



# Monthly Editorial Consolidation



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Drishti, 641, First Floor, Dr. Mukharjee Nagar, Delhi-110009  
Inquiry: 87501-87501  
Email: [care@groupdrishti.in](mailto:care@groupdrishti.in)

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## India's Space Power Revolution

*India's space program* has entered a new era of sophistication with ISRO's latest **SpaDeX** mission - a pioneering attempt at space docking that could place India alongside the US, Russia, and China in an elite group of nations. This milestone comes after the successful **Chandrayaan-3** lunar landing and **Aditya-1** solar mission in 2023, showcasing ISRO's rapid evolution from a satellite-launching agency to a leader in planetary exploration. ISRO's growing expertise across all aspects of space exploration signals its readiness to emerge as a global space power, capable of contributing significantly to humanity's understanding of the cosmos.

Tag: GS Paper - 3, Space Technology, Achievements of Indians in Science & Technology, 2nd ARC



### How is India Strengthening its Space-Based Capabilities?

- **Mastery in In-Orbit Docking and Space Station Development:** India's **SPADEX** mission (Space Docking Experiment), launched by ISRO recently, exemplifies its move towards advanced space technologies.

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- The experiment involves two satellites, **Chaser and Target**, autonomously performing docking maneuvers, crucial for future missions like on-orbit satellite servicing and assembling a potential Indian space station.
- This complements ISRO's **Gaganyaan program**, aiming for human space exploration by 2025.
  - Such initiatives place India among the select few nations mastering autonomous docking technologies, with broader implications for interplanetary missions.
- **Strengthening Indigenous Satellite Constellations:** India has prioritized building **home-grown satellite constellations** to reduce dependency on foreign data.
  - **30 Indian companies** are collaborating to build and operate Earth observation satellite constellations for defense, infrastructure management, and mapping
  - **ISRO's NavIC upgrade** aims to enhance India's navigation system to compete with global counterparts like GPS.
  - This initiative boosts **data sovereignty and aligns with India's vision for self-reliance in critical infrastructure**, fostering public-private collaboration.
- **Expanding Small Satellite Capabilities and Global Launch Services:** India's **Small Satellite Launch Vehicle (SSLV)**, caters to the booming demand for launching nanosatellites.
  - By tapping into the \$14 billion small satellite market expected by 2031, India has emerged as a cost-effective global player.
  - The **PSLV-C56 mission** in 2023 successfully deployed commercial payloads, reflecting India's reliability in the space launch sector.
  - Additionally, **SSLVs are enabling universities and startups to deploy experimental satellites**, accelerating technological innovation.
- **Boosting Space Startup Ecosystem and Private Sector Involvement:** The **10 billion rupee fund** for space startups, approved in 2024, has catalyzed innovation in the private sector.
  - Companies like **Pixxel** and **Skyroot Aerospace** are revolutionizing Earth imaging and rocket technologies, with **Pixxel launching hyperspectral satellites** and Skyroot's **Vikram-S** marking India's first private rocket launch.
- This strategy fosters entrepreneurial participation, with over **40 startups** contributing to India's space economy and creating employment opportunities across sectors.
- **Advancements in Defense and Dual-Use Technologies:** The launch of defense-oriented satellites, such as **GSAT-7**, strengthens India's strategic surveillance and communication capabilities.
  - **India's Anti-Satellite (ASAT) test in 2019** demonstrated its readiness for space warfare, complemented by a dedicated **Defense Space Agency (DSA)** operational from 2020.
  - This ensures India's preparedness in addressing emerging security challenges, especially in the context of militarization of space by global powers.
- **Strategic International Partnerships and Outreach:** India is forging strategic partnerships to enhance its global space standing.
  - **Axiom Space**, U.S.-based startup, plans to utilize Indian rockets for space station missions, showcasing India's cost-efficient launch capabilities.
  - Collaboration with **NASA and ESA** under climate and planetary science missions, like the **NISAR satellite**, also boosts India's role in addressing global challenges.
    - Such partnerships align India's space ambitions with geopolitical objectives, fostering soft power.
- **Enhancing Space Sustainability and Global Contribution:** India is advocating sustainable space practices, as demonstrated by missions like **Aditya-L1** for solar observation, aimed at mitigating space weather impacts on satellites.
  - Additionally, India is contributing to **global debris management through ISRO's NETRA program** for space situational awareness.
  - By balancing growth with sustainability, India aligns with international norms like the **Artemis Accords**, fostering responsible behavior in outer space.
- **Pursuit of Lunar and Interplanetary Exploration:** India's **Chandrayaan-3** success in 2023 marked its entry into the lunar south pole exploration, a feat accomplished by very few nations.
  - **ISRO's plans for Shukrayaan-1, Venus exploration**, signify its ambitions to lead interplanetary research.

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- These missions provide critical insights into planetary sciences, boosting India's academic and research credentials globally.
- **Utilization of Space for Socio-Economic Benefits:** Space-based services are transforming sectors like agriculture, disaster management, and urban planning.
  - For instance, **ISRO's Bhuvan Geoportal** assists in real-time disaster monitoring, while satellite data supports crop monitoring under the **PM Kisan Scheme**.
  - India's space initiatives align with SDG goals, enhancing resilience and inclusivity in governance.
- **Space Policy and Vision for the Future:** The **2023 Indian Space Policy** emphasizes **democratizing space by enhancing private sector participation** and integrating space assets into national security and economic frameworks.
  - With **plans for a national space station by 2035**, India is charting a robust roadmap for space dominance.

### What are the Key Issues Related to India's Space Sector?

- **Limited Budget Allocation and Financial Constraints:** India's space ambitions are restricted by a **relatively modest budget**, impacting large-scale projects and technological advancements.
  - While India is achieving **high returns on its investments**, its space budget pales compared to global counterparts, limiting exploration programs, infrastructure, and R&D.
  - India only spends **0.04% of its GDP on space**, whereas the United States spends 0.28% of its economy on space.
    - ISRO's budget for 2024-25 is **Rs 13,042.75 crore (about \$1.95 billion)**. In contrast, NASA operates with a much larger budget of around **\$25 billion**.
- **Technological Dependence on Foreign Players:** Despite progress, India relies heavily on **foreign suppliers for critical components like advanced sensors, propulsion systems, and semiconductors**.
  - Indigenous technology development lags behind global standards, limiting India's ability to achieve self-reliance in areas like deep-space exploration and satellite manufacturing.

- India largely depends on space-tech dependence along with imports. India's solar sector imports reached \$7 billion in FY 2024. The **cryogenic CE-20 engine** for GSLV Mk III took a long time to develop, highlighting delays in indigenous innovation.
- **Regulatory and Policy Gaps:** India lacks a robust legal framework governing its space activities, deterring private sector participation and international partnerships.
  - While the **Indian Space Policy 2023** was a positive step, it does not adequately **address liability, intellectual property rights, or dispute resolution mechanisms**.
  - The **Outer Space Treaty (1967)** mandates liability for damages caused by space objects, but **India has no dedicated Space Act to codify such provisions**.
  - Delays in launching private satellites stem from the absence of clear licensing mechanisms, affecting startups like **Pixxel** and **Agnikul Cosmos**.
- **Space Debris and Sustainability Concerns:** India's increasing satellite launches and defunct satellites contribute to growing space debris, posing risks to operational assets.
  - **ISRO's growing footprint in orbit is accompanied by environmental concerns**, with limited mitigation strategies and debris removal mechanisms.
  - By 2022, India had **103 active or defunct spacecraft and 114 objects categorised as 'space debris' in orbit**.
- **Limited Defense and Security Preparedness:** India's space capabilities for defense remain underdeveloped compared to global powers, despite growing threats of space militarization.
  - The **absence of robust anti-satellite systems, space-based early warning systems, and a cohesive military-space policy** leaves India vulnerable.
  - India conducted its first **ASAT test in 2019**, while the **U.S. and China maintain dual-use satellites** capable of offensive operations.
  - India's **GSAT-7** is designed for Navy communications but lacks integration with ground-based and space-based surveillance systems.
- **Brain Drain and Human Capital Deficit:** The migration of skilled professionals to global space giants undermines India's domestic innovation capabilities.

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- With better funding, infrastructure, and career opportunities abroad, India faces a talent gap in advanced space research.
  - 70% of Indian students studying abroad opt for STEM fields reducing retention rate for top scientists in India.
  - Indian-origin scientists contribute to major **NASA and SpaceX projects**, including **Mars Perseverance** and **Starship development**.
  - **Inadequate Global Market Share:** India's contribution to the global space economy is disproportionately small, considering its cost-effective capabilities.
    - India's share of the global space economy is **2-3%**. Missions like **PSLV-C56** have attracted commercial payloads but **fall short of maximizing international contracts compared to SpaceX**.
  - **Lagging Human Spaceflight Capabilities:** India lags behind global leaders in human space exploration, with no operational capacity for sustained manned missions.
    - While the **Gaganyaan mission** is promising, delays in development and reliance on foreign life-support systems highlight gaps in India's capabilities.
    - India's first manned mission is planned for **2025**, nearly **20 years behind China** and **55 years after the U.S. Apollo mission**.
  - **Rising Geopolitical and Strategic Challenges:** The global competition for space dominance creates geopolitical challenges for India, **especially with China's rapid advancements**.
    - India's focus on civilian applications leaves it lagging in space diplomacy and dual-use technologies compared to aggressive competitors.
    - China's **Tiangong Space Station** became operational in 2022. India's regional navigation system, **NavIC**, has limited international adoption compared to **China's BeiDou**.
- What Measures Can India Adopt to Ensure Sustained Space Exploration and Strengthen Its Space-Based Capabilities?**
- **Enhance Budgetary Allocation and Diversify Financing Mechanisms:** Increase the space sector's share of GDP to support high-priority projects like human spaceflight and deep-space exploration.
  - Introduce **sovereign space bonds** and **public-private co-financing models** to attract long-term investments.
  - Establish an **Indian Space Fund** under IN-SPACe to support R&D, startups, and disruptive innovation.
  - **Promote Public-Private Collaboration:** Operationalize seamless **public-private partnerships (PPPs)** by granting private players access to ISRO's infrastructure, such as launchpads and testing facilities.
  - Develop **joint venture models** for satellite constellations, reusable launch vehicles, and lunar missions.
  - Simplify the regulatory ecosystem with **single-window clearances for private space missions** under IN-SPACe.
  - **Prioritize Indigenous Technology Development:** Accelerate the establishment of **dedicated Space Technology Innovation Hubs** focusing on propulsion systems, AI in satellite operations, and space-grade semiconductors.
    - Collaborate with academic institutions and startups to create **disruptive tech solutions**, including reusable rockets and in-orbit docking systems.
    - Implement **import substitution policies** for critical components to achieve strategic autonomy.
  - **Focus on Talent Retention and Workforce Development:** Launch **specialized space education programs** in universities, integrating disciplines like robotics, astrophysics, and aerospace engineering.
    - Establish **national-level space training academies** to groom a skilled workforce for advanced missions like **Gaganyaan** and **Shukrayaan-1**.
    - Incentivize research fellowships and retain talent through lucrative career pathways and international collaborations.
  - **Develop Modular Space Station and Advanced Space Infrastructure:** Commit to building a **modular space station** to support long-term human presence in space.
    - Expand launch capacity by upgrading **Satish Dhawan Space Centre** and establishing new launch sites with cutting-edge technology for **hypersonic and reusable vehicles**.
    - Develop in-orbit servicing and assembly systems for satellite maintenance and expansion of mission capabilities.

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- **Strengthen Satellite Constellation Development:** Accelerate deployment of indigenous **Earth observation, navigation, and communication constellations** like NavIC and RISAT to enhance data sovereignty.
  - Integrate **dual-use satellites** that serve civilian and defense needs for applications such as disaster management and military surveillance.
  - Encourage **private participation** in satellite manufacturing through policy incentives.
- **Foster Space Sustainability and Debris Mitigation:** Adopt **space situational awareness (SSA) technologies** to track and manage space debris and prevent collisions.
  - Invest in **de-orbiting technologies** and adherence to international standards on debris mitigation.
  - Introduce a **National Space Sustainability Plan** to ensure India's compliance with global norms and promote leadership in sustainable space exploration.
- **Strengthen Strategic Space-Based Defense Capabilities:** Expand the role of the **Defense Space Agency (DSA)** to develop counter-space technologies, including satellite jammers and anti-satellite (ASAT) weapons.
  - Focus on developing **dual-use platforms** that **enhance India's strategic advantage in communication, reconnaissance, and navigation.**
  - Collaborate with DRDO to integrate space technologies into national defense frameworks.
- **Advance International Collaborations for Technology Sharing:** Deepen cooperation with global agencies like **NASA, ESA, and Roscosmos** to gain access to advanced technology and shared resources.
  - Leverage bilateral agreements to participate in international missions like **Artemis and planetary defense initiatives.**
  - Strengthen ties with emerging space nations in Africa and Southeast Asia for **space diplomacy** and capacity-building.
- **Establish a Comprehensive Space Act:** Draft a **dedicated Space Act** to provide a robust legal framework governing space activities, ensuring clarity on licensing, intellectual property rights, and dispute resolution.
  - Codify India's liability under international treaties like the **Outer Space Treaty** and promote ease

of doing business in space ventures. Include provisions for **private sector indemnification** to attract foreign investments.

- **Expand Socioeconomic Applications of Space Technology:** Leverage satellite-based geospatial data for **precision agriculture**, water resource management, and urban planning.
  - Expand the scope of programs like **Bhuvan Geoportal** to include telemedicine and e-education for rural areas.
  - Integrate space assets into national missions like **PM-Kisan, Digital India, and Smart Cities** for transformative impact.
- **Build Reusable and Hypersonic Launch Systems:** Accelerate the development of **Reusable Launch Vehicles (RLVs)** to reduce launch costs and enhance mission frequency.
  - Invest in **hypersonic propulsion systems** to support rapid deployment of satellites and exploration payloads.
  - Collaborate with private firms to operationalize technologies like **scramjets** and **spaceplanes** for next-generation launch capabilities.
- **Promote Space-Based Entrepreneurship:** Create a **National Space Innovation Framework** to encourage startups and MSMEs in areas like satellite manufacturing, data analytics, and payload development.
  - Offer incubation support through ISRO's facilities and mentorship programs for entrepreneurs.
  - Launch **hackathons and space innovation challenges** to tap into youth-driven ideas and solutions

### Conclusion:

India's space program is at a transformative juncture, marked by significant advancements in **technology, strategic collaborations, and a growing ecosystem of public-private synergy.** While challenges persist in terms of funding, regulatory frameworks, and indigenous capability development, India's cost-effective innovations and ambitious missions position it as a rising global space power.



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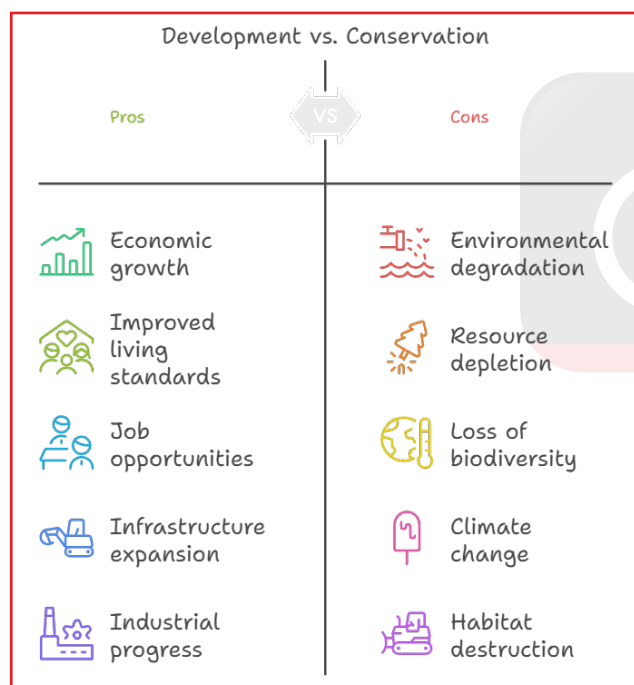
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## Balancing Development & Conservation

*This editorial is based on “[Ken-Betwa river project: Balancing development with ecological concerns](#)” which was published in Business Standard on 31/12/2024. The article brings into focus the Ken-Betwa River Linking Project, India’s first major river-interlinking initiative, highlighting its long-awaited commencement after 29 years and the critical debate it sparks between development and environmental conservation.*

**Tag:** GS Paper-3, Industrial Policy, Infrastructure, Growth & Development, Planning, Fiscal Policy, Inclusive Growth



The [Ken-Betwa River Linking Project](#), which received its ceremonial inauguration recently, stands as a watershed moment in India’s ambitious river-interlinking vision. 29 years after its conception, this first-of-its-kind venture among **16 proposed river-linking projects** has finally **broken ground**, igniting fresh debates about the delicate balance between **development** and **environmental conservation**. As excavators ready their blades and engineers unfurl their blueprints, the Ken-Betwa project serves as a critical lens through which to examine the

broader narrative of progress in modern India, where every developmental stride must be measured against its ecological footprint.

### What Constitutes India’s Current Core Development Priorities?

- **Infrastructure Development:** India’s economic ambitions are centered around creating world-class infrastructure to enhance productivity, facilitate trade, and attract investments.
  - A strong infrastructure base not only supports industrial growth but also bridges regional disparities by connecting remote areas to mainstream economic activities.
  - Initiatives like the [National Infrastructure Pipeline](#) (₹111 lakh crore over 5 years) and [Gati Shakti](#) aim to integrate sectors and improve connectivity.
  - In 2023-24, the capital expenditure allocation was raised to ₹10 lakh crore (3.3% of GDP), signaling the government’s infrastructure-centric growth model.
- **Climate Change Mitigation and Renewable Energy Transition:** Addressing climate change is a critical priority for India as it seeks to balance development with environmental sustainability.
  - Transitioning to renewable energy and low-carbon technologies is imperative to reduce greenhouse gas emissions while ensuring energy security for its growing economy.
  - The [Green Hydrogen Mission](#) (₹19,700 crore) and solar energy expansion (installed capacity at 71 GW in 2023) underscore this shift.
    - As of **October 2024**, renewable energy-based electricity generation capacity stands at **201.45 GW**, accounting for **46.3% of the country’s total installed capacity**, aligning with its Paris Agreement commitments.
- **Human Capital Development:** Investing in human capital is vital for India’s socio-economic transformation.
  - Improving **education and healthcare** ensures an empowered, healthy, and skilled workforce, which is indispensable for sustained growth.
  - The [PM e-Vidya scheme](#) expanded digital education for childrens during Covid-19, while [Ayushman Bharat](#) covers over 50 crore citizens with health insurance.

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- India's literacy rate has risen to **77.7%** and the **Infant Mortality Rate reduced from 32 per 1000 live births in 2018 to 28 per 1000 live births in 2020**.
- **Financial Inclusion and Digital Economy Expansion:** India's emphasis on digital and financial inclusion aims to democratize access to financial services and accelerate socio-economic upliftment.
  - Bridging the digital divide empowers rural and urban populations, enabling seamless economic participation and fostering equitable growth.
  - In 2024, **Unified Payments Interface (UPI)** processed around 172 billion transactions, marking a **46% increase from 118 billion in 2023**, driving financial democratization.
  - The **Jan Dhan Yojana** has brought **53 crore unbanked individuals into the financial system**, supporting poverty alleviation and equitable growth.
- **Employment Generation and Rural Empowerment:** Generating sustainable employment is key to addressing India's demographic challenges and ensuring rural prosperity.
  - Targeted programs for skills enhancement and industrial growth play a pivotal role in reducing unemployment and empowering rural communities.
  - The **PM Vishwakarma Yojana (₹13,000 crore)** is enhancing traditional artisans' livelihoods, while **MGNREGA** continues as a rural employment safety net.
  - There is a notable rise in **Rural Female Labour Force Participation Rate** from 19.7 % in 2018-19 to 27.7% in 2020-21, reflecting measures' impact.
- **Technological Innovation and Industry 4.0:** Technology is a cornerstone of India's strategy to become a global economic leader, enabling economic diversification, boosting efficiency, and creating high-value jobs.
  - Pioneering initiatives aim to establish **India as a hub for advanced manufacturing and innovation**.
  - Programs like **Semicon India (₹76,000 crore)** aim to make India a global semiconductor hub, reducing dependence on imports.
  - The IT and BPM industries' revenue is estimated at US\$ 245 billion in FY 2023, while **Artificial intelligence (AI)** is expected to add \$967 billion to the Indian economy by 2035
- **Social Justice and Gender Equality:** Fostering an inclusive society is a key development priority for India, emphasizing equitable opportunities for marginalized groups and addressing systemic inequalities.
  - Legal reforms and targeted schemes ensure that economic growth translates into social upliftment.
  - The **Nari Shakti Vandan Adhiniyam 2023** seeks 33% representation in Parliament and state legislatures, and **Beti Bachao Beti Padhao** has improved child sex ratios.
  - The **SC/ST scholarships and EWS reservation policy** further uplift underrepresented groups.
- **Defense Modernization and Strategic Autonomy:** Strengthening India's defense capabilities and achieving self-reliance in defense production are crucial for national security and global strategic autonomy.
  - Investments in **indigenous manufacturing** reduce reliance on imports and boost technological capabilities.
  - **Defence sector allocated 13% of Budget 2024**, emphasis is placed on indigenous weapon production under Make in India.
    - **The exports of defense equipment, worth ₹16,000 crore in FY 2022-23**, underline India's progress toward self-reliance.
- **Urban Development and Smart Cities Mission:** Transforming urban spaces into resilient, efficient, and sustainable ecosystems is central to India's development strategy.
  - Smart cities aim to harness technology and innovation to address urban challenges and improve citizens' quality of life.
  - As of July, 2024, the **100 cities under the Mission have successfully completed 7,188 projects**, accounting for **90% of the total projects**, fostering digital and physical infrastructure in urban areas.
- **Agriculture Modernization:** Enhancing agricultural productivity through sustainable practices and technological innovation is vital for achieving food security and doubling farmers' incomes.
  - Market reforms and financial support are driving rural growth.
  - The **Digital Agriculture Mission and e-NAM (National Agriculture Market)** have improved market linkages for farmers.

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- The country's agri exports are expected to cross **\$50 billion in 2024-25** on account of healthy demand and lifting curbs on non-basmati rice, and the **PM-KISAN scheme** provided more than **₹2 lakh crore in direct benefits to farmers since inception**.
- **Industrial Growth and Manufacturing Boost:** India is prioritizing industrial growth to establish itself as a global manufacturing hub and create employment opportunities.
  - Policies like **"Make in India"** and the **Production Linked Incentive (PLI)** scheme aim to boost domestic manufacturing and reduce import dependency, fostering economic self-reliance.
  - Sectors like **electronics, pharmaceuticals, and textiles** have seen substantial investments. India is keen to increase the share of manufacturing in GDP from **17-18% to 25%**.
- **Tourism and Cultural Heritage Development:** India's rich cultural heritage and diverse landscapes offer immense potential for tourism-led economic growth.
  - Efforts to promote heritage conservation and ecotourism aim to boost local economies while preserving cultural identity.
  - The **PRASHAD Scheme and Dekho Apna Desh** initiative aim to revitalize heritage sites.
  - The total **Foreign Tourist Arrivals (FTAs)** stood at **9.52 million in 2023**, contributing significantly to foreign exchange earnings and local economies.

### What are the Key Environmental Concerns Arising out of Development Aspirations?

- **Deforestation and Habitat Loss:** Rapid urbanization and infrastructure development are compromising India's ecological balance.
  - The clearing of forests for **highways, mining, and urban projects** has not only displaced wildlife but also disrupted ecological services, such as carbon sequestration and groundwater recharge.
  - Projects in eco-sensitive zones, like the **Hasdeo Aranya forest in Chhattisgarh**, exemplify the ongoing conflict between development and conservation.
  - According to the FAO, the **rate of deforestation in India was 668 kha per year** between 2015 and 2020, while species like the **Great Indian Bustard** are critically endangered due to habitat encroachment.

- **Air Pollution from Industrialization:** India's industrial growth has come at the cost of clean air, with rising emissions from factories, power plants, and vehicles causing severe public health crises.
  - The lack of stringent enforcement of pollution norms and dependency on fossil fuels exacerbates the problem.
  - In 2023, **India accounted for 39 of the world's 50 most polluted cities** (IQAir report). Cities like **Delhi and Kanpur** consistently feature among the most polluted globally, with PM2.5 levels far exceeding WHO standards.
- **Water Stress and Over-Extraction:** The **over-reliance on groundwater for agriculture and industry** has led to alarming depletion levels, threatening the sustainability of India's water resources.
  - Poor irrigation practices and excessive water-intensive cropping patterns compound the problem, particularly in already arid regions.
  - Of the farmers using irrigation in the country, **70-80% are groundwater dependent**, with aquifers in Punjab and Haryana at critical levels.
  - According to the **NITI Aayog**, **600 million Indians face extreme water stress and over half of India's 605 rivers** were found to be polluted by the **Central Pollution Control Board in 2022**.
- **Land Degradation and Soil Erosion:** **Unsustainable land use, driven by deforestation and exploitative agricultural practices**, is causing widespread soil erosion and desertification.
  - This undermines agricultural productivity and threatens food security in a country heavily reliant on its agrarian economy.
  - **Land degradation is a major environmental issue in India**, with nearly **30% of its land already affected**.
    - Around **100 million hectares are degraded**, with 3 million hectares added between 2004 and 2019.
- **Marine Pollution and Coastal Erosion:** **Unchecked industrial and urban waste disposal into oceans** has severely **impacted marine ecosystems**, while **rampant coastal development has accelerated erosion**.
  - These issues not **only threaten biodiversity** but also undermine the livelihoods of coastal communities.

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- India leads globally in plastic waste production with an **annual output of 9.3 million tonnes**.
  - A recent study reveals that India burns **5.8 million tonnes** and releases another **3.5 million tonnes** into the environment each year
- A study by the **National Centre for Coastal Research (NCCR)** reveals that **33.6% of India's coastline is eroding**, 26.9% is accreting, and 39.5% remains stable.
- **Climate Change and Extreme Weather Events:** Developmental activities have **amplified greenhouse gas emissions**, exacerbating climate change and increasing the frequency of extreme weather events.
  - These disruptions have severe socio-economic impacts, particularly on vulnerable populations.
  - India's **greenhouse gas emissions** **surged by 6.1% in 2023**, contributing to 8% of the global total emission.
  - India experienced extreme weather events on **85 out of 92 days in 2023**, including floods, cyclones, and heatwaves.
- **Urban Waste Management Crisis:** India's urbanization has outpaced the infrastructure needed to manage the rising volume of waste, leading to environmental degradation and public health risks.
  - The situation is aggravated by insufficient waste segregation and recycling mechanisms.
  - India generates **62 million tonnes of waste** annually and **only 70% is collected**, and **12 million tonnes are treated**.
    - The **Ghazipur landfill in Delhi, which caught fire in 2023**, exemplifies the severity of this crisis.
- **Loss of Wetlands and Natural Carbon Sinks:** The encroachment and degradation of wetlands, **crucial for carbon sequestration** and biodiversity, are alarming.
  - The unregulated expansion of urban areas and infrastructure projects has resulted in their rapid decline.
  - A study by **Wetlands International (WI)** shows nearly **2 out of every 5 wetlands** in India have lost their natural existence in the last 30 years.
- **Lack of Sustainable Tourism Practices:** **Unregulated tourism** in fragile ecosystems has led to waste accumulation, biodiversity loss, and ecosystem degradation.

- Hill stations and coastal regions are particularly vulnerable to over-tourism.
- Places like **Ladakh** saw a **drastic increase in tourist footfall between 2015 and 2023**, resulting in waste management crises and water shortages.
- For instance, **Goa state** has witnessed a **sharp decline in mangrove** areas over the last three decades.

### How India can Balance Developmental Aspirations with Environmental Sustainability?

- **Renewable Energy Transition for a Low-Carbon Economy:** Transitioning to **renewable energy** is crucial for reducing **greenhouse gas emissions** while meeting **energy demands**.
  - India must integrate **grid-scale renewable energy storage systems** to address intermittency challenges and invest in offshore wind and decentralized solar energy for rural electrification.
  - Strengthening policy frameworks like **Renewable Purchase Obligation (RPO)** and incentivizing green hydrogen production can secure energy independence and sustainability.
- **Sustainable Urbanization and Climate-Resilient Infrastructure:** India must adopt urban planning models that **incorporate green infrastructure, energy-efficient buildings, and zero-waste policies**.
  - **Mixed land use, vertical green spaces, and climate-resilient infrastructure** must become standard in urban expansions.
  - Integrating initiatives like the **Smart Cities Mission** with **sustainable urban drainage systems, urban forestry, and renewable-powered public transportation** can mitigate urban ecological stress.
- **Forest Conservation and Community-Driven Afforestation:** To balance development with forest preservation, India needs **stricter enforcement of compensatory afforestation laws and enhanced monitoring of ecological offsets**.
  - Community-based afforestation projects and promoting agroforestry can simultaneously boost livelihoods and biodiversity.

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- Policies like the **National Forest Policy** should integrate advanced satellite-based forest cover monitoring and incentivize eco-sensitive tourism to protect biodiversity.
- **Enhanced Environmental Governance and Green Financing:** Strengthening **Environmental Impact Assessments** to include public consultation at all stages, independent expert panels, and robust monitoring systems can reduce project-related ecological damage.
  - India needs to tap its potential of Green Financing as it is the **second-largest issuer of green bonds among emerging markets**, funding projects like renewable energy parks.
  - TCS and Infosys are leading by example with annual sustainability reports.
- **Integrated Water Resource Management:** India must adopt integrated water management by combining **rainwater harvesting, wastewater recycling, and aquifer recharge to ensure equitable water distribution**.
  - Encouraging the use of drip and sprinkler irrigation through subsidies can reduce over extraction in water-stressed regions.
  - **Strengthening watershed development and interlinking rivers** in an ecologically sensitive manner can balance agricultural and industrial water needs.
- **Circular Economy and Sustainable Consumption:** Building a circular economy framework is essential to minimize resource extraction and waste generation.
  - **Encouraging industries to adopt closed-loop production systems** and consumers to shift to sustainable goods can reduce environmental pressures.
- Policies integrating **Extended Producer Responsibility (EPR), decentralized waste management**, and large-scale composting of biodegradable waste are essential for systemic change.
- **Electrification of Transport and Green Mobility:** Decarbonizing the transport sector requires a robust push for **electric vehicles, hydrogen fuel-cell vehicles, and bio-CNG buses**.
  - Strengthening EV manufacturing, battery recycling, and charging infrastructure will accelerate clean mobility adoption.
  - Policies like the **Faster Adoption and Manufacturing of Hybrid and Electric Vehicles** must be complemented with **city-level initiatives** for congestion pricing and vehicle scrappage incentives.
- **Climate-Smart Agriculture for Resilient Food Systems:** Promoting climate-resilient agriculture through **precision farming, conservation tillage, and integrated pest management** is key to sustainable productivity.
  - Expanding **crop insurance, agroforestry, and resilient seed varieties** can mitigate risks associated with climate change.
  - Encouraging **renewable-powered cold storage and supply chains** can reduce post-harvest losses and enhance agricultural sustainability.
- **Marine Ecosystem Protection and Blue Economy:** India must strengthen marine protection through policies addressing **overfishing, mangrove deforestation, and marine plastic pollution**.
  - **Sustainable fishing practices, eco-tourism, and renewable offshore energy** can harness the blue economy without ecological degradation.
  - **Coastal regulation zones** must be strictly implemented to protect vulnerable ecosystems from unregulated industrial development.

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- **Behavioral Change and Grassroots Sustainability:** Promoting public awareness campaigns on energy conservation, waste segregation, and sustainable consumption is essential for lasting impact.
  - **Eco-literacy programs in schools and local governance bodies** can cultivate a culture of sustainability.
  - Leveraging community-based initiatives like **Self-Help Groups (SHGs)** for decentralized waste management and renewable energy adoption can empower grassroots efforts.

### Conclusion:

India's development aspirations, exemplified by projects like the Ken-Betwa River Linking, must **balance economic progress with environmental sustainability**. Transitioning to renewable energy, adopting sustainable urbanization, and enhancing environmental governance are key to **reconciling development with ecology**. India's future growth hinges on ensuring that ecological integrity is preserved alongside its ambitious developmental goals, aligning with **SDG 6 (Clean Water and Sanitation)**, **SDG 7 (Affordable and Clean Energy)**, **SDG 11 (Sustainable Cities and Communities)**, and **SDG 13 (Climate Action)**.



## Advancing the Growth of Core Technologies

*This editorial is based on "How do we develop 'core' technologies?" which was published in The Hindu Business Line on 02/01/2025. The article brings into focus the critical need to address India's persistent challenge of translating scientific innovations into commercial success, emphasizing stronger academia-industry-government collaboration as the key to building a technology-driven developed economy.*

**Tag:** GS Paper-3, IT & Computers, Government Budgeting

From the **Raman effect** in 1930 to modern **semiconductor tech**, India has repeatedly demonstrated its capability to develop groundbreaking '**core**' technologies. However, the nation has consistently struggled to commercialize these breakthroughs, often losing market advantages to foreign competitors. The

historical disconnect between academia, industry, and government has resulted in India remaining dependent on imports for critical technologies, despite having the intellectual capacity to develop them. This gap in **translating scientific excellence into commercial success remains a crucial challenge** that must be addressed for India to achieve its vision of becoming a technology-led-developed economy.

### What does the term Core Technology mean?

- **About: Core Technology (Core Tech)** refers to the **foundational, advanced, and critical technologies** that form the backbone of innovation and drive growth across industries, economies, and national priorities.
- **Key Characteristics of Core Tech**
  - **Foundational Nature:** Core tech serves as the building blocks for other technologies and applications.
  - **Wide Applicability:** These technologies find applications across multiple domains such as defense, healthcare, education, and manufacturing.
  - **Strategic Importance:** Core tech often determines a nation's economic, military, and geopolitical power due to its critical role in security, governance, and innovation.
- **Examples of Core Tech**
  - **Semiconductors:** Chips used in electronics, computing, and AI.
  - **Artificial Intelligence (AI):** Technologies for machine learning, natural language processing, and automation.
  - **Quantum Computing:** Advanced computing leveraging quantum mechanics for unparalleled processing power.
  - **Cybersecurity:** Tools to protect digital infrastructure and data from threats.
  - **Space Technology:** Satellites, launch vehicles, and space exploration tools.
  - **Advanced Manufacturing:** 3D printing, robotics, and Industry 4.0 technologies.
  - **Green Technologies:** Renewable energy solutions like solar panels, wind turbines, and green hydrogen.
  - **Telecommunications:** Core technologies enabling 5G, fiber optics, and next-generation communication systems.

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## Why Investing in Core Technologies is Crucial for India?

- **Economic Growth and Global Competitiveness:** Investment in core technologies like **Artificial Intelligence (AI)**, **semiconductor manufacturing**, and **quantum computing** is crucial for boosting India's economic growth.
  - These technologies drive **innovation**, **improve productivity**, and **create high-value jobs**.
  - For instance, the **global AI market is projected to reach \$900 billion by 2030**, and India's share is expected to grow with its AI investments through the **National AI Mission**.
  - Similarly, the **PLI scheme** for semiconductors aims to **establish India as a global chip manufacturing hub**, addressing the **\$110 billion semiconductor market deficit by 2030**.
- **Strengthening National Security:** Core tech like **cybersecurity**, **drone technology**, and **AI-driven surveillance** are critical for addressing modern security threats, including cyberattacks and border management.
  - For example, AI-enabled tools can be used for **real-time monitoring of the Line of Actual Control (LAC)**.
  - CERT-In tackled over **1.39 million cybersecurity incidents in 2022**, making indigenous cybersecurity development imperative.
  - Additionally, the **Defence Ministry's collaboration with private firms under iDEX** has led to advances in drone and anti-drone systems, enhancing security readiness.
- **Reducing Technological Dependence:** India's reliance on imports for critical technologies like **semiconductors and high-end electronics hampers strategic autonomy**.
  - Investing in indigenous R&D ensures self-reliance in critical sectors like **telecom (5G)**, **defense**, and **space**.
  - The inauguration of the **Semicon India program in 2023** aims to make India self-sufficient in chip production.
- **Building a Knowledge-Based Society:** Core technology investments enhance education, healthcare, and governance by fostering innovation and improving access.
  - Initiatives like the **Digital India Mission** have brought rural households online, boosting e-learning and e-health services.
  - For example, AI tools are being used to predict disease outbreaks, while platforms like **e-Sanjeevani** have facilitated over **276 million teleconsultations** in rural India.
  - Similarly, **India's EdTech sector**, currently valued at **\$7.5 billion**, highlights how digital tools are transforming education.
- **Driving Climate Resilience and Sustainability:** Advanced technologies like **renewable energy tech**, **smart grids**, and **climate modeling** are critical for India's energy transition and climate action goals.
  - India has committed to achieving **500 GW of non-fossil fuel capacity by 2030** under its Nationally Determined Contributions (NDCs).
  - Investment in **green hydrogen** and **solar power tech** will help in fulfilling its commitments,
  - Furthermore, the **use of AI in crop monitoring** has improved agricultural productivity while conserving resources.
- **Boosting Startups and Entrepreneurship:** A robust tech ecosystem nurtures **startups** and **fosters entrepreneurship**, driving economic diversification and innovation.
  - With over **100 unicorns** and a thriving community of more than **157,000 startups**, the country is shaping the future of global business.
  - Programs like **Startup India** and the **DPIIT's support for tech startups** are instrumental in positioning India as a global innovation hub.
- **Geopolitical Leverage:** Investments in core technologies enhance India's strategic positioning and global partnerships.
  - India's partnership with the US under the **iCET (Initiative on Critical and Emerging Technologies)** highlights the role of tech in bilateral ties.
  - Additionally, India's role in **semiconductor alliances like the Quad Semiconductor Supply Chain Initiative** positions it as a key player in countering China's dominance in tech supply chains.

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## What are the Key Issues Hindering the Growth of Core Tech in India?

- **Inadequate R&D Investment and Ecosystem Support:** India's low investment in **research and development (R&D)**, at just **0.65% of GDP**, constraints innovation and technological advancement, especially in critical fields like **AI, semiconductors, and robotics**.
  - This underfunding also **discourages private sector participation and collaboration with academia**, which are essential for breakthrough technologies.
  - In comparison, countries like Israel and South Korea have robust tech ecosystems due to significantly higher R&D investments.
- **Shortage of Industry-Ready Workforce:** India lacks an **adequately skilled workforce** capable of meeting the demands of emerging technologies like **blockchain, quantum computing, and AI**, limiting industrial innovation and global competitiveness.
  - Only **51% of graduates are employable**, reveals **Economic Survey 2023-24**.
  - Roles such as data analysts and AI specialists are expected to see high demand, with projections indicating employment for **2.5 to 2.8 million professionals** by 2030, yet existing training programs fail to address this requirement adequately.
- **Dependence on Imports for Strategic Technologies:** India's reliance on imports for critical technologies such as **semiconductors, lithium-ion batteries, and advanced machinery undermines self-reliance** and exposes the economy to global supply chain disruptions.
  - Currently, **India imports 95% of its semiconductors** from countries like **China, Taiwan, South Korea, and Singapore**.
  - The global semiconductor shortage during the pandemic severely affected India's automobile and electronics industries, costing billions in lost output and highlighting the need for domestic capacity under initiatives like **Make in India**.
- **Policy Inconsistencies and Bureaucratic Delays:** Frequent shifts in government policies and **lengthy approval processes discourage investments in core technologies**, stalling projects in critical areas like chip manufacturing and green tech.
  - For instance, while the government announced ₹76,000 crore for semiconductor manufacturing in 2021, **no large-scale fab facilities have become operational** due to procedural delays and lack of clarity.
  - India ranks **63rd in the World Bank's Doing Business Report (DBR), 2020** published in October, 2019 before its discontinuation by the **World Bank**, underscores the regulatory challenges in attracting FDI for tech innovation.
- **Weak Collaboration Between Academia and Industry:** India's innovation ecosystem **suffers from limited partnerships between academic institutions and industries**, leading to isolated research efforts without scalable outputs.
  - India witnessed a **record 31.6% increase in patent applications in 2022**, but despite world-class research from premier institutes like IITs, only a small fraction of these patent were successfully commercialized.
  - In comparison, the **US fosters tech transfer through programs like the Bayh-Dole Act**, which mandates the commercialization of federally funded research, creating a thriving innovation ecosystem.
- **Limited Deep-Tech Startup Funding:** India's startup ecosystem is skewed towards **consumer tech and e-commerce**, with insufficient venture capital for deep-tech sectors like AI, quantum computing, and space tech, which require long gestation periods.
  - Nasscom reports a surge in Indian deep-tech startups in 2023, but funding dropped by **77%**.
  - For example, space-tech companies like **Agnikul Cosmos** have struggled to **secure funding for scaling operations** despite their pioneering achievements in India's private space sector.
- **Fragmented Approach to Climate-Tech Innovation:** India's climate-tech innovation is limited by a lack of coordinated policy and investment despite the **pressing need for sustainable technologies like green hydrogen and advanced battery storage**.
  - For instance, while India committed to 500 GW of renewable capacity by 2030, investments in **energy storage technologies remain insufficient**.
  - In contrast, **countries like Germany and Japan have made significant strides in hydrogen technology** by investing heavily in R&D and creating public-private partnerships.

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## What Measures can India Adopt to Enhance the Development of Core Tech?

- **Increase R&D Investment and Public-Private Collaboration:** India must increase R&D spending to at least **2% of GDP**, aligning with global leaders like South Korea and the US, to foster breakthrough innovations.
  - A dedicated **National Core Technology Fund** could finance advanced research in AI, quantum computing, and semiconductors, with incentives for private sector contributions.
  - Linking programs like **Semicon India** with academia and industry under the **National Research Foundation** can bridge research and commercialization gaps, creating a cohesive innovation pipeline.
- **Establish World-Class Infrastructure for Core Tech:** India must prioritize building cutting-edge infrastructure such as semiconductor fabs, quantum labs, and AI testbeds.
  - Special incentives for technology parks like the **Bangalore Technology Cluster** could attract global tech giants to set up facilities.
  - Integrating **PLI Schemes** with **Smart Cities Mission** can help build advanced industrial zones with sustainable infrastructure, ensuring a steady supply chain and streamlined logistics.
- **Develop a National Talent Strategy:** A nationwide strategy focusing on **skilling and reskilling** must be implemented to meet the demand for an industry-ready workforce in core tech sectors.
  - Programs like **Skill India** should partner with global firms to provide **hands-on training in AI, robotics, and blockchain**.
  - Additionally, **reforming STEM curricula to include emerging technologies can close the skill gap**; for instance, embedding AI and data analytics courses in all engineering programs.
- **Boost Domestic Manufacturing with Strategic Investments:** India should invest in high-tech manufacturing sectors like semiconductors, lithium-ion batteries, and advanced machinery to reduce import dependency.
  - The **National Manufacturing Policy** must integrate with the **Atmanirbhar Bharat** initiative to support startups and MSMEs in these domains.
  - For example, aligning **FAME(Faster Adoption and Manufacturing of Electric Vehicles)** with domestic **lithium-ion battery production** can create a sustainable EV ecosystem, reducing reliance on Chinese imports.
- **Create a Unified Innovation Ecosystem:** Strengthen collaboration among academia, startups, and industries to foster innovation and commercialization of technology.
  - Programs like the **Startup India** initiative can be expanded to provide funding and mentorship to core-tech startups.
  - Connecting **IITs and NITs** with industrial hubs through an **Innovation Exchange Platform** could replicate the success of **Silicon Valley-style ecosystems**, leading to more effective tech transfer and scalable solutions.
- **Focus on Cybersecurity and Indigenous Solutions:** India must prioritize building indigenous cybersecurity infrastructure to safeguard critical sectors amid rising cyber threats.
  - Programs like **Cyber Surakshit Bharat** need expansion to include **real-time threat monitoring tools** and robust AI-driven defense systems.
- **Leverage Global Partnerships for Technology Transfer:** India should deepen collaborations with global tech leaders through initiatives like the **India-US iCET (Initiative on Critical and Emerging Technologies)** to acquire advanced expertise in semiconductors and AI.
  - Expanding such partnerships with **Japan (for robotics)** and **Germany (for green hydrogen tech)** can fast-track India's capabilities.
  - For example, linking the **Quad Semiconductor Initiative** with domestic efforts under **Semicon India** can help build resilient supply chains.
- **Enhance Tech Accessibility in Rural Areas:** To bridge the rural-urban divide, India must ensure core technologies like AI and IoT reach underserved areas.
  - Programs like **BharatNet** should be accelerated to provide broadband connectivity to all rural regions, enabling digital inclusion.

