on slaughter of camels
 - ii. Restriction on transport/export outside the state
 - iii. Regulation of migration of camels
3. Camel declared as the State Animal of Rajasthan.

About Camels

1. They are exceptionally suited to dryland ecosystems, and deeply embedded in the cultural lives of pastoral communities such as the Raika, Rabari, and Fakirani Jat.

Key Camel Breeds in India

1. **Dromedary Camels (Rajasthan and Gujarat):**

- i. **Bikaneri (Rajasthan):** Commonly used for cart pulling and heavy draught work.
 - ii. **Jaisalmeri (Rajasthan):** Primarily used for riding, camel safaris, and long-distance travel, especially in the Thar Desert.
 - iii. **Mewari (Southern Rajasthan):** This is a dual-purpose breed, utilized for both milk production and draught.
 - iv. **Kachchhi (Gujarat):** It is commonly used for ploughing and carting in the Rann of Kachchh and surrounding regions.
 - v. **Kharai (Gujarat):** Adapted to coastal and mangrove ecosystems. It is an excellent swimmer, capable of crossing creeks and feeding on mangroves.
2. **Bactrian (Camelus bactrianus), Ladakh:** The double-humped camel, or Bactrian camel, is found exclusively in the high-altitude cold desert of Ladakh.
- i. Critically Endangered on the IUCN Red List of Threatened Species.
 - ii. Gobi and Gashun Gobi deserts of northwest China and Mongolia.

11. Illegal Sand Mining in National Chambal Wildlife Sanctuary

Context

1. A Supreme Court-appointed Central Empowered Committee (CEC) has flagged rampant illegal sand mining in the National Chambal Wildlife Sanctuary (NCWS). The issue highlights governance failures across Rajasthan, Madhya Pradesh, and Uttar Pradesh.

About National Chambal Wildlife Sanctuary

1. It is a tri-state protected area (Rajasthan, Madhya Pradesh, Uttar Pradesh).
2. It is notified for conservation of critically endangered species like Gharial (*Gavialis gangeticus*); Gangetic River dolphin; and Indian skimmer.
3. It is recognized as an Important Bird Area (IBA).
4. It features a fragile riverine ecosystem with sandbanks crucial for breeding.

Key Findings of the CEC

1. **Continuous illegal mining:** Sand extraction, transportation, and storage ongoing inside sanctuary limits.
2. **Weak coordination:** Poor inter-state and inter-departmental cooperation.
3. **Denotification concerns:** States have denotified forest areas without central approval, facilitating mining.
4. **Regulatory failure:** Ineffective enforcement of environmental laws and court orders.

Environmental Impacts

1. **Threat to Biodiversity:** Destruction of nesting sites of gharials and turtles. Disturbance to river dolphins and bird habitats.
2. **River Ecology Degradation:** Alteration of river flow and sediment balance. Increased erosion and habitat fragmentation.
3. **Pollution and Noise:** Mining machinery leads to noise pollution, affecting aquatic fauna.

Legal and Governance Issues

1. Violations of Wildlife Protection Act, 1972; and Environment Protection Act, 1986
2. Weak implementation of Eco-Sensitive Zone (ESZ) norms.
3. Federal governance gap: lack of coordinated action among states.

CEC Recommendations

1. Immediate ban on mining, extraction, transportation, storage of sand in sanctuary and ESZ.
2. Strengthening inter-state coordination mechanisms.
3. Strict enforcement of forest and wildlife laws.

Way Forward

1. Establish a joint inter-state task force.
2. Use technology (drones, GIS) for monitoring.
3. Ensure community participation in conservation.
4. Strengthen accountability of state authorities.

12. Global Energy Crisis Amid Conflict in West Asia

Context

1. The ongoing geopolitical conflict involving the US, Israel, and Iran has triggered a global energy crisis.

About

1. Disruptions in critical supply routes, especially maritime chokepoints like the Strait of Hormuz have historically posed major risks to global oil flows, affecting nearly one-fifth of global petroleum trade.
2. It has led to acute shortages of fuel (petrol, diesel, LPG), rising inflation and trade deficits, and long queues and rationing in several countries.

The crisis is not merely economic but humanitarian, disproportionately affecting vulnerable populations.

Socio-Economic Impacts

1. **Energy Poverty and Inequality:** Over 700 million people lack reliable energy access, making them highly vulnerable.
 - i. Rising LPG and fuel prices strain household incomes, especially in developing countries.

2. **Impact on Agriculture and Food Security:** Fertilizer supply disruptions (linked to natural gas) threaten agricultural productivity.
 - i. Combined with climate change, this may intensify global food insecurity.
3. **Macroeconomic Stress:** Increased oil import bills worsen current account deficits.
 - i. Developing economies face currency depreciation and fiscal instability.

Pre-existing Energy Transition Trends

1. Even before the crisis, the world was transitioning toward clean energy: Renewables accounted for ~50% of installed electricity capacity by 2025.

Around 85% of new capacity additions were solar and wind.
2. This transition is driven not only by climate goals but also by cost-effectiveness and technological advancements.

Role of Developing Countries in Energy Transition

1. Low and middle-income countries are leading adoption:
 - i. Countries like Namibia and Togo (solar);
 - ii. Jordan and Kyrgyzstan (battery systems);
 - iii. Nepal and Sri Lanka (electric vehicles)
2. These trends are supported by falling costs of solar panels and batteries, flexibility to bypass legacy fossil fuel infrastructure, dependence on energy imports, and pushing energy independence.

War-Induced Structural Shifts in Energy

1. **Short-Term Responses:** Diversification of suppliers: US, Russia, Nigeria, Guyana;
 - i. Increased reliance on domestic fossil fuels (coal, charcoal)
2. **Long-Term Structural Changes:** Possible end of cheap fossil fuel era; acceleration of energy nationalism and protectionism; and supply chain restructuring for energy technologies.

Energy systems are becoming more geopolitically fragmented.

Clean Energy: From Climate Imperative to Security Necessity

1. The crisis reframes renewable energy as a tool for energy security, a hedge against geopolitical shocks, and a pathway to economic resilience. Crises often accelerate energy transitions, as seen in Europe post-Ukraine war.

Challenges Ahead

1. Infrastructure damage in conflict zones delays supply recovery; fragmented global cooperation weakens climate action; and risk of reverting to polluting fuels in the short term.
2. The global order governing energy and climate is increasingly unstable.

Way Forward

1. Diversification of energy mix: renewables, storage, and green hydrogen
2. Strengthening strategic reserves
3. Decentralized energy systems (mini-grids, rooftop solar)
4. International cooperation despite geopolitical tensions
5. Domestic manufacturing of clean technologies

13. Maternal Mortality in India and The World

Context

1. Recent findings from the Global Burden of Disease (GBD) 2023 Study highlight a significant decline in maternal mortality globally and in India. However, progress remains uneven, with major challenges persisting in high-burden countries.

About Maternal Mortality

1. It refers to the death of a woman during pregnancy, childbirth, or within 42 days after termination of pregnancy, from causes related to or aggravated by the pregnancy or its management (excluding accidental or incidental causes).
2. It is a critical indicator of women's health and healthcare delivery. It is included in SDG Goal 3 (Good Health and Well-being).
3. Maternal Mortality Ratio (MMR) is the key indicator used to measure maternal mortality.
4. It reflects the quality of the healthcare system, access to maternal services, and socio-economic conditions.

India's Progress

1. India has reduced its Maternal Mortality Ratio (MMR) by nearly 80%, from 508 (1990) to 116 (2023). It reflects improvements in institutional deliveries, access to antenatal care, and government schemes (e.g., JSY, JSSK).
2. Despite this progress:
 - i. India recorded 24,700 maternal deaths in 2023, making it the second-highest globally after Nigeria.
 - ii. Indicates that absolute burden remains high due to population size and regional disparities.