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- Linking this with the **Digital India Initiative** can promote **AgriTech solutions like AI-driven crop monitoring and precision farming tools**, enhancing rural productivity.
- **Adopt a Circular Economy for Sustainable Tech Development:** India must integrate sustainability into its core tech development by focusing on **recycling e-waste and reducing resource-intensive practices**.
  - Establishing **Green Technology Zones** in collaboration with the **National Green Hydrogen Mission** can promote eco-friendly innovation.
  - For example, **combining solar energy with battery recycling plants** can support the EV sector sustainably, creating a circular economy for clean energy technologies.
- **Strengthen Intellectual Property (IP) Framework:** India must **simplify its IP filing process** and enhance enforcement to encourage innovation and attract foreign investments.
  - Establishing **fast-track IP courts and IP awareness campaigns** can ensure quicker commercialization of innovations.
  - Linking this with **Startup India** can provide startups with subsidized patent filing assistance, fostering a culture of protecting and monetizing innovations.
- **Encourage Gender Diversity in Tech:** India must focus on increasing the participation of women in STEM and core tech roles to enhance its talent pool.
  - Initiatives like **Women in STEM** should be expanded to provide scholarships, mentorship, and leadership training for women in AI, quantum, and robotics.
  - Linking these with programs like **Digital Saksharta Abhiyan (DISHA)** can ensure grassroots participation by women in tech innovation.
- **Build Strategic Reserves of Rare Earths:** India must invest in exploring and mining rare earth minerals domestically to reduce dependence on imports for semiconductors and EV batteries.
  - The **National Mineral Exploration Trust** should integrate with the **Make in India** program to incentivize private firms to develop rare earth processing facilities.
  - For example, building partnerships with **Australia, the fourth-largest rare earth mining country in 2023**, can secure India's supply chains.

## Conclusion:

To achieve its vision of becoming a technology-driven developed economy, India must address the **critical gaps in the commercialization of core technologies**. By fostering stronger collaboration between academia, industry, and government, and **significantly increasing investment in research and development**, India can create a thriving innovation ecosystem. Strengthening these efforts will not only drive economic growth but also contribute to **national security, sustainability, and global competitiveness**.



## India's Defence Modernisation

*This editorial is based on "**How India's defence sector is shaping up?**" which was published in The Hindu Business Line on 31/01/2025. The article brings into focus India's position as the world's fourth-largest defense spender in 2023, highlighting a shift towards defense self-reliance with rising domestic exports and reduced reliance on foreign military imports post-pandemic.*

**Tag:** GS Paper-2, Government Policies & Interventions, GS Paper-3, Defence Technology, Indigenization of Technology

India maintains its position as the **world's fourth-largest defense spender in 2023**, following only the **United States' commanding lead in military expenditure**. The nation's strategic pivot is **evident in its robust capital outlay growth**, which outpaces other **defense segments**. Most notably, the post-pandemic era has marked a **transformative shift in India's defense landscape** while dependency on foreign military imports has plateaued since FY22, domestic defense exports have charted an impressive upward trajectory. This dual trend of reduced import reliance and growing export capabilities signals a significant milestone in India's journey toward defense self-reliance and modernization.

## What are the Key Strides in India's Defence Modernisation?

- **Transforming Indigenous Defense Manufacturing:** India is strategically **transitioning to a self-reliant defense ecosystem** by bolstering indigenous production and reducing reliance on imports.

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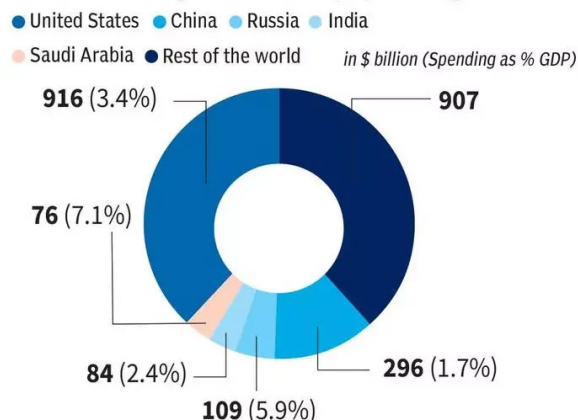
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### India is 4th in global military spending in 2023



- Policies like the **Defence Acquisition Procedure (DAP)-2020** mandate prioritization of domestic procurement, driving this transformation.
- In 2023-24, domestic defense production hit a record ₹1.27 lakh crore, a **16.7% rise from the 2022-23** and **75% of the ₹1,40,691 crore capital procurement budget for 2024-25 was reserved for indigenous products**, including advanced weapon systems.
- **Surge in Defense Exports:** India is rapidly emerging as a defense exporter, reshaping its global presence by providing cost-effective, high-quality weaponry.
  - Products like **BrahMos missiles** and **Pinaka rocket systems** have gained international recognition.
  - **Defense exports soared to ₹21,083 crore in FY 2023-24**, a 31-fold increase from a decade ago.
  - The government aims to further boost exports to **₹35,000 crore by 2025**, leveraging initiatives like the **IDEX scheme** to develop globally competitive technologies.
- **Strategic Defence Partnerships:** India is strategically partnering with global defense leaders to bridge critical technological gaps and co-develop advanced platforms.
  - The **Mazagon Dock Shipbuilders'** collaboration with **Thyssenkrupp Marine Systems** for **Project P-75(I) submarine** and the **US-India INDUS-X** initiative for co-developing AI and hypersonic technologies are examples of strategic collaborations.

- In 2023, India and France agreed to jointly produce aero engines, demonstrating a commitment to high-tech indigenization.
- **Breakthroughs in Missile Technology and Tactical Systems:** India's missile programs exemplify its progress in achieving strategic autonomy and enhanced deterrence.
  - **The induction of the 'Pralay' tactical missile** provides battlefield flexibility against adversaries.
  - Furthermore, the **successful tests of the Agni Prime missile in 2024**, with improved precision reinforce India's long-range strike capabilities, showcasing significant advancements in defense technology.
- **Expanding Defense Industrial Corridors for Regional Growth:** The establishment of **Defense Industrial Corridors** in **Tamil Nadu and Uttar Pradesh** exemplifies India's focus on regional development and manufacturing capacity.
  - These corridors aim to attract ₹20,000 crore in investments. Tamil Nadu's corridor alone is expected to have secured **₹11,794 crore in commitments as of 2024**, with major players like **L&T** setting up manufacturing units, driving regional defense innovation.
- **Focus on Space and Cybersecurity Defense:** India is integrating space and cybersecurity into its defense strategies to address emerging threats.
  - The establishment of the **Defense Space Agency** and the planned deployment of satellites for surveillance and communication reflect India's evolving priorities.
  - **Gaganyaan mission in 2025** for potential military applications and **CERT-In's cybersecurity initiatives** to protect sensitive defense networks showcase readiness in non-traditional domains.
- **Implementation of Positive Indigenization Lists:** The government has accelerated indigenization by implementing **five Positive Indigenization Lists**, banning their import post-specified deadlines.
  - This initiative has driven innovation, with components like the **K9 Vajra artillery systems** and **LCA Tejas** parts now indigenized.
  - The success of these lists highlights India's ability to replace imports with high-quality domestic products, significantly reducing dependence on foreign suppliers.

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- **Strengthening Anti-Piracy and Maritime Capabilities:** India is enhancing its naval power to address piracy and protect maritime interests, especially in the Indo-Pacific region.
  - The **induction of INS Vikrant**, India's first indigenous aircraft carrier, into the Navy in 2023 showcases growing maritime prowess.
  - Patrol vessels like the **Sumedha class** are regularly deployed to critical regions like the **Gulf of Aden**, reflecting India's commitment to regional security.

### What are the Key Issues Related to India's Defence Sector?

- **Persistent Dependence on Imports:** India remains one of the **world's largest arms importers**, undermining its strategic autonomy in defense preparedness.
  - With an **11% share of total global arms imports**, India was the world's biggest importer of major arms in **2018–22**.
  - For instance, the ongoing Russia-Ukraine war has disrupted the **supply of S-400 missile systems**, exposing vulnerabilities in **India's dependency on external suppliers for critical assets**.
- **Delays in Procurement:** India's defense procurement process is marred by bureaucratic inefficiencies, resulting in significant delays in acquiring advanced weaponry.
  - The **Tejas Light Combat Aircraft (LCA)**, for example, took decades to move from concept to induction, highlighting systemic inefficiencies.
  - Similarly, the **Project 75(I)** submarine acquisition for the **Navy**, critical for countering China in the Indian Ocean, **has faced repeated delays, leaving operational gaps**.
- **Outdated Inventory:** A significant portion of India's defense inventory is outdated, compromising operational efficiency and combat readiness.
  - For instance, the **Indian Army's tank fleet still includes T-72 tanks**, which are over 40 years old and technologically obsolete.
  - Similarly, the **Bofors howitzers, inducted in the 1980s**, remain the mainstay of artillery, despite advancements in modern artillery systems.
- **Insufficient Indigenous Manufacturing Capacity:** Despite the push for self-reliance under the **Aatmanirbhar Bharat** initiative, India's defense manufacturing ecosystem remains underdeveloped, especially for critical technologies like engines and sensors.
  - For example, India still relies on **General Electric (GE)** for jet engines for its **LCA Tejas**, reflecting a gap in core technology capabilities.
  - **While defense production increased to ₹1.27 lakh crore in 2023-24**, it still lags behind global standards in terms of innovation.
- **Inadequate Budget for Modernization:** India's defense budget allocation, though increasing, is skewed toward revenue expenditure (salaries, pensions), leaving limited room for modernization.
  - Together, salaries and allowances at **30.68%** and **pensions at 22.7%**, together, account for **53.38%** of total defence expenditure under the current budget.
  - Leaving **inadequate funds to address modernization needs** given the rapidly evolving security environment, especially in the Indo-Pacific.
- **Cybersecurity Vulnerabilities in Defense Infrastructure:** India's growing reliance on digital systems exposes critical defense infrastructure to cyber threats.
  - In 2013, reports indicated that **Chinese hackers breached DRDO's systems**, stealing sensitive electronic files related to the **Cabinet Committee on Security (CCS)** and transferring them to a server in Guangdong, China.
  - While initiatives like **CERT-In** aim to address such threats, India lags behind global peers like the **U.S. in cybersecurity readiness**, posing risks to sensitive data and systems.
- **Lack of Joint Command Structure:** The absence of a unified command structure hampers interoperability between the Army, Navy, and Air Force, affecting joint operations.
  - Despite the creation of the **Chief of Defence Staff (CDS)** in 2020, theater commands remain unimplemented.
  - For example, during the 2020 **Galwan Valley standoff**, a lack of seamless coordination among forces delayed optimal deployment strategies.

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- **Weak Domestic R&D Ecosystem:** India spends less than **1% of its defense budget on R&D**, significantly lower than global standards.
  - Institutions like DRDO have struggled with delays in delivering key projects, such as the development of **Arjun tanks** and **Kaveri engines**, forcing reliance on foreign technology.
  - The gap in indigenous innovation is a critical roadblock to achieving technological independence.
- **Limited Skilled Workforce in Defense Manufacturing:** India faces a shortage of skilled personnel in advanced fields like **robotics, AI, and precision manufacturing**, which are essential for next-gen defense systems.
  - The **Skill India initiative**, though promising, has **not adequately addressed the specific needs of the defense sector**, slowing the growth of domestic manufacturing and innovation.
- **Geopolitical Challenges in Defense Diplomacy:** India's reliance on Russian arms poses risks amidst evolving geopolitical dynamics, especially with increasing U.S.-Russia tensions.
  - Simultaneously, India's maritime security remains under strain as **China expands its naval presence** in the Indian Ocean, including the deployment of surveillance vessels in the region.
  - Addressing these dual challenges requires robust diplomatic and defense strategies.
- Enhanced funding can expedite the induction of advanced platforms like the **LCA Tejas Mark II** and **S-400 missile systems**, crucial for maintaining technological parity with adversaries.
- **Strengthening Indigenous Defense Manufacturing via Schemes Integration:** Combining the **Make in India** and **PLI (Production Linked Incentive)** schemes can incentivize domestic manufacturing of critical technologies like **engines, avionics, and sensors**.
  - By linking these schemes, India can encourage private players and startups to co-develop cutting-edge technologies while reducing reliance on imports.
- **Expanding Global Partnerships for Technology Transfer:** India should deepen collaborations with technologically advanced nations to co-develop defense platforms.
  - For instance, partnerships like the **India-US Defense Acceleration Ecosystem (INDUS-X)** have opened avenues for acquiring critical technologies like AI and hypersonics.
  - Such collaborations can enable local production of advanced systems while addressing technology gaps.
- **Establishing Robust Cyber and Space Defense Capabilities:** Given the growing threats in cyberspace and outer space, India must prioritize the development of dedicated cyber defense and space command units.
  - Strengthening the **CERT-In** framework and enhancing partnerships with global leaders like the US in space warfare can address vulnerabilities.
- **Implementing Joint Theater Commands for Enhanced Interoperability:** India must fast-track the implementation of joint theater commands to integrate the **Army, Navy, and Air Force** for seamless operations.
  - Theater commands will enhance resource utilization and enable coordinated responses to challenges like the **China-Pakistan nexus**.
- **Leveraging Startups and MSMEs through the iDEX Scheme:** Expanding the scope of the **iDEX (Innovations for Defence Excellence)** initiative can bring innovative startups into the defense ecosystem.
  - Engaging over 200 startups has already led to the development of 14 viable technologies.

### What Measures can India Adopt to Enhance Defense Modernisation?

- **Streamlining Procurement Processes for Timely Acquisitions:** India must reduce delays in defense procurement by revising and simplifying the **Defence Acquisition Procedure (DAP)-2020**, ensuring faster decision-making and contract finalization.
  - A single-window clearance system for acquisitions can help eliminate bureaucratic inefficiencies.
  - Implementing AI-driven procurement systems can further optimize timelines and enhance transparency.
- **Increasing Budget Allocation for Capital Expenditure:** Allocating a higher percentage of the defense budget to modernization is **essential to address critical capability gaps**.

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- By linking iDEX with the **Defence Industrial Corridors**, MSMEs can gain the infrastructure and support needed to scale production of cutting-edge technologies like UAVs and precision-guided munitions.
- **Modernizing the Navy to Address Indo-Pacific Challenges:** India should prioritize the modernization of its naval fleet to counter China's growing influence in the Indo-Pacific region.
  - The induction of platforms like **INS Vikrant** and future **Project 75(I) submarines** is essential for maintaining maritime dominance.
  - Boosting naval capabilities can also support India's **SAGAR (Security and Growth for All in the Region)** vision by ensuring the security of critical sea lanes.
- **Enhancing Export Capabilities through Focused Policies:** India should aim to become a major defense exporter by focusing on globally competitive platforms like the **BrahMos missile** and **Akash air defense systems**.
  - Streamlining the export approval process and engaging with global buyers through defense expos can expand India's market share.
  - Achieving the **₹35,000 crore export target by 2025** will also enhance India's defense industry's global reputation.
- **Developing Skill Ecosystems for Defense Manufacturing:** India must invest in creating a skilled workforce specializing in robotics, AI, and advanced manufacturing for defense production.
  - Linking the **Skill India Mission** with the defense sector can address this gap by creating dedicated training programs.
  - For example, upskilling initiatives in the **Defence Industrial Corridors** of Tamil Nadu and Uttar Pradesh can ensure a steady supply of skilled workers.
- **Focusing on R&D to Foster Indigenous Innovation:** Increasing R&D expenditure in defense to at least 5% of the budget can boost innovation and reduce dependency on imports.
  - Institutions like **DRDO should be partnered with private firms** for co-development of critical technologies like jet engines and hypersonic missiles.
- **Promoting Green Technology in Defense:** Integrating green technologies into defense can reduce

environmental impact and enhance operational efficiency. Initiatives like developing **electric-powered military vehicles** and energy-efficient bases can align with global sustainability goals.

- Collaborations with domestic firms under the **SRIJAN portal** can further ensure that eco-friendly innovations are indigenously developed and deployed.

### Conclusion:

India's defense modernization journey reflects a strategic balance between **strengthening self-reliance and embracing global partnerships**. Achievements like increased indigenous production, rising defense exports, and advancements in missile technology highlight significant progress.. The road ahead requires sustained focus on **innovation, interoperability, and adaptability to ensure comprehensive national security**.



## Empowering India's Migrant Workforce

*This editorial is based on "**Building a system that sees the migrant worker**" which was published in The Indian Express on 06/01/2025. The article brings into picture the e-Shram portal, the world's largest unorganized worker database, launched in 2021 to address migrant workforce challenges exposed by the pandemic. While initiatives like the 'One-Stop Solution' aim to integrate social security schemes, persistent issues such as documentation gaps, gender inequality, and non-portable benefits hinder inclusive progress.*

**Tag:** GS Paper-2, Human Resource, Population and Associated Issues, Poverty and Developmental Issues, Government Policies & Interventions, GS Paper-3, Growth & Development

**India's e-Shram portal**, launched in 2021, stands as the world's largest database of unorganized workers with over 300 million registrations - a belated response to the migrant crisis exposed by the pandemic. The recent 'One-Stop Solution' initiative promises to bridge crucial gaps by integrating various social security schemes, from ration

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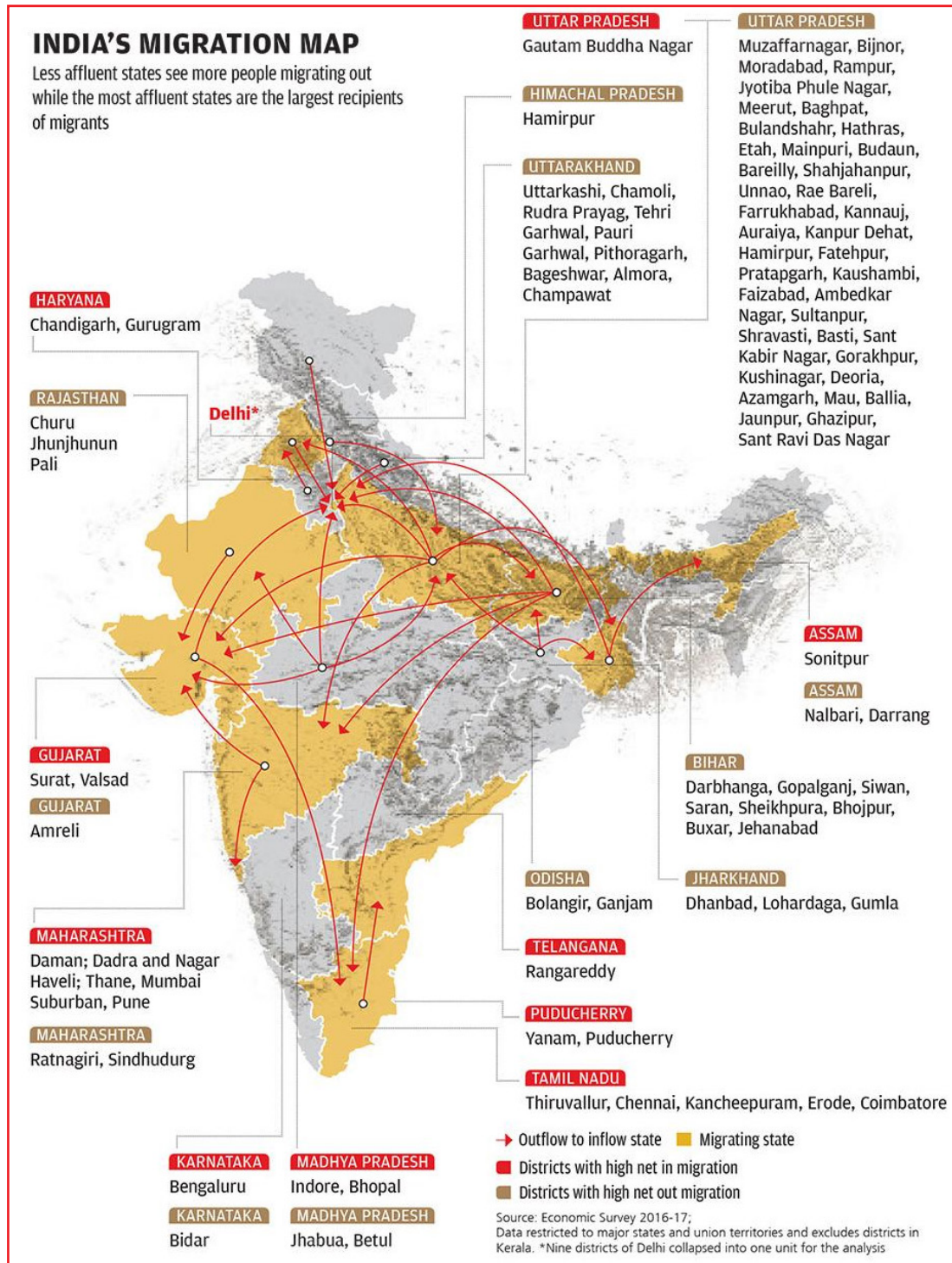
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cards to pension benefits. However, fundamental challenges persist - **from documentation barriers and gender inequalities to the lack of portable benefits across states**. As India aspires towards '**Viksit Bharat**', the meaningful inclusion of its migrant workforce, **who fuel the nation's economy**, remains both a critical challenge and an urgent necessity.



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### Who are Considered as Migrant Workers?

The term “migrant workers” lacks a uniform definition, but conventional and legislative provisions provide some clarity:

- **International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families, 1990:** Defines a migrant worker as a person who is engaged, has been engaged, or is to be engaged in a remunerated activity in a state of which they are not a national.
- **Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979:** Defines an “inter-state migrant workmen” as a person recruited through a contractor in one state under an agreement for employment in another state, with or without the principal employer’s knowledge.

### What are the Push and Pull Factors Related to Migration in India?

#### ➤ Push Factors:

- **Economic Distress and Rural Unemployment:** Rural areas in India face **persistent poverty, disguised unemployment**, and limited access to sustainable livelihoods, driving people to cities.
  - Rural unemployment rate climbed to **7.8% in April 2024 (CMIE)**.
  - Declining farm incomes due to **erratic monsoons**, with agriculture contributing only **16% to GDP despite employing 42% of the population**, further pushes migration.
  - Recent farmer protests over **Minimum Support Prices (MSP)** highlight the vulnerabilities in the agrarian economy.
- **Healthcare and Educational Deficiencies in Rural Areas:** Limited access to quality healthcare and education in rural India pushes families toward urban centers.
  - Rural areas face a shortfall of **79.9% of specialists in Community Health Centres**.
- Moreover, **urban literacy rates (87.7%)** far exceed rural rates (**73.5%**).
  - This creates a significant pull towards cities offering better infrastructure.

#### ○ Climate Change and Environmental Degradation:

Increasing climate-induced calamities like droughts, floods, and cyclones force internal migration.

- For instance, the **NDMA Report 2021-22 states that 68% of India’s cultivable area is vulnerable to droughts**, affecting livelihoods.
- **Cyclone Amphan in 2020 displaced over 2.4 million people**. Rising sea levels also threaten coastal populations, especially in regions like the **Sundarbans**.

#### ○ Social Insecurity and Caste-Based Discrimination:

Marginalized communities often migrate due to social exclusion and lack of equitable opportunities in their native places.

- Scheduled Castes and Tribes face higher unemployment rates.
- This disparity is more pronounced in rural areas where caste-based violence, such as the **Hathras incident (2020)**, further exacerbates migration pressures.

#### ○ Political Instability and Conflict Zones:

Insurgency in northeastern states and **Naxalite** activity in central India have forced families to migrate for safety.

- For example, **Manipur violence** accounted for **97% of displacements** in South Asia in 2023.
- Conflict-driven migration is also seen in **Jammu & Kashmir**, where incidents like the **Pulwama attack (2019)** destabilized local economies and security.

#### ➤ Pull Factors:

#### ○ Urban Job Opportunities and Industrialization:

Cities attract migrants with **better-paying jobs in construction, services, and manufacturing sectors**.

- India’s urban population will contribute as high as **75% to GDP by 2030 (CMIE)**.
- Initiatives like the **Make in India** and infrastructure projects, such as **PM Gati Shakti**, have increased demand for low-skilled labor.
- **Bengaluru’s booming IT sector** has also pulled high-skilled professionals across India.

#### ○ Improved Healthcare and Educational Facilities:

Urban centers like Delhi, Mumbai, and Chennai offer **advanced medical care and top-tier educational institutions**.

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- According to **National Health Profile 2022**, rural hospitals comprise only **36.5% of the total beds and urban hospitals hold 63.5%.**
- Furthermore, institutions like **IITs and AIIMS act as magnets for talent from remote regions** seeking higher education and better health outcomes.
- **Social Mobility and Diverse Opportunities:** Urban spaces provide anonymity and reduced social constraints, enabling marginalized communities to pursue better opportunities.
  - For example, cities like **Mumbai have higher representation of women in the workforce**, driven by service sectors like IT and hospitality.
  - Female Labour Force Participation Rate in urban areas rises from **22.7% to 25.6%** during January – March 2023 to **January – March 2024.**
- **Improved Infrastructure and Livability in Urban Regions:** Urban areas offer superior **transport, housing, and digital connectivity**, driving migration.
  - India's **Smart Cities Mission** has enhanced infrastructure in 100 cities, attracting skilled and unskilled labor.
- **Globalization and Aspirations for Better Quality of Life:** Exposure to global markets and culture through digital media has raised aspirations for urban lifestyles.
  - **Metropolitan cities serve as hubs for international companies** and better amenities, pulling migrants.
  - Metropolitan cities dominate fresher hiring in India. **Delhi/NCR** accounts for the largest share of job postings for freshers at **21%**, followed by **Bengaluru at 14%.**
- Also, Mumbai, Chennai, Pune, and Hyderabad each contributed **8% to the total postings.**

### What is the Legal Framework for Migrant Welfare in India?

- **Key Legislation**
  - Inter-State Migrant Workmen Act, 1979:
    - Mandates the registration of establishments employing migrant workers.
    - Requires contractors to obtain licenses from both home and host states.

- Challenges: Poor implementation in practice.
- **Labour Codes:**
  - Code on Wages, 2018
  - Industrial Relations Code, 2020
  - Code on Social Security, 2020
  - Occupational Safety, Health, and Working Conditions Code, 2020
- Steps Taken by the Government for Migrant Welfare
  - **Central Government Initiatives:**
    - Relief and Rehabilitation of Migrants and Repatriates Scheme:
  - Continuation of 7 sub-schemes approved by the Union Government.
    - **Draft National Migrant Labour Policy** (2021):
  - Prepared by NITI Aayog in collaboration with civil society.
    - **Major Projects and Schemes:**
  - **One Nation One Ration Card (ONORC):** Ensures food security for migrants.
  - **Affordable Rental Housing Complexes (ARHC):** Provides low-cost housing options.
  - **PM Garib Kalyan Yojana:** Offers financial assistance and food security.
    - **e-Shram Portal:** Aims to create a comprehensive database of unorganized workers.
  - State Government Initiatives:
    - Kerala's Facilitation Centres:
  - Maintain data on incoming migrant workers and address their grievances.
    - Jharkhand's Safe and Responsible Migration Initiative (SRMI) (2021):
  - Systemic registration of migrant workers for monitoring in source and destination districts.
  - Establishment of 'Labour Consulates' in various states for assistance.

### What are the Key Issues Faced by Migrant Workers in India?

- **Lack of Social Security and Legal Protections:** Migrant workers, mostly in the **informal sector**, lack access to formal social security systems like EPF, health insurance, or maternity leave due to unregistered employment and interstate mobility.

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- According to the **Periodic Labour Force Survey (PLFS) 2021-22**, 90% of India's workforce is informal.
- The **Inter-State Migrant Workmen Act, 1979**, meant to safeguard them, remains poorly enforced.
- **Exploitation and Wage Discrimination:** Migrant workers often face **underpayment, wage theft, and longer working hours** compared to local workers due to weak enforcement of labor laws.
  - A survey revealed that **64% of migrant workers did not receive full wages during the Covid-19 lockdown**.
- **Poor Living Conditions and Housing Exclusion:** Migrants live in **overcrowded spaces with inadequate sanitation, water, and electricity** due to the unavailability of affordable housing in cities.
  - India's **slum population in 2020 is estimated at 236 million** suggesting that nearly half of its urban population lives in slums (UN-Habitat 2021)
- **Loss of Entitlements Due to Documentation Issues:** Migrant workers face challenges in accessing welfare schemes like PDS and housing due to the lack of portability of documents across states.
  - The **One Nation, One Ration Card (ONORC) scheme**, meant to ensure food security, but its reach remains weak.
  - Similarly, the **lack of voter ID portability disenfranchises millions during elections**.
  - Migrant families struggle to access healthcare and education due to **documentation issues, exclusion from local services, and language barriers in host states**.
- **Gender-Specific Challenges:** Female migrant workers face added **vulnerabilities, including sexual harassment, low wages, and lack of access** to childcare or reproductive healthcare services.
  - Between 2018 and 2022, over 10,000 trafficking cases were reported, many of whom were migrant workers but convictions were **only 4.8% of the 26,849 arrests**.
  - Also, Female domestic workers, often migrants, earn much **less than their male counterparts in informal jobs**.
- **Social Alienation and Discrimination:** Migrant workers often face **xenophobia, exclusion, and discrimination** in host states due to linguistic, cultural, and regional biases.

- During the **Covid-19 crisis**, several states imposed strict movement restrictions, labeling migrants as **"virus carriers,"** exacerbating their marginalization.
- **Absence of Childcare Support:** Migrant families face challenges in securing childcare, leading to children either being left behind in their native places or exposed to unsafe conditions at worksites.
  - **Global Education Monitoring Report 2019** reveals that about **80% of seasonal migrant children** in seven cities in India lacked access to education near work sites.
- **Children accompanying parents to construction sites** or fields are at risk of accidents, malnutrition, and neglect.
- **Inconsistent Policies Between States:** A lack of policy harmonization among states leads to unequal treatment of migrants, especially those crossing state boundaries.
  - For example, migrants from **Bihar and UP working in Gujarat or Maharashtra often face difficulties** accessing local welfare schemes due to domicile-based restrictions.

### What Measures can be Adopted to Ensure the Welfare and Integration of Migrant Workers?

- **Portable Social Security Systems:** Develop a nationwide platform for portability of social security benefits, such as **EPF, ESIC, and other welfare entitlements**, to address interstate mobility challenges.
  - Integration of the **One Nation, One Ration Card (ONORC) scheme** with health insurance schemes like **PMJAY** can ensure food and healthcare security for migrant families across states.
  - e-Shram can be integrated with schemes like **PM-Svanidhi and Vishwakarma Yojana**, enabling seamless data connectivity.
    - This integration would facilitate tracking worker entitlements, and ensuring easy access to information.
- **Formalization of Employment and Skill Certification:** Encourage formal employment contracts and skill mapping to integrate migrants into organized sectors, ensuring fair wages and legal protections.

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- Programs like **Skill India Mission** and **PM Kaushal Vikas Yojana (PMKVY)** can provide certified training for migrants, increasing their employability.
- Formalization could improve productivity and reduce wage exploitation, benefiting both workers and employers.
- **Affordable Housing and Livelihood Clusters:** Develop affordable rental housing schemes for migrants under the **Affordable Rental Housing Complexes (ARHC) initiative**, integrated with urban development policies like the **Smart Cities Mission**.
  - Creating livelihood clusters near these housing complexes can reduce travel costs and enhance work-life balance.
  - For example, **linking ARHCs with manufacturing hubs under Make in India** could ensure proximity to job opportunities while improving living standards.
- **Digitization of Welfare Delivery and Mobile Connectivity:** Develop migrant-friendly mobile applications to provide digital access to entitlements, including ration, healthcare, and financial services.
  - Strengthen the **implementation of Aadhaar-linked benefits and integrate them with state-specific welfare schemes** to ensure seamless delivery.
- **Gender-Sensitive Policies for Female Migrants:** Develop targeted policies addressing the unique needs of female migrants, including safety measures, wage parity, and access to childcare facilities.
  - For instance, **integrating Anganwadi services with urban housing policies can provide childcare support for working mothers** in informal sectors.
  - Enabling workplace safety and gender equality could significantly improve female labor force participation among migrants.
- **Healthcare Inclusion and Occupational Safety:** Introduce **mobile health clinics and occupational health programs for migrants**, especially those working in hazardous industries like construction and mining.
  - Strengthening the reach of **Ayushman Bharat** by linking it with employers in the unorganized sector can ensure **health insurance coverage for workers and their families**.
  - Preventive care at workplaces can reduce healthcare costs and improve productivity.
- **State Collaboration for Unified Policies:** Encourage state governments to harmonize labor policies through a national framework for interstate migrant workers.
  - The implementation of the **Inter-State Migrant Workmen Act** should be revamped to ensure coordination between source and destination states for grievance redressal.
  - **NITI Aayog's suggestion for a "National Migrant Policy"** could provide a blueprint for better integration of welfare schemes across states.
- **Creation of Livelihood Zones in Rural Areas:** Develop agro-industrial hubs and rural livelihood zones under **National Rural Employment Guarantee Act (MGNREGA) and SFURTI (Scheme of Fund for Regeneration of Traditional Industries)** to reduce distress migration.
  - Linking these programs with self-help groups under the **Deendayal Antyodaya Yojana (DAY-NRLM)** could generate sustainable employment locally.
  - This would empower rural communities while reducing migration pressures on urban areas.
- **Educational and Skill Support for Migrant Children:** Establish portable education systems with **open schooling and mid-day meal portability** to ensure uninterrupted education for migrant children.
  - Link the **Samagra Shiksha Abhiyan** with state-level programs to address language barriers in schools for migrant children.
- **Financial Inclusion and Credit Access:** Promote financial literacy programs and ensure easy access to banking services for migrants through simplified KYC norms and mobile banking.
  - Strengthen outreach of programs like **Jan Dhan Yojana** and democratise linkage with Aadhaar-enabled direct benefit transfers (**JAM Trinity**) to reduce dependency on informal moneylenders.
- **Public-Private Partnerships for Welfare Delivery:** Leverage private sector participation in implementing welfare measures like skill training, affordable housing, and healthcare for migrants.
  - **Corporate Social Responsibility (CSR) initiatives** can complement government efforts by funding social infrastructure projects for migrant communities.

### Conclusion:

The welfare of migrant workers is crucial for India's

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inclusive growth and economic resilience. While existing frameworks like the e-Shram portal and initiatives such as **ONORC** and **ARHC** show promise, gaps in implementation, portability of benefits, and gender-sensitive policies persist. A **comprehensive and inclusive national migrant policy** is essential to ensure equitable opportunities and dignity for this vital workforce.



## The Collegium Conundrum

*This editorial is based on “[The Collegium and changes — it may still be early days](#)” which was published in The Hindu on 07/12/2024. The article brings into focus the complexities of India’s Collegium system, highlighting its efforts to ensure judicial independence while grappling with opacity, government delays, and the challenge of balancing autonomy with accountability.*

**Tag:** GS Paper-2, Separation of Powers, Judiciary, Transparency & Accountability, Judgements & Cases

**India’s Collegium system**, born from judicial interpretation, stands as the mechanism for appointing judges to the higher judiciary. While recent reforms like **conducting interviews and limiting nepotism show promise**, the system continues to face challenges due to **governmental delays and lack of formal binding rules**. Though designed to ensure judicial independence, the **opaque nature of its functioning and the government’s ability to stall appointments** have created a paradoxical situation where theoretical primacy meets practical constraints. This delicate balance between **judicial autonomy and accountability remains a critical constitutional challenge**, even as the system attempts to evolve through incremental reforms.

### What is the Collegium System?

- **About:** The Collegium system refers to the mechanism for the **appointment and transfer of judges** in the Supreme Court and High Courts of India.
  - It is **not explicitly mentioned in the Constitution** but has evolved through various **Supreme Court judgments**.

- **Composition:**
  - **Supreme Court Collegium:** Includes the **Chief Justice of India (CJI)** and the **four senior-most Supreme Court judges**.
  - **High Court Collegium:** Led by the Chief Justice of the High Court and its **two senior-most judges**.
- **Constitutional Provisions for Judicial Appointments**
  - **Article 124:** Supreme Court judges are appointed by the **President**, in consultation with the CJI and other judges as necessary.
  - **Article 217:** High Court judges are appointed by the **President**, in consultation with the CJI, the Governor of the state, and the Chief Justice of the High Court.
- **Government’s Role:** The government can raise objections or seek clarifications.
  - However, if the Collegium reiterates its recommendations, the government is bound to comply.
- **Evolution of the Collegium System**
  - **First Judges Case (1981):** Held that “consultation” with the CJI does not mean “concurrence.”
    - Gave primacy to the executive in judicial appointments.
  - **Second Judges Case (1993):** Overturned the First Judges Case. Redefined “consultation” to mean “concurrence,” giving the CJI a primary role.
    - Introduced the **concept of a Collegium**, requiring the CJI to consult two senior-most judges.
  - **Third Judges Case (1998):** Expanded the Collegium to include the **CJI and four senior-most judges**.
    - Stated that dissent by even two Collegium members can halt a recommendation.
- **National Judicial Appointments Commission (NJAC):** Proposed via the **99th Constitutional Amendment Act, 2014**, to replace the Collegium system.
  - **Composition included:** CJI (Chairperson), two senior SC judges, Law Minister, and two eminent persons.
  - **Struck down in 2015 by the Supreme Court**, citing a violation of judicial independence and the basic structure of the Constitution.
- **Memorandum of Procedure (MoP):** A framework outlining procedures for judicial appointments, jointly framed by the government and judiciary.

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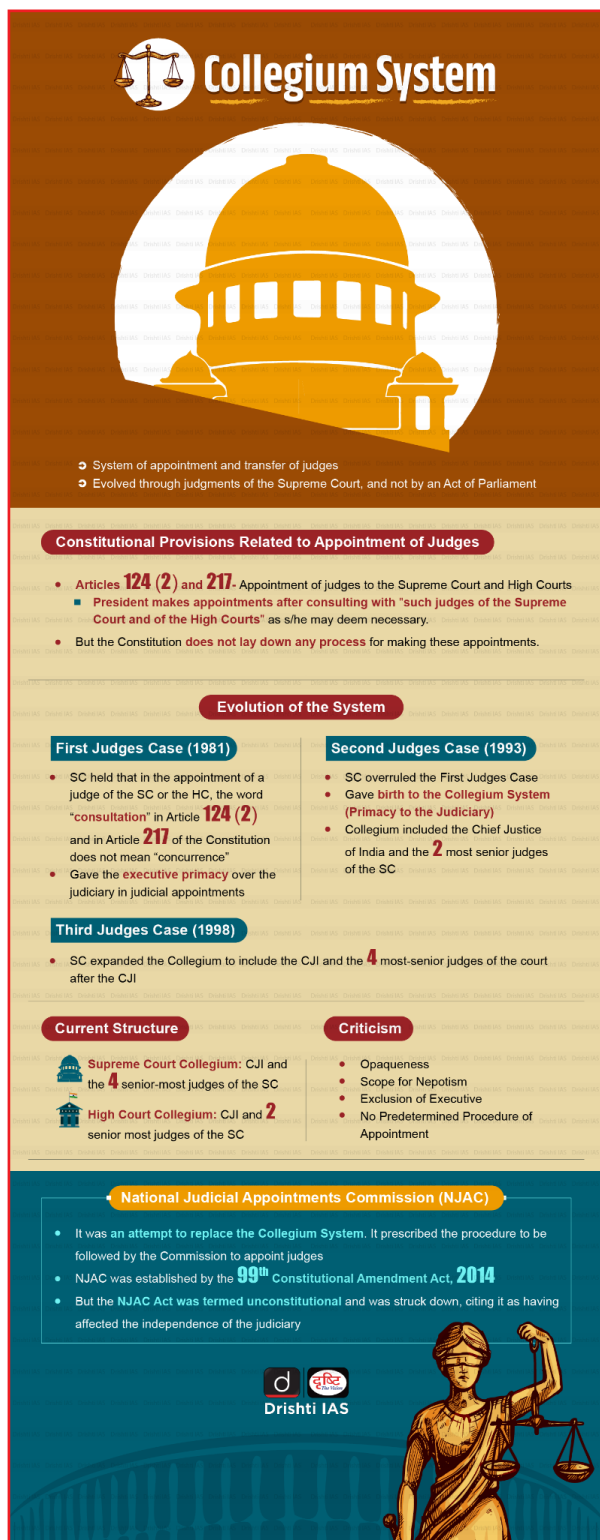
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- A revised MoP was sought in 2015 to enhance transparency but remains unresolved.



## Collegium System

○ System of appointment and transfer of judges  
○ Evolved through judgments of the Supreme Court, and not by an Act of Parliament

### Constitutional Provisions Related to Appointment of Judges

- Articles **124 (2)** and **217**. Appointment of judges to the Supreme Court and High Courts
  - President makes appointments after consulting with "such judges of the Supreme Court and of the High Courts" as s/he may deem necessary.
- But the Constitution does not lay down any process for making these appointments.

### Evolution of the System

#### First Judges Case (1981)

- SC held that in the appointment of a judge of the SC or the HC, the word "consultation" in Article **124 (2)** and in Article **217** of the Constitution does not mean "concurrence"
- Gave the **executive primacy** over the judiciary in judicial appointments

#### Second Judges Case (1993)

- SC overruled the First Judges Case
- Gave birth to the **Collegium System** (Primacy to the Judiciary)
- Collegium included the Chief Justice of India and the **2** most senior judges of the SC

#### Third Judges Case (1998)

- SC expanded the Collegium to include the CJI and the **4** most-senior judges of the court after the CJI

#### Current Structure

- Supreme Court Collegium:** CJI and the **4** senior-most judges of the SC
- High Court Collegium:** CJI and **2** senior most judges of the SC

#### Criticism

- Opaqueness
- Scope for Nepotism
- Exclusion of Executive
- No Predetermined Procedure of Appointment

### National Judicial Appointments Commission (NJAC)

- It was an attempt to replace the Collegium System. It prescribed the procedure to be followed by the Commission to appoint judges
- NJAC was established by the **99<sup>th</sup>** Constitutional Amendment Act, **2014**
- But the NJAC Act was termed unconstitutional and was struck down, citing it as having affected the independence of the judiciary

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## What are the Key Benefits of the Collegium System in India?

- **Judicial Independence:** The collegium system ensures judicial independence by **keeping the process of judicial appointments free from executive** (separation of judiciary from executive under Article 50) or legislative interference.
  - This autonomy **safeguards the judiciary's ability to act as a countermajoritarian institution**, protecting constitutional values and fundamental rights.
  - Moreover, Government is litigant in majority of the cases giving **government a say in justice delivery might compromise the justice**
    - Recent rulings, such as the **SC's verdict on the Electoral Bonds**, underscore the importance of a judiciary that is insulated from political pressures.
  - As per the **Fourth Judges Case (2015)**, the collegium's primacy is integral to maintaining the judiciary's autonomy, a key feature of the **Constitution's basic structure**.
- **Expertise-Driven Selection:** The collegium system ensures that **judges, rather than politicians or bureaucrats**, select appointees, promoting meritocracy and judicial competence.
  - This **peer-driven selection process leverages the experience of senior judges** to identify candidates with judicial acumen and integrity.
  - For instance, the inclusion of specialists in constitutional or commercial law strengthens the judiciary's ability to address complex legal challenges.
  - Additionally, **Supreme Court judgments on cryptocurrency regulation** required nuanced legal expertise, **highlighting the benefit of this system**.
- **Insulation from Populism:** The collegium system acts as a **bulwark against populism by ensuring judicial appointments are not swayed** by transient public pressures.
  - For instance, the **SC's proactive stance on environmental protection** (e.g., banning firecrackers in Delhi) or upholding individual freedoms (e.g., **Puttaswamy Case** on privacy) demonstrates this impartiality.