Global Scenario

1. Total maternal deaths worldwide (2023): ~240,000
2. Global MMR: 190.5 per 100,000 live births
3. This is ~3 times higher than the SDG target (≤ 70 by 2030)
4. **High-Burden Countries:** Five countries account for 36% of global maternal deaths: Nigeria, India, Ethiopia, Pakistan, and Cameroon.

5. These countries face weak health systems, inequitable access, and socio-economic barriers.

Major Medical Causes of Maternal Deaths

1. **Haemorrhage (Severe Bleeding):** Leading cause globally; especially postpartum haemorrhage; and requires timely emergency obstetric care.
2. **Hypertensive Disorders:** Includes preeclampsia/eclampsia; share increased from 16.6% to 20.1%; and reflects rising non-communicable disease burden.

These two causes account for over 40% of maternal deaths globally.

Emerging Concern: Late Maternal Deaths

1. Defined as deaths 43 days to 1 year after childbirth
2. Increased from 1.3% (1990) to 3.2% (2023)
3. It indicates gaps in postnatal care, and need for continuum of care beyond delivery.

Key Challenges

1. **Structural Issues:** Regional disparities (e.g., BIMARU states); rural-urban divide; and shortage of skilled birth attendants.
2. **Health System Gaps:** Inadequate emergency obstetric care. weak referral systems, and poor postnatal follow-up.
3. **Social Determinants:** Early marriage and pregnancy, malnutrition and anemia, and gender inequality.

Way Forward

1. **Policy Measures:** Strengthen primary healthcare (Ayushman Bharat, HWCs); and improve maternal death surveillance systems
2. **Clinical Interventions:** Timely management of haemorrhage & hypertension, and scale up skilled birth attendance.
3. **Social Interventions:** Delay age of marriage, and improve female education and nutrition.

14. India's Updated Climate Commitments (NDCs) For 2035

Context

1. Recently, India has updated its Nationally Determined Contributions (NDCs) under the Paris Agreement (2015), marking its third submission to the UNFCCC.
2. These commitments reflect a balanced approach between development and decarbonisation, especially in a global context of geopolitical tensions and supply-chain disruptions.
3. The update follows the first Global Stocktake (2023), which highlighted that the world is off track to limit warming to 1.5°C.

Key Targets for 2035

1. **Emissions Intensity Reduction:** Reduce emissions intensity of GDP by 47% from 2005 levels
2. **Clean Energy Transition:** Achieve 60% of installed power capacity from non-fossil fuel sources
3. **Carbon Sink Expansion:** Create 3.5–4 billion tonnes CO₂ equivalent carbon sink through forests and tree cover.

Qualitative Targets

1. Climate-friendly economic pathways
2. Climate-resilient infrastructure
3. Mobilisation of low-cost finance (domestic & international)
4. Capacity building and R&D
5. Promotion of Lifestyle for Environment (LiFE)

These aim to embed sustainability into governance and ensure a just and inclusive transition.

Significance of the Updated NDCs

1. Aligns with India's net-zero target by 2070
2. Reflects commitment to climate multilateralism
3. India differs from developed nations by focusing on emissions intensity, not absolute cuts
4. Positions India among 130+ countries submitting updated NDCs.

Analysis

1. **Incremental but Cautious Approach:** Targets represent a gradual increase, not a major leap
 - i. **Concerns:** Lack of sector-specific pathways; and weak integration of existing decarbonisation roadmaps.
2. **Energy Transition Challenges (Installed Capacity vs Actual Generation):** More than 50% installed capacity from non-fossil fuels (~283 GW), but only about 29% actual electricity generation is non-fossil.
 - i. **Key Issues:** Structural inefficiencies in the energy system; grid constraints and transmission bottlenecks; renewable energy curtailment (e.g., 2.3 TWh solar curtailed in 2025); coal plants not flexible enough.
3. **Strategic Shift in Energy Policy:** Renewables now seen as a climate necessity and energy security tool, and reduces dependence on imported fossil fuels.
 - i. However, risk of new dependency on Lithium, and solar components supply chains.
4. **Role of Technology:** Key sectors (cement, aluminium, MSMEs) rely on energy efficiency improvements, and Carbon Capture, Utilisation and Storage (CCUS)
 - i. **Concern:** Pace of technological scaling may be insufficient.

5. **Climate Finance Challenge:** Estimated \$8 trillion (2025–2050) required, and \$5 trillion for the power sector alone.
 - i. **Constraints:** Global climate finance inadequate; \$300 billion/year vs \$1.3 trillion demand (COP29); and heavy reliance on domestic funding, and debt financing.

15. Artemis II And the New Lunar Race

Context

1. Half a century after Apollo, NASA's Artemis II aims to open a new chapter in deep-space exploration.

About Artemis Programme

1. **Return to the Moon:** NASA's Artemis programme aims to return humans to the Moon after the Apollo missions (ended in 1972).

Artemis II is a crewed lunar flyby mission, paving the way for Artemis III (planned landing mission).

2. **Focus on Lunar South Pole:** The south pole region is the primary target due to presence of Permanently Shadowed Regions (PSRs), high possibility of water ice deposits, and geological diversity useful for scientific study.
3. **Gateway to Mars:** The Moon is envisioned as a launch base for deep-space missions, especially Mars.

Artemis aligns with NASA's long-term goal of interplanetary exploration.

Importance of Lunar Far Side Observation

1. The far side of the Moon is less explored due to lack of direct communication with Earth.
2. Artemis II observations under partial illumination enhance detection of crater rims, ridges, slopes, and understanding of lunar geology and evolution.

Global Lunar Competition

1. **United States (NASA):** Artemis missions aim for human landing, lunar base establishment, and sample return missions.
2. **China:**
 - i. Target: Crewed Moon landing by 2030
 - ii. Achievements: First landing on far side (2019); and sample return missions (2020, 2024)
 - iii. Plans: International Lunar Research Station (ILRS) with Russia by 2035, and possible landing sites near equatorial volcanic regions (e.g., Rimae Bode)
3. **India:**
 - i. Chandrayaan-3 (2023): Successful south pole landing
 - ii. Chandrayaan-4 (2027 planned): Sample collection and return; focus on south pole exploration

Strategic and Geopolitical Dimensions

1. **Resource Competition:** Key lunar resources like Helium-3 (potential fusion fuel), water ice raises concerns about resource control, and economic exploitation
2. **Military Concerns vs Scientific Cooperation:**
 - i. Moon could become a strategic control point (Earth-Moon gravity well concept) & risk of militarization of space.
 - ii. Moon is too distant and costly for effective military use; and limited direct strategic advantage.
3. **International Space Law:** Governed by the Outer Space Treaty (1967), prohibits weapons of mass destruction in space, and promotes peaceful use of outer space.

16. Land Consolidation in India: Key to Agrarian Reform and Productivity

Context

1. Land consolidation has become more relevant than ever for sustainable agriculture and rural development with rising land fragmentation due to demographic and economic pressures.
2. Implementation of land consolidation in India remains uneven and incomplete, despite early adoption and proven benefits.

About Land Consolidation in India

1. It refers to the reorganization of fragmented agricultural landholdings into compact blocks to improve efficiency, reduce costs, and enhance productivity.
2. **Two Approaches:**
 - i. **Voluntary Approach:** Based on consent of all landowners; more democratic and sustainable
 - ii. **Majority-Based Approach:** Implemented with majority approval; faster but may lead to disputes.

Historical Evolution in India

1. **Pre-Independence:** Introduced in Punjab (1920) on an experimental basis; supported by cooperative societies
2. **Post-Independence:** Became a key component of land reforms (Kumarappa Committee); Adopted alongside Zamindari abolition, Tenancy reforms, and Land ceiling laws.