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- These cases reaffirm the judiciary's critical role in protecting constitutional democracy.
- **Flexibility and Responsiveness:** The collegium system, with its informal structure, **allows flexibility to adapt to emerging judicial needs and challenges.**
- Recent decisions to interview High Court candidates and avoid nepotism demonstrate **a willingness to address criticisms and enhance the process's credibility.**
- This dynamic approach has resulted in the appointment of judges with significant trial court experience, addressing long-standing gaps in judicial diversity.
- This adaptability ensures that the judiciary evolves to meet societal expectations.

### What are the Key Issues Related to the Collegium System in India?

- **Lack of Transparency:** The collegium system is criticized for its **opaque functioning**, with **decisions on judicial appointments often shrouded in secrecy** and lacking accountability.
  - The absence of publicly accessible criteria for selection undermines public confidence and raises questions about favoritism.
  - Justice Kurian Joseph admitted that **"the present collegium system lacks transparency, accountability and objectivity"**.
  - For example, the **controversial transfer of Justice Sanjaya Kumar Mishra** raised concerns about the rationale behind such decisions.
  - Globally, **India's judiciary ranks 79th on the Rule of Law Index (2023)**, reflecting its relative independence. Despite efforts like publishing resolutions online, **inconsistency in disclosures persists.**
- **Nepotism and Favoritism (Uncle Judge Syndrome):** Critics argue that the collegium system perpetuates **nepotism**, with **many judges being related to existing or former judges**, leading to a judiciary that appears elitist and non-representative.
  - Recent moves to exclude candidates with judicial kinship have been welcomed but **remain inconsistently applied.**
- A 2015 report stated that around **50% of the judges of high courts and 33% judges in the Supreme Court** were family members of those in "higher echelons of judiciary", **creating barriers for first-generation lawyers.**
- **Executive Delays in Appointments:** Despite the collegium's primacy, the **executive often delays approving its recommendations**, stalling the process and creating judicial vacancies.
  - While over **60 lakh cases remain pending at High Courts** across the country, **30% of the seats remain vacant**, due to prolonged government inaction.
  - For example, a **six-month delay by the government** in approving the Collegium's recommendation for **Justice Bidyut Ranjan Sarangi** as the Chief Justice of Jharkhand resulted in the judge **receiving a tenure of only 15 days.**
- **Lack of Diversity:** Despite recent improvements, the collegium system has been slow to address issues of **representation for women, marginalized communities, and regional identities.**
  - As of January 2024, **only 13.4% of judges in the High Court and 9.3% judges in the Supreme Court are women.**
  - Similarly, less than **25% of HC Judges belong to SC, ST, OBCs & Minorities.**
- **Judicial Backlog and Inefficiency:** The lack of a timely and consistent appointment process exacerbates the pendency of cases, undermining public trust in the judiciary.
  - A backlog of **around 80,000 cases at India's Supreme Court** is impeding access to justice'
  - **Judicial inefficiency costs India 1.5% of GDP annually**, delaying crucial economic and social reforms.
    - While the collegium seeks merit-based appointments, the inefficiencies in its operations counteract its intended goals.

### What Measures can be Adopted to Reform Judicial Appointments in India?

- **Codification of Collegium Procedures:** Codifying the collegium functioning into a **formal institutional framework is essential to bring transparency, consistency, and accountability.**

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- A detailed **Judicial Appointments Procedure** can include **clear guidelines on candidate selection**, timelines for decision-making, and criteria for eligibility.
  - This would ensure that recent practices, such as interviews and steps to discourage nepotism, are institutionalized.
- Justice J.S Khehar proposed that an **advisory committee of “eminent persons,” including experienced lawyers, jurists, and retired judges**, be consulted during the judicial appointment process.
  - The collegium would consider their opinions without being bound by them.
  - To enhance the process, a **Statutory Search Committee, involving representatives from the judiciary, government, Bar, and academics, should assist the collegium** in selecting candidates.
  - Separate committees for the Supreme Court and High Courts, ideally led by a respected retired Chief Justice, should be established
- **Reforming Appointment of Judges:** The appointment system of judges needs to be more **transparent and accountable under the Right to Information (RTI) Act**, allowing citizens to access information on the selection process.
  - Judges of questionable integrity, appointed by the collegium, **should be removed through methods like voluntary retirement**.
  - The **“uncle judges” issue can be addressed by not posting judges in High Courts where their relatives practice**.
  - Ad hoc or additional judges should be appointed to address pending cases.
  - A uniform retirement age for **Supreme Court and High Court judges should be implemented to prevent bias**, and **minimum tenures should be set for Chief Justices**. Court management practices should be reformed for efficiency.
    - The Supreme court has also asked the government to establish a secretariat for each High Court and the Supreme Court, outlining its functions, duties, and responsibilities.
- **Enforceable Time Limits for Appointments:** Introducing **strict, enforceable timelines for the executive to process collegium recommendations** would address the chronic delays in judicial appointments.
  - A statutory deadline for the government to approve or return recommendations can reduce vacancies.
- **Enhancing Diversity in Appointments:** An affirmative action framework within judicial appointments can ensure better **representation of women, Scheduled Castes, Scheduled Tribes**, and other marginalized communities.
  - For instance, the Supreme Court could mandate that at least 25% of judges in higher courts be women, reflecting societal demographics.
  - This **approach could help create a judiciary more attuned to the needs of diverse populations**, enhancing public trust in justice delivery.
- **Greater Transparency in Collegium Decisions:** Publishing comprehensive records of collegium discussions and decisions, including reasons for selecting or rejecting candidates, can improve transparency.
  - Such disclosures would counter allegations of favoritism and nepotism while building public trust.
  - Countries like the **UK publish judicial reports**, which serve as benchmarks for transparency.
    - Similar practices in India would make the collegium system more accountable.
- **Performance-Based Assessments:** Adopting performance-based evaluations for candidates can ensure **merit-driven appointments, prioritizing competence, integrity, and judicial temperament**.
  - These assessments could consider criteria such as the number of judgments delivered, innovative legal interpretations, and public confidence in their rulings.
  - For instance, **trial court judges with a strong track record** could be given preference for High Court elevations.
- **Leveraging Technology for Efficiency:** Using technology, such as **Artificial Intelligence (AI)**, to manage data on eligible candidates, performance metrics, and judicial vacancies can enhance decision-making efficiency.

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- AI tools can ensure **objective evaluations**, identifying the best candidates based on a combination of merit and diversity metrics.
- For instance, pilot projects like the **SC's SUPACE AI tool** show the judiciary's willingness to integrate technology.
  - Expanding such initiatives to judicial appointments can reduce human bias and delays.

### Conclusion:

The Collegium system has played a crucial role in safeguarding judicial independence. However, its **lack of transparency, executive delays, and limited diversity continue to present significant challenges**. Reforms like **codifying procedures, introducing enforceable timelines, and enhancing diversity could address these issues**. A balance between **judicial autonomy and accountability remains essential for the system's evolution**. Ultimately, **a more transparent, efficient, and inclusive approach** can strengthen the judiciary and restore public trust.



## Navigating India's Digital Growth

*This editorial is based on "**Making Digital India safe, secure and inclusive**" which was published in Hindustan Times on 05/01/2025. The article brings into focus the Draft Digital Personal Data Protection Rules, 2025, highlighting key rights like informed consent and data erasure while emphasizing the need to address digital access and awareness for meaningful inclusion and security.*

**Tag:** GS Paper-2, Government Policies & Interventions, E-Governance, GS Paper-3, Inclusive Growth, Achievements of Indians in Science & Technology

India's **Draft Digital Personal Data Protection Rules, 2025**, represents a significant milestone in the country's digital governance. The framework introduces crucial rights like **informed consent, data erasure, and digital nominees**, making data protection accessible to every Indian through language inclusivity. The **digital-first philosophy**, exemplified by the **Data Protection Board**,

promises efficient grievance resolution and compliance monitoring. The new framework, though promising, must grapple with **on-ground realities where millions still lack basic digital access and understanding**. As India positions itself as a digital pioneer, addressing these fundamental challenges becomes crucial for transforming policy promises into meaningful **digital inclusion and security for all citizens**.

### What is the Digital India Initiative?

- **About:** Launched on July 1, 2015, by the Indian Government, **Digital India** builds upon previous e-governance efforts from the mid-1990s. Unlike earlier attempts, it brings greater cohesion and interactivity to digital initiatives.
- **Objectives:**
  - **Bridging the Digital Divide:** The initiative aims to reduce the gap between digitally literate individuals and those with limited access to technology.
  - **Fostering Digital Inclusion:** It focuses on ensuring that all citizens, regardless of their background, can benefit from digital advancements in areas like education, healthcare, and government services.
  - **Driving Economic Growth:** By harnessing technological innovations, Digital India seeks to stimulate economic development throughout the country.
  - **Improving Quality of Life:** The program aims to improve the standard of living by applying technology to enhance various aspects of daily life.
- **Pillars:**



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## What are the Key Drivers of India's Digital Growth?

- **Expanding Digital Infrastructure:** India's growing digital infrastructure is bridging urban-rural connectivity and supporting a robust digital economy.
  - Programs like **BharatNet** aim to provide high-speed internet to rural areas, while **5G rollout** is accelerating digital adoption.
  - These developments are critical for enabling e-governance, e-commerce, and digital education in underserved regions.
  - India boasts an impressive internet user base exceeding 800 million, with 86% engaging in **over-the-top (OTT) audio** and video services, making it the primary use of technology in the country, as per the **Internet in India Report 2023** by IAMAI and Kantar.
- **Booming Digital Economy:** India's digital economy is rapidly expanding, driven by e-commerce, fintech, and IT services.
  - Platforms like **Open Network for Digital Commerce** are democratizing digital commerce for small businesses, while startups leverage technology to innovate.
  - This growth is transforming consumer habits and generating significant employment opportunities.
  - A recent report by Ask Capital says India is set to become a **USD 1 trillion digital economy by 2028**.
- **Digital Skilling and Workforce Enablement:** India's focus on digital skilling is creating a workforce ready for emerging technologies.
  - **Skill India Digital Hub** achieves a milestone with over 1 crore registrations.
  - The IT industry added 2.9 lakh new jobs taking the industry's workforce tally to 5.4 million people in FY23.
- **Rising Smartphone Penetration:** Affordable smartphones and low-cost data have turned India into a mobile-first digital economy.
  - High smartphone penetration enables greater access to online education, digital payments, and entertainment.
  - Domestic manufacturing incentives are boosting production and exports, supporting **India's Atma Nirbhar Bharat vision**.
- The Indian smartphone market shipped 69 million smartphones in the first half of 2024, with **7.2% growth year-on-year**
- **Start-Up Ecosystem and Innovation:** India's start-up ecosystem is driving digital innovation and economic growth.
  - With support from government initiatives like **Start-Up India** and a strong funding landscape, tech startups are solving unique market challenges.
  - Indian startups raised a total of **\$30.4 billion in funding throughout 2024** despite global economic uncertainties.
- **Digital Financial Inclusion:** India's focus on financial inclusion through **UPI and Jan Dhan accounts** is transforming access to banking and financial services.
  - This has empowered millions, especially in rural areas, to engage with the digital economy. Initiatives like the **Digital Rupee pilot** reflect India's readiness for next-gen financial systems.
  - The total number of **Jan Dhan accounts** have crossed 50 crore as in **August 2023**. Out of these accounts **56% accounts belong to women**
  - UPI processed an impressive **Rs 23.49 lakh crores** across 16.58 billion financial transactions in October 2024
- **Tech-Driven Public Service Delivery:** Tech-enabled governance reforms like **Aadhaar and DBT** have made welfare delivery more efficient and transparent.
  - Platforms like **CoWIN** during Covid-19 showcased the scalability of digital solutions for national challenges.
    - This ensures that public services reach even the remotest parts of the country.
  - **PM-Kisan Samman Nidhi** is one of the largest DBT schemes globally, directly transferring funds to farmers' **Aadhaar-linked bank accounts**
- **Digital Content and Entertainment Growth:** The rise of **OTT platforms, online gaming, and regional content** has revolutionized India's entertainment sector.
  - Affordable data and smartphones have enabled access to content across urban and rural markets.
    - This sector is becoming a significant contributor to digital growth.

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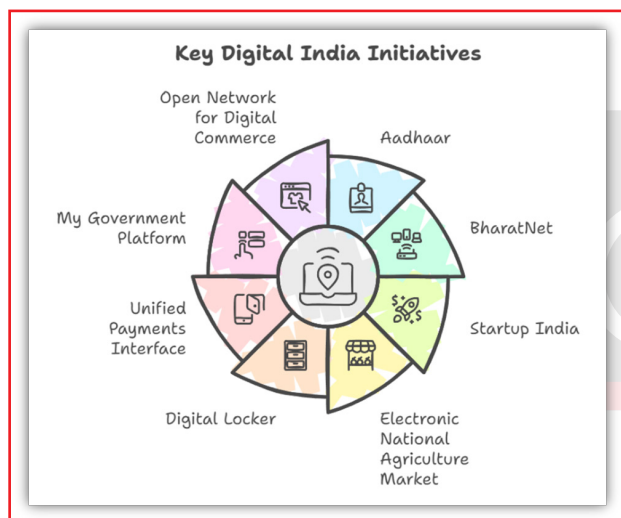
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- Millennials and Gen Z are the main contributors for social media usage in India. **52.3 % of social media results come from millennials.**
- The Indian gaming industry clocked **\$3.1 billion in FY23 and is set to hit \$7.5 billion by FY28**
- **Policy Support and Regulatory Frameworks:** Progressive policies like the **Digital Personal Data Protection Act, 2023**, ensure data privacy and trust in the digital ecosystem.
  - These policies balance citizen protection with business growth, fostering innovation.
    - The **DPDP Act, 2023**, mandates **rights like data erasure and informed consent.**



### What are the Key Issues Associated with India's Digital Growth?

- **Digital Divide:** India's digital growth is **uneven**, with significant gaps between **urban and rural areas**, and among **different socio-economic groups**.
  - While urban regions enjoy **robust internet connectivity and digital services**, rural areas struggle with **low penetration, digital literacy, and affordability issues.**
  - As of 2023, **rural internet penetration** stood at **only 37%**. Also, India's digital literacy rate stands at approximately **37%**, according to the **National Association of Software and Service Companies (NASSCOM).**

- **Cybersecurity Threats:** India faces increasing cybersecurity challenges as **digital adoption rises**, including data breaches, phishing attacks, and ransomware incidents.
  - The lack of robust infrastructure to counter cyber crimes threatens the safety of individuals and businesses.
  - India witnessed **13.91 lakh cyber security incidents in 2022**. A recent **Data Security Council of India (DSCI) report** indicates the country faces a shortage of about **7,90,000 cyber security professionals.**
- **Data Privacy and Protection:** The absence of strong data protection frameworks until recently exposed citizens to risks like unauthorized data collection and misuse.
  - Even with the **Digital Personal Data Protection Act, 2023**, concerns remain about enforcement and potential misuse of provisions.
  - A recent survey by CII and Protiviti revealed that **61% of respondents believed Indian companies were engaging in activities like excessive data collection** and secondary processing without consent, which violate the DPDP Act and raise concerns about user privacy.
- **Infrastructure Bottlenecks:** While India has made strides in **digital infrastructure**, challenges such as **low broadband speed, patchy 5G rollout**, and insufficient fiber-optic networks hinder progress. Infrastructure gaps in remote areas limit access to digital services.
  - India ranks **25th** globally for mobile internet speeds as of **November 2024**, lagging behind countries like **South Korea.**
- **Regulatory and Policy Challenges:** Frequent regulatory changes and overlapping jurisdictions create confusion and compliance burdens for businesses.
  - For instance, the spectrum auction process has faced several delays due to complex regulatory procedures, **overlapping jurisdiction between the Department of Telecommunications (DoT) and other agencies**, and long negotiations regarding spectrum pricing.
    - This has hindered the timely rollout of 5G services in the country, affecting digital growth and technological advancements.

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- **Complex data localization requirements** add costs for global businesses operating in India.
- **Inefficiencies in Public Digital Systems:** Public digital platforms face challenges such as **low user adoption, data accuracy issues, and occasional technical glitches.**
  - Systems like CoWIN, while successful, highlight gaps in scalability and usability for non-urban populations.
  - **Aadhaar experienced several instances of identity fraud**, raising concerns about its robustness.
- **Environmental Impact of Digital Expansion:** India's rapid digital expansion has led to increasing **e-waste and energy consumption in data centers**, raising environmental sustainability concerns.
  - The **absence of robust e-waste management policies** exacerbates the problem.
  - India witnessed a **surge in electronic waste (e-waste) generation** over the past five years, rising from 1.01 million metric tonnes (MT) in 2019-20 to **1.751 million MT in 2023-24.**

### What Steps can be taken to Strengthen and Secure the Digital Landscape in India?

- **Bridging the Digital Divide:** India must expand its digital infrastructure to rural and remote areas while ensuring affordability and accessibility.
  - Programs like **BharatNet** can be complemented with **PM-WANI** to create a robust public Wi-Fi ecosystem, particularly in underserved regions.
  - Subsidizing **internet-enabled devices and promoting regional language content** can further increase digital participation.
- **Enhancing Cybersecurity Framework:** India needs a comprehensive cybersecurity strategy that includes capacity building, real-time threat detection systems, and stringent regulations.
  - Expanding the **Cyber Surakshit Bharat** initiative to **SMEs and startups** can ensure wider adoption of security best practices.
  - Targeted training programs under the **Skill India Mission** can address the **3.5 million cybersecurity professional gap.**
  - Encouraging **R&D in indigenous cybersecurity solutions** through PLI schemes can boost digital resilience.

- **Strengthening Data Privacy and Protection:** Effective implementation of the **Digital Personal Data Protection Act, 2023** is crucial for safeguarding citizen data.
  - Setting up regional **Data Protection Offices** can ensure accountability at the local level while reducing response times for grievances.
  - India should also **create clear guidelines on data localization to balance privacy, security, and international trade considerations.**
    - Regional Data Protection Offices can function as digital-first entities, as seen with the **CoWIN platform's decentralized management.**
- **Promoting Digital Literacy:** Digital literacy programs should extend beyond basic usage to include cybersecurity awareness, online etiquette, and skill enhancement.
  - Linking **PMGDISHA** with **Skill India Mission** can create holistic training for rural populations and youth.
  - **Community-driven initiatives**, such as digital ambassadors or local champions, can ensure sustained participation.
- **E-Waste Management and Sustainability:** India needs a national e-waste management framework focusing on collection, recycling, and upcycling.
  - Linking **Swachh Bharat Mission** with **e-waste collection initiatives** can create awareness and streamline processes.
  - **Incentivizing startups specializing in green technology** and recycling can also reduce environmental impact.
  - Extending the **PLI scheme** to green tech industries can boost eco-friendly manufacturing.
- **Integrating Digital Public Goods:** India must leverage digital public goods like **Aadhaar, UPI, and DigiLocker** to enhance service delivery while addressing system inefficiencies.
  - This **integration improves governance efficiency** and reduces bureaucratic delays.
  - Linking **DigiLocker** with **Ayushman Bharat Digital Mission** can streamline health record management.

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- **Boosting Startups and Innovation:** Simplified regulatory frameworks and targeted funding can nurture startups, especially in **Tier II and Tier III cities**.
  - Enhancing the **Start-Up India** initiative by linking it with **ONDC (Open Network for Digital Commerce)** can democratize digital access for MSMEs and boost entrepreneurship.
  - Dedicated **incubation centers focusing on AI, blockchain, and IoT** can drive next-gen innovation.
- **Ensuring Inclusive Digital Access:** Policies should focus on making digital services accessible to people with **disabilities and marginalized communities**.
  - Mandating assistive technologies like screen readers for public platforms and promoting affordable internet plans for economically weaker sections can bridge gaps.
  - Integrating **Accessible India Campaign** with **Digital India initiatives** ensures inclusivity.
  - Promoting **AI enabled voice-based interfaces in regional languages** can improve accessibility.
- **Aligning with Global Standards:** India should harmonize its digital regulations with global frameworks like the **European Union's General Data Protection Regulation (GDPR)** while maintaining its unique socio-economic context.
  - Creating **bilateral agreements for cross-border data flow** and intellectual property sharing can foster international collaboration.
  - India can initiate programs like **Indo-Pacific Digital Alliance** to shine as a leader in global digital governance.

### Conclusion:

India's Draft Digital Personal Data Protection Rules, 2025, mark a significant step towards a secure and inclusive digital future. While the country's digital landscape continues to grow rapidly, **addressing the digital divide, cybersecurity challenges, and data privacy concerns remains crucial**. A focused effort on enhancing digital infrastructure, promoting digital literacy, and ensuring data protection will be key in realizing the full potential of Digital India.



## Balancing Protectionism with Globalization

*This editorial is based on "**Raghuram Rajan: How emerging economies can prosper in a protectionist world**" which was published in Mint on 08/01/2025. The article brings into focus the pivotal challenges and opportunities faced by emerging economies, particularly India, in navigating a shifting global economic landscape shaped by protectionism and automation.*

**Tag:** GS Paper-2, Deglobalisation & Protectionism, Effects of Globalization on Indian Society

As global trade tensions rise and automation transforms manufacturing, **emerging economies face a pivotal moment in their development journey**. The traditional path of **export-led manufacturing growth**, which helped countries like **China** achieve middle-income status, is **becoming increasingly challenging due to protectionist barriers** in developed nations. Despite India's impressive growth in services exports and its emerging position in the global economy, **policymakers must remain vigilant about addressing challenges in human capital development, infrastructure, and economic inclusivity** to ensure **sustainable growth in an increasingly protectionist world**.

### What Factors Are Driving the Rise of Protectionism in a Globalized World?

- **Economic Nationalism and Deindustrialization:** **Economic nationalism**, fueled by the loss of manufacturing jobs in developed countries, drives protectionist policies to **"reshore" industries and revive domestic production**.
  - For instance, the U.S. enacted the **Inflation Reduction Act (2022)** to subsidize domestic green technology production, prioritizing American firms over imports.
  - Similarly, the **EU's Critical Raw Materials Act (2023)** aims to reduce **dependency on imports in clean energy**.
- **Geopolitical Rivalries and Strategic Decoupling:** Tensions between major powers like the **U.S. and China** have led to **economic decoupling**, with nations prioritizing self-reliance in critical industries.

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- The U.S. imposed restrictions on China's access to advanced **semiconductor technology** in 2023, citing national security concerns.
- Meanwhile, **China retaliated by restricting exports of gallium and germanium**, critical to global chip manufacturing, affecting global supply chains.
- **Supply Chain Vulnerabilities Exposed by Covid-19:** The pandemic revealed **over-dependence on global supply chains**, pushing nations to localize production for critical goods.
  - For example, during 2020, global trade in medical supplies saw disruptions, with countries like **India banning the export of ventilators**.
  - According to the **World Trade Organization (WTO)**, **global trade dropped by 5.3% in 2020**, highlighting vulnerabilities in international supply chains.
  - In response, many nations have since adopted **"China+1" strategies**, diversifying supply chains to mitigate risks.
- **Rising Inequality and Populism:** Economic inequality within and between nations has **fueled populist demands for protectionist policies** to safeguard domestic jobs and industries.
  - **Brexit (2016)** is an example, where **governance and voters blamed EU trade policies for local job losses**, particularly in manufacturing regions.
    - Populist leaders leverage these grievances to justify tariffs and trade barriers.
- **Environmental and Climate Concerns:** Governments increasingly use environmental policies as protectionist tools under the guise of sustainability.
  - The **EU's Carbon Border Adjustment Mechanism (CBAM) (2023)** imposes tariffs on imports with higher carbon footprints, affecting industries in developing countries.
  - According to the **International Energy Agency (IEA)**, global carbon dioxide (CO<sub>2</sub>) emissions from energy combustion and industrial processes **grew 0.9% or 321 Mt in 2022 to a new all-time high of 36.8 Gt**, making carbon tariffs a tool for environmental goals and industrial protection.
- **Technological Dominance and Digital Protectionism:** The race for technological supremacy has led to restrictions on data flows, intellectual property, and digital goods.
  - India, for instance, enacted **data localization rules in 2022**, mandating firms like Google and Amazon to store data within its borders to protect national security and foster domestic digital ecosystems.
  - Similarly, the **EU's Digital Services Act (2022)** regulates the obligations of digital services, including marketplaces.
- **Protection of Domestic Agriculture:** Agricultural subsidies and tariffs are employed to shield domestic farmers from volatile global markets and foreign competition.
  - The **U.S. Farm Act (2018)** allocated \$428 billion in subsidies for domestic agriculture, shielding farmers from price shocks.
  - In India, **protests against agricultural reforms in 2020** were rooted in fears of reduced protections from global competition.
    - In 2024, India invoked the **peace clause at the World Trade Organization (WTO)** for the **fifth consecutive time** due to breaching the prescribed subsidy limit for rice.
- **Inflationary Pressures and Economic Instability:** Rising inflation and economic instability have prompted governments to **impose export bans and import restrictions to control domestic prices**.
  - For example, **in 2022, Indonesia banned palm oil exports** to stabilize local cooking oil prices.
  - Similarly, **India restricted wheat and rice exports in 2023** to curb domestic inflation.
- **Weakening Multilateral Institutions:** Global trade institutions like the **WTO face challenges in resolving disputes**, leading nations to resort to unilateral protectionist measures.
  - For instance, the **WTO's Appellate Body has been non-functional** since 2019 due to U.S. opposition to judicial appointments.
  - Nations now increasingly rely on bilateral trade agreements or impose unilateral tariffs, reflecting a decline in trust in multilateral mechanisms.
- **Domestic Political Pressures:** Short-term political considerations, such as **elections, often drive protectionist policies to appease domestic constituencies**.

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- In the run-up to the 2024 U.S. presidential elections, both major parties advocated for **stricter tariffs**, reflecting bipartisan support for protectionism.
- The newly elected U.S. President warns of **imposing 100% tariffs on the BRIC nations** if they undermine the dominance of the U.S. dollar in global trade.

### What are the Issues Arising Out of Protectionism for India?

- **Export Competitiveness and Market Access:** Protectionism limits India's access to global markets, reducing its export competitiveness and threatening sectors like textiles and clean energy.
  - Countries imposing tariffs or subsidies for domestic industries, such as the US under the **Inflation Reduction Act (2022)**, put Indian exports at a disadvantage.
  - Recent reports state that India's merchandise exports for 2023 was **\$432 billion, 5% lower than 2022**, especially in key sectors like textiles.
- **Disruption in Supply Chains:** Global protectionism disrupts India's supply chain participation, **increasing costs for critical imports like semiconductors**.
  - For example, the US-China tussle on the semiconductor supply chain hurt India's electronics and EV industries.
  - In the financial year 2023-24, **India imported electronic components worth over \$12 billion from China** and any disruptions in raw materials threaten its **\$10 billion semiconductor mission**.
- **Impact on Domestic MSMEs:** Protectionist barriers in developed markets reduce demand for Indian MSME products, undermining exports and employment.
  - When the **Carbon Border Adjustment Mechanism (CBAM)** becomes fully operational, India's steel and cement industry will be heavily impacted.
    - India will face a duty of **Euro 173.8 per tonne (Indian Rupees 15,394)** on steel exports to the European Union.
- **Inflationary Pressures from Import Barriers:** Protectionism drives up the cost of imports, increasing inflationary pressures in India, particularly for essential goods.

- By the end of April 2022, refined palm oil had **become 27% more expensive for Indians** due to Indonesia's palm oil export ban.
- Similarly, restrictions on fertilizer exports by Russia and Belarus raised Indian DAP fertilizer prices, **affecting agricultural productivity and consumer costs**.
- **Reduced FDI Inflows:** Protectionism creates uncertainty, discouraging foreign investors from committing to Indian projects.
  - **Foreign institutional investors** have withdrawn **nearly \$10 billion from the Indian stock market in October 2024**, marking a record high, reflecting caution amid rising global tariffs and trade barriers.
  - **Foreign Direct Investment (FDI) inflows** to India **dropped by 43% in 2023**, totaling \$28 billion, while global FDI declined by 2%.
- **Diversion of Resources to Trade Disputes:** Protectionist trends force India to divert resources and diplomatic focus to **managing trade disputes instead of fostering new trade relationships**.
  - For example, in 2024, India has sought arbitration proceedings under the **World Trade Organization (WTO)** rules against Australia to resolve an issue concerning the services sector.

### Is India's Atmanirbhar Bharat a Form of Protectionism?

- **Arguments Suggesting Atmanirbhar Bharat is Protectionist**
  - **Increased Tariffs and Import Restrictions:** India has raised import duties on goods like **electronics, solar panels, and toys** to protect domestic industries under **Atma Nirbhar Bharat**.
    - For instance, the **Basic Customs Duty (BCD)** increased from 14.5% in 2021 to **40% on solar PV modules and 25% on solar PV cells in 2022**.
  - **Production-Linked Incentive (PLI) Scheme:** The PLI scheme incentivizes domestic manufacturing in sectors like electronics, pharmaceuticals, and semiconductors, **which critics argue is a form of indirect protectionism**.
    - The government allocated **₹1.97 lakh crore across 14 sectors** to promote domestic production, reducing import reliance.

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- **Withdrawal from Free Trade Agreements (FTAs):** India has taken a cautious stance on FTAs, pulling out of the **Regional Comprehensive Economic Partnership (RCEP)** in 2019, citing concerns about flooding of imports.
  - This decision aligns with **Atmanirbhar Bharat's** goal but limits India's export potential in key markets.
- **Counter Arguments Suggesting Atmanirbhar Bharat is Not Protectionist**
- **Global Competitiveness Through Domestic Capacity Building:** Atmanirbhar Bharat is not solely about protecting domestic markets but aims to enhance India's global competitiveness.
  - For instance, India crossed the **Rs 90,000 crore mark in mobile exports in FY 2023**, showcasing integration into global value chains.
- **Strategic Resilience Rather Than Isolation:** The focus on self-reliance in critical sectors like **semiconductors and defense** is driven by **geopolitical and supply chain vulnerabilities** rather than protectionist motives.
- **Selective Liberalization:** India has actively pursued trade agreements with **Australia and the UAE** and the **UK and EU are negotiating new FTAs**.
  - These efforts highlight a balance between Atmanirbhar Bharat's domestic focus and external market integration.

### What Measures India Can Adopt to Balance Protectionism with Globalization?

- **Strengthen Strategic Trade Partnerships:** India can balance protectionism by engaging in carefully negotiated **Free Trade Agreements (FTAs)** that provide reciprocal benefits while safeguarding sensitive sectors.
  - For instance, agreements like the **India-Australia Economic Cooperation and Trade Agreement (ECTA, 2022)** focus on tariff reductions in key export areas **such as textiles while excluding vulnerable sectors like dairy**.
- **Promote Selective Liberalization:** India should identify sectors where liberalization enhances competitiveness and export potential while protecting nascent or critical industries.

- For example, the **Production-Linked Incentive (PLI)** schemes can coexist with **reduced tariffs on components required for electronics and EV manufacturing**.
- In 2023, mobile exports from India reached **₹90,000 crore**, showing how selective liberalization, **paired with domestic incentives**, can integrate India into global supply chains.
- **Focus on Building Resilient Supply Chains:** India must reduce over-dependence on single nations for critical imports by diversifying supply chains and fostering domestic alternatives.
  - The **China+1 strategy**, already adopted by industries like electronics, should be expanded to pharmaceuticals and renewable energy.
- **Enhance Multilateral Engagement:** India should play an active role in reviving and reforming multilateral institutions like the WTO to address trade disputes and non-tariff barriers.
  - By championing **fair trade practices and seeking dispute resolution reforms**, India can ensure a level playing field without resorting to unilateral protectionist measures.
- **Strengthen Domestic Infrastructure for Competitiveness:** Investing in world-class infrastructure, logistics, and innovation ecosystems can make Indian industries globally competitive without relying on protectionist tariffs.
  - The **PM Gati Shakti initiative** aims to reduce **logistics costs from 13% of GDP to 8%**, aligning with global benchmarks.
  - This will enable India's MSMEs and exporters to compete on cost and quality, mitigating the need for protective trade barriers.
- **Create Sector-Specific Safeguards:** India can implement targeted safeguards for vulnerable sectors while allowing liberalization in others.
  - For example, imposing **anti-dumping duties on subsidized imports in steel and aluminum** ensures fair competition while facilitating tariff reductions in sectors like textiles and electronics.
- **Leverage Digital and Services Trade:** India should capitalize on its strengths in digital services and IT by fostering global collaborations and attracting investments in high-skilled sectors.

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- The **Global Capability Centers (GCCs)** model has already generated **\$36 billion in annual revenue**, with companies like **JPMorgan and Qualcomm** expanding operations in India.
- Policies promoting services trade liberalization can ensure growth without heavy reliance on protectionist industrial policies.
- **Prioritize Skilling for Global Competitiveness:** Balancing globalization with domestic needs requires an adaptable workforce skilled in emerging industries.
  - Initiatives like **Skill India** should focus on **advanced manufacturing and renewable energy** to enhance global competitiveness.
  - By training engineers in **chip design and green technologies**, India can attract FDI in high-value sectors while reducing dependency on imports.
- **Foster Export-Oriented Ecosystems:** India must create specialized zones and clusters that cater to export-oriented industries while integrating with global value chains.
  - The **Special Economic Zones (SEZs)** model can be revamped to align with modern manufacturing and services needs, particularly for EVs and semiconductors.
  - Export hubs like Tamil Nadu's **automotive cluster**, demonstrate how targeted policies can balance global integration with local development.
- **Adopt Climate-Conscious Trade Policies:** India should align its trade policies with global sustainability trends to avoid protectionist backlash under green tariffs like the **EU Carbon Border Adjustment Mechanism (CBAM, 2023)**.
  - By investing in renewable energy manufacturing and **certifying exports as low-carbon**, India can remain competitive in green markets.
  - Programs like the **National Green Hydrogen Mission** showcase India's potential to lead in sustainable trade while integrating with global markets.

### Conclusion:

While the rise of protectionism presents significant challenges for India, particularly in terms of export competitiveness, supply chain disruptions, and foreign investments, it also **offers an opportunity for strategic**

**reorientation.** India's approach, exemplified by initiatives like **Atmanirbhar Bharat**, seeks to balance self-reliance with global competitiveness. By adopting **selective liberalization, strengthening trade partnerships, enhancing infrastructure, and focusing on resilience** in critical sectors, India can navigate the complexities of a protectionist world.



## India's Energy Evolution

*This editorial is based on "**India shows the way on energy transformation**" which was published in The Hindustan Times on 03/01/2025. The article brings into picture India's rapid economic growth, marked by an 8% rise in electricity demand, its ambitious 500 GW renewable energy target, and progress in adding 24.2 GW in 2023-24, while highlighting challenges in grid infrastructure, storage, and equitable access.*

**Tag:** GS Paper-2, GS Paper-3, Renewable Energy, Government Policies & Interventions

As India maintains its position as the **fastest growing major economy in the world**, its surging **electricity demand**, expected to rise by 8% this year, reflects the nation's rapid digital transformation and economic expansion. The country's ambitious target of deploying 500 GW of **renewable energy** showcases its commitment to sustainable growth, having already achieved universal electricity access and added 24.2 GW of renewable energy in 2023-2024.

While India's renewable energy journey marks significant progress and sets an example for other emerging economies, **critical challenges remain in grid infrastructure, storage capacity, and equitable access** that need careful attention to ensure the sustainability of this energy revolution and its benefits for all citizens.

### How India is Navigating Energy Transformation?

- **Decentralized Energy Access Solutions:** Decentralized renewable solutions like **solar mini-grids and rooftop solar systems** have emerged as critical tools to bridge India's energy divide.

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- Micro-grids, such as the **Tata Power initiative** covering 10,000 villages, provide electricity to remote areas that were historically underserved, supported by subsidies under the **PM-KUSUM** scheme.
- Moreover, the adoption of **solar powered irrigation will not only help reduce the burden of over Rs 1 lakh crore** towards electricity subsidy for agriculture but also reduce oil import bill by reducing diesel consumption by **1.38 billion liters per annum**.
- **Energy Storage-Tackling Intermittency Challenges:** To ensure a reliable grid with high renewable penetration, India is ramping up investments in battery storage systems.
  - For instance, JSW Group is set to establish **50 GWh battery manufacturing capacity in India by 2030**.
  - The **Global Energy Alliance for People and Planet (GEAPP)**, active in India, has begun deploying energy storage solutions, including battery-integrated solar farms.
  - This will enable India to stabilize its grid while meeting the growing demand for electricity.
- **Electrifying the Mobility Sector:** India is leveraging clean energy to decarbonize its transportation sector, aiming for 30% electric vehicle (EV) penetration by 2030.
  - **Electric buses** and **Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME II)** schemes have enhanced urban public transport while reducing emissions.
  - EV sales surged to over **1.5 million units in 2023**, driven by the government's **PLI Scheme for Advanced Chemistry Cells** and partnerships with companies like **Tesla**.
- **Global Advocacy and International Leadership:** India's global leadership in renewable energy is evident in initiatives like the **International Solar Alliance (ISA)** and its push for equitable energy funding at **COP29 in Baku**.
  - The **International Solar Alliance (ISA)** aims to unlock **USD 1 trillion in solar investments by 2030** through its 'Towards 1000' strategy
  - India advocates for free access to green technology and climate finance while criticizing unilateral actions by developed nations at **COP29**.
- These efforts solidify India's role as a catalyst for global energy transformation.
- **Balancing Energy Security with Sustainability:** India's energy strategy balances a shift to renewables with the need for **reliable coal-based power during peak demand**.
  - **Coal's share**, including lignite, in India's total power generation capacity dropped **below 50% for the first time since the 1960s**, but also ensured stability amid an increase in electricity demand.
  - Between April and November of 2024 alone, **India added nearly 15 GW of renewable energy capacity**, almost double the 7.57 GW added during the same period in 2023.
  - The government's phased approach ensures energy security while scaling sustainable alternatives.
- **Investing in Energy Efficiency:** Energy efficiency programs are critical to reducing emissions and improving affordability.
  - Initiatives under the **Perform, Achieve, and Trade (PAT) scheme** have saved over **68 million tonnes of CO2 emission**.
  - More than **36 crore LED bulbs** have been distributed across India over the past decade under the **UJALA scheme**, leading to annual savings of **Rs 19,153 crore**.
  - These efforts demonstrate India's dual focus on demand-side management and clean energy supply.
- **Harnessing Offshore Wind Potential:** India is exploring **offshore wind energy** to diversify its renewable portfolio.
  - Recently, India approved its first **1 GW offshore wind projects in Tamil Nadu and Gujarat**, aiming for **140 GW installed capacity by 2030**.
  - Supported by international collaborations like Denmark's **Energy Partnership**, this sector could attract investments while reducing emissions significantly.
  - Offshore wind can complement **India's solar energy push, ensuring a more balanced renewable mix**.
- **Fostering Private Sector Participation:** Private investments are central to India's energy transformation.

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- Adani Group plans to build **10 gigawatts of hydroelectric projects** overseas to achieve net zero carbon emissions by 2050.
- India's Reliance Industries Ltd plans to convert **around 5,000 existing internal combustion engine (ICE)-powered trucks into hydrogen ICE trucks**, reinforcing the importance of public-private synergies in achieving energy goals.

### What are the Key Issues Associated with India's Energy Transition?

- **Intermittency and Reliability of Renewables:** India's rapid shift to renewable energy faces challenges due to the **intermittency of solar and wind power**.
  - A lack of robust energy storage infrastructure limits the grid's ability to supply power consistently during peak demand.
  - India's **Battery Energy Storage Systems (BESS)** infrastructure remains inadequate, with the capacity to store only **33 MW**, despite generating **213 GW** of renewable energy, according to a **Confederation of Indian Industry (CII) report**.
  - Recent blackouts in states like **Maharashtra** highlight the need for greater **investment in grid stabilization technologies** like pumped hydro and advanced battery systems.
- **Dependence on Coal for Baseline Energy:** Despite the growth in renewable energy, **coal continues to dominate India's electricity generation**, creating challenges for decarbonization efforts.
  - India remained **heavily reliant on coal-based electricity during the summer of 2024**, with peak demand expected to surpass 260 gigawatts.
  - However, coal-based emissions undermine India's global commitments, including the **pledge to achieve net-zero emissions by 2070**. Balancing coal usage with renewable integration remains a critical concern.
- **Inadequate Financial Support for Green Energy:** The transition to green energy is capital-intensive, and funding gaps hinder progress, particularly for large-scale renewable projects.
  - India would need cumulative investments of USD 10.1 trillion to achieve net-zero emissions by 2070.
- Moreover, **delays in subsidy disbursal under schemes like PM-KUSUM** have slowed adoption of solar irrigation systems, impacting farmers and rural electrification.
- **Grid Infrastructure and Integration Issues:** India's aging grid infrastructure struggles to handle the **growing share of renewable energy**, leading to frequent curtailment of solar and wind power.
  - Outdated turbines have reduced wind energy's share to **just 15% of Tamil Nadu's power generation**.
    - Additionally, shortcomings in the state's wind energy repowering policy have hindered its ability to fully realize its potential.
  - **Green Energy Corridor**, aimed at improving grid connectivity for renewables, has faced delays.
- **Energy Access Inequality:** Despite achieving universal village electrification in 2018, energy access disparities persist, especially in remote and rural areas.
  - Recent survey revealed that **2.4% of Indian households still remain unelectrified**, most of them concentrated in rural northern and eastern states of Uttar Pradesh, Madhya Pradesh, Rajasthan, Haryana and Bihar.
- **Dependence on Imported Technology:** India's renewable energy expansion heavily depends on **imported solar modules, batteries, and wind turbines**, making the sector vulnerable to geopolitical risks and supply chain disruptions.
  - In 2023-24, India imported **\$7 billion worth of solar equipment**, with China supplying **62.6%** of it.
  - The **PLI Scheme for Solar Manufacturing**, is a step forward but is yet to achieve significant domestic capacity.
- **Land Acquisition and Environmental Concerns:** Renewable energy projects require **vast land parcels**, often leading to conflicts with local communities and biodiversity concerns.
  - For example, **protests against solar parks in Rajasthan and Gujarat** highlighted displacement issues and ecological disruptions.
    - In 2024, residents of Baiya village in Jaisalmer staged a demonstration attempting to **halt the construction of the Adani Solar Power Project**.

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- Additionally, studies show that **wind farms in Western Ghats have affected migratory bird patterns**, raising the need for sustainable project planning.

### What Measures can be Adopted for a More Efficient and Sustainable Energy Transition in India

- **Promoting Domestic Manufacturing of Renewable Technology:** To reduce dependency on imports, India must strengthen its domestic renewable manufacturing ecosystem, particularly in **solar modules, wind turbines, and battery systems**.
  - Expanding the **PLI Scheme for Solar Manufacturing**, can attract more investments in giga-factories. Partnerships with global leaders, **such as Reliance Industries' tie-up for advanced battery technology**, can further bolster local capacity.
    - This will shield India from geopolitical risks and supply chain disruptions.
- **Transitioning to Green Hydrogen:** Green hydrogen, derived from renewable energy, can **decarbonize hard-to-abate sectors like steel, cement, and heavy transport**.
  - The government's National Green Hydrogen Mission should include subsidies for electrolysis technology and support for R&D.
  - Large-scale hydrogen hubs should be developed near renewable energy zones to ensure affordability and accessibility.
  - This aligns with India's goal to become a global leader in green hydrogen production, leveraging its abundant solar resources.
- **Modernizing Transmission and Distribution Infrastructure:** A robust and smart grid system is crucial for handling the variability of renewable energy.
  - Investments in **smart meters, AI-based grid management, and predictive maintenance technologies** can enhance efficiency.
  - The Revamped Distribution Sector Scheme (RDSS) must prioritize reducing **Aggregate Technical and Commercial (AT&C) losses**.
- **Integrating Circular Economy Principles:** Adopting circular economy practices in energy systems can reduce waste and resource use.
  - Initiatives like **recycling solar panels and reusing materials from decommissioned wind turbines** should be incentivized.
  - Coal-dependent regions can explore **waste-to-energy projects** to manage urban waste sustainably.
    - These measures ensure resource efficiency while providing livelihood opportunities in rural areas.
- **Focus on Just Energy Transition for Coal-Dependent States:** A fair transition for coal-dependent states like **Jharkhand, Odisha, and Chhattisgarh** is critical to avoid socio-economic disruptions.
  - Skill development programs for coal workers, **alternative employment in renewable energy**, and financial assistance to state governments can facilitate a smoother transition.
  - Setting up **green industries in coal belts ensures economic diversification** while utilizing existing infrastructure.
  - A just transition framework aligns with India's equitable growth objectives and ensures no community is left behind.
- **Expanding Energy Storage Solutions:** Investing in scalable and affordable energy storage technologies like **lithium-ion, solid-state batteries, and pumped hydro** is essential for addressing the intermittency of renewables.
  - Recent battery swapping policies should be expanded for smaller EVs and rural applications.
  - Encouraging domestic production of energy storage systems under the **Production-Linked Incentive (PLI) scheme** can reduce costs and dependence on imports.
    - Energy storage will **enable round-the-clock availability of renewable energy**, stabilizing the grid and supporting peak demand.
- **Promoting Agri Voltaics for Dual Use of Land:** Integrating solar panels with agricultural practices, known as agrivoltaics, can optimize land use and benefit farmers.
  - By installing **solar panels above crops, farmers can earn additional income from selling surplus electricity** while protecting crops from extreme weather.

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- Scaling this through **subsidies or buy-back guarantees** will improve rural energy access while reducing the strain on agricultural lands.
- **Waste Heat Recovery in Industries:** India's energy-intensive industries, such as cement, steel, and chemicals, generate significant waste heat, which often goes unused.
  - Mandating **waste heat recovery systems (WHRS) in large-scale manufacturing** units can reduce overall energy consumption and emissions.
  - For instance, the adoption of such systems in cement plants has led to energy savings and reduced carbon footprints.
    - Providing fiscal incentives for WHRS installation can accelerate its uptake across industries.
- **Exploring Small Modular Reactors (SMRs) for Clean Nuclear Energy:** **Small modular reactors (SMRs)** represent an innovative nuclear technology that can **provide scalable and safer clean energy**.
  - These reactors require **smaller initial investments** compared to traditional nuclear plants, making them ideal for developing economies like India.
  - By partnering with countries like the **US**, which are advancing in SMR technology, **India can diversify its energy mix while maintaining low emissions**. SMRs also hold potential for off-grid energy applications in remote areas.
- **Policy Support for Carbon Capture and Utilization (CCU):** **Carbon capture and utilization (CCU) technologies** can complement India's efforts to decarbonize fossil-fuel-based industries.
  - Establishing policies to **incentivize the adoption of CCU in sectors like thermal power, steel, and cement** can turn emissions into valuable by-products (e.g., **industrial-grade carbonates or synthetic fuels**).
  - India's burgeoning startup ecosystem can be mobilized to develop affordable CCU technologies, reducing reliance on costly imports.
- **Energy Transition in Urban Planning:** Integrating energy-efficient infrastructure into urban development is critical to manage the rising energy demands of India's growing cities.
  - **Green building norms, district cooling systems, and the promotion of energy-efficient public transport** like metros and electric buses can significantly reduce urban energy intensity.
  - Programs like **Smart Cities Mission** should **prioritize sustainable energy solutions in planning urban expansions**.
  - By adopting low-energy urban designs, cities can contribute to the national energy transition goals.
- **Tapping Into Geothermal Energy:** Though underexplored, India has geothermal potential in regions like **Ladakh, Himachal Pradesh, and Gujarat**.
  - Developing pilot geothermal projects, particularly for heating applications, can diversify the renewable energy mix.
  - **Geothermal energy provides a stable, low-maintenance, and base-load power source**, suitable for remote regions with extreme climates.
  - Partnerships with countries experienced in geothermal technology, like Iceland, can accelerate India's capacity in this domain.
- **Biomass-Based District Heating Systems:** Biomass, sourced sustainably from agricultural residues, can be utilized for district heating systems in cold regions like **Himachal Pradesh and Uttarakhand**.
  - Such systems can replace conventional coal or diesel-based heating solutions, reducing emissions and energy costs.
  - Policies to **incentivize biomass collection and processing**, along with community-led operations, can ensure the long-term viability of these systems.
    - This approach **addresses both agricultural waste management and energy access challenges**.
- **Mandatory Renewable Energy Procurement for Corporates:** To engage the private sector in the energy transition, the government can mandate a **percentage of renewable energy procurement in corporate energy consumption**.
  - Large energy-intensive industries, IT firms, and commercial establishments can be incentivized to invest in captive renewable power projects or purchase green power from developers.
  - This can complement **India's Renewable Energy Certificates (REC) market** and encourage large-scale investments in renewables.

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- **Incentivizing Vehicle-to-Grid (V2G) Technology:** Vehicle-to-grid (V2G) technology allows **electric vehicles to feed electricity back into the grid when not in use**, thus acting as decentralized energy storage units.
  - Incentives for **V2G-enabled EVs** and integration with smart grids can help balance peak demand.
  - Deploying this **technology in urban hubs can reduce dependency on standalone energy storage systems**. This approach enhances grid stability while promoting electric mobility.

### Conclusion:

India's energy transition is driven by a vision for a **sustainable, inclusive future, leveraging clean technologies, decentralized solutions, and strong policies**. While progress is seen in renewable energy scaling, decentralized access, and private sector involvement, challenges like **grid instability, coal dependence, and energy access gaps remain**. By investing in **smart grids, energy storage, and innovations like green hydrogen**, India can build a more resilient energy system. Prioritizing just transitions for coal-dependent states and improving energy efficiency will ensure broad benefits, supporting both national growth and global sustainability goals (**SDGs 7 and 13**).



## India's Global Reach Through Its Diaspora

*This editorial is based on "[How Indian diaspora can contribute to Viksit Bharat](#)" which was published in Hindustan Times on 08/01/2025. The article highlights that Odisha hosts the Pravasi Bharatiya Divas 2025, a key event for the Indian diaspora. The event has grown over the years, fostering a strong sense of community and pride among overseas Indians.*

**Tag:** GS Paper-2, Effect of Policies & Politics of Countries on India's Interests, Indian Diaspora, Government Policies & Interventions, Welfare Schemes, Effects of Globalization on Indian Society.

The **Indian diaspora**, encompassing over **35 million people** globally in 2024, symbolizes India's vast reach

and influence. Representing the **largest diaspora worldwide**, these individuals serve as economic drivers, cultural ambassadors, and strategic allies for India. Their contributions, including **\$129.1 billion in remittances** in 2024, are celebrated during the **Pravasi Bharatiya Divas (PBD)**, held biennially on **9<sup>th</sup> January** to honor their role in shaping India's global identity. With a strong presence in over 200 countries, the diaspora bridges India with the world, fostering innovation, strengthening diplomatic ties, and enhancing India's global stature in the **21<sup>st</sup> century**.

### What Defines the Indian Diaspora?

- **Indian Diaspora:** The Indian diaspora refers to individuals of Indian origin who reside outside India, including both **Non-Resident Indians (NRIs)** and **Persons of Indian Origin (PIOs)**.
  - According to the **Ministry of External Affairs (MEA)**, as of November 2024, the total population of Overseas Indians was 35,421,987.
  - The top three countries with the largest Indian overseas populations are the **United States** (5.4 million), the **United Arab Emirates** (3.6 million), and **Malaysia** (2.9 million).
- **Categories of the Diaspora:**
  - **Non-Resident Indians (NRIs):** These are Indian citizens residing abroad **temporarily** for work, education, or other purposes.
  - **Persons of Indian Origin (PIOs):** These are foreign citizens of Indian ancestry, who may have been **born or settled abroad** for generations but retain a strong cultural connection to India.
  - **Overseas Citizens of India (OCIs):** This category includes individuals of Indian origin who **hold foreign citizenship** but are granted specific privileges by the Indian government through the **OCI card**.

### What is the Significance and Contribution of the Indian Diaspora ?

- **Economic Significance:** In 2024, India received an astounding **\$129.1 billion** in remittances, the highest for any country in a single year.
  - This represented **14.3% of global remittances**, a remarkable feat that underlines India's dominance in this sector.

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- Remittances accounted for **3.3% of India's GDP**, providing critical support to families and supporting **consumption expenditure** and investment in local economies.
- By bridging Indian enterprises with global markets and fostering collaborations, the **diaspora enriches India's business landscape**, supports underserved regions, and propels the country toward its **goal of becoming a developed economy**.
- **Role in Administration and Soft Power:** The Indian diaspora plays a crucial role in influencing **administrative frameworks** and strengthening bilateral relations with key global powers.
  - **Indian-origin professionals and lawmakers** in the US and UK promote **India-US collaborations** in trade, defense, and technology.
  - For example, Indian-origin officials have contributed significantly to the discussions around the **India-UK Free Trade Agreement**, showcasing their pivotal role in enhancing strategic partnerships.
- **Enhancing Cultural Connectivity:** Acting as cultural ambassadors, the diaspora strengthens India's soft power by promoting its traditions, art, and heritage in host countries.
  - Initiatives like **declaring Diwali as a holiday** in several US states highlight the successful integration of Indian culture abroad, fostering greater acceptance and appreciation.
  - Indian festivals, **yoga**, Bollywood, and cuisine have gained global popularity, enhancing **India's soft power**.
- **Knowledge Economy:** Indians have a significant presence in global tech hubs, for instance, CEOs of major tech firms like **Google, Microsoft, and Adobe** are of Indian origin.
  - Many diaspora members are returning to India, bringing their expertise and fostering innovation, particularly in sectors like **IT and healthcare**.
- **Philanthropic Contributions:** Indian-origin philanthropists contribute generously to causes in India, supporting education, healthcare, and rural development.
  - For example, initiatives like the **India Development Foundation of Overseas Indians (IDF-OI)** facilitate such contributions.

## What are Government Initiatives to Engage with the Indian Diaspora?

### ➤ Employment and Welfare Support:

- **E-Migrate:** This online platform regulates recruitment and provides safe avenues for Indian workers seeking overseas employment.
  - It ensures transparency, protects workers from exploitation, and simplifies the recruitment process for both employers and employees.
- **Madad Portal:** The **Madad (Help)** portal provides a grievance redressal mechanism for Indians abroad.
  - It addresses issues ranging from legal assistance to repatriation in emergencies, ensuring timely support to distressed Indians.
- **Pravasi Bharatiya Bima Yojana (PBBY):** Introduced in 2003, it is a mandatory insurance scheme for **Indian emigrant workers** in the **Emigration Check Required (ECR)** category.
  - It offers insurance coverage of **Rs. 10 lakhs** for accidental death or permanent disability, with premiums of **Rs. 275** for two years and **Rs. 375** for three years.

### ➤ Cultural and Heritage Engagement:

- **Overseas Citizenship of India (OCI) Scheme:** Grants lifelong visa-free travel and other privileges to PIOs, fostering stronger ties with India.
  - Benefits include **property ownership, financial investments, and access to educational institutions** in India.
- **Chalo India Programme:** Encourages Indian-origin youth worldwide to visit India and reconnect with their heritage.
  - This program includes cultural tours, heritage site visits, and interactions with local communities.
- **Bharat Ko Jaaniye Quiz (BKJ):** An online quiz designed to connect diaspora youth with India's history, culture, and contemporary developments, fostering a sense of pride and belonging.

### ➤ Research and Academic Initiatives:

- **Visiting Advanced Joint Research (VAJRA) Faculty Scheme:** Attracts overseas scientists to work in Indian institutions, fostering high-quality **collaborative research** in cutting-edge areas.

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- **Ramanujan Fellowship:** Provides opportunities for Indian researchers abroad to work in Indian institutions in science, engineering, and medicine.
- **Ramalingaswami Re-entry Fellowship:** Supports scientists returning to India to pursue research in life sciences and **biotechnology**.
- **Biomedical Research Career Programme (BRCP):** Facilitates career development for researchers in biomedical and public health sectors in India.
  - For instance, **DBT/Wellcome Trust India Alliance** is a collaborative partnership between the **Department of Biotechnology (DBT)**, Government of India, and **The Wellcome Trust, UK**, aimed at supporting the **Biomedical Research Career Program (BRCP)**.
- **Scholarship Programmes for Diaspora Children:** Offers financial assistance for higher education in India to children of NRIs and PIOs.
- **Community Support and Welfare:**
  - **Indian Community Welfare Fund (ICWF):** Provides emergency assistance to Indians citizens abroad, including repatriation during crises, **legal aid**, and **financial support** in emergencies.
  - **Pravasi Bharatiya Kendra:** A hub for diaspora-related activities and a resource center in New Delhi, offering facilities for conferences and events.
  - **Senior Research Associateship (SRA) - Scientist's Pool Scheme:** Administered by the **Council of Scientific and Industrial Research (CSIR)**, the scheme offers temporary placement to highly qualified **Indian scientists, engineers, technologists, and medical personnel** returning from abroad without employment in India.
- **Crisis Management and Evacuations:**
  - The government has conducted several large-scale evacuation operations to protect its citizens during crises, demonstrating robust crisis management capabilities.
  - **Operation Ganga (2022), Operation Kaveri (2023), Operation Rahat (2015), and Operation Devi Shakti (2021)** were all successful Indian government-led evacuation missions that rescued thousands of nationals and foreign allies from conflict zones.

## What are the Challenges Associated with the Indian Diaspora?

- **Economic Challenges:**
  - Indian workers in **Gulf Cooperation Council (GCC)** nations often face **job insecurity** due to volatile oil prices and changing labor laws.
    - This exposes them to **financial instability** and uncertain futures.
  - Many diaspora members, especially in **low-skilled jobs**, are unable to fully utilize their potential, leading to **underemployment and income disparity**.
- **Social and Cultural Challenges:**
  - Second and third-generation Indians face challenges in maintaining their **cultural identity**, balancing integration with host cultures while preserving their heritage.
  - Instances of **racism and xenophobia** remain significant concerns in many host countries, affecting the well-being of diaspora members.
- **Political and Legal Issues:**
  - Stricter **immigration policies** in countries like the **US and UK** create challenges for NRIs and their families, limiting their opportunities for settlement and growth.
  - **Marital and property disputes** often complicate the lives of overseas Indians, requiring diplomatic and legal interventions.
- **Engagement Barriers:**
  - Many diaspora members are unaware of **government schemes** aimed at engaging them, resulting in underutilization of these initiatives.
  - Complex processes and red tape can deter effective participation in **diaspora-focused** programs.

## What Should be Way Forward to Tap the Potential of Indian Diaspora?

- **Economic Strategies:** Enhance **skill-building initiatives** to prepare workers for global markets, focusing on high-demand sectors such as **IT, healthcare, and engineering**.
  - Streamline processes to encourage diaspora investments in India, including **simplified taxation** and **regulatory frameworks**.

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- **Cultural Integration:** Develop programs to teach Indian languages to diaspora children, **ensuring cultural continuity**.
  - Organize Indian festivals abroad to strengthen **cultural ties** and **foster community** spirit.
- **Policy Reforms:** Simplify voting mechanisms for NRIs to encourage political participation and representation.
  - Offer more privileges to **OCIs**, such as participation in local governance and access to more public services.
- **Strengthening Community Support:** Strengthen the **ICWF** to provide better crisis support, including mental health services and repatriation assistance.
  - Develop apps and portals for real-time engagement with the **diaspora**, **ensuring accessibility and ease of use**.
- **Strategic Partnerships:** Leverage the diaspora for stronger **bilateral relations** and global influence, emphasizing mutual benefits.
  - Focus on **youth-centric initiatives**, such as **cultural exchange programs** and **scholarships**, to ensure sustained connections with **future generations**.

## Conclusion

The **Indian diaspora** stands as a pillar of India's global identity, significantly contributing to its **economy, culture, and soft power**. With proactive engagement and robust policies, India can further strengthen these ties, ensuring **mutual growth** and prosperity.



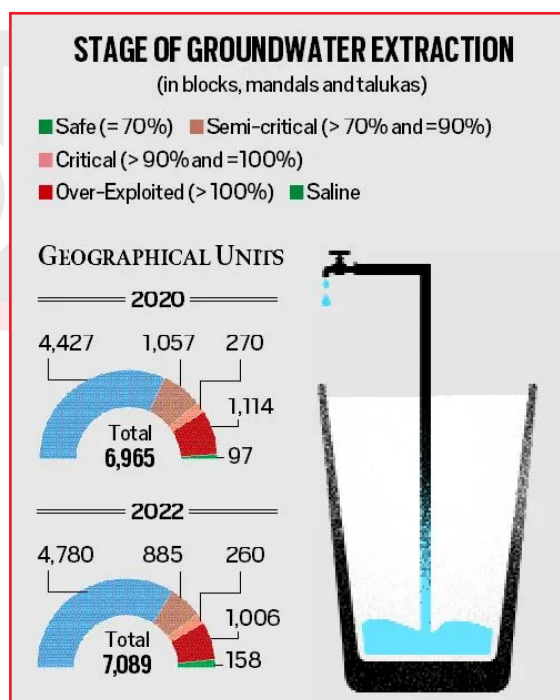
## India's Groundwater Crisis

*This editorial is based on "**Make country's groundwater sustainable**" which was published in The Hindustan Times on 10/01/2025. The article brings into picture the growing strain on India's groundwater due to increased irrigation for cultivation, worsened by population growth. Despite initiatives like the Atal Bhujal Yojana, urgent action is needed to address the looming water crisis.*

**Tag:** GS Paper-3, Conservation, Environmental Pollution & Degradation, Irrigation

India's agricultural prowess, particularly in **water-intensive crops like paddy**, comes at a severe cost to its **finite groundwater resources**. Between 2016 and 2024, while the country's population grew from **1.29 billion to 1.45 billion**, groundwater usage for irrigation jumped dramatically from **38% to 52%**. Major paddy-producing states like Punjab, Haryana, and Rajasthan face a critical situation with most districts **over-exploiting their groundwater**, leading to issues of salinization and chemical contamination. While government initiatives like the **Atal Bhujal Yojana** have helped reduce unsustainable groundwater levels from 23% to 19% across districts, the looming population growth projections demand **urgent and scaled-up interventions for water security**.

## What is the Current Scenario of Groundwater Usage in India?



- **Extraction and Availability:** India extracts nearly **25% of the world's groundwater**, making it the largest user globally.
  - **Annual groundwater extraction (2023): 241.34 bcm.**
  - **Overexploited units:** 736 assessment units (**11.23%**) show extraction exceeding replenishable recharge. (**Dynamic Groundwater Resource Assessment Report 2023**)

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- **Dependency:** Groundwater is the backbone of India's water needs:
  - 62% of irrigation needs are met through groundwater.
  - 85% of rural water supply and 50% of urban water supply depend on groundwater.

### What is the Current Regulatory Framework for Groundwater Management in India?

- **Central-Level Regulation**
  - **Central Ground Water Authority (CGWA):** Established in 1997 under the Environmental Protection Act, 1986.
    - Responsible for **issuing guidelines, granting permits, and regulating groundwater extraction** in notified areas.
    - Monitors overexploited zones and mandates rainwater harvesting in industries, housing, and urban projects.
  - **Central Ground Water Board (CGWB):** Conducts groundwater assessments, mapping, and artificial recharge projects.
    - Implements the **Master Plan for Artificial Recharge to Groundwater (2020)**, aiming for 1.42 crore recharge structures.
- **State-Level Regulation**
  - **State Groundwater Acts:** Several states, such as **Gujarat, Andhra Pradesh, Maharashtra, and Uttar Pradesh**, have enacted specific groundwater acts to regulate extraction and conservation.
    - These laws generally empower local authorities to monitor and manage groundwater.
  - **Model Groundwater Bill:** A 2017 framework for states to adopt sustainable groundwater practices, focusing on participatory and equitable use.

### What are the Key Factors Responsible for Groundwater Shortage and Contamination?

- **Water-Intensive Agriculture Practices:** India's agricultural practices prioritize **high-yield crops like paddy and sugarcane**, which are **water-intensive**, leading to excessive groundwater withdrawal.
  - **Subsidies for electricity and free water** in states like **Punjab and Haryana** encourage unregulated pumping.

- As a result, groundwater extraction reached **241.34 bcm in 2023**, with **90% used for irrigation**. For example, **Haryana faces an annual water deficit of 14 billion cubic meters**, with total water demand reaching 35 billion cubic meters per year.
- **Population Growth and Urbanization:** Rising population and rapid urbanization have amplified groundwater demand for drinking water, sanitation, and industrial use.
  - Between 2016 and 2023, India's population increased from **1.29 billion to 1.45 billion**, and urban migration has stressed city aquifers.
  - Groundwater contributes roughly **45% to urban water consumption**. Major cities like **Bengaluru** now rely on tankers due to declining groundwater levels.
- **Climate Change and Erratic Rainfall:** Climate change exacerbates groundwater stress by reducing recharge rates due to erratic monsoons and increasing evaporation.
  - The southwest monsoon, **which contributes 60% of India's groundwater recharge**, has become unpredictable, with 2023 witnessing a cumulative rainfall shortfall of **5.6%** and over **200 districts** experiencing deficient precipitation.
  - For example, **Tamil Nadu's dependence on groundwater** has surged due to reduced monsoon rainfall, causing deeper aquifer exploitation.
- **Industrial Effluent Discharge:** Unregulated industrial discharges and untreated urban **wastewater contaminate groundwater** with heavy metals and chemicals like **lead, mercury, and chromium**.
  - For instance, **contaminated water in Kanpur's industrial areas**, particularly from tanneries, contain heavy metals like **chromium and mercury**, leading to widespread health issues.
- **Fertilizer and Pesticide Runoff:** Excessive use of **fertilizers** and pesticides has led to **nitrate and phosphate** seepage into groundwater.
  - Government's recent estimates suggest that consumption of chemical fertilizers has increased by around **16% between 2015-16 & 2020-21**.
  - Consequently, about **56% of India's districts have been found to have nitrates beyond the safe limit of 45 mg/L** in their groundwater.

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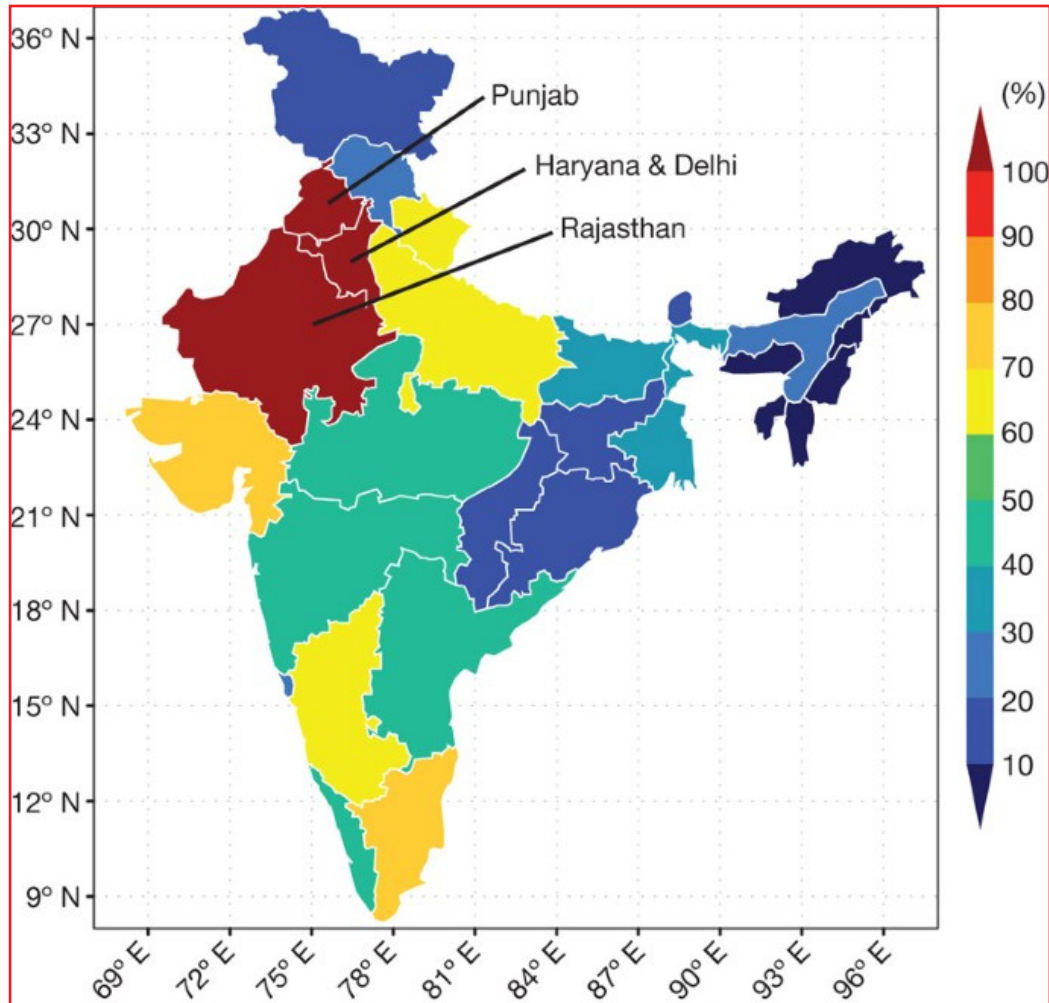
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- **Unsustainable Mining Activities:** Mining operations, especially in states like **Jharkhand and Chhattisgarh**, lead to heavy metal contamination and aquifer depletion.
  - Uranium and fluoride seepage from mines contaminates groundwater, posing severe health risks.
  - For instance, Uranium levels in groundwater exceeding the permissible limit have been detected in **Ballari, Kalaburagi, Kolar, Mandya, and Raichur in Karnataka**
    - Excessive **fluoride concentrations beyond permissible limits** are a significant concern in Rajasthan, Haryana, Karnataka, Andhra Pradesh, and Telangana.
- **Salinity from Coastal Intrusion:** Coastal regions face saline water intrusion into aquifers due to over-pumping and rising sea levels.
  - A recent CGWB report states that groundwater contamination in **Gujarat** due to salinity affects **28 out of 33 districts (85%)**, impacting agriculture and drinking water availability.



### What are the Key Government Initiatives in India for Groundwater Management?

- **Jal Shakti Abhiyan (JSA):** Launched in 2019 and now in its **5th phase ("Catch the Rain" 2024)**, the JSA focuses on rainwater harvesting and water conservation across rural and urban districts through the convergence of various schemes.

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- **Atal Mission for Rejuvenation and Urban Transformation (AMRUT) 2.0:** This mission supports rainwater harvesting via stormwater drains and promotes groundwater recharge through 'Aquifer Management Plans.'
  - **Atal Bhujal Yojana (2020):** This initiative targets water-stressed Gram Panchayats in 80 districts across 7 states, focusing on groundwater management.
  - **Pradhan Mantri Krishi Sinchai Yojana (PMKSY):** The PMKSY aims to expand irrigation coverage and improve water use efficiency through components like Har Khet Ko Pani, Repair & Renovation of water bodies, and Surface Minor Irrigation schemes.
  - **Bureau of Water Use Efficiency (BWUE):** Set up under the **National Water Mission** in 2022, the BWUE promotes **water use efficiency across sectors such as irrigation, drinking water supply, power generation, and industries.**
  - **Mission Amrit Sarovar (2022):** This mission aims to create or **rejuvenate 75 Amrit Sarovars** in every district to enhance water harvesting and conservation.
  - **National Aquifer Mapping (NAQUIM):** Completed by the **Central Ground Water Board (CGWB)** for **over 25 lakh sq. km**, this initiative supports groundwater recharge and conservation planning.
  - **National Water Policy (2012):** Formulated by the Department of Water Resources, this policy advocates for rainwater harvesting, water conservation, and augmenting water availability through direct use of rainfall.
  - **Watershed Development Component of PMKSY (WDC-PMKSY):** This component focuses on **rainfed and degraded lands**, integrating activities like soil conservation, rainwater harvesting, and livelihoods development.
- What Measures can be Adopted for Effective Groundwater Management in India?**
- **Promoting Water-Efficient Agriculture:** Adopting water-saving practices like **drip irrigation, micro-irrigation, and zero tillage** can significantly reduce groundwater extraction for agriculture.
    - Linking the **Pradhan Mantri Krishi Sinchai Yojana (PMKSY)** with the **Atal Bhujal Yojana** can ensure that efficient irrigation methods are adopted in critical groundwater-stressed regions.
  - **Managed Aquifer Recharge (MAR) with Solar Desalination:** In regions with saline or contaminated aquifers, combine **Managed Aquifer Recharge (MAR)** with solar-powered desalination plants to enhance groundwater quality and quantity.
    - **Solar desalination removes excess salts** and contaminants before recharging aquifers.
    - For example, **MAR coupled with desalination in Gujarat's Kutch region** could address both salinity intrusion and water scarcity, providing a sustainable solution for arid coastal areas.
  - **Aquifer Mapping with AI and IoT:** Use **Artificial Intelligence (AI)** and **Internet of Things (IoT)** technologies to map aquifer health and predict recharge and extraction patterns.
    - Deploy IoT-enabled sensors to monitor water levels and quality in real time, integrated into a central AI-powered decision-making platform.
    - For instance, **Maharashtra can adopt this to monitor stressed aquifers in Vidarbha** and deploy corrective actions dynamically.
  - **Biochar for Aquifer Recharge:** Introduce **biochar-based filtration systems** for aquifer recharge projects to enhance water quality and remove contaminants like heavy metals and nitrates.
    - **Biochar, derived from agricultural residues**, acts as a natural filter and reduces pollution during recharge.
    - This method can be tested in **Punjab's paddy fields** to mitigate nitrate contamination from fertilizer runoff.
  - **Rainwater Harvesting and Aquifer Recharge:** Scaling up **rainwater harvesting** structures in urban and rural areas can help recharge aquifers.
    - Linking the **Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)** with groundwater recharge projects can mobilize community efforts.
    - For example, **Tamil Nadu's ancient extensive rainwater harvesting system** can be expanded throughout the country.
  - **Crop Diversification:** Encouraging farmers to transition from water-intensive crops like paddy and sugarcane to **less water-intensive crops such as millets, pulses, and oilseeds** can reduce groundwater stress.

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- Linking the **National Food Security Mission (NFSM)** with state crop insurance schemes and **higher MSP on pulses and millets** can incentivize farmers to adopt **crop diversification**.
- **Revising Electricity Subsidies:** Reforming free or subsidized electricity policies that encourage unregulated pumping of groundwater is essential.
  - Introducing **metered electricity connections** and linking them with subsidies for efficient water usage can incentivize conservation.
  - For instance, **Gujarat's Jyotigram Yojana**, which introduced separate electricity feeders between agricultural and consumer usage, which can be expanded throughout the country.
- **Strengthening Groundwater Monitoring:** Improving monitoring networks with real-time groundwater-level sensors can provide actionable data for policymakers.
  - Integrating **India's Water Resources Information System (WRIS)** with local groundwater monitoring can ensure better decision-making.
  - For example, **Telangana's Mission Kakatiya** combines local data insights to track aquifer health and aims to restore the minor irrigation tanks and lakes.
- **Urban Water Management:** Promoting urban wastewater recycling for **non-potable uses**, such as industrial cooling and irrigation, can reduce groundwater dependency in cities.
  - Integrating the **AMRUT 2.0 (Atal Mission for Rejuvenation and Urban Transformation)** with **wastewater recycling policies** can ensure sustainable urban water use.
  - For instance, Bangalore Water Supply and Sewerage Board (BWSSB) aims to **recycle 1 crore MLD of sewage to reduce pressure on the Cauvery by 50%**, marking a significant step in the right direction
- **Incentivizing Private Sector Participation:** Encouraging corporate social responsibility (CSR) investments in groundwater recharge projects can mobilize additional resources.
  - Linking CSR with schemes like the **Atal Bhujal Yojana** can attract funding for community-level interventions.
- **Climate-Resilient Strategies:** Preparing for erratic monsoons with groundwater banking and adaptive recharge systems is crucial to mitigate climate risks.
  - Linking climate-resilient agriculture practices under the **National Adaptation Fund for Climate Change (NAFCC)** with **groundwater recharge projects** can strengthen resilience.
- **Phytoremediation for Contaminated Aquifers:** Adopt **phytoremediation**, a plant-based method, to clean up contaminated groundwater.
  - Select plants like **water hyacinth or vetiver** that absorb heavy metals and chemicals through their roots.
  - Deploying this method in heavily contaminated areas like **Kanpur**, affected by tannery effluents, can improve groundwater quality effectively.
- **Community Awareness and Participation:** Educating communities about **sustainable groundwater practices** through campaigns and training programs can empower them to adopt conservation measures.
  - Linking **Jal Shakti Abhiyan** with **local self-help groups (SHGs)** and **NGOs** can amplify outreach.

#### What India Can Learn from Other Countries for Groundwater Management?

- **Regulated Groundwater Extraction (California, USA):** California's **Sustainable Groundwater Management Act (SGMA)** enforces local plans for sustainable aquifer use with real-time monitoring.
  - India can empower **Panchayati Raj Institutions** to develop region-specific groundwater plans and enforce extraction limits.
- **Precision Irrigation (Israel):** Israel's **drip irrigation** and soil moisture monitoring save water while increasing crop yields.
  - India can integrate precision irrigation into **PMKSY**, especially in water-stressed states like Punjab and Haryana.
- **Water Trading (Australia):** Australia's **water markets** enable buying and selling of water rights within sustainable limits.
  - India can pilot water trading systems in overexploited regions like Rajasthan to promote efficient water allocation.

#### Conclusion:

India's groundwater crisis, exacerbated by **excessive use for irrigation, population growth, and contamination**,

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demands immediate and sustained action. While initiatives like the Atal Bhujal Yojana and the Jal Shakti Abhiyan show promise, further strengthening of groundwater management frameworks, **adoption of water-efficient agricultural practices**, and **innovative solutions like aquifer mapping and biochar filtration** are essential.



## Revitalizing Startups for a Resilient India

*This editorial is based on “**Startup India has fuelled entrepreneurial spirit**” which was published in The Hindu Business Line on 13/01/2025. The article highlights the transformative impact of India’s Startup India initiative in fostering a thriving entrepreneurial ecosystem, positioning startups as global leaders in sectors like fintech and healthtech. To sustain this momentum, addressing regulatory bottlenecks and boosting industry-academia collaboration is imperative.*

**Tag:** GS Paper-3, Employment, Growth & Development, IT & Computers, Mobilization of Resources

**India’s Startup India initiative**, launched in 2016, has transformed the nation into a global innovation powerhouse, fostering over 500 incubation centers and creating a robust ecosystem for **entrepreneurship**. The program has democratized innovation by breaking down bureaucratic barriers and enabling entrepreneurs from **Tier 2 and 3 cities** to compete on equal footing. From **fintech to healthtech**, Indian startups have emerged as global leaders. While India’s startup ecosystem shows immense promise, **challenges in regulatory frameworks and the need for stronger industry-academia collaboration** must be addressed to maintain this growth trajectory and fully realize its potential in the global digital economy.

### What Role does Startups Play in India’s Economic Growth?

- **Employment Generation:** Startups have emerged as significant contributors to job creation, offering employment opportunities across diverse sectors such as **IT, fintech, and e-commerce**.

- As of 31st December 2023, the **Department for Promotion of Industry and Internal Trade (DPIIT)** recognized a total of **1,17,254 startups**.
  - These startups have generated over **12.42 lakh direct jobs**, making a substantial contribution to the economy.
- Startups also foster indirect employment through **ancillary services like logistics, marketing, and vendor management**, boosting the overall employment ecosystem.
- **Driving Innovation and Technology Adoption:** Startups are at the forefront of technological innovation, leveraging **AI, blockchain**, and **IoT** to address real-world challenges.
  - For instance, **Ather Energy** is revolutionizing India’s EV sector with its cutting-edge electric scooters, while **Drones by Garuda Aerospace** are transforming agricultural productivity.
  - **India’s R&D spending** remains low but **startups are filling this gap by innovating in areas like agritech, edtech, and health-tech**.
- **Boosting Exports and Global Outreach:** Startups have significantly boosted India’s export capabilities by scaling their businesses to international markets.
  - **Fintech companies like Razorpay and Paytm** are now exporting payment solutions globally, while **SaaS (Software-as-a-Service) firms like Zoho and Freshworks** dominate international markets. India’s SaaS sector alone is expected to reach **\$100 billion in revenue by 2030**, up from **\$13 billion in 2023 (NITI Aayog)**. This global presence enhances India’s brand value and contributes to foreign exchange earnings, supporting the nation’s balance of payments.
- **Supporting Financial Inclusion:** Startups in fintech are expanding financial inclusion by offering affordable and accessible digital financial services to underserved populations.
  - **Companies like PhonePe, BharatPe, and Paytm** have brought digital payments to rural areas, with **UPI transactions in December 2024 hit a record 16.73 billion**,
  - Startups in **micro-lending and neobanking** are empowering MSMEs and individuals with access to credit.

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- India boasts one of the **world's fastest-growing fintech markets**, with a current size of **USD 584 billion** and a **projected jump to USD 1.5 trillion by 2025.**, driving inclusive economic growth.
- **Strengthening the Rural Economy:** Startups are bridging rural-urban divides by leveraging technology to empower rural communities.
  - **Agritech startups** like **DeHaat** and **Cropin** are providing real-time solutions for farmers, enhancing productivity and incomes.
  - The Indian ag tech industry is expected to experience significant growth in the coming years, with revenue predicted to reach \$204 billion by 2025.
  - Additionally, **solar startups** like **Vikram Solar** are addressing energy needs, reducing reliance on costly diesel pumps, and supporting sustainable rural livelihoods. This **decentralization of innovation** is **fostering equitable economic growth**.
- **Promoting Women Empowerment:** Startups are empowering women entrepreneurs, offering opportunities to participate actively in the economy.
  - **Ventures** like **Mann Deshi Foundation** are fostering female-led ventures through mentorship and funding.
  - Today, **18% of startups in India are led by women**, contributing significantly to the economy.
  - Initiatives like the **NSRCEL's Women Startup Program at IIM Bangalore**, a **CSR initiative by Kotak** and financial incentives under **Startup India** are creating a more inclusive ecosystem.
- **Fostering Green and Sustainable Growth:** Startups in the **renewable energy** and sustainability sectors are pivotal in combating climate change.
  - **ReNew Power** and **Ecozen Solutions** are spearheading solar and renewable energy adoption, while **Cero Recycling** focuses on **recycling end-of-life vehicles (ELVs)**
  - India's renewable energy startups are aligned with the target of **500 GW of renewable capacity by 2030**, with the green energy market expected to grow at **15% CAGR (MNRE)**.
    - These startups contribute not just to economic growth but also to environmental preservation.

- **Attracting Foreign Investments:** The Indian startup ecosystem has become a magnet for foreign direct investment (FDI),
  - Global investors are drawn to India's massive market, robust digital infrastructure, and thriving entrepreneurship.
  - Investment in the **Deep Tech (R&D-oriented) sector** has been growing consistently over the years, with a **total funding of \$6.73 billion**.
  - Startups like **Ola Electric** and **Lenskart** have raised billions in funding, bolstering economic growth and innovation.
- **Supporting MSMEs and Ancillary Industries:** Startups act as enablers for MSMEs by offering digital tools, credit, and market access.
  - **India's MSME sector**, which contributes **30% to GDP** and employs over **150 million people**, benefits from these tech-driven solutions.
  - This synergy between startups and MSMEs strengthens supply chains and improves the overall competitiveness of India's economy.

### What are the Key Issues Related to India's Startup Ecosystem?

- **Funding Constraints for Early-Stage Startups:** Many early-stage startups struggle to access adequate funding due to limited angel investors and venture capital interest.
  - In 2023, **around 35,000 Indian startups shut down** as a result of the funding winter, with fundraising for Indian startups dropping by nearly **73%**.
  - The absence of **robust seed funding mechanisms** and dependency on foreign investors leads to gaps in nurturing innovative ideas at their inception stages.
- **Regulatory and Compliance Burden:** Despite reforms under the **Startup India initiative**, startups face complex regulatory requirements, especially concerning taxation and company registration.
  - For instance, **angel tax issues (Section 56(2)(viib), Income Tax Act, 1961)** still create uncertainty for foreign investments, discouraging early-stage funding.

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- Additionally, a **World Bank** report highlights that it takes an average of **18 days to start a business in India**, while for OECD high-income countries, it **normally takes 5 procedures and 9 days** indicating the scope for simplifying compliance procedures further.
- **Lack of Skilled Talent and Brain Drain:** Startups face challenges in finding skilled talent, especially in emerging technologies like **AI, blockchain, and IoT**, while top Indian talent often migrates abroad.
  - India ranks **103rd in the Global Talent Index 2023**, making it the least desirable country among the BRICS. China leads the group at 40, followed by Russia (52), South Africa (68), and Brazil (69).
  - Additionally, over **16 lakh Indians have renounced their Indian citizenship since 2011**, with many moving to innovation hubs like the U.S.
    - This talent gap significantly impacts the growth trajectory of Indian startups in knowledge-intensive sectors.
- **Limited Infrastructure in Tier-2 and Tier-3 Cities:** Although startups are emerging from smaller towns, the lack of robust infrastructure—**such as access to high-speed internet, logistics, and incubation centres**—limits their scalability.
  - For example, around half of the people in rural India are non-active internet users, **affecting digital-first startups**.
  - While programs like the **Digital India initiative** are improving connectivity, startups in rural areas still face significant barriers in leveraging technology and infrastructure effectively.
- **Gender Inequality in Entrepreneurship:** Despite some progress, women entrepreneurs remain underrepresented in India's startup ecosystem due to societal barriers, funding biases, and limited mentorship opportunities.
  - Women-led startups account for **18% of India's total startups**, but receive less than **3% of total venture capital funding**.
  - Initiatives like the **Women Entrepreneurship Platform (WEP)** under NITI Aayog have made efforts to address these gaps, but **structural challenges persist in empowering female entrepreneurs**.
- **High Mortality Rate of Startups:** A significant percentage of startups fail within the first five years due to poor business models, lack of market research, and operational inefficiencies.
  - In India, approximately **90% of startups fail, often within their initial years**. This high failure rate is largely due to factors such as inadequate market research, poor product-market fit, financial mismanagement, team conflicts and an inability to establish a trustworthy brand.
  - High-profile failures like **Zilingo (a Singapore-India cross-border startup)** highlight the need for better mentorship, financial planning, and long-term sustainability strategies in the ecosystem.
- **Weak Industry-Academia Collaboration:** India lacks strong synergies between academia and startups, which is critical for innovation-driven entrepreneurship.
  - Unlike countries like the U.S., where institutions like **Stanford drive startups like Google**, Indian universities contribute minimally to the ecosystem, **limiting access to cutting-edge research and innovation ecosystems**.
- **Limited Market Access and Scalability:** Startups often struggle to scale their operations due to limited access to domestic and global markets.
  - For instance, **agritech startups like DeHaat** face challenges in connecting smallholder farmers to larger supply chains.
  - Despite the government's push for digital marketplaces like **ONDC (Open Network for Digital Commerce)**, **startups market penetration remains low**.
  - This bottleneck prevents innovative products from reaching broader audiences.
- **Rising Competition and Market Saturation:** The startup ecosystem, particularly in sectors like **e-commerce and fintech**, has become highly competitive and saturated.
  - Companies like **Flipkart, Paytm, and Amazon** dominate the market, leaving little room for new entrants.
  - This intense competition discourages innovation and limits entrepreneurial diversity.
- **Cybersecurity and Data Privacy Concerns:** Startups working with sensitive consumer data, especially in fintech and health-tech, face mounting challenges related to data privacy and cybersecurity.