Legal Provisions

1. **Constitutional Position:**
 - i. Land is a State Subject (Entry 18, State List)
 - ii. States are responsible for enacting and implementing consolidation laws
2. **Central Support:**

- i. Department of Land Resources (DoLR), Ministry of Rural Development
- ii. Provides policy guidance and promotes best practices
- iii. Supports Digital India Land Records Modernization Programme (DILRMP)

3. Major State Laws:

- i. Uttar Pradesh Consolidation of Holdings Act, 1953
 - **Uttar Pradesh Model:** Initiated in 1954 (Muzaffarnagar, Sultanpur); expanded statewide in 1958; and covered over 100,000 villages (Phase I).
- ii. Punjab Consolidation of Holdings Act, 1948
- iii. Haryana Consolidation of Holdings Act, 1948 (adapted)
- iv. Madhya Pradesh Land Revenue Code, 1959 (Sections 205–221)
- v. Himachal Pradesh Holdings (Consolidation and Prevention of Fragmentation) Act, 1971

Objectives of Land Consolidation | Process of Land Consolidation

1. Reduce fragmentation of holdings | Notification of Area by state government
2. Promote economies of scale | Updating Land Records
3. Enable mechanization and irrigation efficiency | Valuation of Land Parcels
4. Improve land records and tenure security | Preparation of Consolidation Scheme
5. Facilitate rural infrastructure development (roads, irrigation channels) | Reallocation of Land (Chakbandi) into contiguous plots | Provision for Compensation (if value differs) | Creation of New Land Records (Jamabandi)

Evidence of Effectiveness

1. **Empirical Findings:** Fragmentation reduces productivity significantly; even a 10% reduction in fragmentation can boost output per acre.
 - i. **Field Study (Rajasthan, 2025):** Cultivation cost reduced by more than 30%; Labour days reduced from 220 to 140; and tractor use reduced by almost 50%.
2. **Regional Success:** Punjab, Haryana, Western UP have better irrigation systems, higher mechanization, and strong foundation for Green Revolution
 - i. **Lagging States (e.g., Bihar, Odisha)** lack of consolidation linked to lower agricultural development.

Global Perspective

1. FAO (2020) identifies land consolidation as a key tool for rural development
2. Contributes to SDGs: SDG 1 (No Poverty); & SDG 2 (Zero Hunger)

Challenge of Land Fragmentation

1. **Rising fragmentation:** 86.2% of India's operational holdings are small and marginal (<2 ha) (Agriculture Census 2021–22).
 - i. Average landholding declined from 1.08 ha (2016–17) to 0.74 ha (2021–22) (NABARD).
 - ii. **Causes:** Population growth, inheritance laws leading to subdivision, economic compulsions
 - iii. **Impacts:** Increased cost of cultivation, reduced mechanization efficiency, higher labour and time costs, lower agricultural productivity and incomes
2. **Administrative & Governance Issues:** Corruption and lack of transparency, weak land records and mapping systems, and revenue department-led process lacks local accountability.
3. **Social Resistance:** Disputes over land valuation and allocation, and lack of consent (e.g., cases from Uttar Pradesh villages).
4. **Legal and Policy Gaps:** Excessive exemptions in laws, and irregular implementation across states.
5. **Infrastructure Issues:** Missing access roads; and loss of trees, wells without compensation.

Policy Innovations & Suggestions

1. **Strengthen Institutional Mechanisms:** Involve Gram Panchayats for transparency; digitize land records (SVAMITVA, DLRS initiatives).
2. **Ensure Farmer Participation:** Minimum 75% consent rule (as suggested in UP)
3. **Periodic Consolidation:** Repeat exercise every 10–15 years
4. **Integrate with Rural Development:** Align with irrigation, roads, and livestock policies.
5. **Protect Common Lands:** Ensure proper demarcation of grazing and community lands.

Way Forward

1. Land consolidation is not merely a technical reform but a structural transformation tool for Indian agriculture.
2. It improves productivity, reduces costs, and enhances rural livelihoods. However, its success depends on transparent governance, community participation, and periodic updates.