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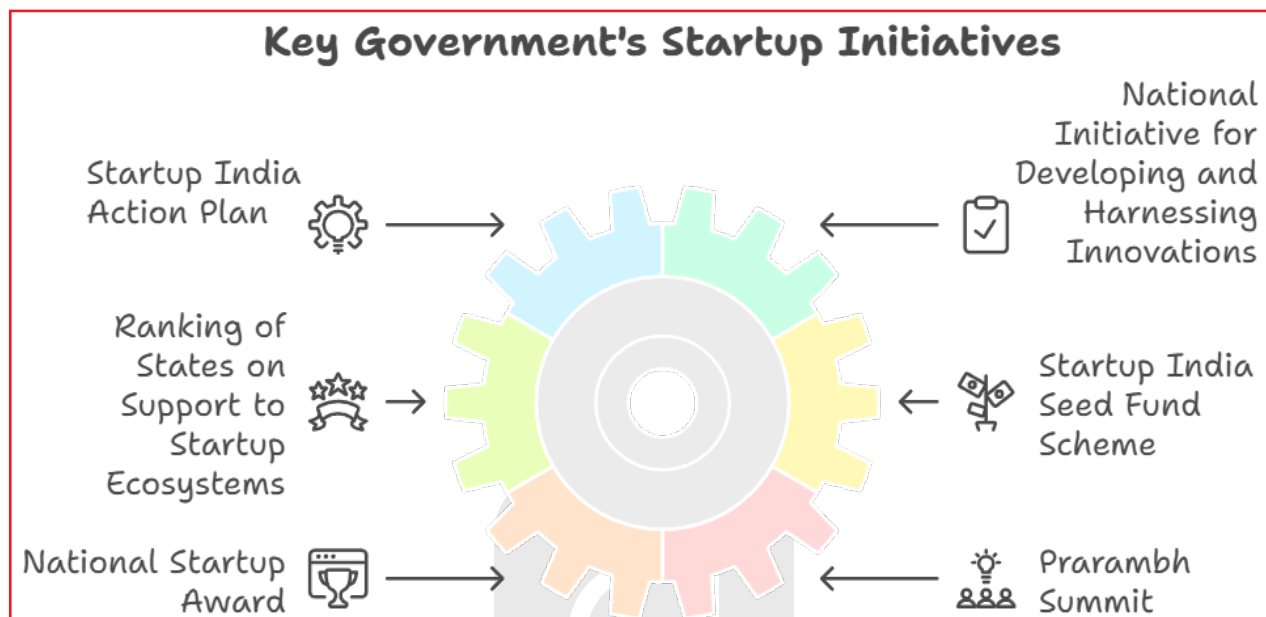
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- In 2023 alone, India saw more than **79 million cyber attacks**, marking a 15 per cent rise compared to 2022, exposing startups to reputational and financial risks.
- While the **Digital Personal Data Protection Act, 2023** aims to address these concerns, compliance with its provisions can be resource-intensive for smaller startups.



### What Measures can be Adopted to Enhance India's Startup Ecosystem?

- **Simplifying Regulatory Frameworks:** The government must streamline regulatory procedures, such as **company registration, tax filings, and compliance norms**, to reduce bureaucratic hurdles for startups.
  - Expanding initiatives like the **National Single Window System (NSWS)** to cover all states can provide a one-stop solution for clearances and approvals.
  - Removing ambiguities around taxation policies like the **angel tax** would encourage more domestic and foreign investments.
  - Strengthening grievance redressal mechanisms under schemes like **Startup India Seed Fund Scheme** can further ensure smooth operations for startups.
- **Strengthening Access to Early-Stage Funding:** To address funding gaps, the government should expand initiatives like the **Fund of Funds for Startups (FFS)** and introduce **co-investment models with private investors**.
  - A dedicated venture debt fund under **SIDBI** can be established to offer financial support to startups that face challenges in equity fundraising.
  - Promoting alternative financing methods, such as crowdfunding platforms, through updated legal frameworks can also attract small investors.
  - Strengthening credit guarantee schemes like the **Credit Guarantee Scheme for Startups (CGSS)** will enable startups to access collateral-free loans.
- **Boosting Women Entrepreneurship:** Tailored financial incentives and mentorship programs can empower more women to enter the startup ecosystem.
  - Expanding the scope of **Women Entrepreneurship Platform (WEP)** under NITI Aayog to include **sector-specific training and market linkages** can foster inclusivity.

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- Launching dedicated funds for **women-led startups** under **Startup India** can address gender-based funding biases.
- Integrating support for women entrepreneurs into state-level initiatives like **Mission Shakti in Odisha** would ensure regional outreach.
- **Enhancing Industry-Academia Collaboration:** Establishing stronger links between startups and academic institutions can foster research-driven entrepreneurship.
  - Expanding initiatives like the **National Initiative for Developing and Harnessing Innovations (NIDHI)** can promote incubation programs in universities and R&D centres.
  - Encouraging **IITs, IIMs, and other premier institutions** to establish industry-focused innovation labs can bridge the gap between academic research and market demands.
  - Aligning academia with government schemes like **Atal Innovation Mission (AIM)** can further drive knowledge-based startups.
- **Promoting Startups in Tier-2 and Tier-3 Cities:** To decentralize the startup ecosystem, the government must focus on building digital and physical infrastructure in smaller towns.
  - Expanding programs like the **Digital India Initiative** and ensuring high-speed internet connectivity through **BharatNet** will empower startups in rural areas.
  - Tailored mentorship programs and workshops in partnership with local industries can tap into the entrepreneurial potential of these regions.
- **Facilitating Market Access and Scalability:** Providing startups access to domestic and global markets is crucial for their scalability.
  - Strengthening platforms like **ONDC (Open Network for Digital Commerce)** can integrate small startups into broader supply chains and e-commerce networks.
  - Establishing **startup export hubs** under the **Champion Services Sector Scheme (CSSS)** can help startups tap into international markets.
  - Government procurement policies should mandate a certain percentage of contracts for startups, as done through the **Government e-Marketplace (GeM)** portal.
- **Improving Skilling and Talent Development:** Startups require a workforce skilled in emerging technologies like AI, blockchain, and IoT. Programs under the **Skill India Mission**, such as the **Pradhan Mantri Kaushal Vikas Yojana (PMKVY 4.0)**, should include modules designed specifically for startup demands.
  - Encouraging private-sector collaboration to offer internships and apprenticeships with startups can align skill sets with industry needs.
  - Setting up dedicated **"Startup Skilling Centres"** in partnership with platforms like **Startup India Learning Program** can prepare the next generation of entrepreneurs.
- **Encouraging Sustainable and Green Startups:** Promoting green entrepreneurship can address climate goals while boosting innovation.
  - Expanding subsidies and incentives for clean energy startups under the **National Green Hydrogen Mission** and **Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME)** can accelerate their adoption.
  - **Dedicated green startup zones** under **Make in India 2.0** can provide incubation support for companies focusing on renewable energy, waste management, and sustainable agriculture.
- **Building Cybersecurity and Data Privacy Frameworks:** Startups dealing with sensitive user data in fintech, health-tech, and edtech need robust cybersecurity frameworks.
  - Implementing stricter standards under the **Digital Personal Data Protection Act, 2023** can protect startups from reputational and financial risks.
  - Providing subsidized cybersecurity tools and training programs through the **India Cyber Crime Coordination Centre (I4C)** can strengthen defenses for smaller startups.
  - **Government-backed platforms for knowledge sharing on cyber threats** can be an added layer of support.
- **Nurturing Global Competitiveness and Innovation:** To boost global competitiveness, startups must be incentivized to adopt frontier technologies.
  - Strengthening programs like the **IndiaAI Mission** can ensure more startups work in fields like AI, quantum computing, and blockchain.

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- Supporting international collaborations through schemes like the **India-Israel Industrial R&D and Technological Innovation Fund (I4F)** can integrate Indian startups into global value chains.
- Promoting cross-border startup summits and exchange programs under **Startup India** will help Indian startups learn from global best practices.
- **Expanding Support for Agritech Startups:** Given India's agrarian economy, agritech startups can revolutionize farming practices through innovations like precision farming and supply chain digitization.
  - Expanding programs under the **Agriculture Infrastructure Fund (AIF)** can provide low-cost funding for agritech innovations.
  - Initiatives like **PM-KUSUM** can be integrated with startups working on solar-powered irrigation solutions.
    - State-level programs, such as **Maharashtra's AgriTech Policy**, can serve as models to promote region-specific agritech innovations.
- **Strengthening Mentorship and Ecosystem Networking:** Mentorship plays a key role in guiding startups through funding, operations, and scaling challenges.
  - Expanding mentorship networks under programs like the **Startup India Hub** can provide startups with access to industry experts and investors.
  - Partnering with industry associations like **NASSCOM** to hold regional startup summits can create networking opportunities.

### Conclusion:

The Startup India initiative has significantly boosted India's entrepreneurial ecosystem, driving innovation and job creation while **positioning Indian startups as global leaders**, especially in sectors like **fintech and healthtech**. However, to maintain momentum, addressing challenges such as regulatory barriers, funding constraints, and enhancing industry-academia collaborations is essential. Strengthening these areas will ensure the sustainability of startups, contribute to inclusive growth, and support key **Sustainable Development Goals (SDGs)** like **decent work (SDG 8)** and **industry innovation (SDG 9)**, fostering long-term economic progress.



## Rationalizing Subsidies in India

*This editorial is based on "**Subsidy reforms need a fresh push, open-ended sops are irrational**" which was published in The Financial Express on 14/01/2025. The article brings into picture the evolving subsidy landscape in India, highlighting reforms like fuel price deregulation and targeted LPG subsidies, while addressing persistent inefficiencies in food and fertilizer subsidies. Explicit subsidies have fallen to 9.3% of the budget in FY24, with further rationalization needed to reduce them below 1% of GDP.*

**Tag:** GS Paper-3, Agricultural Resources, Mobilization of Resources, Direct & Indirect Farm Subsidies, GS Paper-2, Government Policies & Interventions

**India's subsidy landscape** has undergone significant reforms, including fuel price deregulation, streamlined LPG subsidies, and technology-driven delivery systems. However, challenges persist, such as targeting inefficiencies in food subsidies under **Pradhan Mantri Garib Kalyan Anna Yojana** and static fertilizer MRPs despite rising costs. Explicit subsidies have decreased **from 12.7% of the budget in FY23 to 9.3% in FY24**. Achieving further rationalization below **1% of GDP** requires targeted measures without undermining genuine beneficiaries' support.

### What are Subsidies?

- **About: Subsidies** are financial assistance or benefits provided by the government to **individuals, businesses, or sectors to promote public welfare, economic development, and social equity**.
  - Subsidies are aimed at reducing the cost of goods and services, supporting vulnerable populations, and incentivizing activities that align with national priorities, such as **agricultural production, renewable energy adoption, and industrial development**.
  - These can be **direct (cash payments)** or **indirect (tax breaks or price support)**.

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## ➤ Types:

| Key Types of Subsidy                       | Description                                                                  | Examples                                                                                                                       |
|--------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Direct Subsidies</b>                    | Financial assistance directly transferred to beneficiaries.                  | <a href="#">PM-KISAN Samman Nidhi</a>                                                                                          |
| <b>Indirect Subsidies</b>                  | Support provided indirectly via tax exemptions, reduced duties, etc.         | <b>Section 80C tax exemptions</b> for investments like housing and insurance.                                                  |
| <b>Input-Based Subsidies</b>               | Reduce costs of inputs like fertilizers, seeds, electricity, and irrigation. | <a href="#">Nutrient Based Subsidy (NBS)</a>                                                                                   |
| <b>Consumption-Based Subsidies</b>         | Make essential goods and services affordable to the public.                  | Subsidized grains under <b>NFSA</b> (₹2-3/kg), <b>Subsidized rail tickets</b> for senior citizens by Indian Railways.          |
| <b>Production-Linked Subsidies</b>         | Promote production in specific sectors to boost economic activity.           | <a href="#">Production Linked Incentive (PLI) Scheme</a>                                                                       |
| <b>Export Subsidies</b>                    | Encourage exports by making them competitive in global markets.              | <a href="#">Remission of Duties and Taxes on Exported Products (RoDTEP) scheme</a>                                             |
| <b>Cross-Subsidies</b>                     | Higher prices for one group subsidize lower prices for another.              | Railways cross subsidises passenger fare making freight expensive                                                              |
| <b>Climate and Environmental Subsidies</b> | Support for eco-friendly practices and renewable energy adoption.            | Subsidies for <b>solar pumps</b> under <b>PM-KUSUM</b> , <a href="#">FAME-II Scheme</a> for electric vehicles.                 |
| <b>Food and Nutritional Subsidies</b>      | Ensure food security and better nutrition for vulnerable populations.        | <b>Midday Meal Scheme (PM Poshan)</b> , <a href="#">Anganwadi Nutrition Programs</a> under ICDS.                               |
| <b>Regional Subsidies</b>                  | Incentives for backward regions to promote equitable growth.                 | <b>North East Industrial and Investment Promotion Policy</b> ), Tribal subsidies under <a href="#">Vanbandhu Kalyan Yojana</a> |

### What Are the Major Advantages of Government Subsidies in Promoting Development and Ensuring Equity?

- **Ensuring Food Security and Alleviating Hunger:** Government subsidies, particularly on food, play a critical role in ensuring that the most vulnerable sections of society have access to affordable nutrition.
  - Subsidized grains distributed through the [Public Distribution System \(PDS\)](#) and schemes like **Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY)** have significantly reduced hunger during crises like **Covid-19**.
  - For example, **810 million beneficiaries** receive free grains under PMGKAY. In FY25, **food subsidy expenditure is projected at ₹2.25 lakh crore**, highlighting the government's focus on food security amidst global inflation and supply chain disruptions.
- **Supporting Farmers and Enhancing Agricultural Productivity:** Agricultural subsidies on **fertilizers, irrigation, and power** ensure affordable input costs for farmers, enabling them to maintain profitability and increase yields.
  - In 2022, the **Centre increased the fertilizer subsidy by more than double** due to a surge in prices, ensuring farmers were shielded from inflationary pressures.
    - Recently, Centre has extended the special subsidy of **Rs 3,500 per tonne** on [di-ammonium phosphate \(DAP\)](#) for an additional year, starting from **1st January, 2025**
  - Similarly, the [Pradhan Mantri Krishi Sinchayee Yojana - Per Drop More Crop \(PDMC\) scheme](#) government offers financial assistance of **55% for small and marginal farmers**, and **45% for others**, to install these systems.

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- **Promoting Clean Energy and Sustainability:** Subsidies in renewable energy sectors, such as solar and wind, accelerate the transition to green energy and reduce dependence on fossil fuels.
  - For instance, The **Pradhan Mantri Kisan Urja Suraksha evam Utthan Mahabhiyan (PM-KUSUM)** subsidizes solar pumps for farmers, reducing diesel consumption and groundwater depletion.
    - This reduces carbon emissions while ensuring energy equity.
- **Enabling Affordable Healthcare and Social Security:** Subsidies in healthcare ensure access to quality medical services for economically weaker sections, reducing the burden of out-of-pocket expenditure.
  - For instance, **Ayushman Bharat - Pradhan Mantri Jan Arogya Yojana** is the world's largest health assurance scheme, providing **₹5,00,000 per family** annually for secondary and tertiary care hospitalization, covering more than **50 crore beneficiaries in India's bottom 40%**.
- **Reducing Inequality through Targeted Welfare:** Subsidies reduce disparities by ensuring **basic services and goods for marginalized groups**, thus fostering social equity.
  - LPG subsidies under the **Pradhan Mantri Ujjwala Yojana (PMUY)** provided clean cooking fuel access to over **9.6 crore households**, significantly reducing health risks from indoor pollution.
  - Recent stabilizations in LPG prices since **March 2024** have improved refill rates for Ujjwala beneficiaries to **4 refills per year**, ensuring long-term adoption.
    - This **empowers women** and promotes gender equity in rural India.
- **Spurring Industrial Growth and Employment:** Subsidies in industrial sectors like manufacturing and MSMEs stimulate production, create jobs, and enhance India's global competitiveness.
  - For example, the **Production-Linked Incentive (PLI) Scheme** allocated **₹1.97 lakh crore** across 14 key sectors (e.g., electronics, automobiles, pharma) and is expected to generate **over 60 lakh jobs** and contribute significantly to GDP growth.
  - India's smartphone exports have set a new benchmark, surging past the **\$2 billion mark in October 2024, which can be credited to the PLI Scheme**.
- **Mitigating Climate Change and Environmental Degradation:** Environmental subsidies reduce reliance on harmful practices and encourage sustainable alternatives.
  - Subsidies for **electric vehicles (EVs)** under the **Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME-II)** scheme have led to the sale of **1.67 million units of EVs in FY24**, reducing CO<sub>2</sub> emissions.
  - Similarly, subsidies for afforestation and clean water initiatives under **Namami Gange** have improved river health and groundwater recharge, fostering long-term environmental equity.
- **Strengthening Human Capital through Education and Skill Development:** Education subsidies reduce barriers for **underprivileged students**, enhancing access to quality learning and boosting long-term economic prospects.
  - For example, **scholarships for SC/ST students** and subsidies under schemes like **PM Poshan (Midday Meal)** have increased enrollment and retention rates, especially among girls.
  - Recent data shows that the gross **enrollment ratio in higher education reached 28.3%**.
- **Empowering Women and Marginalized Communities:** Subsidy schemes targeted at women and marginalized groups promote inclusivity and empowerment.
  - For instance, **stand-up India subsidies** have supported over **1.8 lakh women entrepreneurs**, enabling access to affordable credit and capacity building.
  - Similarly, maternal healthcare under schemes like **Janani Suraksha Yojana** have led to a reduction in maternal mortality rates from **130 per lakh live births in 2014 to 97 in 2018-20**, fostering gender equality.
- **Facilitating Inclusive Digital Transformation:** Subsidies in the digital sector ensure access to technology and connectivity for underserved areas, bridging the digital divide.
  - For example, the **PM-WANI scheme** subsidizes Wi-Fi hotspots, ensuring internet access in rural and semi-urban regions.

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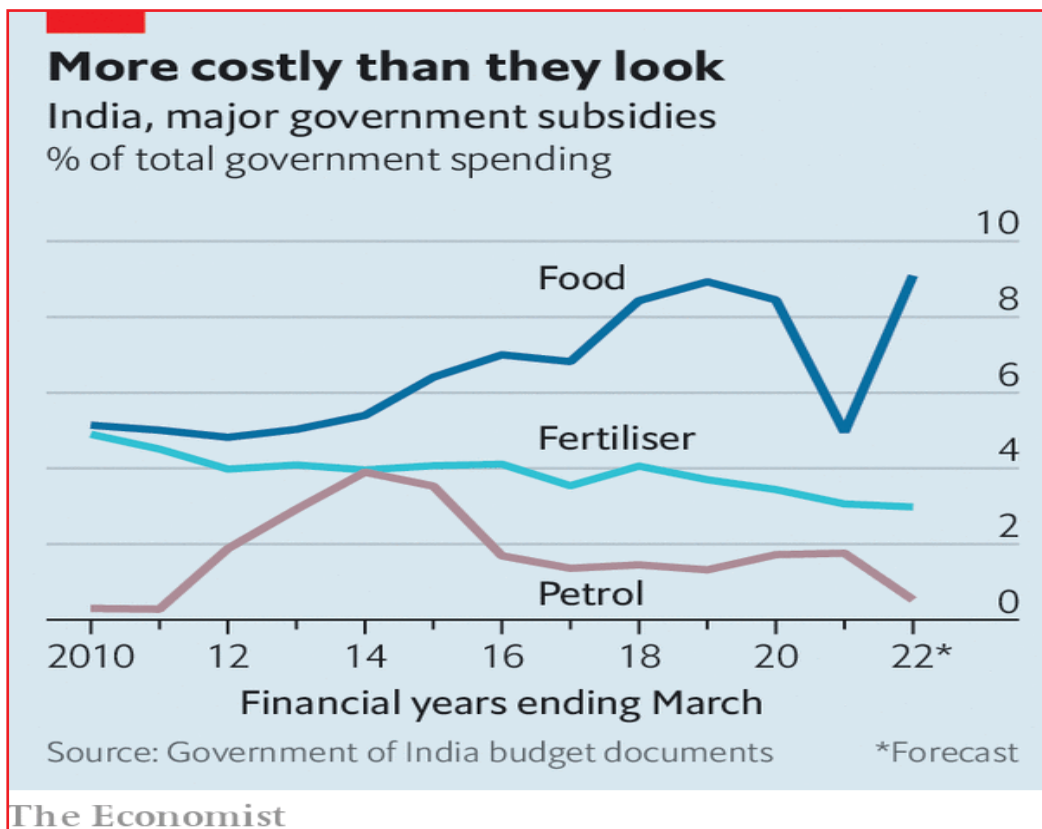
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- India's digital payments ecosystem, with **UPI transactions reaching Rs 23.25 lakh crore in December 2024**, has been bolstered by subsidies and incentives for small merchants, fostering financial inclusion and digital empowerment.

### What Are the Key Challenges Linked to Government Subsidies?

- **Fiscal Strain and Resource Misallocation:** Government subsidies place a heavy burden on public finances, often **diverting resources from critical sectors like health, education, and infrastructure**.
- The government will spend around Rs 4.1-4.2 lakh crore on major subsidies in FY25, with food subsidies taking the lead.
- While public health spending remains stagnant at just **1.84% of GDP**, far below the global average of 6%.



- **Poor Targeting and Ghost Beneficiaries:** Subsidies often fail to reach intended beneficiaries due to inefficiencies, resulting in inclusion errors and leakages.
  - The **National Food Security Act, 2013 (NFSA)** targets coverage for up to **75% of the rural** and **50% of the urban population**; however, concerns persist regarding the inclusion of undeserving beneficiaries.
  - More than **40% of the total subsidized rice and wheat** meant for distribution to households through fair-price shops (FPS) gets diverted to open markets and similar **challenges exist in LPG subsidies under Ujjwala Yojana due to poor last-mile delivery**.
  - Former PM Rajiv Gandhi once remarked that **out of every rupee spent** by the government on welfare and poverty alleviation, **only 15 paise effectively reaches** the intended beneficiaries.
- **Encouraging Overuse and Resource Depletion:** Subsidized electricity and fertilizers promote overuse, depleting natural resources and causing environmental harm.

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- The provision of free electricity for irrigation has contributed to the over-extraction of groundwater.
  - According to the **Central Ground Water Board (CGWB)**, approximately **230 billion cubic meters of groundwater** are drawn annually for agricultural irrigation, leading to rapid depletion in many regions of India.
- Similarly, **excessive fertilizer use, supported by subsidies**, has led to imbalanced soil nutrients and environmental damage, with India's agricultural sector contributing **18% of greenhouse gas emissions**.
- **Market Distortions and Private Sector Disincentives:** Subsidies distort markets by artificially lowering costs, discouraging competition, innovation, and private investment.
  - For instance, the **fertilizer subsidy of ₹1.75 lakh crore (Budget 2024-25)** has disincentivized the usage of organic and biofertilizers.
  - Similarly, heavy subsidization of LPG under Ujjwala reduces the economic viability of alternatives like **biogas**, hindering market diversification.
- **Lack of Transparency and Delayed Payments:** Subsidies often lack transparency and proper accounting, leading to **delays in fund transfers and accumulation of fiscal liabilities**.
  - For instance, the **Food Corporation of India (FCI)** accrued ₹1.18 lakh crore in debt with the **National Small Savings Fund (NSSF)** for food subsidy payments (**though cleared in 2021**).
  - Such practices undermine fiscal discipline and increase the government's interest burden.
- **Global Trade Challenges and WTO Criticism:** Subsidies attract criticism in global trade forums, leading to disputes and reputational risks.
  - India's **\$48 billion farm input subsidies in 2022-23** drew criticism from WTO members like the **US, EU, and Canada** for allegedly distorting trade.
  - These countries argue that India's subsidies breach **WTO's Aggregate Measurement of Support (AMS)** norms, giving Indian farmers an unfair competitive advantage in global markets.
- **Populism and Electoral Motivations:** Subsidies are frequently used as populist tools for electoral gains, leading to unsustainable policies and delays in necessary reforms.

- The rising trend of **freebie culture**, such as promises of **free electricity and other resources**, undermines long-term fiscal sustainability and governance credibility.
- For instance, the annual electricity bill for providing free power to the agricultural sector has surpassed **₹6,500 crore**, yet persists due to political compulsions.
- Also, Subsidies often foster **dependence rather than enabling beneficiaries** to achieve self-sufficiency or productivity improvements.
- **Weak Incentive for Innovation:** Subsidies often fail to incentivize innovation and the adoption of modern technologies, entrenching inefficiencies.
  - While **nano urea** has been introduced as a sustainable alternative, traditional **urea remains heavily subsidized**, reducing farmers' incentive to adopt newer options.
  - Similarly, **delays in fertilizer DBT rollout** and lack of awareness about advanced irrigation techniques hinder technology-led improvements in agriculture.

### How Can India Rationalize its Subsidy System for Greater Efficiency?

- **Comprehensive Implementation of DBT for Enhanced Targeting:** Complete transitioning to DBT ensures subsidies are **directed to the intended beneficiaries, reducing leakages and inefficiencies**.
  - The **successful DBT implementation in LPG under PAHAL** demonstrates the potential.
  - Extending **DBT to fertilizer subsidies** can curtail misuse and ensure that subsidies reach genuine farmers.
    - To enhance transparency, **linking DBT with Aadhaar** and real-time digital monitoring is essential.
  - The **Shanta Kumar Committee** also emphasized the importance of shifting towards cash transfers rather than **grain-based distribution**, improving efficiency and reducing leakages.
- **Dynamic Targeting Based on Poverty and Consumption Data:** Periodic revision of beneficiary lists using dynamic poverty data, such as the **Socio-Economic and Caste Census (SECC)** and **household consumption surveys**, ensures more accurate targeting.

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- The integration of **advanced analytics and AI-based data verification** can refine the subsidy pool, ensuring that only the most deserving populations benefit from support.
- These refinements align with the **Expenditure Management Commission (2014)**'s call for **rationalizing subsidies based on targeted needs**.
- **Promote Sustainable Alternatives to Reduce Overdependence:** Encouraging the adoption of technologies like **nano urea and organic fertilizers** can significantly reduce the demand for traditional subsidies.
  - Nano urea can save the government ₹10,000–₹15,000 crore annually while mitigating environmental harm.
  - Additionally, the **NITI Aayog** recommends **targeted subsidies for liquid fertilizers** to promote **fertigation in micro-irrigation systems**, ensuring more efficient resource use.
  - Linking **solar-powered irrigation systems under PM-KUSUM with fertilizer DBT schemes** can also help reduce electricity subsidies and promote cleaner, more efficient energy use in agriculture.
  - The **Kelkar Committee (2012)** suggested reducing subsidies on fuel, food, and fertilizers to curb unnecessary public expenditure.
- **Integrate Technology for Better Monitoring and Accountability:** Technologies such as **GIS and blockchain** can be deployed to improve the efficiency and transparency of subsidy distribution.
  - **GIS mapping** ensures that subsidies like fertilizers are granted only to actual cultivators, avoiding diversion.
  - **Blockchain can enhance transparency** in the Public Distribution System (PDS), ensuring that subsidies reach the correct beneficiaries.
- **Align Subsidies with Environmental Sustainability:** Subsidies should be aligned with sustainable agricultural practices and environmental goals.
  - Replacing **free electricity for irrigation with time-bound, metered electricity** can help reduce groundwater depletion, which is exacerbated by unsustainable irrigation practices.
  - Additionally, **redirecting fossil fuel subsidies to renewable energy initiatives**, can contribute to India's transition to a cleaner energy future.
- **Link Subsidies with Behavioral Change Campaigns:** Combine subsidies with behavioral change programs to ensure long-term adoption of sustainable practices.
  - Linking Ujjwala with programs like **PM Poshan (Midday Meal Scheme)** can encourage households to prioritize clean cooking for better health outcomes.
  - Similarly, **integrating subsidies for fertilizers with Soil Health Card Scheme** can promote scientific nutrient usage and reduce environmental degradation.
- **Foster Public-Private Partnerships (PPP) for Efficiency:** Encourage **Public-Private Partnerships (PPP)** to leverage private sector expertise and funding in delivering subsidies.
  - For example, fertilizer companies can collaborate with the government to promote nano fertilizers and improve distribution networks.
  - PPPs can also enhance **infrastructure for e-PoS systems in rural areas**, ensuring better delivery of food and LPG subsidies.
- **Reform Agricultural Subsidies with Crop Diversification:** Encourage crop diversification by linking agricultural subsidies to sustainable farming practices.
  - For example, **incentivizing farmers to grow pulses and oilseeds** through MSP subsidies rather than **water-intensive rice and wheat** can conserve resources and reduce buffer stock surpluses.
  - Recent procurement data shows that rice stocks are **4 times above required buffer norms**, leading to wastage and fiscal strain.
  - Integrating diversification incentives with subsidies under **Mission for Integrated Development of Horticulture (MIDH)** can promote horticulture, improve farmer incomes, and reduce environmental stress.
- **Subsidy "Credit Points" Linked to Beneficiary Performance:** Introduce a **subsidy credit system** where beneficiaries earn subsidies based on responsible usage and performance in sustainable practices.
  - For example, farmers who adopt **micro-irrigation or reduce fertilizer overuse (verified by soil health data)** earn additional fertilizer subsidies.

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- LPG subsidy eligibility can depend on **consistent Ujjwala refill usage**. This would create incentives for sustainable behavior while reducing waste.
- Linking these points to a **Unified Subsidy Wallet (Aadhaar-linked)** would make the process seamless.
- **Introduce “Graduated Exit Plans” for Beneficiaries:** Create a **graduated exit strategy** where subsidies are phased out as beneficiaries achieve self-sufficiency.
  - For example, farmers receiving free electricity for irrigation could gradually shift to **metered power tariffs** as their incomes increase.
  - Ujjwala LPG beneficiaries could transition from full to partial subsidy over 3-5 years based on household income growth, verified by **Aadhaar-linked income data**.
  - This ensures subsidies are temporary support rather than long-term dependence.
- **Encourage Agri-Startups to Replace Subsidies with Innovation:** Shift from direct subsidies to **funding agri-startups that provide sustainable farming solutions** at affordable costs.
  - Subsidies for fertilizers and pesticides could be reduced by promoting startups offering **drone-based precision agriculture** or **biological pest control**.
  - Under the **Agriculture Infrastructure Fund (AIF)**, startups providing AI-based **soil testing** or **irrigation solutions** can receive financial incentives instead of blanket subsidies.
  - This fosters entrepreneurship while reducing dependence on direct subsidies.

### Conclusion:

India's subsidy system plays a crucial role in providing social security, but **inefficiencies and fiscal burdens pose significant challenges**. To improve its effectiveness, a more targeted approach, **integrating Direct Benefit Transfers (DBT), can ensure that benefits reach the right beneficiaries**. Additionally, promoting sustainable alternatives to subsidies, such as **renewable energy and agricultural reforms**, is necessary to reduce long-term dependency. Leveraging technology can further streamline the delivery of benefits.



## Future of Indian Higher Education System

*This editorial is based on “**How Not To Run Unis**” which was published in Times of India on 14/01/2025. The article brings into picture the controversy surrounding UGC’s draft guidelines on Vice-Chancellor appointments, raising concerns over state autonomy and broader challenges in India’s higher education. Achieving NEP 2020’s vision requires urgent reforms in governance, funding, and academic quality.*

**Tag:** GS Paper-2, Education, Welfare Schemes, Issues Related to Children, Human Resource, Skill Development, Government Policies & Interventions

The recent controversy over **UGC’s draft guidelines on Vice-Chancellor appointments** has reignited the broader debate about reforms needed in **India’s higher education sector**. While the proposed centralization of VC appointments has drawn criticism for potentially undermining state autonomy, it merely **scratches the surface of the deep-rooted challenges facing Indian universities**. The **National Education Policy 2020** envisions greater institutional autonomy and academic excellence, but achieving these goals requires addressing a complex web of issues - **from governance structures and funding mechanisms to academic quality and research output**. As India aims to position itself as a global knowledge hub, the time is ripe for a comprehensive examination of the reforms needed to **revitalize our higher education landscape**.

### What are Key Reforms Taken in the Indian Higher Education System?

- **National Education Policy (NEP) 2020:** NEP 2020 is the cornerstone reform **introduced in higher education**, focusing on flexibility, multidisciplinary learning, and global standards.
  - It introduces the **5+3+3+4 structure**, multiple entry-exit options in degree programs to foster flexibility and lifelong learning.
  - The policy aims to increase the **Gross Enrolment Ratio (GER) in higher education to 50% by 2035** and emphasizes vocational education, research, and innovation.

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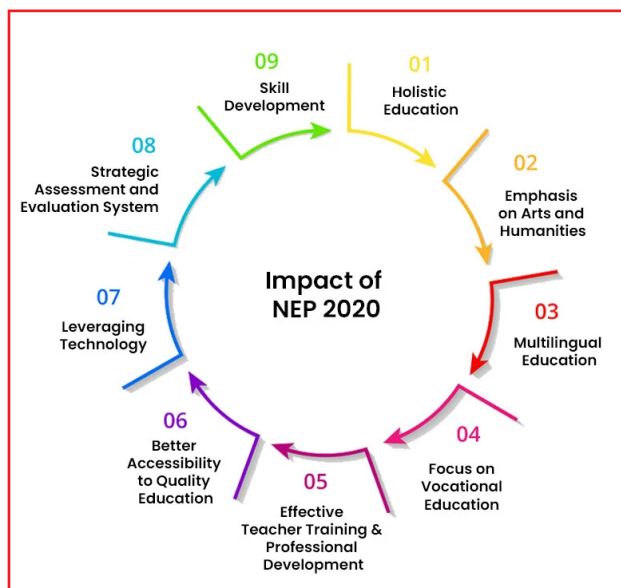
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- It replaces the **rigid discipline-based system** with an **interdisciplinary and student-centric approach**.



- **Academic Bank of Credits:** The ABC system allows students to **store and transfer academic credits earned** from different higher education institutions, providing flexibility in completing degree programs.
  - This promotes multiple entry-exit options and ensures that students' academic progress is not disrupted due to institutional changes
- **National Research Foundation (NRF):** NRF, proposed under NEP 2020, aims to improve the research ecosystem by funding interdisciplinary research and promoting academia-industry collaboration.
  - It focuses on fostering innovation and entrepreneurship, addressing societal challenges, and increasing India's global research output.
- **Emphasis on Digital Learning and EdTech:** The government has prioritized digitalization of education, especially during the **Covid-19 pandemic**.
  - Initiatives like **SWAYAM**, **DIKSHA**, and **PM eVidya** offer Massive Open Online Courses (MOOCs) and digital resources to improve access to quality education.
- **Internationalization of Higher Education:** India is opening its education system to global institutions, **allowing top 100 universities worldwide to establish campuses in India**.

- The **Study in India program** has been launched to attract foreign students, while Indian universities are encouraged to set up offshore campuses to enhance India's global education footprint.
- For instance, The **Zanzibar campus of IIT Madras** leverages the wide expertise of IIT Madras faculty in interdisciplinary education,
- **Atal Tinkering Labs and Start-Up Ecosystem:** Initiatives like **Atal Tinkering Labs** under the **Atal Innovation Mission (AIM)** encourage innovation and entrepreneurship among students.
  - These labs, equipped with **modern tools like 3D printers and robotics kits**, foster creativity and problem-solving from a young age.
- **Improving Faculty Quality and Recruitment:** The **Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT)** focuses on faculty development, teacher training, and pedagogy reforms.
- **PM SHRI Schools for Rising India:** Though focused on school education, **PM SHRI schools** aim to act as **role models for implementing NEP 2020 principles**, which will ripple into higher education.
  - These schools emphasize multidisciplinary learning, digitalization, and joyful learning experiences, preparing students for higher education challenges.
- **Flexible Degree Programs and Lifelong Learning:** Universities now offer **4-year multidisciplinary undergraduate programs** with multiple exit options to cater to diverse learner needs.
  - Lifelong learning initiatives through **MOOCs, digital libraries, and continuing education programs** ensure upskilling opportunities for working professionals.

### What are the Key Issues Associated with India's Higher Education System?

- **Poor Research Ecosystem:** India's higher education system lags in fostering a **robust research culture**, with inadequate focus on interdisciplinary and industry-oriented research.
  - This is compounded by **limited funding, infrastructure constraints, and the absence of incentives for innovation**, especially in Tier-2 and Tier-3 institutions.

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- Despite the establishment of initiatives like the National Research Foundation under NEP 2020, **India's research spending is only 0.7% of GDP, far behind the global average of 1.8%.**
  - India ranked **40th in the Global Innovation Index 2023**, trailing countries like Malaysia and Thailand.
- **Faculty Shortage and Quality Gaps:** India suffers from an acute shortage of qualified faculty, undermining the quality of education across institutions.
  - Even premier institutions like IITs and IIMs face **40% and 31% faculty vacancies**, respectively, while **most Tier-2 and Tier-3 colleges** struggle to attract skilled educators due to poor pay and lack of professional growth.
  - The **teacher-student ratio in higher education is 1:26**, far below the ideal **1:10** prescribed by global standards.
  - Despite programs like the **Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching**, recruitment and professional development initiatives have been inadequate.
- **Low Gross Enrolment Ratio (GER) in Higher Education:** India's GER in higher education remains low at **27.3% (AISHE 2023)**.
  - This highlights inequitable access to higher education, particularly for marginalized groups and rural populations.
  - Although initiatives like the NEP 2020 target a **50% GER by 2035**, challenges such as affordability, infrastructure gaps, and gender disparity persist.
- **Inadequate Industry-Academia Linkage:** There is a severe disconnect between **academia and industry**, with institutions failing to align curriculum with market demands, resulting in low employability of graduates.
  - India's employability rate stood at **54.81% in 2024** highlighting a lack of skill-oriented training.
  - Despite schemes like the **"Professor of Practice" initiative**, most colleges fail to integrate **work-related learning opportunities**.
- **Governance Challenges and Over-Centralization:** India's higher education governance faces challenges of excessive centralization, lack of autonomy, and bureaucratic inefficiencies.
  - Overlapping mandates of regulatory bodies like **UGC and AICTE, combined with limited institutional independence**, stifle innovation and hinder effective decision-making.
  - The recent controversy over UGC's draft guidelines on Vice-Chancellor appointments highlights this issue.
    - Critics argue that the proposed **centralization of VC appointments undermines state autonomy and federal principles**, reflecting the need for governance reforms to balance accountability with institutional freedom.
- **Digital Divide and Uneven Digitalization:** While digital education gained momentum **post-Covid-19**, its adoption has been uneven due to inadequate infrastructure in rural areas and smaller towns.
  - A 2022 report stated that **only about 34% of schools** in India have internet facilities till date and more than **50% do not have functional computers**.
  - Government initiatives like **PM eVidya and SWAYAM** aim to enhance access, but their outreach is limited.
  - Additionally, lack of teacher training on digital tools further restricts the potential of edtech solutions.
- **Funding Constraints and Rising Privatization:** Public spending on higher education remains low at **4.1% and 4.6% of its GDP**.
  - Due to insufficient state support, private institutions now dominate the education sector, with **78.6% of colleges in India being privately managed**.
  - This over-reliance on privatization raises concerns about affordability and quality. For instance, private colleges often charge **exorbitant fees, creating accessibility barriers for economically weaker sections**, while many lack NAAC accreditation or quality assurance mechanisms.
- **Focus on Quantity Over Quality:** India's higher education expansion has prioritized increasing the number of institutions over maintaining quality.
  - With over **56,000 colleges and 1,113 universities**, many lack proper accreditation and competent faculty.
  - India has a total of 1,113 universities and 43,796 colleges, but **only 37.6% of universities and 20.7% of colleges** are accredited by NAAC, while the rest operate below quality benchmarks.

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- This mass proliferation **has diluted academic standards**, with graduates from such institutions often deemed unemployable.
- **Limited Internationalization:** India has yet to emerge as a preferred higher education destination globally, with only **46,000 foreign students** studying in Indian institutions as of 2021-22.
- Despite favorable policies like the **“Study in India” program and NEP 2020’s push** for international branch campuses, issues like outdated pedagogy, low global rankings, and poor infrastructure deter foreign students.
- The **University of Delhi** is India’s **only institution ranked in the top 200 of the QS World University Rankings: Sustainability 2024**, reflecting India’s limited global competitiveness.
- **Lack of Innovation in Curriculum:** The higher education curriculum in India remains outdated, rigid, and disconnected from 21st-century skills and interdisciplinary approaches.
- Western institutions have successfully adopted the multi-entry and exit system, **but Indian institutions face challenges**, as noted by the Parliamentary Standing Committee on Education.
- Moreover, the majority of universities lack updated syllabi for emerging fields like **AI, robotics, and data science**, leaving graduates ill-equipped for modern job markets.
- This failure to modernize is evident in the **Global Employability University Ranking and Survey (GEURS) 2025**, only 10 Indian institutions, including IIT Delhi and IISc Bengaluru, rank among the top 250 universities globally for graduate employability.

### What Measures can be Adopted to Revitalise India’s Higher Education System?

- **Enhancing Research and Innovation:** To foster a research-driven ecosystem, institutions must focus on quality over quantity by encouraging interdisciplinary research and innovation.
- Establishing **Research and Innovation Clusters** that connect academia, industry, and government can enhance outcomes in key sectors like **AI, green energy, and healthcare**.
- The **National Research Foundation (NRF)**, proposed under NEP 2020, should work in tandem with **Atal Innovation Mission (AIM)** to promote startups and incubators within campuses.
- **Strengthening Industry-Academia Linkages:** Higher education institutions should actively collaborate with industries to co-develop market-oriented curricula, focusing on emerging areas like robotics, blockchain, and data science.
- Measures such as establishing **Centers of Excellence (CoEs)**, appointing **“Professors of Practice,”** and offering internships integrated into degree programs can bridge the skill gap.
- Linking **PM Kaushal Vikas Yojana (PMKVY)** with universities can ensure graduates are industry-ready with practical and job-relevant skills.
- **Improving Faculty Recruitment and Training:** Addressing faculty shortages and enhancing their quality is key to revitalizing higher education.
- Recruitment processes should focus on merit-based selection and the removal of bureaucratic delays, while capacity-building programs should focus on continuous professional development.
- The **Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT)** should be linked with initiatives like **SWAYAM**, enabling teachers to upskill using Massive **Open Online Courses**.
- Faculty exchange programs with international universities can further enhance teaching quality and foster global exposure.
- **Promoting Digital and Hybrid Learning:** Universities need to embrace digital transformation by adopting **hybrid models of education that integrate online and offline learning**.
- This includes creating virtual labs, investing in edtech tools, and encouraging the use of platforms like **DIKSHA** and **SWAYAM** for content dissemination.
- To bridge the digital divide, the **government must collaborate with tech firms to provide affordable devices** and reliable internet in rural and underprivileged areas.
- **Boosting Internationalization of Education:** To attract foreign students and faculty, India must reform visa policies, improve infrastructure, and create a global-friendly academic environment.

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- Indian universities should establish more overseas campuses learning from IITs and forge partnerships with top global universities to increase international credibility.
  - Simplifying procedures for **joint PhDs and dual degrees with international institutions** can further promote global academic collaboration.
- **Reforming Governance and Autonomy:** Granting greater academic and financial autonomy to higher education institutions can enable innovation and flexibility in decision-making.
  - Replacing the current regulatory multiplicity with a single, empowered body like the **Higher Education Commission of India (HECI)**, as proposed by NEP 2020, can streamline operations and reduce bureaucratic delays.
  - Institutions should also **adopt transparent governance models** by involving stakeholders, including students, faculty, and industry representatives, in decision-making processes.
  - Performance-based funding can further encourage accountability and institutional reforms.
- **Promoting Vocational Education and Skill Integration:** Higher education institutions should embed vocational education into mainstream curricula, as envisioned in NEP 2020.
  - Collaborations between universities, industries, and initiatives like the **National Apprenticeship Promotion Scheme (NAPS)** can provide hands-on training in real-world settings.
  - Encouraging **interdisciplinary degrees that combine core academics with practical skills**, such as engineering with AI or humanities with digital marketing, can create holistic graduates.
  - Integrating **skill-based certifications with university degrees** can make education both academically enriching and employment-oriented.
- **Fostering Inclusivity and Accessibility:** Higher education reforms must prioritize the inclusion of marginalized and underrepresented groups, ensuring equity in access and opportunities.
  - Initiatives like **Eklavya Model Residential Schools** and **scholarships for SC/ST and economically weaker students** should be expanded to cover higher education expenses.
- Universities must **improve physical infrastructure**, such as ramps and braille libraries, to accommodate students with disabilities.
- NEP 2020's focus on **providing education in regional languages** must be implemented to ensure inclusivity while bridging linguistic barriers.
- **Modernizing the Curriculum:** Universities should move away from rigid and outdated curricula by introducing interdisciplinary and flexible learning models.
  - Multiple entry-exit options, credit transfer systems under the **Academic Bank of Credits (ABC)**, and project-based learning should become standard practices.
  - Institutions must incorporate emerging fields like **climate science, AI, biotechnology**, and sustainability into their core programs.
  - Periodic curriculum reviews in collaboration with industries and international academic bodies can ensure that higher education remains relevant and future-ready.
- **Encouraging Public-Private Partnerships:** To address resource constraints, public and private entities should collaborate to improve infrastructure, research funding, and innovation ecosystems.
  - For example, partnerships under **Rashtriya Uchchatar Shiksha Abhiyan (RUSA)** can help scale quality improvements in public universities.
  - Private entities can be **incentivized to invest in incubation centers**, skill development programs, and scholarships for students in rural or economically weaker areas.
  - Collaborative ventures can also modernize campuses by providing smart classrooms and updated lab facilities..
- **Focusing on Regional Equity:** Ensuring equitable access to higher education across regions requires targeted investments in underserved areas, particularly in states like **Bihar, Odisha, and northeastern regions**.
  - Establishing specialized universities, such as central universities in Ladakh or the Northeast, can address regional disparities in quality education.
  - Linking **regional colleges with national institutions like IITs and NITs** through mentoring programs can improve standards and create a more balanced education ecosystem.

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- Building rural digital infrastructure and promoting community colleges can make higher education accessible for all.
- **Integration of Micro-Credentials into Mainstream Education:** Incorporating micro-credentials—short, skill-focused certifications—into degree programs can offer students flexibility and help them acquire industry-specific skills quickly.
  - For example, pairing traditional degrees with certifications in AI, blockchain, or sustainable practices can enhance employability.
  - These modular certifications would allow students to customize their education, aligning it with career aspirations.
- **Creation of Green Campuses as Learning Laboratories:** Institutions should transform into sustainability hubs by adopting green infrastructure and renewable energy solutions.
  - Green campuses can serve as living laboratories for students to learn and implement sustainable practices in real-time.
  - For instance, colleges could mandate student-led renewable energy or water management projects, aligned with the [National Action Plan on Climate Change \(NAPCC\)](#).
  - These campuses could also partner with private green tech companies to pilot cutting-edge innovations in real-world settings.
- **Leveraging Cultural Education for Global Soft Power:** Indian universities should establish specialized programs focusing on India's cultural heritage, including yoga, Ayurveda, philosophy, and performing arts.
  - By integrating these programs with global courses, such as sustainable development or mental wellness, India can leverage its rich cultural resources to enhance soft power.
  - Linking such courses with **Indian Knowledge Systems (IKS)** cells can attract foreign students while preserving India's traditions.
- **Start-Up Universities Focusing Solely on Entrepreneurship:** India should create universities exclusively focused on nurturing entrepreneurship.
  - These institutions can provide incubation support, access to venture capital, and dedicated courses in business innovation.

- Linking such universities with regional startup ecosystems can encourage students to build scalable startups.
- For instance, Gujarat's iCreate initiative can be replicated nationally.

### Conclusion:

Achieving the goals of NEP 2020 requires a comprehensive approach to governance, funding, research, and academic quality. Reforming the sector must focus on fostering **institutional autonomy, addressing faculty shortages, and improving industry-academia linkages**. Only with a systemic overhaul can India realize its aspirations of becoming a global knowledge hub. The time for decisive action is now.



## Unlocking India's Export Potential

*This editorial is based on "[How To Attract World's Top Manufacturers](#)" which was published in Times of India on 15/05/2025. The article brings into picture the ambition of making India a developed nation by 2047, achieving sustained 8% growth is non-negotiable. Export-led manufacturing, inspired by the success of nations like China and Vietnam, holds the key to creating millions of quality jobs and significantly improving living standards.*

**Tag:** GS Paper-2, Government Policies & Interventions, GS Paper-3, Achievements of Indians in Science & Technology, Liberalization, Fiscal Policy, Growth & Development

India's ambition to become a **developed nation by 2047** hinges on sustaining and accelerating economic growth beyond **8% annually**, which is essential to achieve a **\$20 trillion economy** and lift millions out of poverty. A **laser-sharp focus on exports** is critical, as global examples like China, South Korea, and Vietnam demonstrate how export-led growth drives prosperity. India must leverage its **labor force and industrial potential to attract global manufacturers**, shifting beyond its current reliance on services and capital-intensive sectors. By becoming a hub for world-class manufacturing, India can create over 200 million quality jobs and raise living standards.

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## How Export-Led Growth Drives India's Economic Transformation?

- **Driving Employment Generation:** Export-led growth can create millions of jobs by expanding **labor-intensive sectors like textiles and pharmaceuticals**.
  - Sectors focusing on global markets provide employment opportunities to India's young workforce, reducing **unemployment and underemployment**.
  - For instance, the rapid rise in smartphone manufacturing under the **Production Linked Incentive (PLI) scheme** has led to significant job creation.
    - India's smartphone exports surged to ₹90,000 crore in FY23, a doubled year-on-year, creating nearly 300,000 direct jobs and 600,000 indirect jobs
- **Reducing Trade Deficit and Enhancing Foreign Exchange Reserves:** Focusing on export growth **reduces reliance on imports, particularly in sectors like electronics and renewable energy components**.
  - Boosting exports not only narrows the trade deficit but also strengthens India's **foreign exchange reserves**, making the economy more resilient to external shocks.
  - **India's merchandise exports** rose 6% to a record **\$447 billion** during the financial year 2022-23, aided by healthy growth in outbound shipments of sectors such as petroleum, pharma and chemicals and marine and narrowing the trade deficit to **\$21.94 billion in December 2024**.
- **Integrating into Global Value Chains (GVCs):** Export-driven manufacturing **integrates India into global value chains**, facilitating access to advanced technologies and international best practices.
  - This can improve productivity and innovation, making domestic industries globally competitive.
  - For instance, **Apple and its suppliers aim to reach 32% of global iPhone manufacturing and 26% of their production value in India by 2026-27**.
- **Promoting Regional Development:** Export-oriented growth can drive industrialization in **Tier-2 and Tier-3 cities**, decentralizing economic activity and reducing regional disparities.
  - The expansion of manufacturing hubs, especially in states like **Tamil Nadu, Karnataka, and Uttar Pradesh**, has brought inclusive development to underdeveloped regions.
  - In **FY23, Tamil Nadu emerged as India's foremost exporter of electronic goods**, contributing 30% to the country's total electronic goods exports, highlighting the rise of regional export hubs.
- **Boosting Technological Upgradation:** Export-driven sectors incentivize firms to adopt **advanced technologies and improve quality standards** to compete in global markets. This leads to technological upgradation and efficiency gains across industries.
  - For instance, **Generic drugs** account for 20% of the global export in terms of volume, making the country the largest provider of generic medicines globally, driven by **adherence to global standards and innovation in generics and biosimilars**.
    - The Serum Institute of India is **recognized as the world's largest vaccine manufacturer**, with its multifunctional production facility in **Manjri, Pune**, having an annual capacity to produce 4 billion doses.
- **Strengthening India's Strategic Geopolitical Position:** Export growth enhances **India's soft power and strengthens economic diplomacy** by creating interdependencies with key trading partners.
  - This has been instrumental in strengthening trade ties with **ASEAN and the US** through bilateral and multilateral agreements.
  - For instance, **India signed trade agreements with Australia (ECTA) and UAE (CEPA) in 2022**, boosting trade volumes and is negotiating with the **EU and United Kingdom**.
- **Accelerating Green Growth and Sustainability:** Export-oriented **renewable energy** and green technology sectors can **position India as a leader in the global energy transition**.
  - Focused policies in **green hydrogen** and **solar energy exports** align with both economic and environmental objectives.
  - For instance, **domestic manufacturers exported 4.8 GW of solar modules in 2023, up 204% compared to 1.6 GW in 2022**.

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- Also, India's export of wind turbine components in 2023 nearly doubled in revenue terms compared to 2019

➤ **Attracting Foreign Investments through Export-Oriented Growth:** Countries with strong export sectors attract higher **foreign direct investment (FDI)**, as global firms prefer economies integrated into international trade networks.

- This further boosts capital inflows and technology transfer.
- India has recorded the **highest ever annual FDI inflow of USD 83.57 billion in the financial year 2021-22** with major contributions from export-focused sectors like electronics.

### What are the Key Challenges Affecting India's Export Growth and Capabilities?

➤ **High Logistics Costs and Poor Trade Infrastructure:** India's logistics inefficiencies and outdated infrastructure increase export costs, making Indian goods less competitive globally.

- **Limited container capacity, port congestion, and last-mile connectivity** challenges further exacerbate the problem.
- Despite improvements through initiatives like the **PM Gati Shakti Plan**, India's logistics cost-to-GDP ratio remains high compared to global benchmarks.
  - The **Economic Survey 2022-23** pointed out that logistics costs in India have been in the range of **14-18% of GDP against the global benchmark of 8%**
- Though India's rank in the **World Bank's Logistics Performance Index (LPI)** improved to 38th in 2023, **bottlenecks in port handling continue to impact export efficiency.**

➤ **Lack of Diversification in Export Basket:** India's export basket is concentrated in a few sectors, such as **IT services, petroleum products, and gems and jewelry**, making it vulnerable to sectoral downturns.

- Emerging sectors like **green energy exports are still underdeveloped**. A lack of **value-added exports**, particularly in agriculture and textiles, further limits growth potential.
- In FY23, **petroleum products alone accounted for 21.1% of total merchandise exports**, while India's merchandise exports fell 4.83% in November 2024.

➤ **Weak Integration into Global Value Chains:** India's participation in GVCs remains limited due to inadequate **supply chain networks, low R&D investments, and lack of trade facilitation agreements.**

- Unlike **China and Vietnam**, India has struggled to position itself as a reliable supplier for global manufacturing hubs.
- Despite being the **second-largest textile producer globally**, India lags behind Bangladesh in textile exports due to limited automation and innovation.
  - Though this can be **partly attributed to Bangladesh's duty and quota-free access as a Least Developed Country**, structural differences still persist between India's and Bangladesh's textile industries.
- Also, a challenge to India's aspirations of becoming a manufacturing hub is the **10% import duty on information and communication technologies**, which is higher than Vietnam's average import duties of approximately 5%.

➤ **Trade Protectionism and Geopolitical Uncertainties:** The rise of **trade protectionism, tariffs, and shifting geopolitical alignments** pose significant challenges to India's export growth.

- For instance, developed countries like the **US and EU have imposed carbon tariffs and stricter environmental standards**, which could impact India's carbon-intensive exports.
  - Additionally, global supply chain disruptions caused by the **Russia-Ukraine war have affected critical raw materials.**
- **Example:** Once the **Carbon Border Adjustment Mechanism (CBAM)** is fully implemented, **India will incur a duty of ₹173.8 per tonne (₹15,394) on its steel exports to the European Union (EU).**

➤ **Limited Export Financing and Credit Accessibility:** Exporters, particularly small and medium enterprises (SMEs), **face challenges in accessing affordable export financing.**

- High interest rates, complex lending procedures, and limited awareness of export credit schemes restrict their capacity to scale up operations and expand to new markets.
- Recently, Indian exporters are experiencing a significant credit crunch, despite overall growth in economic lending.

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- **Export credit has declined by 5% over the past two years**, with priority sector lending for exports dropping by **41%**.
  - The **Federation of Indian Export Organisation (FIEO)** has raised alarms, urging the Reserve Bank of India and the finance ministry to take immediate action on this issue.
- **Non-Tariff Barriers (NTBs) in Key Markets:** Non-tariff barriers, including stringent **quality standards, technical regulations, and certification requirements**, act as significant obstacles for Indian exporters.
- Key markets such as the EU and US impose stricter standards on pharmaceuticals, agro-products, and engineering goods, increasing compliance costs.
  - In the past four years, **3,925 human food export shipments from India have been rejected at US customs**, due to non-compliance with sanitary and phytosanitary measures.
  - Also, in 2023, the **European Union** issued a rise in alerts over **pesticide residues found in rice shipments**, especially basmati from India and Pakistan, which **did not meet the EU's maximum residue limits (MRLs) for pesticides**.
- **Volatile Global Demand and Recessionary Pressures:** Global economic slowdowns and inflationary pressures in developed markets reduce demand for Indian exports.
- Key sectors like **IT services and textiles** are particularly sensitive to these fluctuations.
  - The **ongoing monetary tightening in the US and EU** has constrained consumer spending and import demand.
  - For instance, **textile and apparel exports for FY24 saw a 3.24% decline**, totaling **US\$ 34.4 billion** (though recently improved).
- What Steps Can India Take to Boost Export Growth and Capabilities?**
- **Modernizing Trade Infrastructure to Reduce Costs:** India must continue upgrading its **logistics and trade infrastructure** to reduce export costs and improve efficiency.
- Expanding multi-modal transport networks through the **PM Gati Shakti National Master Plan** can complement the ongoing **Bharatmala** and **Sagarmala** projects, ensuring seamless connectivity from production hubs to ports.
- Streamlining **customs processes using digital tools**, such as **AI-based risk management systems**, will also cut export delays.
  - Special focus should be given to creating **export hubs near ports to minimize transportation bottlenecks**.
- **Diversifying Export Basket and Markets:** India needs to move beyond its reliance on traditional export items like petroleum products, IT services, and gems and jewelry by **promoting high-value manufacturing and processed goods**.
- Encouraging exports in sectors like **renewable energy, semiconductors, and electric vehicles** can tap into global demand for green technologies.
  - At the same time, trade agreements like **India-Australia ECTA** and **India-UAE CEPA** should be leveraged to access **non-traditional markets in Latin America, Africa, and Oceania**, reducing dependency on the US and EU.
- **Promoting MSMEs as Export Powerhouses:** Micro, Small, and Medium Enterprises (MSMEs), which contribute nearly **45% to India's exports**, need enhanced financial and technological support to scale globally.
- Linking the **RAMP (Raising and Accelerating MSME Productivity)** program with **TIES (Trade Infrastructure for Export Scheme)** can provide targeted assistance to MSMEs for upgrading manufacturing capabilities and improving logistics.
  - Additionally, **facilitating access to export credit at lower interest rates** and expanding marketing platforms like **GeM** for global trade can empower MSMEs to compete in international markets.
- **Enhancing Technological Upgradation in Manufacturing:** Indian industries need to adopt advanced manufacturing technologies, including **automation, robotics, and artificial intelligence**, to improve product quality and competitiveness.
- Expanding the scope of **PLI (Production Linked Incentive)** schemes to cover more emerging sectors such as **precision machinery** can incentivize industries to modernize.
  - Integrating the **Digital India** initiative with **industrial clusters** can further drive adoption of **smart manufacturing technologies**, enabling participation in global value chains.

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- **Strengthening Global Value Chain (GVC) Integration:** India must position itself as a reliable supplier in global value chains by focusing on sectors like **electronics, automotive components, and textiles**.
  - Encouraging joint ventures with global firms and creating manufacturing clusters similar to **Vietnam's electronics hubs** can attract global investments.
  - Linking **PLI schemes** with **Skill India** programs will ensure the availability of a trained workforce to **meet GVC requirements**, enabling Indian firms to serve as suppliers for global companies like **Apple and Samsung**.
- **Addressing Non-Tariff Barriers:** To counter NTBs in global markets, India must develop **domestic testing, certification, and quality assurance mechanisms** that align with international standards.
  - Establishing **mutual recognition agreements (MRAs)** with key trading partners can reduce compliance costs for exporters.
  - Linking **Quality Council of India (QCI)** initiatives with export promotion councils will help exporters navigate global regulatory frameworks effectively.
- **Expanding Digital Trade and E-Commerce Exports:** India must capitalize on the booming global e-commerce market by promoting digital trade.
  - Empowering India manufacturers to sell on international **e-commerce platforms** and facilitating cross-border digital payments will enhance their global reach.
  - The **Open Network for Digital Commerce (ONDC)** can be **integrated with export promotion initiatives** to enable Indian small businesses to participate in the global digital economy.
  - India should actively market its products and services under the **"Brand India" initiative to enhance visibility and demand in international markets**.
- **Strengthening R&D for High-Tech and Innovation Exports:** India needs a focused push on research and development to boost innovation-driven exports, particularly in sectors like **pharmaceuticals, semiconductors, and artificial intelligence**.
  - Allocating a higher share of GDP to R&D and creating export-focused innovation parks will enable Indian firms to compete in high-value global markets.
- **Collaborating with global universities and organizations** can enhance technology transfer and foster innovation ecosystems.
- **Establishing India as a Global Skill Export Hub:** India can actively promote itself as a hub for skilled manpower exports by entering into agreements with developed countries **facing aging populations and labor shortages**.
  - The **Global Talent Partnership Model** can allow Indian workers to receive training tailored to the needs of host countries, particularly in **high-demand sectors like healthcare, construction, and IT**.
  - This strategy will not **only boost remittances** but also create a global workforce branding for India.
- **Creating Export-Linked Special Purpose Vehicles (SPVs):** India can set up export-specific SPVs that aggregate resources from **industries, states, and trade councils** to collectively focus on scaling exports in a single sector.
  - For example, **an SPV for green hydrogen or semiconductors could bring together R&D funding, infrastructure investments, and export financing** under one umbrella.
  - This approach will help industries move faster in developing high-potential export sectors without overlapping or fragmented efforts.
- **Promoting Export of Space Technologies:** India's space sector, led by ISRO, has gained global recognition for low-cost and reliable space missions.
  - By leveraging this reputation, India can position itself as a **major exporter of space technologies**, including satellites, launch services, and space-related components.
  - Collaborations with private players under the **Indian Space Policy, 2023**, and branding Indian space technologies for commercial use globally, can create a unique export niche.

#### What are the Key Export Hubs in India?

- **Gujarat:** Textiles, petrochemicals, and gems. Major hubs: Mundra, Kandla ports.
- **Tamil Nadu:** Automobiles, electronics, textiles. Key port: Chennai.
- **Maharashtra:** Pharmaceuticals, IT services, engineering. Key port: JNPT.

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- **Karnataka:** IT services, aerospace, electronics. Bengaluru as an IT hub.
- **Andhra Pradesh:** Marine products, agro exports, textiles. Key hub: Visakhapatnam.
- **Rajasthan:** Gems, jewelry, handicrafts. Notable hubs: Jaipur, Jodhpur, Udaipur.
- **West Bengal:** Jute, tea, leather. Key hub: Kolkata.
- **Odisha:** Minerals, steel, aluminum. Key port: Paradip.
- **Assam & North-East:** Tea, organic products, handicrafts. **Key focus: ASEAN connectivity.**

### Conclusion:

India stands at a pivotal moment where export-driven growth can transform its economic future. By **leveraging digital capabilities, strengthening manufacturing prowess, and positioning itself as a reliable alternative in global value chains**, India can become a major export powerhouse. Strategic focus on emerging sectors like **green technology, space tech, and high-value manufacturing**, combined with infrastructure modernization and MSME empowerment, will be key to reaching the \$20 trillion economy goal by 2047.



## Rise of Quick Commerce in India

*This editorial is based on “**Foster competition: Policy should support, not restrict quick commerce**” which was published in Business Standard on 06/01/2025. The article brings into focus the evolving landscape of India’s*

*e-commerce, with quick commerce ventures like Zepto and Blinkit reshaping retail through instant delivery. Amid rapid growth and a \$5.5 billion market share, concerns raised by the Confederation of All India Traders (CAIT) have led to government scrutiny over their business practices.*

**Tag:** GS Paper-3, Capital Market, Industrial Growth, Industrial Policy

**India’s e-commerce revolution** has entered its next frontier with **quick commerce** emerging as a game-changing innovation. While established players like **Amazon and Flipkart** dominate traditional e-commerce, ventures like **Zepto, Blinkit, and Dunzo** are carving out a distinct market in instant gratification retail. However, their meteoric rise and aggressive expansion have **drawn scrutiny from government authorities following concerns raised by the Confederation of All India Traders (CAIT)** about their business practices and market impact. As India’s overall e-commerce market surges toward an **estimated \$200 billion by 2026**, quick commerce represents both an evolution and disruption of digital retail, accounting for nearly \$5.5 billion of this growing pie.

### What is a Quick Commerce?

- **Quick commerce**, often referred to as **q-commerce**, is a disruptive business model in the e-commerce landscape that focuses on **ultra-fast delivery of goods and services**, typically within **10 to 30 minutes**.
- It caters to **consumers’ demand for instant gratification** by delivering essential items such as groceries, medicines, personal care products, and even cooked food at lightning speed.

### How Quick Commerce is Different From Traditional E-Commerce?

| Aspect                 | Quick Commerce                                                                                                                                         | Traditional E-Commerce                                                                 |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| <b>Delivery Speed</b>  | Ultra-fast delivery, usually within 10-30 minutes.                                                                                                     | Delivery timelines range from 1-7 days.                                                |
| <b>Product Range</b>   | Limited to <b>fast-moving consumer goods (FMCGs)</b> , essentials like groceries, medicines, and personal care items. (Currently undergoing expansion) | Broad range, including electronics, apparel, furniture, and non-urgent goods.          |
| <b>Inventory Model</b> | Uses <b>micro-warehouses</b> or “ <b>dark stores</b> ” located close to customers for hyper-local inventory management.                                | Relies on <b>centralized warehouses</b> spread across regions with larger inventories. |

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|                             |                                                                                                                              |                                                                                                              |
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| <b>Target Audience</b>      | Targets <b>impulse buyers</b> or those with urgent needs (e.g., groceries for cooking or emergency medicines).               | Caters to <b>planned purchases</b> like <b>big-ticket items</b> , offering variety and price deals.          |
| <b>Technology Use</b>       | Relies on <b>advanced AI for hyper-local demand prediction</b> , real-time inventory updates, and optimized delivery routes. | Uses <b>large-scale logistics networks</b> and predictive analytics for bulk shipments.                      |
| <b>Pricing Strategy</b>     | Focuses on <b>convenience and speed</b> , often charging premium delivery fees;                                              | <b>Heavy discounts, deals, and seasonal offers</b> to attract bulk buyers.                                   |
| <b>Environmental Impact</b> | Higher emissions due to <b>frequent, small deliveries and increased single-use packaging waste</b> .                         | Lower emissions per order due to bulk shipping but long-haul logistics still contribute to carbon footprint. |

### What are the Key Opportunities Associated with Quick Commerce?

- **Enhanced Urban Consumer Convenience:** Quick commerce caters to the growing **demand for ultra-fast delivery**, especially in urban areas, where **busy lifestyles prioritize convenience**.
  - With rising internet penetration and smartphone usage, urban consumers are increasingly relying on platforms like **Blinkit, Zepto, and Swiggy Instamart** for instant delivery of groceries, medicines, and personal goods.
    - The rise in demand for quick delivery services, **particularly post-Covid-19**, has made this sector a crucial part of the urban retail ecosystem.
  - **India's internet landscape** is projected to reach over **900 million users by 2025**, with rural India driving much of this growth, driving demand for e-commerce services.
- **Boost to Employment Generation and Gig Economy:** The rapid expansion of quick commerce is **creating significant employment opportunities**, particularly for delivery personnel and **micro-warehouse staff**.
  - It has also contributed to the **gig economy**, offering flexible earning opportunities for a large section of the workforce.
  - **NITI Aayog's** report on "India's Booming Gig and Platform Economy" projects **India's gig workforce to reach 23.5 million by 2029-30**, comprising 6.7% of the non-agricultural workforce and 4.1% of total livelihoods.
- Also, the **growth of quick commerce also opens up part-time or night-shift opportunities**, allowing individuals working during the day to earn additional income.
  - This flexibility further strengthens the gig economy, **providing diverse earning avenues for the workforce**.
- **Driving Innovation and Technology Adoption:** Quick commerce is driving advancements in technology, including **AI-powered demand forecasting, inventory optimization, and route planning**.
  - Companies are innovating with **micro-warehousing models, dark stores**, and predictive algorithms to ensure rapid fulfillment of orders.
  - This focus on technology integration aligns with the goals of the **Digital India Mission**, further **boosting India's digital economy**.
  - For instance, **Zepto leverages advanced AI and machine learning technologies** for demand forecasting, efficient inventory management, and optimized delivery routes.
    - The sector is also leveraging technologies like **drone-based delivery pilots** in remote areas.
  - **Swiggy Instamart launched InstaWarmer at CyberHub, Gurugram**, offering an interactive and innovative way for visitors to experience instant warmth during Delhi's winter chill.
- **Expansion into Tier-2 and Tier-3 Cities:** Quick commerce has immense potential to expand into **Tier-2 and Tier-3 cities**, where **digital adoption and e-commerce penetration are increasing**.

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- This expansion can bridge the **gap between urban and semi-urban consumers**, enabling smaller cities to access the same level of convenience as metros.
  - Tier 2 and Tier 3 cities accounted for **60% of India's overall e-commerce demand in 2023**, with a **projected annual growth rate of 30% by 2025**, indicating strong growth potential.
  - **Supporting Emergency and Essential Deliveries:** Quick commerce plays a critical role during emergencies by enabling instant delivery of medicines, baby products, and other essentials.
    - During the **Covid-19 pandemic**, quick commerce platforms proved indispensable in ensuring the supply of essential goods during lockdowns.
    - Expanding this **capability further can provide critical support during natural disasters** or public health emergencies.
    - For instance, **amid Bengaluru's water crisis 2024, Swiggy Instamart partnered with Earth Fokus** to deliver water-saving aerators within 10 minutes.
  - **Contribution to the Startup Ecosystem and Investment Growth:** The quick commerce sector adds momentum to India's booming startup ecosystem by attracting significant venture capital and global investments.
    - It has become a **high-growth sector, with startups valued at billions of dollars**, positioning India as a global innovation hub.
    - In 2023, as venture capital funding for startups dwindled, **Zepto defied the trend to become India's 84th unicorn**.
  - **Driving Export of Quick Commerce Expertise:** As India's quick commerce companies grow, they have the potential to export their expertise and business models to emerging markets in **Southeast Asia and Africa**.
    - This would not **only boost India's global presence but also contribute to the export of Indian technologies** and logistics solutions.
    - Companies like Swiggy and Zomato are already exploring market expansion opportunities in regions like **Southeast Asia**.
- What are the Key Issues Associated with the Quick Commerce Landscape?**
- **Worker Exploitation and Unethical Labor Practices:** Delivery riders face immense pressure to **meet ultra-fast delivery targets**, often compromising their safety and well-being.
    - This **gig-based model lacks labor protections** and is heavily criticized for promoting unsafe working conditions with adequate **social security, insurance, or fixed salaries**, leaving them vulnerable to financial instability.
    - In social media, a video shared by a delivery agent, claiming to **earn just Rs 300 for six hours of work on Diwali**, sparked an online debate about gig economy working conditions, particularly during festive seasons.
      - In November 2024, Bengaluru traffic police collected **₹30.57 lakh in fines from delivery riders in a crackdown**.
    - Protests by gig workers demanding better pay and benefits have been witnessed across cities like Bengaluru and Mumbai.
  - **Unsustainability of the Business Model:** The quick commerce business model heavily relies on **discounts, cash burn, and investor funding**, making it unsustainable in the long term.
    - Companies struggle to **balance operational costs with profitability**, as high delivery expenses and customer acquisition costs erode margins.
    - Overdependence on venture capital without a **clear path to profitability** raises concerns about the sector's viability.
    - For instance, industry reports indicate that **Zepto has burned through approximately Rs 1,200 crore in the last quarter of 2024**, averaging nearly ₹400 crore per month.
      - Despite high valuations, most players remain unprofitable, relying on frequent fund infusions to survive.
  - **Impact on Local Kirana Stores:** The rapid expansion of quick commerce platforms has adversely affected local **kirana stores, which have traditionally been the backbone of Indian retail**.
    - The convenience, discounts, and ultra-fast deliveries offered by these platforms have led to a significant shift in customer preferences, **resulting in reduced footfall and sales for neighborhood shops**.
    - Additionally, the **disruption of supply chains and dependency on aggregators for survival** increase financial strain on small retailers.

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- **Strain to Urban Infrastructure and Traffic Congestion Issues:** Quick commerce adds strain to already overburdened urban infrastructure, with **delivery fleets contributing to traffic congestion and pollution.**
  - The constant movement of delivery riders on **two-wheelers**, particularly during peak hours, **creates inefficiencies in traffic management.**
  - The lack of dedicated delivery lanes or logistics infrastructure further exacerbates these problems.
  - **Mumbai and Bengaluru have been ranked 5th and 10th in the global ranking of urban congestion**, contributing significantly to peak-hour traffic.
- **Environmental Impact of Rapid Deliveries:** The quick commerce sector is contributing to **rising carbon emissions and packaging waste**, with most deliveries relying on non-sustainable practices.
  - Fast deliveries require extensive use of motorbikes and single-use plastic packaging, increasing the environmental burden.
    - The sector lacks a unified effort to adopt **green logistics or carbon-neutral delivery practices.**
  - Though Zomato and Swiggy initiated a move to reduce plastic waste by introducing **100% plastic-neutral deliveries**, they failed to implement them.
    - E-commerce transportation contributes significantly to **CO<sub>2</sub> emissions**, with India accounting for **285g CO<sub>2</sub> per parcel**, making up **51% of total delivery emissions.**
- **Limited Focus on Tier-2 and Tier-3 Cities:** While quick commerce thrives in Tier-1 cities, it has largely failed to penetrate Tier-2 and Tier-3 cities, where infrastructure and demand patterns differ.
  - **Poor digital penetration, lower disposable incomes, and logistical challenges** hinder the sector's growth in semi-urban and rural areas.
    - This limits the scope of market expansion and keeps quick commerce confined to urban hubs.
  - For instance, while Blinkit offers services in 26 cities, 80% of the new dark-store openings took place in the top **8 cities only.**
- **Consumer Protection Concerns:** The push for speed in deliveries often results in quality compromises, with incorrect or damaged products being delivered to customers.

- Additionally, **opaque pricing structures, hidden delivery fees, and inconsistent refund policies** harm consumer trust.
  - Lack of regulatory oversight on quick commerce operations raises issues of accountability and transparency.
- A recent report highlights that **48% of online shoppers faced issues with incorrect products due to return and refund policies**, while 20% received fake or counterfeit items at least once in the past year.

### How India Can Effectively Regulate Quick Commerce and the Broader E-Commerce Sector?

- **Strengthen Labor Protections for Delivery Personnel:** The government must mandate **fair wages, insurance, and safety measures** for gig workers in the quick commerce and e-commerce sectors.
  - This can be achieved by enforcing the provisions under the **Code on Social Security, 2020**, which aims to provide social security benefits to gig and platform workers.
  - **Companies should also be required to offer riders health insurance**, accident coverage, and fixed working hours to reduce exploitation and improve their quality of life.
- **Introduce Delivery Time Standards to Ensure Safety:** Regulating delivery timelines is critical to prevent overburdening delivery riders and promoting road safety.
  - The government can mandate a **minimum delivery time for non-essential goods to discourage unsafe practices** and over-speeding.
  - A **public-private dialogue** between regulatory bodies and companies can ensure timelines are customer-friendly yet realistic, balancing speed with rider safety.
- **Environmental Standards for Sustainable Logistics:** To address rising carbon emissions and packaging waste, the government can introduce green logistics mandates.
  - **Quick commerce and e-commerce** firms should transition to electric vehicles (EVs) and adopt eco-friendly packaging under the **FAME scheme** and the **Plastic Waste Management Rules, 2022.**

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- Tax benefits and incentives could encourage companies to adopt sustainable practices, such as setting up EV-based delivery fleets or using biodegradable materials.
- **Create a Centralized Regulatory Authority for E-Commerce:** A **National E-Commerce Regulatory Authority** should be established to oversee compliance, resolve disputes, and monitor fair practices in the sector.
  - This body can handle issues like predatory pricing, data protection, and monopolistic practices.
  - It can also provide **clear guidelines for investments in e-commerce and quick commerce** to prevent unfair market domination.
- **Mandate Data Privacy and Consumer Protection Measures:** India must enforce stronger data privacy and consumer protection laws, especially as e-commerce platforms collect vast amounts of customer data.
  - The **Digital Personal Data Protection Act, 2023** should be strictly applied to regulate how customer data is stored, used, and shared.
  - Transparency in **terms and conditions for consumers, clear refund policies, and accountability for faulty deliveries** should also be made mandatory.
- **Certification System for Ethical Practices:** The government can launch a certification program for ethical and fair practices in e-commerce and quick commerce.
  - Companies meeting standards for labor safety, sustainability, and customer satisfaction can be awarded a **“Responsible E-Commerce” label**.
  - Linking this certification to public recognition or financial incentives could encourage self-regulation and compliance across the industry.
- **Standardize Grievance Redressal Mechanisms:** The government should mandate a standardized, **time-bound grievance redressal mechanism for all e-commerce and quick commerce platforms**.
  - Companies must provide transparent escalation processes for issues like late deliveries, damaged goods, and payment refunds.
  - An **independent ombudsman for consumer complaints** in e-commerce could help ensure faster resolution and build trust.
- **Promote Tier-2 and Tier-3 City Penetration:** The government can incentivize quick commerce and e-commerce platforms to expand into Tier-2 and Tier-3 cities.
  - This can be linked with schemes like **PM Gati Shakti** to improve **rural and semi-urban infrastructure**, enabling better logistics connectivity.
  - Expansion into smaller cities will ensure equitable growth, reduce pressure on metros, and promote local entrepreneurship.
- **Mandate Transparency in Pricing and Discounts:** To address predatory pricing concerns, the **government should require e-commerce platforms to disclose the methodology behind pricing and discounts**.
  - Companies must show **clear breakdowns of how discounts are funded (e.g., subsidies, retailer contributions)**.
  - This will ensure fair competition and protect smaller sellers from being undercut by unsustainable discounting practices.
- **Support MSME and Local Store Integration:** E-commerce and quick commerce platforms can be mandated to **source a percentage of their inventory from MSMEs and local stores**.
  - The **ONDC (Open Network for Digital Commerce)** framework can be used to integrate small businesses into the organized retail ecosystem.
  - This will ensure fair market access for MSMEs and foster localized economic growth.

### Conclusion:

**Quick commerce** is revolutionizing **India's retail landscape** by meeting the demand for instant gratification, offering opportunities for **innovation, employment, and market expansion**. However, challenges such as **worker exploitation, environmental impact, and competition with local stores** need careful regulation. Strengthening labor protections, environmental standards, and consumer rights is essential for sustainable growth. A centralized regulatory body, transparency in pricing, and promoting equitable growth in smaller cities can ensure a fair and balanced sector.



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## India and China: Rivalry to Resilience

*This editorial is based on “[The balancing China question before India](#)” which was published in The Hindustan Times on 19/01/2025. The article brings into picture the October 2024 India-China disengagement agreement, highlighting it as a temporary pause amidst ongoing challenges due to China’s growing influence and territorial ambitions. India must navigate domestic reforms, global partnerships, and supply chain diversification to counterbalance China and protect its regional role.*

**Tag:** GS Paper-2, India and its Neighbourhood, Important International Institutions, Groupings & Agreements Involving India and/or Affecting India’s Interests, International Treaties & Agreements, Effect of Policies & Politics of Countries on India’s Interests

The **October 2024 India-China disengagement agreement** offers a temporary reprieve, not a lasting solution to their relationship’s deeper issues. China’s growing influence and territorial ambitions continue to challenge India’s strategic position. At this crossroads, **India must decide whether to counterbalance China** through internal reforms and global partnerships or risk diminishing its regional role. The path ahead demands careful engagement with China, avoiding unnecessary conflict. Additionally, India must diversify its **supply chains to reduce dependence on China** and strengthen its economic resilience.

### What are the Key Areas of Convergence Between India and China?

- **Trade and Economic Ties:** India and China have become **significant trading partners**, with mutual economic interests driving bilateral trade.
  - India’s dependency on Chinese imports for **machinery, electronics**, and chemicals complements China’s import of **Indian raw materials and software services**.
  - In FY24, bilateral trade stood at **US\$ 118.40 billion**, with India exporting goods worth **US\$ 16.65 billion** and importing goods worth **US\$ 101.74 billion**.
- **Infrastructure Financing and Connectivity:** Both nations collaborate in multilateral platforms like the **Asian Infrastructure Investment Bank (AIIB)** and the **New Development Bank (NDB)** to finance infrastructure projects.
  - These platforms align with the shared goal of improving regional infrastructure and connectivity, critical for economic development in Asia.
  - Recent developments like the **inauguration of the China Calcutta Service (CCS)** in July 2024 aim to improve trade connectivity and reduce transit times.
- **Climate Change and Renewable Energy:** Both India and China have committed to global efforts to combat climate change and achieve sustainable development.
  - As large developing economies, they converge on issues like **renewable energy promotion, carbon neutrality**, and climate finance under frameworks like the **Paris Agreement**.
  - China leads the world as the top producer of **solar energy**, installing more than 105 GW of photovoltaic (PV) capacity in 2022 while India has rapidly expanded its renewable energy capacity to **203.18 GW** (as of 2024), targeting **500 GW by 2030**.
  - Both countries have worked in forums like the **BASIC group (Brazil, South Africa, India, China)** to demand financial and technological support for clean energy transitions.
- **Health and Pharmaceutical Cooperation:** The Covid-19 pandemic highlighted the need for collaboration between India’s pharmaceutical industry and China’s raw material supply chain.
  - Both countries are **working to strengthen supply chains for Active Pharmaceutical Ingredients (APIs)** and vaccines to ensure regional and global health security.
    - China supplies **70% of APIs** required by Indian pharmaceutical companies.
  - India’s role as the **“pharmacy of the world”** complements China’s production capabilities, especially during joint initiatives like vaccine distribution in developing countries.
- **Tourism and People-to-People Exchanges:** Tourism and cultural exchanges have gained momentum, fostering mutual understanding.

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- **Shared Buddhist heritage and interest in educational collaborations** have strengthened people-to-people ties.
  - In December 2024, India and China agreed on a set of “six consensus” including **resumption of the Kailash Mansarovar Yatra**, trans-border river cooperation and **Nathula border trade**.
  - **Science and Technology Cooperation:** The two countries recognize the need for cooperation in technology, including **artificial intelligence (AI)**, space research, and **5G telecommunications**.
    - While competition exists, platforms like the **BRICS Science, Technology, and Innovation (STI) framework** offer avenues for joint research and development.
    - China is a global leader in **AI and 5G**, while India has built robust capabilities in IT services, as evidenced because services trade surplus has grown by a **CAGR of 13.91% in the last 5 years**.
  - **Regional Stability and Counterterrorism:** Both nations aim for regional stability to ensure economic growth and development.
    - They converge on **counterterrorism efforts** and resolving border insurgencies in neighboring states like **Myanmar and Afghanistan**, despite geopolitical tensions.
    - As SCO members, India and China have participated in joint anti-terrorism exercises like the **SCO Peace Mission drills**.
  - **Space Exploration and Technology Sharing:** India and China see immense potential in space exploration for **peaceful purposes**, such as **weather monitoring, disaster management, and scientific research**.
    - Collaboration in space technology can strengthen regional capacity for tackling environmental challenges and resource management.
    - **China's Tiangong Space Station** and **India's aim to build “Bharatiya Antriksh Station” by 2035** highlight their advanced capabilities in space exploration.
- What are the Key Areas of Friction Between India and China?**
- **Border Disputes and Military Standoffs:** The unresolved boundary issues along the **Line of Actual Control (LAC)** have been the most contentious point in bilateral relations.
    - **Periodic military standoffs**, such as the **Galwan Valley clash (June 2020)**, have heightened tensions, eroding trust.
    - Despite multiple rounds of military and diplomatic talks, the two nations remain locked in a stalemate over disengagement in **eastern Ladakh and other disputed regions**.
  - **Trade Imbalance and Economic Concerns:** The growing trade imbalance remains a major friction point, with India heavily dependent on Chinese imports while facing restricted market access for its goods.
    - India's concerns include **dumping of low-cost Chinese products** and reliance on Chinese machinery, adversely affecting domestic industries.
    - In FY24, India's trade deficit with China reached **US\$ 85 billion**, with imports worth **US\$ 101.74 billion** and exports at only **US\$ 16.65 billion**.
    - India's restrictions on Chinese investments post-2020, particularly in sensitive sectors like **telecom and fintech**, have added to the economic friction.
  - **Infrastructure Development in Border Areas:** China's aggressive infrastructure development along the LAC, such as **building roads, airstrips, and villages**, has been a source of concern for India.
    - These projects aim to bolster China's military logistics, altering the strategic balance in border regions like Arunachal Pradesh and Ladakh.
    - China has been constructing over **600 Xiaokang or “well-off villages”** along India's borders with the Tibet Autonomous Region for over 5 years now, while India is ramping up its **Vibrant Villages Program** to counter this.
  - **China's Support for Pakistan:** China's close partnership with Pakistan, including its support on contentious issues like Kashmir, has strained **India-China relations**.
    - Beijing's investments under the **China-Pakistan Economic Corridor (CPEC)** pass through **Pakistan-occupied Kashmir (PoK)**, violating India's sovereignty.
    - At the **UN Security Council**, China blocked India's efforts to designate Pakistan-based terrorists like **Masood Azhar** as global terrorists **until 2019**.
  - **Opposition to India's Global Aspirations:** China has consistently opposed India's bid for a permanent seat in the **United Nations Security Council (UNSC)** and membership in the **Nuclear Suppliers Group (NSG)**.

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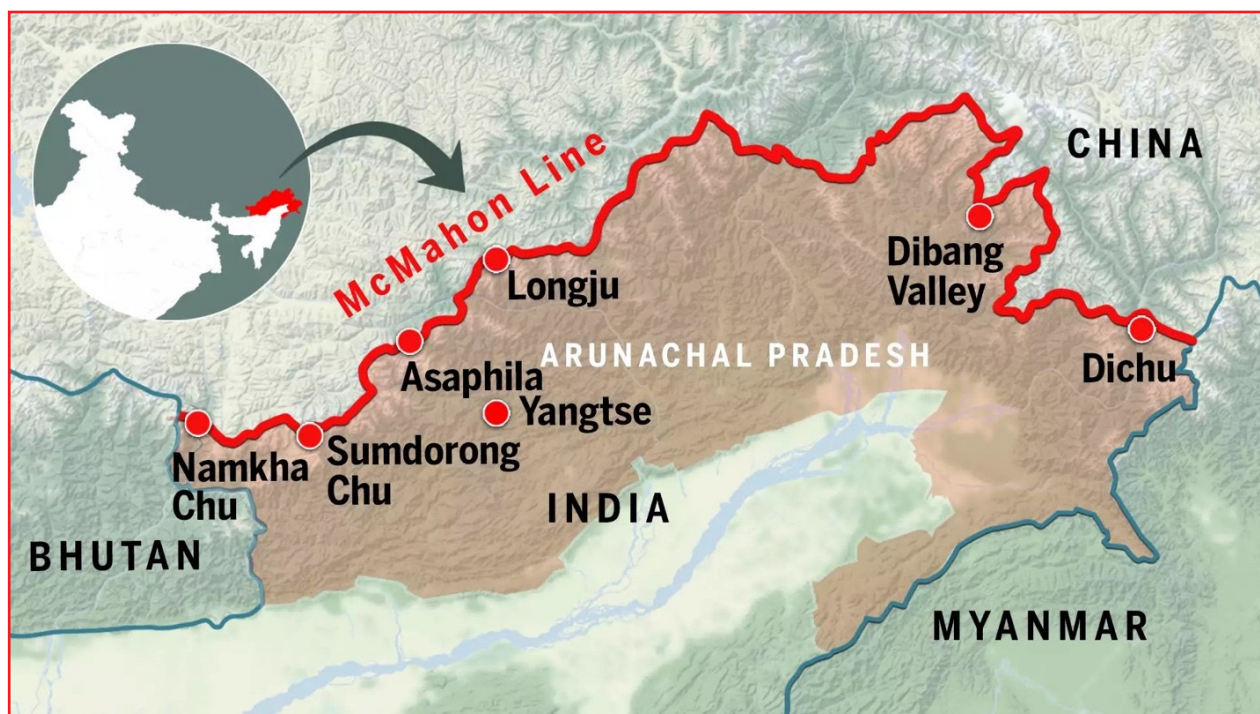
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- Beijing cites procedural and non-proliferation concerns, limiting India's ability to achieve global recognition commensurate with its stature.
- Despite support from countries like the US, India's **NSG bid has been stalled since 2016** due to China.
- **Belt and Road Initiative (BRI):** India's rejection of China's **Belt and Road Initiative (BRI)** stems from its sovereignty concerns over CPEC and apprehensions about the initiative's debt-trap diplomacy.
  - The BRI's expansion in South Asia is viewed as China encroaching upon India's traditional sphere of influence.
  - The **Hambantota port deal** in Sri Lanka, **leased to China for 99 years**, exemplifies India's concerns over China's strategic footprint in the Indian Ocean.
- **Water Disputes on Transboundary Rivers:** China's construction of dams and diversion of rivers like the **Brahmaputra (Yarlung Tsangpo)** has raised concerns in India over potential impacts on water flow and ecology.



- As the upper riparian state, **China's actions affect India's northeastern states**, leading to tensions over water security.
- China operationalized the **Zangmu Dam** on the Brahmaputra in 2015 and announced plans for a **mega dam** in the same river's lower reaches.
- China has been accused of withholding hydrological data during critical periods, as seen during the **2017 floods in Assam**.
- **Geopolitical Rivalry in the Indo-Pacific:** India and China are engaged in strategic competition in the **Indo-Pacific region**, with India opposing China's militarization of the South China Sea and Beijing viewing India's participation in the **Quad (India, US, Japan, Australia)** as part of a containment strategy.
  - India conducts the **Malabar exercises** with Quad partners, focusing on countering China's assertive actions in the region.
  - China's claims over **80% of the South China Sea** through its **Nine-Dash Line** have been declared illegal by the **Permanent Court of Arbitration (2016)**, a stance supported by India.

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- **Cybersecurity Threats and Digital Dependency:** India has raised concerns over **Chinese cyberattacks on critical infrastructure** and increasing dependence on Chinese technology.
  - India's restrictions on Chinese apps and investments reflect its apprehension about security vulnerabilities in sectors like telecom and fintech.
  - In **2020**, India banned **59 Chinese apps**, including **TikTok and WeChat**, citing security concerns after the Galwan clash.
  - In 2022, the hacking group **TAG-38** employed **ShadowPad malware**, a tool previously associated with **China's People's Liberation Army (PLA)** and Ministry of State Security, highlighting its possible links to Chinese state-backed cyber activities.



### How can India Balance China Relations While Strengthening Self-Reliance and Supply Chain Diversification?

- **Strengthening Manufacturing, Gradual Decoupling:** India can boost domestic production in **critical sectors** while maintaining selective trade ties for non-substitutable imports.
  - For instance, the **PLI scheme for semiconductors** is attracting global players like **Micron Technology**, while India continues importing advanced **silicon wafers from China until domestic capacity scales up**.
  - Similarly, India's **toys industry**, supported by tariff increases and local manufacturing, reduced imports from China.
- **Collaboration in Green Energy, Diversifying Partners:** India can engage with China on multilateral climate platforms like **BRICS** to address shared concerns, while **sourcing renewables from diverse nations**.
  - India partnered with **Germany** in green hydrogen development through the **Indo-German Green Hydrogen Task Force**, while also negotiating solar battery technology transfers with **Japan**.

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- Meanwhile, India can leverage China's expertise in wind turbines for capacity-building in domestic renewable industries.
- **Joint Ventures in Non-Sensitive Sectors:** Encourage partnerships with Chinese firms in non-sensitive sectors like EV manufacturing while focusing on indigenous development for critical technologies.
  - For instance, China's electric vehicle major BYD is keen to have manufacturing operations in India as soon as 'all factors' suggest a 'go ahead' and the plan is under constant evaluation.
- **Border Development with Strategic Talks:** India can develop border infrastructure to counter China's assertive presence while continuing diplomatic engagement.
  - For example, India's BRO (Border Roads Organisation) completed the Atal Tunnel to improve access to Ladakh, while diplomatic efforts through the 23rd Meeting of the Special Representatives of India and China in December 2024 reduced tensions in certain areas.
- **Multilateral Cooperation, Bilateral Caution:** India can leverage platforms like AIIB and SCO for shared development goals while counterbalancing China's influence through partnerships like Quad.
  - For example, India's active participation in SCO's Regional Anti-Terror Structure ensures counterterrorism collaboration, while simultaneously using Quad's Supply Chain Resilience Initiative (SCRI) to diversify sourcing of semiconductors and rare earths.
- **Technology Collaboration, Indigenous Innovation:** India can collaborate with China in less sensitive areas like AI for agriculture while focusing on self-reliance in critical tech sectors.
  - For instance, India could tap into China's expertise in precision farming AI, while advancing domestic efforts in 5G and satellite tech through programs like BharatNet and Chandrayaan missions.
- **Diversifying Trade, Engaging Diplomatically:** India can reduce its dependency on Chinese imports by deepening trade partnerships with ASEAN, South Korea, and African nations while maintaining economic engagement with China.
  - For example, India's Act East Policy facilitated stronger trade ties with Vietnam, particularly in electronics and chemicals, reducing dependency on Chinese supply chains.
- **Maritime Security, Regional Engagement:** India can strengthen naval alliances through Quad naval drills while engaging China diplomatically to prevent escalation in the Indian Ocean.
  - For instance, India conducted Malabar 2023 Exercises with the US, Japan, and Australia to enhance interoperability.
  - Whereas, India's Sagarmala Project ensures the development of strategic Indian ports to counterbalance Chinese influence at the ocean like in Hambantota.
- **Regional Manufacturing Hubs in South Asia and Africa:** India can strategically invest in developing regional manufacturing hubs in neighboring countries like Bangladesh, Nepal, and African nations to counter China's supply chain dominance.
  - By building industrial parks and incentivizing Indian firms to expand operations in these regions, India can create alternative supply chains.
  - For example, India could partner with Ethiopia for textile manufacturing thereby diversifying dependencies and creating geopolitical goodwill.
- **Dual-Use Infrastructure in Strategic Zones:** India can develop infrastructure in sensitive areas like the Northeast and Andaman and Nicobar Islands to serve both civilian and military needs while maintaining diplomatic discussions with China to manage regional stability.
  - For instance, expanding Port Blair's capacity for logistics demonstrates India's strategic autonomy without escalating conflict.
  - This also ensures supply chain connectivity in the Indo-Pacific while countering China's String of Pearls strategy.
- **Strategic Stockpiling and Reserves:** India can create strategic reserves of critical imports like rare earth minerals, APIs, and semiconductors to buffer short-term disruptions caused by over-reliance on China.
  - For instance, India could establish partnerships with Australia and Chile for lithium, building reserves to support industries like EV manufacturing.

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- This ensures supply chain resilience while reducing panic-driven dependencies during geopolitical tensions.

➤ **Reviving India's Traditional Strengths in Textiles and Handicrafts:** To counter cheap Chinese imports in sectors like textiles and toys, **India can revive traditional industries by integrating them with e-commerce platforms** and international branding.

- For example, exporting products under schemes like **"One District, One Product (ODOP)"** while partnering with platforms like **Amazon and Flipkart** could enhance the reach of **Pochampally silk, Banarasi sarees**, and Indian wooden toys globally.
- This reduces reliance on Chinese imports in low-tech sectors while boosting India's MSME ecosystem.

### Conclusion:

The **India-China relationship** is marked by **both convergence and friction**, requiring a nuanced approach. While areas like **trade, climate action, and multilateral cooperation** offer opportunities, challenges like **border disputes, trade imbalances, and geopolitical rivalry** persist. India must balance engagement with strategic caution, focusing on self-reliance and supply chain diversification. **Strengthening alliances, fostering domestic innovation, and promoting economic resilience** are vital. By adopting a pragmatic and multifaceted strategy, India can safeguard its interests while fostering regional stability.



## Empowering Women for Sustainable Economic Growth

*This editorial is based on **"Labour force participation of teen girls and elderly women in rural India is increasing"** which was published in The Hindu Business Line on 19/01/2025. The article brings into picture the significant rise in women's labor force participation, particularly in rural areas, but highlights that economic necessity, especially for teenage girls and elderly women, overshadows true empowerment, revealing deep structural barriers to gender equality.*

**Tag:** GS Paper-2, Issues Related to Women, Inclusive Growth

According to recent **Periodic Labour Force Survey data (2023-24)**, women's labor force participation has shown significant growth, particularly in rural areas where it **nearly doubled from 18.2% to 35.5% over 6 years**. However, deeper analysis reveals concerning patterns - **there's a sharp rise in participation among teenage girls (15-19) and elderly women (60+), often driven by economic necessity rather than empowerment**. While the increasing participation marks progress, significant structural barriers remain to be addressed before we can achieve a truly **gender-sensitive economy** that offers **equal opportunities and choices to all workers**.

### What are the Factors Driving India's Improved Female Labour Force Participation?

- **Reduced Household Drudgery through Welfare Schemes:** Government schemes like **Ujjwala Yojana** (free LPG connections) and **Har Ghar Jal** (tap water to households) have eased women's domestic burdens, creating more time for economic activities.
  - With less time spent on firewood collection or fetching water, women, especially in rural areas, have moved into agriculture and allied activities.
  - The number of total refills taken by Ujjwala Yojana beneficiaries has risen from 159.9 million in 2018-19 to **344.8 million in 2022-23**, and household tap water connections under **Jal Jeevan Mission** reached **78% of rural homes** as of **October 2024**, directly reducing drudgery for women.
- **Increased Employment under Government Schemes:** Women have benefited from wage employment schemes like **MGNREGA**, which provide local opportunities with equal wages for men and women.
  - In 2021-22, women constituted **54.54% of the MGNREGA workforce**, according to the Ministry of Rural Development.
  - Similarly, initiatives like **National Rural Livelihood Mission (NRLM)** have empowered over **9.89 crore women** as of 2023 through self-help groups (SHGs), helping them engage in micro-enterprises and financial activities.
- **Declining Fertility Rates and Smaller Families:** India's declining **fertility rate**, now at **2.0 (NFHS-5, 2021)**, has reduced the burden of child-rearing on women, allowing them more time to participate in paid work.

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- Smaller family sizes, especially in urban areas, have enabled women to enter the workforce and focus on career development.
- This demographic shift is evident in the **rising FLFP in younger age groups (20-35 years)** in urban areas, as per **PLFS 2023-24**.
- **Improved Literacy and Education Levels:** Women's literacy and access to education have steadily improved, enhancing their employability and participation in the workforce.
  - Schemes like **Beti Bachao Beti Padhao** and **Samagra Shiksha Abhiyan** have helped boost female literacy, now at **77%**.
  - Additionally, programs like **Skill India Mission** and **Digital Saksharta Abhiyan** are equipping women with vocational and digital skills, enabling participation in emerging fields like e-commerce and gig work.
- **Shift Towards Self-Employment and Entrepreneurship:** Women are increasingly entering self-employment and entrepreneurship, aided by financial inclusion initiatives like **PM Jan Dhan Yojana (PMJDY)** and **Stand-Up India Scheme**.
  - **55% of Jan Dhan account holders are women**, providing them with formal banking access and enabling credit linkages.
  - As of March 2023, loans amounting to ₹40,710 crore were sanctioned under the **Stand-Up India scheme**, with **80% allocated to women entrepreneurs**, fostering economic independence.
- **Technology and Digitization as Enablers:** The rapid expansion of internet access and digital platforms has created new opportunities for women to participate in gig and remote work.
  - Platforms like **Amazon Saheli** and **Mahila E-Haat** are enabling women to sell products and services from home.
  - With rural India accounting for **53% of internet consumption**, more women are leveraging digital tools to join the workforce, **reducing the constraints of mobility**.
- **Supportive Legal Frameworks:** Progressive legal measures like **Maternity Benefit (Amendment) Act, 2017**, which provides 26 weeks of paid maternity leave,

and **POSH Act, 2013**, have created a more supportive environment for women to remain in the workforce.

- Recent steps like the passage of the **Women Reservation Act, 2023** indicate a **political commitment to improving women's representation and opportunities**, creating a ripple effect on workforce participation.
- **Rising Role of Self-Help Groups:** Self-help groups under **Ministry of Rural Development's Deendayal Antyodaya Yojana-National Rural Livelihoods Mission (DAY-NRLM)** and other state-level programs have empowered women through credit access, skill development, and collective bargaining.
  - Till February 2024, **Self-Help Groups (SHGs)** had **mobilized over ₹1.7 lakh crore** in loans for women-led enterprises.
  - States like **Tamil Nadu and Kerala**, where SHGs are particularly active, have seen a direct correlation with higher FLFP compared to the national average.

### What are the Structural Challenges in India's Female Labour Force Participation?

- **Gendered Social Norms and Cultural Constraints:** Despite economic development, traditional social norms discourage women from participating in paid work, confining them to domestic roles.
  - The stigma of women working outside the home, especially in rural areas, limits their access to opportunities.
    - Moreover, **societal expectations for women to prioritize caregiving over careers** reduce workforce inclusion.
  - According to the **Global Gender Gap Report 2023**, India ranks 127th out of 146 in economic participation, highlighting deeply entrenched gender biases.
- **Inadequate Access to Quality Education and Skill Training:** Many women lack access to higher education and vocational training, creating a **skills mismatch in emerging job markets**.
  - **Female literacy and enrollment in STEM fields remain low**, limiting employability in high-growth sectors like IT and manufacturing.

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- In 2022-23, **only 18.6% of women aged 18-59 received vocational training**, with just **7% of skill trainees** being women in 2021, despite **17% of ITIs being women-only**.
- This under-preparedness leaves women confined to informal and low-paying sectors, perpetuating economic dependency.
- **Unpaid Care Work Burden:** The disproportionate burden of unpaid care work—**childcare, eldercare, and household chores**—leaves women with little time for paid work.
  - Welfare measures like **Ujjwala Yojana** and **Har Ghar Jal** have reduced household chores but have not fully translated into workforce inclusion.
  - According to NFHS (2019-21) data, **approximately 85% of women aged 15-59 engage in unpaid domestic work**, with minimal variation between urban and rural areas.
    - This inequality limits women's ability to access full-time employment.
- **Structural Informality and Gender Wage Gap:** A significant share of women in India's workforce are in informal jobs, such as **agriculture and garment manufacturing**, which are low-paying and lack social security.
  - This structural informality results in precarious employment and a persistent gender wage gap.
  - According to the **World Inequality Report 2022 estimates**, men earn **82%** of the labour income in India, whereas women earn **18%**.
  - Additionally, over **90% of women workers** are in the informal sector, as per the **Economic Survey 2023**, making decent work conditions inaccessible.
- **Weak Implementation of Gender-Sensitive Workplace Policies:** Poor enforcement of **maternity benefits, flexible work policies, and crèche facilities** discourages women from continuing in the workforce.
  - Private sector compliance with **The Maternity Benefit Act, 2017**, remains low, especially in smaller enterprises.
  - According to a report by OP Jindal Global University, **93.5% of women workers in the country cannot access maternity benefits**.
- This lack of structural support for working mothers forces many women to drop out of the workforce post-childbirth.
- Despite laws like **POSH Act, 2013**, enforcement remains weak in informal and small enterprises.
- **Persisting Security Concerns:** The **National Crime Records Bureau (2022)** revealed a **12.9% rise in crime against women between 2018 and 2022**, leading many families to discourage women from traveling for work.
  - However, **more than half of the women who died by suicide in the 2020-2022** were housewives, a 2022 report by **National Crime Records Bureau**.
  - Furthermore, **lack of safety infrastructure in cities** limits women's mobility and reduces their access to employment opportunities.
- **Economic Necessity Driving Constrained Choices:** The recent surge in rural women's LFPR, especially in agriculture, highlights participation driven by necessity rather than agency.
  - **Women are often forced to step in as primary earners** due to male out-migration or the absence of earning members in small households (**feminisation of agriculture**).
  - The **PLFS (2023-24)** shows elderly rural women and teenage girls entering the workforce, **often reflecting economic vulnerability rather than empowerment**. This indicates that many women remain trapped in low-value, survival-driven jobs.
- **Limited Representation in Leadership Roles:** Women continue to face significant barriers in breaking the "glass ceiling" and reaching leadership positions in both public and private sectors.
  - As of April 2024, there are 77 women lawmakers in India, making up **14.7% of the total seats**. The **Women's Reservation Act, 2023** will come into effect after 2029.
  - A 2024 report on '**Women in Leadership in Corporate India**,' revealed that women held **only 18.3% of senior leadership roles (managerial levels and above)**.
  - This lack of representation limits women's role in decision-making and perpetuates gender stereotypes.

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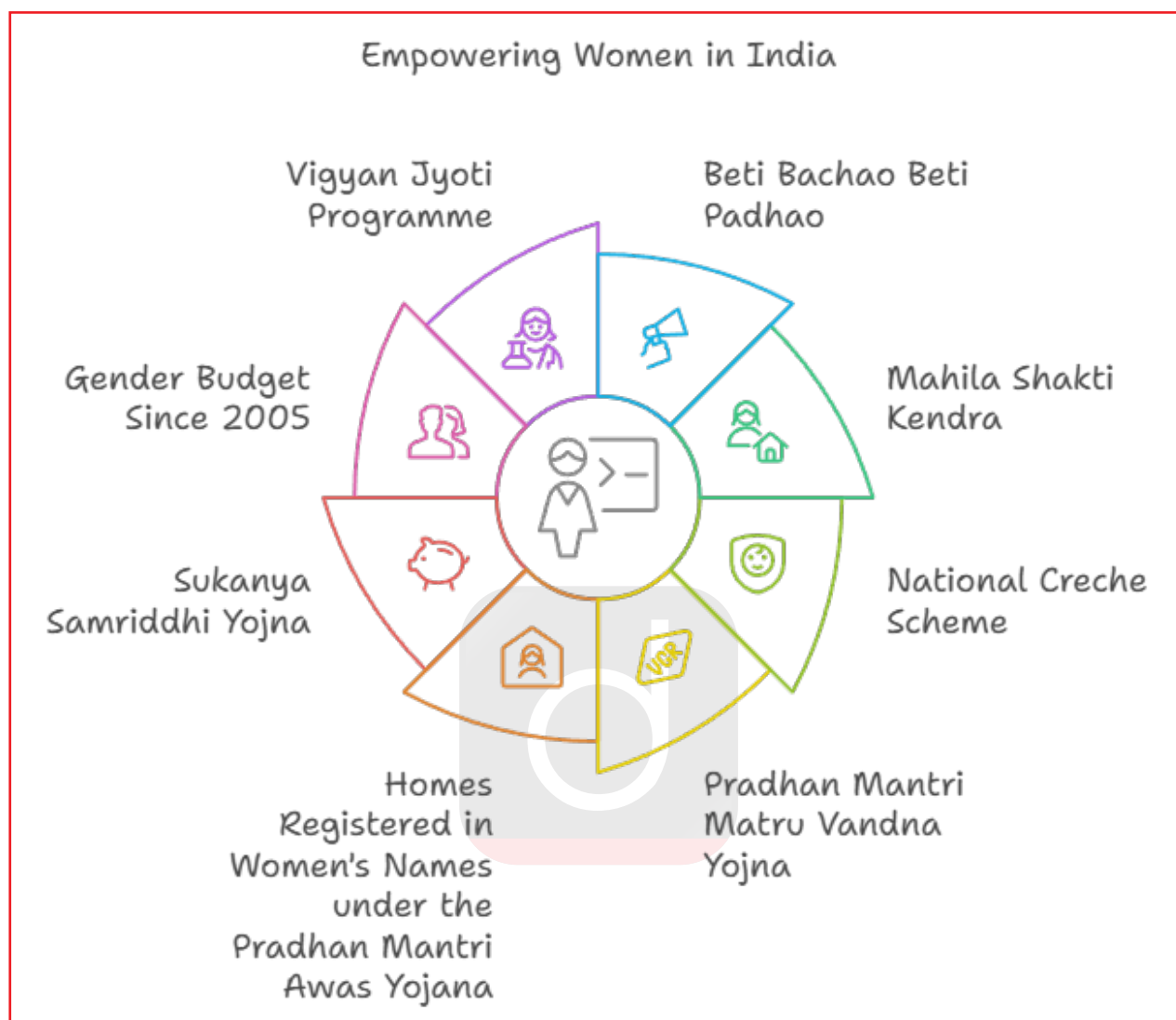


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### What Strategies Can Address Structural Issues and Promote Effective Economic Empowerment of Women?

- **Strengthen Skill Development with a Focus on Emerging Sectors:** Launch tailored skill development programs for women in high-growth sectors like **IT, renewable energy, and healthcare**, alongside traditional sectors like **textiles and handicrafts**.
  - Programs under **Skill India Mission** and **Digital India** can integrate gender-specific initiatives like digital literacy for rural women or advanced STEM training for urban women.
  - Ensuring convergence with initiatives like **Stand-Up India** will provide financial and entrepreneurial support, encouraging women to become job creators.
- **Expand Access to Affordable Childcare and Crèche Facilities:** Introduce a nationwide **Childcare Support Mission** to scale up implementation of crèche facilities under the **National Creche Scheme** in both urban and rural areas.
  - Link this with workplace policies under the **Maternity Benefit (Amendment) Act, 2017**, mandating affordable daycare centers for all enterprises, including informal setups.

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- This would enable women, **especially in the 25-40 age group**, to re-enter the workforce without the burden of caregiving.
- **Enhance Women's Access to Formal Credit:** Expand the outreach of **PM Jan Dhan Yojana** and ensure seamless access to affordable credit under **Mudra Yojana** for women-led businesses.
  - Combine this with financial literacy programs under **National Rural Livelihood Mission (NRLM)** to empower self-help groups (SHGs) with entrepreneurial skills.
  - Support **women entrepreneurs by simplifying loan procedures**, offering mentorship programs, and setting up gender-sensitive financial support desks at banks.
- **Promote Gender-Responsive Infrastructure Development:** Invest in gender-sensitive public infrastructure like safe and **affordable transport**, **separate sanitation facilities**, and **well-lit roads**, especially in rural and urban peripheries.
  - Expand urban safety initiatives like **Safe City Projects** to enhance women's mobility and reduce workplace barriers.
  - Partner with state governments to implement such infrastructure under the **Smart Cities Mission** for better inclusivity and accessibility.
- **Strengthen Workplace Policies for Gender Equality:** Mandate gender-sensitive workplace policies, including flexible working hours, paid maternity leave, and anti-harassment measures under the **POSH Act, 2013**.
  - **Promote hybrid work opportunities and remote jobs**, particularly for women in urban areas, to retain them in the workforce post-childbirth.
  - Incentivize companies to conduct gender audits and improve workplace diversity under corporate social responsibility (CSR) initiatives.
- **Promote Representation in Leadership and Decision-Making Roles:** Introduce capacity-building programs for women under **Mission Shakti** to prepare them for leadership roles in politics, governance, and corporate sectors.
  - Encourage private companies to adopt diversity benchmarks and ensure at least **30% representation of women in leadership** positions.
- **Focus on Digital Inclusion to Leverage Technology:** Bridge the gender digital divide by expanding the **Digital Saksharta Abhiyan** and providing women with subsidized smartphones and internet connections in rural areas.
  - Promote **gig economy opportunities, e-commerce platform** work avenues for women through digital literacy training.
  - Initiatives like **Mahila E-Haat** and **Amazon Saheli** should be scaled up to **connect women entrepreneurs with larger markets** and provide them with marketing, logistics, and financial support.
- **Develop Gender-Responsive Social Protection Frameworks:** Design social protection programs that prioritize the needs of working women, including universal healthcare, old-age pensions, and unemployment benefits.
  - Strengthen insurance schemes like **PM Jeevan Jyoti Bima Yojana (PMJJBY)** and **PM Shram Yogi Maandhan Yojana** to ensure income security for informal women workers.
  - Introduce **conditional cash transfers linked to women's workforce participation** to incentivize their economic activity.
- **Address Region-Specific Barriers with Targeted Interventions:** Design state-specific strategies to address regional challenges, such as **low FLFP in northern states (e.g., Haryana and Uttar Pradesh)** versus relatively **higher participation in southern states (e.g., Kerala and Tamil Nadu)**.
  - States with low FLFP can launch targeted campaigns for gender sensitization, vocational training, and transport access.
  - Collaborative efforts between states and central programs like **Beti Bachao Beti Padhao** can help bridge regional disparities.
- **Recognise Women's Role in the Care Economy:** Recognize the care economy as a key sector for employment and invest in training women as caregivers, nurses, and childcare workers.
  - Initiatives under **Ayushman Bharat** can expand opportunities for women in healthcare and allied services.

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- Create public-private partnerships to set up affordable elder care and childcare centers, where trained women can take up employment, while enabling other women to join the workforce.

### Conclusion:

The rise in women's labor force participation in rural India highlights both progress and persistent challenges. Economic necessity, particularly among teenage girls and elderly women, reveals **deep structural barriers to empowerment**. To achieve genuine gender equality, reforms in education, skills, and work conditions are crucial. **Aligning with SDGs 5 (Gender Equality) and 8 (Decent Work)**, policies must focus on breaking systemic barriers. Empowering women fully will unlock India's economic potential, fostering a more inclusive and sustainable future.



## Conservation vs Greening

*This editorial is based on "Conservation and Greening" which was published in Economics and Political Weekly*

*on 18/01/2025. The article brings into the picture the paradox of India's forest growth, where a net increase of 16,630 sq km masks losses in critical ecosystems like the Northeast, high-altitude regions, and mangroves. It highlights the focus on quantity over quality, exacerbated by the Forest Conservation Rules 2022, posing a serious conservation challenge.*

**Tag:** GS Paper-2, GS Paper-3, Conservation, Issues Relating to Development, Management of Social Sector/ Services, Forest Resources

Over the past decade, India recorded a net increase of 16,630 sq km in forest cover, but this masks alarming losses in ecologically vital areas like the **Northeast, high-altitude regions, and mangroves**. While carbon stock has risen by **81.5 million tonnes**, the quality of forests, especially very dense ones, continues to decline. The **Forest Conservation Rules 2022** exacerbate concerns by **prioritizing commercial forestry over tribal rights and genuine conservation**. This highlights a troubling dichotomy between quantitative expansion and **qualitative degradation in India's forests**. Balancing greening efforts with true conservation remains a key policy challenge.

### What is the Difference Between Conservation and Greening?

| Aspect                       | Conservation                                                                                                                            | Greening                                                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Definition</b>            | Conservation refers to the <b>protection, restoration, and sustainable management</b> of natural forests, ecosystems, and biodiversity. | Greening refers to increasing <b>green cover, often through plantations or afforestation programs</b> , which may include monoculture plantations. |
| <b>Focus</b>                 | Focuses on <b>maintaining ecosystem balance, biodiversity, and natural forest integrity</b> .                                           | Focuses on <b>expanding tree or vegetation cover</b> , sometimes without considering ecological impacts.                                           |
| <b>Biodiversity Impact</b>   | Promotes biodiversity by <b>preserving native forests, wildlife habitats, and ecosystems</b> .                                          | Often reduces biodiversity due to monoculture plantations (e.g., eucalyptus or acacia).                                                            |
| <b>Soil and Water Impact</b> | Improves <b>soil fertility and water retention</b> by restoring natural forests.                                                        | May degrade soil and local ecosystems in the long run, especially in monoculture or non-native species plantations.                                |
| <b>Carbon Sequestration</b>  | Natural forests are more <b>effective carbon sinks</b> due to dense biomass and carbon stored in soil.                                  | Commercial plantations <b>sequester less carbon</b> and often fail to replicate the ecological role of natural forests.                            |
| <b>Example</b>               | Protecting natural forests in the <b>Western Ghats</b> or <b>Sundarbans</b> to preserve ecosystems and biodiversity.                    | <b>Eucalyptus plantations under compensatory afforestation programs</b>                                                                            |

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## Why Forest Conservation Is Vital for India's Future?

- **Climate Change Mitigation and Carbon Sequestration:** Forests play a critical role in **absorbing greenhouse gases**, helping India meet its climate commitments under the **Paris Agreement** and **COP26 targets**.
  - They act as carbon sinks, reducing atmospheric CO<sub>2</sub> levels and combating global warming.
  - The **India State of Forest Report 2023** estimates India's carbon stock at **7,285.5 million tonnes**, with an annual increase of 40.75 million tonnes.
  - Additionally, India has achieved **2.29 billion tonnes of additional carbon sink**, progressing towards its target of 2.5–3 billion tonnes by 2030.
- **Biodiversity Conservation and Ecosystem Services:** India, a megadiverse country, hosts **7-8% of all recorded species**, and forests are critical for preserving this biodiversity.
  - They support **pollination, natural pest control, and genetic diversity** crucial for agriculture and food security.
  - For example, the **Western Ghats**, a **UNESCO World Heritage site**, harbors endemic species and provides genetic resources crucial for **developing climate-resilient crops**.
- **Disaster Resilience and Climate Regulation:** Forests protect against **natural disasters like floods, landslides, and cyclones** by stabilizing soils and acting as buffers.
  - **Coastal mangroves**, for example, reduce the impact of cyclones and tsunamis, saving lives and property.
    - Also, recent studies suggest that **mangroves and coastal wetlands annually sequester carbon at a rate 10 times greater** than mature tropical forests
- **Water Security and Watershed Management:** Forests are vital for maintaining the **hydrological cycle**, ensuring water availability in rivers and aquifers, and regulating rainfall patterns.
  - They prevent **soil erosion and help recharge groundwater**, benefiting agriculture and drinking water supply.
  - For instance, **dense forests in the Western Ghats** act as watersheds for rivers like the **Godavari and Krishna** sustaining millions of people and agricultural activities across peninsular India.

- **Socioeconomic Benefits for Tribal and Rural Communities:** Forests provide livelihoods to over **200 million people in India**, especially tribal and rural communities, through minor forest produce like **bamboo, honey, and medicinal plants**.
  - For instance, the **Pradhan Mantri Van Dhan Yojana** aims to set up 50,000 **Van Dhan Vikas Kendras**, benefiting 10 lakh tribal entrepreneurs nationwide.
- **Combating Urban Heat Islands and Pollution:** Urban forests help **mitigate the urban heat island effect**, reduce air pollution, and provide recreational spaces, improving public health and quality of life.
  - For example, the **Aravali range functions as a check on the movement of sand from the Thar Desert** to Delhi-NCR.
- **Sustainable Economic Growth Through Ecotourism:** Forests drive sustainable economic growth by promoting **ecotourism and creating green jobs** while preserving biodiversity and culture.
  - A study of 10 tiger reserves across India, including **Anamalai, Bandipur, and Simlipal**, revealed they collectively provide annual benefits worth **₹5.96 lakh crore**.
- **Achieving Global Environmental Goals:** As a responsible global actor, India's forest conservation efforts contribute to **Sustainable Development Goals (SDGs)** like **SDG 13 (Climate Action)**, **SDG 15 (Life on Land)**, and **SDG 12 (Responsible Consumption)**.
  - According to the **Global Forest Resources Assessment 2020**, India ranks third globally in forest area gain, with a net positive change of **0.38%**.
  - This aligns with India's commitment to conserving **33% of its geographical area as forest** under the **National Forest Policy, 1988**.

## What are the Key Issues Associated with India's Forest Conservation Efforts?

- **Deforestation Due to Development Projects:** India's ambitious development agenda has led to **large-scale deforestation for infrastructure, mining, and industrial projects**.
  - Linear projects like **highways, railways, and power transmission** lines often cut through dense forest areas, fragmenting ecosystems and endangering biodiversity.

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- The push for “ease of doing business” has also weakened environmental safeguards.
- Over **3 lakh hectares of forest land** has been diverted for **non-forestry use** in India over the last 15 years under the Forest (Conservation) Act, 1980.
- The **Forest (Conservation) Rules, 2022**, now allow **forest clearance before gram sabha consent**, worsening the displacement of tribal communities and forest destruction.
- **Degradation of Very Dense Forests and Loss of Quality:** While forest cover is increasing **quantitatively**, the quality of forests is declining.
  - Very dense forests, which are critical for carbon sequestration and biodiversity, are being replaced by plantations or moderately dense and open forests.
  - This “**greening**” through **afforestation** masks the degradation of natural forests.
  - As per State of Forest Report 2023, the **Western Ghats, known for dense forests, have reportedly lost 58.22 sq km of forest cover** over the past decade.
    - This shows that the net increase in forest area is misleading without considering **forest quality**.
- **Mangrove Degradation and Coastal Vulnerability:** Mangroves, which act as **natural buffers against cyclones and sea-level rise**, are under threat due to aquaculture, agriculture, and industrial expansion.
  - Mangrove loss increases the **vulnerability of coastal communities** to climate-induced disasters.
  - Their destruction has a disproportionate impact on marginalized fishing communities.
  - ISFR 2023 reported that in comparison to the 2021 assessment, there has been a net decrease of **7.43 sq km in the country’s mangrove coverage**.
    - Between 2000 and 2016, **2,193.92 sq km of mangroves** were lost due to aquaculture and agriculture.
- **Inadequate Implementation of Forest Rights Act (FRA), 2006:** The implementation of the **Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006**, has been slow and inconsistent.
  - Tribal communities and forest dwellers often face **eviction** in the name of conservation projects like wildlife sanctuaries and tiger reserves.
- The top-down approach undermines community participation in forest governance. As per the **Ministry of Tribal Affairs**, only **50% of FRA claims** have been approved, and **over 38% of all claims over land were rejected** as of 2022.
  - The forced displacement of tribal groups in **Madhya Pradesh’s Kanha Tiger Reserve** demonstrates the marginalization of forest-dependent communities.
- **Weakening of Environmental Regulations:** Recent policy changes, like the **Forest (Conservation) Rules, 2022**, prioritize **commercial and industrial use of forests over conservation**.
  - These policies dilute safeguards for forest-dependent communities.
  - The **Forest Conservation Amendment Act 2023** introduces additions and exemptions, removing certain types of land from the Act’s scope.
    - However, the **Supreme Court** directed States and Union Territories to adhere to the **1996 Godavarman judgment’s** definition of ‘forest’ for identifying and preserving forest land, cautioning against reliance on the **2023 amendment to the Forest (Conservation) Act**.
- **Forest Fires and Climate Change:** Forest fires are becoming more frequent and intense due to **climate change and human-induced activities** like slash-and-burn agriculture.
  - **Fires not only destroy biodiversity** but also release stored carbon, exacerbating global warming. India’s preparedness to combat large-scale forest fires remains inadequate.
  - According to the Forest Survey of India, **54.40% of forests in India are exposed to occasional fires, 7.49% to moderately frequent fires** and 2.40% to high incidence levels.
  - According to State of Forest Report 2023, **forest fires surged by 1,339% in Himachal Pradesh and 2,822% in Jammu & Kashmir**, highlighting the urgency for better forest fire management.
- **Conversion of Natural Forests to Commercial Plantations:** Afforestation drives often prioritize commercial plantations over restoring natural forests.

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- Monoculture plantations of species like **eucalyptus** and **acacia** degrade soil quality, reduce biodiversity, and are less effective at carbon sequestration compared to native forests.
- **Encroachment and Illegal Activities:** Encroachment by agriculture, real estate, and illegal logging remains a major challenge.
  - **Poaching and illegal mining** further degrade forest ecosystems and disrupt biodiversity. Encroachments also spark conflicts between forest authorities and local communities.
  - For instance, **over 308 hectares of the ecologically sensitive Delhi Ridge** area have been encroached and another 183 hectares “diverted” for “non-forestry purposes”.
    - **Illegal timber smuggling** in the **Northeast** are glaring examples of unchecked forest exploitation.
- **Conflicts Between Conservation and Livelihoods:** The **conservation-versus-livelihood** dilemma often pits environmental goals against the needs of local communities.
  - Protected areas, such as **tiger reserves**, displace forest-dependent communities, while promoting ecotourism often excludes local participation.
    - This leads to social unrest and non-cooperation in conservation efforts.
  - The recent displacement of **Baiga tribes** in **Achanakmar Tiger Reserve (Chhattisgarh)** illustrate how conservation efforts can marginalize indigenous communities without sustainable planning and consultation.

### What Measures India Can Take to Strengthen Its Conservation Efforts?

- **Strengthen Forest Governance with Community Participation:** Empowering local communities, especially **tribal and forest-dwelling groups**, in forest conservation through participatory governance can significantly improve outcomes.
  - Effective implementation of the **Forest Rights Act (FRA), 2006**, along with integrating gram sabhas in decision-making under the **Panchayats (Extension to Scheduled Areas) Act (PESA), 1996**, can protect community rights while ensuring sustainable conservation.
- Co-management models like **Joint Forest Management (JFM)** can foster accountability.
- **Focus on Restoration Over Greening:** India must prioritize the **restoration of natural forests** rather than **expanding monoculture plantations** under afforestation schemes.
  - Restoring degraded ecosystems with **native species** will enhance biodiversity, improve soil quality, and increase the ecological resilience of forests.
  - Afforestation schemes like **National Mission for a Green India (GIM)** can be modified to ensure ecosystem restoration is a priority.
- **Leverage Technology for Monitoring and Conservation:** India can deploy advanced technologies like **satellite imagery**, **Geographic Information Systems (GIS)**, and drones to monitor forest cover, prevent illegal activities, and assess deforestation trends.
  - **Real-time forest monitoring systems** can improve enforcement of forest laws and protect critical biodiversity hotspots.
    - Linking these technologies with citizen engagement apps will also enhance accountability.
  - The **Forest Survey of India's e-Green Watch portal** is a positive step, but it needs greater coverage and integration with forest fire alerts.
- **Adopt Landscape-Based Conservation Model:** A landscape approach integrates forest conservation with **agriculture, water management, and urban planning**.
  - Protecting contiguous ecosystems like the Western Ghats, Sundarbans, and the Himalayan biodiversity hotspots through landscape-level strategies can ensure both conservation and livelihood security.
  - Linking the **Eco-Sensitive Zone (ESZ) framework** with watershed development programs will make conservation more comprehensive.
    - A landscape approach can simultaneously **address biodiversity loss and sustainable development** in this ecologically fragile region.
- **Strengthen Mangrove and Coastal Forest Conservation:** Mangroves play a critical role in protecting coastal areas from **erosion and cyclones**, yet they remain under severe threat.

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- Programs like **Mangrove for the Future (MFF)** should be scaled up and linked with national initiatives like **Blue Economy policies** and the **Sagarmala Project** to ensure coastal conservation is a priority.
  - Additionally, empowering local fishing communities in mangrove restoration can improve outcomes.
- Integrating mangrove restoration into coastal infrastructure development can ensure long-term protection.
- **Integrate Conservation with Climate Action:** India should link forest conservation efforts with its climate goals under the **Nationally Determined Contributions (NDCs)** of the Paris Agreement.
  - Programs like **National Afforestation Programme (NAP)** and **Green India Mission (GIM)** should focus on increasing the carbon stock of degraded forests.
  - Scaling afforestation efforts with **native species** can further enhance carbon sequestration while protecting biodiversity..
- **Promote Agroforestry and Sustainable Livelihoods:** Integrating agroforestry with rural development programs can reduce the dependency of local communities on forests for livelihood.
  - Agroforestry models like **Taungya systems** can ensure both agricultural productivity and conservation goals.
    - Linking agroforestry with the **Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)** can generate jobs while promoting green cover.
  - The **Sub-Mission on Agroforestry (SMAF)** has been successful in promoting agroforestry practices, but its implementation needs to be scaled up in deforestation-prone areas like Madhya Pradesh and Chhattisgarh.
- **Protect Tribal and Indigenous Rights:** Ensuring that tribal and indigenous communities have secure rights over forest resources is critical for long-term conservation.
  - The **Forest Rights Act (FRA), 2006**, should be implemented with greater transparency and efficiency, and policies like the **Forest (Conservation) Rules, 2022** must be **revised to align with tribal welfare**.
- Integrating tribal knowledge into forest management plans can strengthen conservation outcomes.
- Tribal co-management models in areas like **Mendha Lekha village, Maharashtra**, have shown how empowering communities can enhance conservation.
- **Integrate Conservation with Urban Planning:** India needs to focus on increasing urban forests to mitigate pollution, reduce heat islands, and enhance urban biodiversity.
  - Initiatives like **Nagar Van Yojana** should be linked with the **Smart Cities Mission** to ensure green spaces are prioritized in urban development.
    - Urban conservation efforts must focus on **restoring degraded lands and protecting wetlands**.
- **Promote Community-Based Ecotourism:** Instead of mass tourism, India should promote **community-based ecotourism**, empowering local communities to manage tourism in forest areas.
  - This ensures income generation for forest-dependent populations while minimizing environmental damage.
    - Guidelines for sustainable tourism practices must be developed and strictly enforced.
  - In places like **Kaziranga National Park in Assam**, **community-managed tourism** models have successfully reduced poaching and generated sustainable livelihoods.
- **Utilize Carbon Markets to Fund Forest Conservation:** India should leverage global and domestic carbon markets to fund forest conservation projects.
  - By monetizing carbon sequestration through afforestation and natural forest restoration, India can attract both private and international funding.
  - Carbon credits generated from forests can be sold in markets like the **Voluntary Carbon Market (VCM)**.
    - Expanding forest carbon credit programs will make conservation economically viable while meeting climate goals.
- **Implement a National Forest Fire Mitigation Strategy:** India needs a **comprehensive forest fire mitigation strategy** that includes early warning systems, local fire brigades, and forest fire breaks.

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- Controlled burns, community involvement, and real-time data from satellites should be leveraged to prevent and control fires.
- Special emphasis should be placed on **vulnerable zones like Uttarakhand and Himachal Pradesh**.

### Conclusion:

While India has made progress in expanding forest cover, it must focus on **improving forest health and biodiversity**. The degradation of dense forests, mangrove loss, and tribal rights violations highlight the need for a balanced approach. Strengthening forest governance and community participation is essential. Effective restoration of ecosystems and conservation laws are key to achieving sustainable development. **True forest conservation in India requires aligning environmental, social, and economic goals for the benefit of both nature and its people.**



## India's Critical Minerals Roadmap

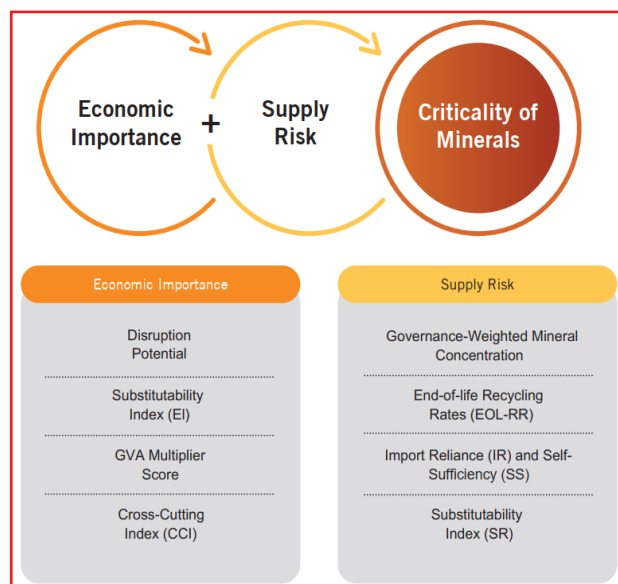
*This editorial is based on "[China's moves must recast India's critical minerals push](#)" which was published in The Hindu on 23/01/2025. The article brings into picture China's strategic control over critical minerals, India's limited progress despite policy reforms, and the need for aggressive fiscal incentives and capital support to unlock its mineral potential.*

**Tag:** GS Paper-1, Mineral & Energy Resources, GS Paper-2, Government Policies & Interventions, GS Paper-3

China's strategic control over **critical minerals**, essential for high-tech industries, is intensifying global economic and geopolitical tensions. India, despite policy reforms like the **Mines and Minerals Amendment Act**, has auctioned **only 48% of available blocks**, with limited foreign investment. Strategic minerals such as **lithium and rare earth elements** are increasingly tied to national security. However, **systemic barriers in exploration and classification hinder progress**. To unlock its mineral potential, India must consider aggressive fiscal incentives and upfront capital support, akin to semiconductor investment models.

### What are Critical Minerals?

- **About: Critical minerals** are those minerals that are essential for a country's **economic development and national security**.
  - Their limited availability or concentrated extraction and processing in a few geographical locations can create **supply chain vulnerabilities** or disrupt critical industries.
- **Global Significance:** Critical minerals like **lithium, graphite, cobalt, titanium, and rare earth elements** underpin future global economies and are indispensable for sectors such as **high-tech electronics, telecommunications, transport, and defense**. They are also pivotal for the **transition to a low-carbon economy** to achieve global **Net Zero commitments** through renewable energy technologies.
- **India's Identification of Critical Minerals:** Recognizing the importance of critical minerals, the Government of India has identified **30 critical minerals** through a three-stage assessment process.
  - This list includes **lithium, cobalt, nickel, rare earth elements, titanium, molybdenum, and vanadium**, among others.
  - The parameters used for selection include resource availability, import dependency, and their significance for future technologies, clean energy, and agriculture.
- **Factors Affecting Criticality:**



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## What Role does Critical Minerals Play in India's Economic Transformation?

- **Catalyzing India's Green Energy Transition:** Critical minerals like **lithium, cobalt, and nickel** are indispensable for India's shift towards renewable energy and EV adoption.
  - They form the backbone of technologies such as lithium-ion batteries, solar panels, and wind turbines.
  - The 2023 amendments to the Mines and Minerals Act and the **discovery of 5.9 million tonnes of lithium reserves in Jammu & Kashmir** underscore India's intent to develop domestic capacity.
  - A World Bank report highlights that the production of minerals like graphite, lithium, and cobalt may surge by **500% by 2050 to support the rising demand for clean energy technologies**, as India has set a target to become a **net-zero emitter of greenhouse gases (GHG) by 2070**.
- **Enhancing Strategic Autonomy and Reducing Import Dependency:** Critical minerals help reduce India's over-reliance on imports, **particularly from China**, which **dominates the global rare earth supply chain**.
  - However, currently, India sources **60% of its rare earth imports from China**. By expanding domestic mining, India can bolster its manufacturing capabilities in strategic sectors like **semiconductors, aerospace, and defense**.
- **Accelerating India's Electric Vehicle (EV) Ecosystem:** India's ambitious target of **30% EV penetration by 2030** hinges on access to critical minerals for battery manufacturing.
  - Indigenous production can lower battery costs, **making EVs more affordable** and accessible.
  - The **Economic Survey 2023-24** predicts that India's electric vehicle market will see a **49% compound annual growth (CAGR)** between 2022 and 2030.
  - India's collaboration with Australia under the Critical Minerals Investment Partnership (2022) and **KABIL's recent efforts to secure lithium and cobalt** abroad highlight the significance of global partnerships in securing supply chains.
- **Supporting Semiconductor and High-Tech Manufacturing:** Semiconductors, which are crucial for India's **digital and industrial revolution**, rely on rare minerals like **gallium and germanium**.
  - Developing a domestic critical mineral base would strengthen **India's \$10 billion semiconductor initiative** and position it as a global electronics hub.
- **Driving Economic Growth and Employment:** Domestic exploration and mining of critical minerals have the potential to create a new industrial ecosystem, generating jobs and boosting GDP.
  - The **government's identification of 30 critical minerals** and reforms like exploration licenses for private players are expected to **de-risk investments and attract foreign players**.
- **Strengthening India's Global Trade Position:** Critical minerals can enhance India's export basket, reducing trade deficits and creating new economic opportunities.
  - For instance, the **export of processed rare earth elements** could mirror India's success in pharmaceuticals and IT services.
  - **With China accounting for 90% of global rare earth processing**, India can leverage its own reserves and KABIL partnerships to diversify supply chains and capture global markets.
- **Fostering Technological Innovation:** Critical minerals underpin advancements in cutting-edge sectors like **AI, robotics, and space technology**, directly supporting India's vision for technological self-reliance under **"Atmanirbhar Bharat."**
  - India's **Chandrayaan-3 mission (2023)** and the **Gaganyaan mission (upcoming)** highlight the strategic importance of **beryllium, tungsten, and rare earths in aerospace and defense**.
  - Currently, **India is import-dependent for beryllium**, but domestic production can help reduce costs and ensure supply security.
- **Securing India's Energy Storage Needs:** Energy storage solutions are critical for grid stability, especially as **India scales up renewable energy installations to meet its target of 500 GW by 2030**.
  - Minerals like **vanadium and graphite** are integral to energy storage technologies like flow batteries and supercapacitors.

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## What are the Key Challenges India Faces Regarding Critical Minerals?

- **Overdependence on Imports:** India relies heavily on imports for critical minerals, making its **strategic industries** vulnerable to global supply chain disruptions and geopolitical tensions.
  - Minerals like **lithium, cobalt, gallium, and rare earth elements** are crucial for green energy, semiconductors, and defense sectors, **yet China dominates 80-90% of their global supply and processing**.
  - For instance, **India imports 100% of its germanium needs**, leaving it exposed to **China's 2023 tightened export policies on these minerals** (though primarily aimed at the United States, it has global implications).
- **Limited Domestic Exploration and Mining:** India's domestic exploration of critical minerals remains **inadequate**, hampering its ability to reduce dependency and capitalize on indigenous reserves.
  - The **absence of detailed geological surveys** and outdated exploration techniques discourages private investment.
  - For example, **only 48% of mineral blocks auctioned between 2020 and 2023 were sold**, and many auctioned blocks **lack G1 or G2-level exploration data**, making them commercially unattractive.
- **Underdeveloped Processing and Refining Capacity:** While India has reserves of some critical minerals, it lacks the infrastructure for **value-added processing**, forcing it to rely on external players for downstream industries.
  - For instance, India has discovered lithium in **Jammu & Kashmir** but lacks the refining capacity to process it domestically.
  - China, by contrast, **processes over 90% of global rare earths**, enabling it to dominate the global supply chain of advanced technologies
    - Also, **India lacks a skilled workforce** and advanced technology for mining and processing critical minerals, **reducing the efficiency and competitiveness of its industry**.
- **Policy and Regulatory Gaps:** India's policy framework for critical minerals, though improving, suffers from inconsistencies and a lack of investor confidence.
  - While the **2023 Mines and Minerals Act** introduced **exploration licenses**, its **execution has been slow**, with only a few licenses cleared and most going to public sector firms.
  - Moreover, the **absence of fiscal incentives for private players** has resulted in tepid interest, with India attracting limited foreign participation in exploration and mining activities.
- **Geopolitical Risks and Global Competition:** Global competition for critical minerals has intensified due to the green energy transition, limiting India's access to overseas mineral reserves.
  - Countries like the **U.S., China, and Australia** are **entering into exclusive agreements with other countries for mineral supplies**, leaving India lagging behind.
  - For instance, **China's Belt and Road Initiative secures mineral resources from Africa and Latin America**, while **India's Khanij Bidesh India Ltd. (KABIL)** has only made modest progress in securing lithium and cobalt from Argentina and Australia.
- **Environmental and Social Concerns:** Critical mineral mining is often associated with **environmental degradation** and social displacement, leading to opposition from local communities.
  - India's lithium reserves in Jammu & Kashmir, for instance, are located in **ecologically sensitive areas**, raising concerns about water contamination and biodiversity loss.
  - Additionally, **India's poorly managed mining sector** has caused significant damage, as seen in the **Bellary mining scam** which reflects broader governance challenges in mineral extraction.
- **High Upfront Costs and Delayed Returns:** The mining of critical minerals requires **substantial upfront investments**, often with a long gestation period before realizing returns.
  - For instance, **it can take 10-15 years to transition from exploration to production**, making it financially risky for private players.
  - **India's decision to reimburse exploration costs only after production begins**, rather than upfront, **has deterred investors**, as seen in the limited success of the exploration license introduced under the **2023 reforms**.

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- **Weak Recycling and Circular Economy Framework:** India's recycling industry for critical minerals is underdeveloped, resulting in **lost opportunities for extracting resources from e-waste and industrial scrap**.
  - India's electronic waste (e-waste) generation has significantly increased over the last five years, growing from 1.01 million metric tonnes (MT) in 2019-20 to 1.751 million MT in 2023-24.
    - This e-waste contains valuable **critical minerals like cobalt and rare earth elements**, but recycling capacity remains limited to informal sectors.
  - In contrast, **countries like Japan solved its rare earth minerals dependency issue through enhanced recycling**, significantly reducing their reliance on imports.
- **Export Restrictions and Trade Barriers:** India faces challenges in accessing critical minerals due to protectionist policies of resource-rich nations, which prioritize their domestic needs.
  - For instance, **Indonesia's export ban on nickel**, a key material for EV batteries, has disrupted global supply chains, affecting India's EV and battery production ambitions.
  - Similarly, the **growing trend of "resource nationalism" in countries like Argentina and Chile** is complicating India's efforts to secure stable mineral supplies through overseas partnerships.

| Sl. No. | Critical Mineral  | Percentage (2020) | Major Import Sources (2020)                         |
|---------|-------------------|-------------------|-----------------------------------------------------|
| 1.      | Lithium           | 100%              | Chile, Russia, China, Ireland, Belgium              |
| 2.      | Cobalt            | 100%              | China, Belgium, Netherlands, US, Japan              |
| 3.      | Nickel            | 100%              | Sweden, China, Indonesia, Japan, Philippines        |
| 4.      | Vanadium          | 100%              | Kuwait, Germany, South Africa, Brazil, Thailand     |
| 5.      | Niobium           | 100%              | Brazil, Australia, Canada, South Africa, Indonesia  |
| 6.      | Germanium         | 100%              | China, South Africa, Australia, France, US          |
| 7.      | Rhenium           | 100%              | Russia, UK, Netherlands, South Africa, China        |
| 8.      | Beryllium         | 100%              | Russia, UK, Netherlands, South Africa, China        |
| 9.      | Tantalum          | 100%              | Australia, Indonesia, South Africa, Malaysia, US    |
| 10.     | Strontium         | 100%              | China, US, Russia, Estonia, Slovenia                |
| 11.     | Zirconium(zircon) | 80%               | Australia, Indonesia, South Africa, Malaysia, US    |
| 12.     | Graphite(natural) | 60%               | China, Madagascar, Mozambique, Vietnam, Tanzania    |
| 13.     | Manganese         | 50%               | South Africa, Gabon, Australia, Brazil, China       |
| 14.     | Chromium          | 2.5%              | South Africa, Mozambique, Oman, Switzerland, Turkey |
| 15.     | Silicon           | <1%               | China, Malaysia, Norway, Bhutan, Netherlands        |

Table.1 The net import reliance for critical minerals of India (2020) (Source: A report on 'Unlocking Australia-India Critical Minerals Partnership Potential' by Australian Trade and Investment Commission, July 2021)

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## What Measures can India Adopt to Secure its Critical Mineral Supply Chain and Boost Processing Capabilities?

- **Centralized National Authority for Critical Minerals:** India needs a unified body to oversee exploration, acquisition, processing, and recycling of critical minerals.
  - This body should coordinate efforts across ministries, streamline decision-making, and **align domestic and international policies to avoid duplication of efforts.**
  - Recommendations to establish the **Center of Excellence for Critical Minerals (CECM)** as recommended by a seven-member Committee established by the Ministry of Mines, **is a step in the right direction.**
- **Develop Strategic Stockpiles of Critical Minerals:** India should establish a **strategic reserve of critical minerals** to safeguard against supply shocks, price volatility, and geopolitical disruptions.
  - This can be modeled on **China's stockpiling strategy for rare earths**, with a focus on high-priority minerals like lithium, cobalt, and gallium.
  - For example, India could prioritize minerals with the **highest import dependence (e.g., 100% imports of germanium and gallium)** and allocate budgetary support to maintain reserves for industries like EV manufacturing and semiconductors.
- **Provide Upfront Fiscal Incentives for Exploration and Processing:** To address the lack of private investment in exploration, the government should provide upfront fiscal incentives such as **subsidies, tax rebates, or soft loans** to de-risk early-stage exploration and processing ventures.
  - For instance, instead of reimbursing exploration costs only after production (as per the 2023 Mines and Minerals Act), the **government can provide direct capital support during the exploration phase.**
  - This approach has been successful in **India's semiconductor PLI scheme**, where upfront incentives attracted major players like Micron Technology.
- **Foster Public-Private Partnerships (PPPs) in Exploration and Refining:** Collaborating with private players can bring advanced technologies, investments, and expertise into the mining and processing sectors.

- The **government could develop a PPP framework** for exploration licenses, offering equity participation and risk-sharing models to attract both Indian and foreign firms.
- For example, partnerships with global leaders like **Australia's Lynas Rare Earths** or **Tesla (battery materials)** could help India boost its domestic refining capabilities and reduce import dependency.
- **Leveraging Mineral Diplomacy:** India should expand its participation in global alliances such as the **Mineral Security Partnership (MSP)** and the **Quad's Critical and Emerging Technology Forum.**
  - Bilateral agreements with resource-rich nations like **Australia, Canada, and Chile can secure diversified and stable supplies** of minerals like lithium, cobalt, and rare earths.
  - For instance, India's 2022 Critical Minerals Investment Partnership with Australia should be expanded to include **joint ventures in refining and processing, ensuring value addition within India.**
- **Incentivize Domestic Manufacturing of Downstream Industries:** India must promote domestic manufacturing of critical mineral-based products, **such as lithium-ion batteries, solar panels, and EV components**, to reduce reliance on imports.
  - The government could **extend PLI schemes to incentivize industries that create end-use products from critical minerals.**
  - For example, a **dedicated PLI scheme for this, similar to the one for Advanced Chemistry Cell**, could attract global companies like **Panasonic or CATL** to set up production units in India, supported by domestic mineral supplies.
- **Accelerate Recycling and Circular Economy Initiatives:** To reduce the demand for virgin critical minerals, India should **invest in advanced recycling technologies** and establish formal recycling ecosystems for e-waste and industrial scrap.
  - Policies like mandatory **take-back schemes for used electronics and batteries** can boost the recovery of minerals like cobalt, nickel, and rare earths.
  - For example, setting up formal recycling hubs in cities like **Bengaluru and Hyderabad (major e-waste generators)** could reduce import dependency while fostering sustainability.

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- **Invest in R&D for Advanced Mining and Processing Technologies:** India needs to focus on R&D for innovative technologies such as **AI-based exploration, in-situ leaching, and solvent extraction** to improve the efficiency of mining and processing operations.
  - Establishing dedicated R&D centers for critical minerals under institutions like **CSIR and IITs can fast-track technology adoption.**
  - For instance, advanced processing techniques could help India utilize low-grade ores in states like **Odisha and Jharkhand**, which remain underexploited due to inefficient recovery methods.
- **Build Infrastructure in Resource-Rich Regions:** To unlock the potential of critical mineral reserves in remote regions, **India must prioritize investments in infrastructure**, including roads, railways, power supply, and processing facilities.
  - For instance, **Arunachal Pradesh's rich mineral reserves** remain untapped due to **poor connectivity**; integrating these areas with the **Bharatmala and Sagarmala projects** could enable cost-effective transportation.
  - Furthermore, setting up integrated mining and processing clusters in mineral-rich regions like **Chhattisgarh and Karnataka** could reduce logistical inefficiencies.
- **Integrate Critical Minerals into India's Energy Security Policy:** India's energy security goals (**500 GW renewable energy capacity by 2030**) must be aligned with its critical minerals strategy to ensure consistent supply for solar panels, wind turbines, and battery storage.
  - For example, the **National Solar Mission and the National Electric Mobility Mission Plan** should have dedicated budgets for securing minerals like silicon, vanadium, and lithium.
  - Creating a **National Energy and Mineral Security Plan** could holistically address the supply chain needs of India's energy transition.
- **Establish a Green Mining Policy:** To address environmental and social concerns, India should implement a green mining policy with guidelines for sustainable practices, including **water management, biodiversity conservation, and rehabilitation of displaced communities.**

- Using renewable energy in mining operations and adopting clean technologies like carbon capture could minimize the environmental footprint.
  - For example, India could mandate **green certifications for projects in sensitive regions like Jammu & Kashmir's lithium reserves** to balance development with sustainability.
- **Promote Skill Development in Critical Mineral Sectors:** India must create a pipeline of skilled professionals for **exploration, mining, and processing** by integrating critical minerals into technical education and vocational training programs.
- Setting up centers of excellence in collaboration with global universities specializing in mining technologies (e.g., **University of Western Australia**) can provide India's workforce with the expertise needed to operate cutting-edge equipment.
  - For instance, training programs focused on rare earth processing could reduce India's dependence on foreign experts.

### Conclusion:

Critical minerals are vital for India's **energy transition, economic growth, and strategic autonomy**. Addressing gaps in exploration, processing, and recycling while leveraging global partnerships can reduce import dependency. **Sustainable practices, infrastructure development, and R&D investments** will strengthen supply chains. An integrated approach is key to securing India's future in high-tech and green industries.



## India's Path to Health Leadership

*This editorial is based on "[The health leadership opportunity for India](#)" which was published in Hindustan Times on 23/01/2025. The article brings into focus the need for new global health leadership following the US withdrawal from the WHO. India, with its growing contributions in health innovation, is well-positioned to lead in fostering equitable and sustainable global health practices.*

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**Tag:** GS Paper-2, Health, Important International Institutions, GS Paper-3, Government Policies & Interventions

The **US withdrawal from the WHO** underlines the need for **global health leadership**, as its departure disrupts funding and expertise crucial to **WHO's functioning**. While the WHO faces criticism for **bureaucracy, political influences, and declining efficiency**, its role in addressing global health challenges remains critical. India's relatively small but impactful contributions, particularly in **traditional medicine and digital health**, highlight its growing potential in global health governance. With reforms in global health institutions on the horizon, **India can leverage its expertise and innovative health solutions to emerge as a leader**. This moment presents India with an opportunity to champion equitable and sustainable global health practices.

### What are the Key Achievements of India in the Healthcare and Healthcare Governance?

- **Democratization of Healthcare:** Ayushman Bharat, launched in 2018, has **revolutionized access to healthcare** by covering over **36 crore beneficiaries (as of 2024)**, ensuring free hospitalization for poor families.
  - It bridges the **urban-rural gap in secondary and tertiary healthcare**.
  - The Ayushman Bharat program has led to a **remarkable 21% reduction in out-of-pocket healthcare expenditures** and an **8% decrease in the incidence of emergency loans** taken for health-related expenses
- **Unparalleled Vaccine Coverage and Disease Elimination:** India's immunization efforts have **eliminated polio and neonatal tetanus** while tackling diseases like **measles and hepatitis**.
  - India effectively mastered its Covid-19 vaccination campaign. As of January 2023, nearly **97% of eligible beneficiaries have received at least one dose of the Covid-19 vaccine**, and approximately 90% have received both doses.
  - **Mission Indradhanush** has boosted full immunization from **62% in NFHS-4 (2015-16) to 76.4% in NFHS-5 (2019-21)**.

- **Strengthening Rural Healthcare Infrastructure:** India has operationalized 1.72 lakh Ayushman Arogya Mandir under Ayushman Bharat as of 31st March 2024, providing **primary healthcare services, maternal health, and Non-communicable disease screenings**.
  - These centers cater to over crores of people annually, improving health outcomes in underserved rural areas.
- **Health Digitization through the National Digital Health Mission (NDHM):** NDHM, launched in 2020, is a game-changer in **health governance, enabling electronic health records and telemedicine services**.
  - Under this, the **QR-code-based OPD registration service** allows patients to share demographic details digitally, reducing wait times from **30-40 minutes to just 5-10 minutes**.
    - By November 2024, **17,481 facilities across 35 states/UTs** had generated 6.64 crore tokens, saving **3.3 crore person-hours**, enhancing accessibility and efficiency in healthcare delivery.
- **Focus on Traditional Medicine through AYUSH Integration:** India is leading globally in traditional medicine with initiatives like the **WHO Global Centre for Traditional Medicine in Gujarat (2022)**.
  - The **AYUSH sector grew by 17% annually**, contributing **\$18 billion** to the economy(2021), while programs promoting yoga and Ayurveda improved preventive care and wellness awareness among citizens.
- **Innovative Health Financing for Equity:** India has improved health governance by increasing health expenditure. India's public expenditure on healthcare touched **2.1% of GDP in FY23 and 2.2% in FY22**, against **1.6% in FY21**, as per the **Economic Survey 2022-23**.
  - The **Health and Education Cess** ensures sustainable funding for welfare programs.
- **Health Governance through Decentralized Efforts:** Localized governance models like **Kerala's participatory health programs** and **Rajasthan's Right to Health Act (2022)** emphasize accountability and citizen-centric healthcare.
  - These frameworks have empowered states to innovate, improving health indicators such as maternal mortality, where India achieved a **maternal mortality rate** of 97 per lakh live birth by 2020, marking a 25% reduction since 2014-16 levels.

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## What are the Major Challenges Holding Back India's Leadership in Global Health Governance?

- **Insufficient Health Expenditure:** India's **public health expenditure**, though improved, lags behind the WHO recommendation of 5%.
  - This underfunding impacts **infrastructure, manpower, and research capabilities** necessary to lead globally.
  - Also, despite improvements through Ayushman Bharat, a recent CAG report revealed that in **6 states/UTs, ineligible households were registered as PMJAY beneficiaries** and received benefits under the scheme.
    - This undermines India's international image as a responsible healthcare provider.
- **Weak R&D in Healthcare Innovations:** Despite strides in vaccine production, India's **healthcare R&D ecosystem is underdeveloped**, limiting its capacity for global leadership in cutting-edge medical research.
  - For instance, **India ranks 40<sup>th</sup> in the Global Innovation Index 2023**, reflecting limited investment in medical technologies.
  - **India's R&D funding stands at 0.64% of GDP**, with state budgets contributing only 0.1% of GSDP, hindering breakthroughs in emerging diseases.
- **Lack of Comprehensive Regulatory Frameworks:** India's health regulatory framework is fragmented, leading to inefficiencies in drug approval and public health emergencies.
  - Issues like the cough syrup controversy in 2023, linked to substandard exports, highlighted gaps in drug quality assurance.
    - For instance, the **World Health Organization linked Indian-made cough syrups to the acute kidney failure and deaths of 66 children in the West African country, The Gambia.**
  - Also, India is becoming a hotspot for Antimicrobial resistance, it is among the countries overusing **"Watch" group antibiotics**, with over 75% of infections for many antibiotic-bacterium combinations caused by resistant bacteria.
- **Disparities in Health Infrastructure:** Regional imbalances in healthcare facilities **undermine India's ability to address health crises equitably**.
  - While southern states like Kerala have advanced health indicators, northern states like **Uttar Pradesh still grapple with high infant mortality.**
  - India faces significant geographic disparities in health outcomes, with life expectancy ranging from **56 years in Madhya Pradesh to 74 years in Kerala.**
    - Also, disparities in health spending per capita worsen inequality and **reduce India's credibility as a health leader.**
- **Challenges in Pandemic Preparedness:** While India managed **Covid-19 effectively**, gaps in pandemic preparedness persist due to **fragmented surveillance systems and poor coordination.**
  - For instance, **India ranked 66th in the Global Health Security Index (2021)**, reflecting weaknesses in biosecurity and zoonotic disease monitoring.
  - Insufficient real-time data integration across states limits India's capacity to respond to global outbreaks like **H3N2 in 2023.**
- **Dual Burden of Communicable and Non-Communicable Diseases (NCDs):** India faces a **dual burden of communicable and non-communicable diseases.**
  - The proportion of deaths due to **Non-Communicable Diseases (NCDs)** in India have increased from **37.9% in 1990 to 61.8% in 2016.**
  - **Poor lifestyle choices and limited preventive care** hinder India's global health leadership in combating these challenges.
    - The **Economic Survey 2023-24** highlights that obesity is significantly higher in urban India than rural areas, with **29.8% of men and 33.2% of women affected**, compared to **19.3% and 19.7% in rural India (NFHS-5).**
- **Dependence on Generic Drug Manufacturing:** While India is the **"pharmacy of the world,"** its focus on generic drug manufacturing limits innovation in novel medicines.
  - At present a major component of Indian exports are **low value generic drugs while a large proportion of the demand for patented drugs is met through imports.**
  - This is because the Indian Pharmaceutical sector still has **much ground to cover in high value production and instil global pharma R&D.**

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- **Global Health Diplomacy Gaps:** India's global health outreach lacks consistency, often overshadowed by **China's Health Silk Road (HSR)**.
  - Though, under the **Vaccine Maitri initiative**, India has supplied over 235 million total supplies of Covid-19 vaccines to 98 countries of the world, but its limited participation in global health alliances like **Gavi, The Vaccine Alliance** reduces its leadership role.
    - This contrasts with the EU and China, which contribute more robustly to global health initiatives.
- **Environmental and Climate Health Challenges:** India's worsening air and water quality undermines its **global credibility in addressing environmental determinants of health**.
  - India is home to 14 of the world's 20 most polluted cities. Air pollution in India resulted in **1.67 million deaths in 2019**—the largest pollution-related death toll in any country in the world
  - India's ineffective implementation of the **National Clean Air Programme (NCAP)** raises concerns about its commitment to global environmental health goals.
- **Brain Drain of Health Professionals:** The migration of skilled doctors and nurses to developed nations limits India's ability to establish global health leadership.
  - India has been a major exporter of healthcare workers to developed nations particularly to the **Gulf Cooperation Council (GCC) countries, Europe and other English-speaking countries**.
- Develop **regional biotech clusters** (e.g., Bengaluru, Hyderabad) as global hubs for health R&D, supported by incubation centers.
- Also, establish a dedicated fund to finance research in **precision medicine, biotechnology, and vaccine development**.
- **Leverage Digital Health to Improve Accessibility:** Expanding the scope of the National Digital Health Mission (NDHM) to **provide services to neighboring nations in the Global South and promoting telemedicine services**.
  - India should actively promote **health-tech start-ups and platforms** for international collaboration in data-sharing and AI-based diagnostics.
    - **Provide seed funding for startups working on wearable health devices** and health management apps.
  - Deploy AI-driven diagnostic tools for early detection of diseases in rural and underserved areas.
- **Integrating AYUSH with Modern Medicine:** India can promote its traditional medicine systems globally by **integrating AYUSH with allopathic healthcare**, focusing on **evidence-based practices**.
  - Establishing more research centers like the **WHO Global Centre for Traditional Medicine (Gujarat, 2022)** in partnership with global organizations will enhance credibility.
  - Increase funding for clinical trials and research to scientifically validate AYUSH practices.
  - Promote **yoga and Ayurveda** through **embassies** and Indian cultural centers worldwide.
- **Expanding the Reach of Affordable Vaccines and Medicines:** India should further expand its leadership in vaccine manufacturing by leveraging its vaccine diplomacy initiatives like the **"Vaccine Maitri" program**.
  - Scaling up initiatives under the **Gavi Alliance** can **ensure global availability of affordable vaccines**.
  - Collaborate with African countries to build vaccine production capacity under **"Vaccine Maitri 2.0."**
  - Ease regulatory approvals for Indian generics in international markets through bilateral agreements.
- **Improving Health Infrastructure through Global Collaboration:** India must invest in health infrastructure under schemes like the **PM-Ayushman Bharat**

### How India Can Emerge as a Global Health Leader?

- **Strengthening Research and Development (R&D) in Health Innovation:** India must invest in R&D to develop **cutting-edge medical technologies, indigenous vaccines, and affordable drugs**.
  - With initiatives like the **Production Linked Incentive (PLI) scheme** for pharmaceuticals, India can boost **manufacturing of complex generics and biosimilars**.
  - By enhancing collaboration between the **private sector, ICMR, and academia**, the country can position itself as a hub for innovation.

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**Health Infrastructure Mission (PM-ABHIM)** while creating avenues for international partnerships in hospital management, diagnostics, and equipment manufacturing.

- Set up **vaccine manufacturing hubs in Tier-2 cities** to boost production and accessibility.
- Encourage foreign investments in tertiary hospitals and medical device manufacturing under “Make in India.”

➤ **Tackling Antimicrobial Resistance (AMR) through Global Leadership:** India, a **hotspot for Antimicrobial resistance** due to overuse of **antibiotics**, should lead the fight by strengthening surveillance mechanisms and promoting the **National Action Plan on AMR**.

- Encouraging responsible antibiotic use in domestic policies and collaborating with **WHO and G20 nations can help address this global health crisis**.
  - Push for global implementation of **WHO’s AMR containment policies**, led by India.
- India reported nearly 60% resistance in common bacterial infections (ICMR, 2023), making it critical to prioritize AMR in global health strategies.

➤ **Expanding the Scope of Ayushman Bharat for Global Health Diplomacy:** India can showcase **Ayushman Bharat as a model for achieving Universal Health Coverage (UHC)** in low- and middle-income countries.

- By assisting developing nations in replicating the program, India can demonstrate its **leadership in global health governance**.

➤ **Addressing Climate Change and Health:** India should lead initiatives **linking climate action to public health**, such as promoting resilient healthcare infrastructure in disaster-prone regions.

- By leveraging the **National Adaptation Fund for Climate Change (NAFCC)** and integrating health impact assessments into climate policies, India can drive global action.
- India can also focus on building **energy-efficient hospitals** with solar power and sustainable waste management.

➤ **Focusing on Women’s and Children’s Health for Global Impact:** India must champion programs targeting

maternal and child health through platforms like **Poshan Abhiyaan** and **Mission Shakti**.

- Expanding these programs globally, especially in **South Asia and Africa**, can reduce maternal and infant mortality worldwide.
- **India’s success in reducing MMR to 97 per lakh live births** and increased institutional delivery rates positions it as a model for addressing gendered health disparities.

➤ **Combining Swachh Bharat and Health Initiatives:** Linking the **Swachh Bharat Mission (SBM)** with **health programs** can improve hygiene-related health outcomes, such as reducing diarrheal diseases globally.

- About **95% of villages in India have declared themselves “open defecation free plus” till now**, India can scale this initiative internationally to address public health challenges in sanitation-deficient regions.

➤ **Improving Global Supply Chain Resilience for Health Products:** India should enhance global health supply chain resilience by **strengthening the pharmaceutical and API (Active Pharmaceutical Ingredients) sectors**.

- Investments in schemes like the PLI for APIs and bulk drugs, combined with trade partnerships in Africa and Latin America, can establish India as a reliable supplier.
- India can also leverage trade pacts to expand the export of affordable generics and medical devices worldwide.

### Conclusion:

India’s potential to emerge as a global health leader lies in **leveraging its achievements in vaccine diplomacy, digital health, and traditional medicine** while addressing critical gaps in **health expenditure, infrastructure, and R&D**. By tackling challenges like antimicrobial resistance and climate-linked health risks, India can set an example for sustainable and inclusive global health governance. With strategic reforms and investments, **India can transform global health systems and promote equality worldwide**.



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## Revamping India's Nuclear Energy Sector

*This editorial is based on “**Nuclear muddle**” which was published in The Hindu on 07/05/2024. The article brings into picture the recent NPCIL RFP for Bharat Small Reactors, highlighting progress in nuclear technology but also the limitations on private sector involvement. It emphasizes the need for policy reforms, increased private participation, and clearer regulations to fully realize India's nuclear potential.*

**Tag:** GS Paper-1, Mineral & Energy Resources, GS Paper-3, Nuclear Technology

India's Nuclear Power Corporation of India Ltd (NPCIL) recent Request for Proposal (RFP) for **Bharat Small Reactors (BSRs)** reflects a significant step towards **small modular reactors**, but the conditions imposed raise concerns about **private sector participation**. Despite significant strides in nuclear technology and strategic capabilities, **India's nuclear sector** continues to grapple with structural impediments. **Transformative policy reforms, enhanced private sector engagement, and more transparent regulatory frameworks** remain critical to realizing the full potential of India's nuclear infrastructure development.

### What is the Current Regulatory Landscape of the Nuclear Energy Sector in India?

- **Centralized Control:** Governed by the **Atomic Energy Act, 1962**, the central government has exclusive authority over nuclear energy.
  - The **Atomic Energy Regulatory Board (AERB)** is responsible for overseeing safety standards and compliance within the nuclear industry in India
- **Civil Liability for Nuclear Damage Act, 2010:** This law caps operator liability at ₹1,500 crore, with a government backstop.
  - The **India Nuclear Insurance Pool (INIP)** provides insurance coverage for accidents.
- **International Compliance:** India adheres to IAEA safeguards under the **Indo-US Civil Nuclear Agreement** but is not a signatory to the **Non-Proliferation Treaty (NPT)**, maintaining strategic autonomy.

## What is the Significance of Nuclear Energy for India?

- **Diversification of Energy Mix:** Nuclear energy provides a **stable and reliable source of electricity**, reducing India's **over-dependence on coal**, which currently accounts for **55% of the country's energy needs**.
  - By diversifying energy sources, **nuclear power mitigates supply risks associated with volatile fossil fuel markets** and complements intermittent renewables like solar and wind.
  - As of May 2023, **nuclear energy contributed 1.6% of India's total energy generation**, with plans to increase nuclear capacity from 7.5 GW to 100 GW by 2047.
  - Furthermore, **nuclear power is envisioned to supply 25% of India's electricity by 2050**, crucial for ensuring energy independence.
- **Climate Change Mitigation and Decarbonization:** Nuclear energy, a low-carbon energy source, plays a **critical role in India's commitment to achieving net-zero emissions by 2070**.
  - With an **emissions intensity of near-zero CO<sub>2</sub> per unit of electricity generated**, nuclear energy is vital to replacing coal and offsetting the intermittency of renewables.
  - India pledged at **COP26** to achieve **500 GW of non-fossil fuel energy by 2030**, and **nuclear energy is projected to help achieve this**, contributing **22.48 GW by 2031-32**.
    - The “**Synchronizing Energy Transitions Report 2024**” emphasized the necessity of nuclear energy for a clean energy future.
- **Reducing Import Dependence:** Nuclear energy reduces **India's reliance on imported fossil fuels**, which constitute **over 85% of crude oil and 50% of natural gas needs**.
  - This reliance increases economic vulnerabilities to global price fluctuations and geopolitical tensions.
  - By 2024, India's progress with indigenous technologies, such as the **Fast Breeder Reactor at Kalpakkam**, reflects its capability to develop domestic nuclear solutions.
- **Economic Growth and Job Creation:** The nuclear energy sector stimulates economic growth through investments in infrastructure, manufacturing, and R&D.

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- Large-scale nuclear projects, such as the **Kudankulam Nuclear Power Plant** expansion (adding 2,000 MW by 2026), provide employment opportunities and spur local economies.
- India's nuclear energy capacity nearly doubled from **4,780 MW in 2014 to 8,180 MW in 2024**, generating jobs in construction, operation, and equipment manufacturing.
  - The **proposed Bharat Small Modular Reactors (BSMRs)** can further drive innovation and create employment in advanced technologies.
- **Base-Load Energy Support for Renewables:** Unlike **solar and wind energy**, which are **weather-dependent**, nuclear provides **consistent base-load electricity**, stabilizing the grid as renewable penetration increases.
  - India's energy demand is predicted to double to around 1200 Mtoe (Millions tonnes of oil equivalent) by 2070, **necessitating a robust grid supported by nuclear power**.
  - Current developments, such as the **addition of 10 reactors totaling 8,000 MW**, showcase nuclear's capacity to bridge supply gaps.
- **Geopolitical Leverage and Strategic Alliances:** Nuclear energy strengthens **India's position in global energy geopolitics** by fostering partnerships and enhancing its energy diplomacy.
  - India's indigenous advancements, such as the **Prototype Fast Breeder Reactor (Kalpakkam)**, underscore its technological prowess, helping India counter strategic vulnerabilities and **negotiate better terms in global energy deals**.
- **Sustainable Urbanization and Industrialization:** With **India's urban population projected to grow to 600 million by 2031**, nuclear energy can meet the rising demand for clean and uninterrupted electricity in cities.
  - It supports **industrial growth**, particularly energy-intensive sectors like manufacturing and steel, which require a steady power supply.
  - Upcoming projects like the **Rajasthan Atomic Power Station Units 7 and 8 (1,400 MW)** aim to address such demands sustainably.
- **Disaster Resilience and Energy Reliability:** Nuclear energy ensures resilience in energy supply during natural disasters or geopolitical disruptions, unlike imported fossil fuels prone to supply chain risks.

- For example, the **Kakrapar Atomic Power Station in Gujarat** demonstrated reliable performance during recent grid disruptions.

### What are the Key Issues Associated with India's Nuclear Sector?

- **Limited Share in Energy Mix:** Despite **decades of investment**, nuclear energy contributes only **1.6% to India's total energy generation**, far below its potential.
  - The reliance on coal and slow expansion of nuclear capacity indicate that the sector has not achieved scalability.
  - Current nuclear capacity is 7.5 GW, with a modest increase to **8.18 GW in 2024**, far from the ambitious goal of 22.48 GW by 2031-32.
  - The limited progress is concerning, **given India's target of 25% electricity from nuclear by 2050**.
- **Financial and Investment Challenges:** Nuclear energy projects require massive capital investments with long gestation periods, deterring private and foreign investment under current policies.
  - The **Atomic Energy Act, 1962**, restricts **private sector involvement** in reactor operations, while FDI is prohibited in the atomic sector.
  - **India aimed to attract \$26 billion in private investment in nuclear energy**, but operational and regulatory bottlenecks remain.
  - Even with **100% FDI allowed in nuclear equipment manufacturing**, financial constraints delay projects like the **Rajasthan and Kakrapar reactor units**.
- **Dependence on Imported Nuclear Fuel:** India's nuclear sector faces significant challenges in securing a **stable supply of uranium**, as domestic reserves are limited and fuel imports are subject to geopolitical risks.
  - For instance, the sanctions following the **1998 nuclear tests** underscored India's vulnerability to disruptions.
  - As per the 2024 **"Energy Transition Report,"** the government is exploring strategic nuclear fuel reserves, but current progress is insufficient.
- **Safety Concerns and Public Opposition:** Safety issues, real and perceived, have led to widespread public opposition to nuclear projects, delaying critical infrastructure.

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- Incidents like the **Fukushima disaster (2011)** in Japan and apprehensions around radioactive waste have fueled protests, as seen at **Kudankulam (Tamil Nadu)**.
- Despite advancements, India lacks a permanent radioactive waste disposal system.
- The **Supreme Court's 2024 judgment** upholding the Atomic Energy Act further emphasized the necessity for stringent safeguards, **but public trust remains fragile**.
- **Technological Delays and Project Inefficiencies:** India's nuclear expansion is marred by **delays in project execution** due to outdated technology, inefficiencies, and bureaucratic hurdles.
  - For instance, the **Prototype Fast Breeder Reactor (Kalpakkam)** was expected to be operational by **2012** but has yet to achieve full functionality.
    - These delays hinder **India's target to triple its nuclear capacity by 2031-32**.
  - Acquiring land for nuclear projects has been a contentious issue, **often leading to delays and escalating costs**.
    - Protests over land acquisition have stalled projects like **Jaitapur Nuclear Power Plant in Maharashtra**, which has faced resistance for over a decade.
- **High Cost of Nuclear Energy:** Nuclear power has a high upfront capital cost compared to renewables, making it less attractive for domestic investment.
  - For instance, according to a 2017 report, the **construction of the fifth and sixth units at India's largest nuclear power plant in Tamil Nadu** is expected to cost around **Rs 50,000 crore**, with half of the funding provided by **Russia as a loan**.
  - Also, the **levelized cost of electricity (LCOE)** for nuclear power is higher than solar and wind, which benefit from declining technology costs.
- **Waste Management and Environmental Risks:** India has **not yet established a long-term solution for radioactive waste disposal**, raising environmental and safety concerns.
  - India produces about four tonnes of nuclear waste for every gigawatt (GW) of electricity generated each year.

- This waste primarily consists of **spent nuclear fuel and radioactive materials that result from the operation of nuclear reactors**.
- The accumulation of such waste poses significant challenges for disposal and long-term storage.
- **Dependence on Foreign Technology:** India's nuclear program heavily relies on foreign technology for reactors and other critical infrastructure.
  - Collaborations with **Russia (Kudankulam)** and **France (Jaitapur)** demonstrate this dependency, which limits technological self-reliance.
  - This reliance hinders India's strategic goal of achieving full nuclear self-sufficiency.
- **Limited Skilled Workforce:** The nuclear sector requires a highly skilled workforce, but India faces a shortage of trained personnel for reactor operations and R&D.
  - Institutions like **BARC** have **limited intake capacity**, and expanding the workforce to meet upcoming projects remains challenging.
  - Without addressing this gap, India risks delays in project execution and safety compliance.

### What Measures can India Adopt to Revamp its Nuclear Sector?

- **Enhancing Private Sector Participation:** India should amend the **Atomic Energy Act, 1962**, to allow private sector participation in reactor operations, ensuring stringent regulatory safeguards.
  - Private investment can accelerate technological innovation, reduce project delays, and unlock funding for large-scale projects.
  - A **hybrid development model**, combining government oversight with private expertise, would fast-track projects like **Bharat Small Modular Reactors (BSMR)**.
- **Expanding Indigenous Technology Development:** Collaborations between government agencies like **BARC (Bhabha Atomic Research Centre)** and private players should focus on indigenous technologies like **Fast Breeder Reactors** and **Small Modular Reactors (SMRs)**.
  - **Public-private partnerships** can enable rapid R&D, reduce dependence on foreign technology, and ensure faster scalability of reactors.

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- These partnerships can also integrate domestic MSMEs into the nuclear supply chain, as successfully demonstrated in the **Kalpakkam Fast Breeder Reactor** project.
- **Accelerating Land Acquisition and Rehabilitation Policies:** Streamlining land acquisition for nuclear projects requires integrating the **Right to Fair Compensation and Transparency in Land Acquisition Act, 2013**, with expedited project clearances under the **Ease of Doing Business (EoDB)** initiative.
- The government should establish special land banks for nuclear projects, ensuring equitable compensation and sustainable rehabilitation for displaced communities.
- **Establishing Strategic Nuclear Fuel Reserves:** India must ensure a **strategic nuclear fuel reserve** to address risks of supply chain disruptions caused by geopolitical uncertainties.
- Leveraging agreements with countries like Russia, Kazakhstan, and Canada under the **Civil Nuclear Cooperation Agreements** can secure long-term uranium supplies.
- Alongside these, **India should invest in advanced fuel-cycle technologies**, including **thorium utilization**, aligning with its abundant domestic reserves and long-term sustainability goals.
- **Fast-Tracking Regulatory Approvals through Institutional Reforms:** India needs to reform the **Atomic Energy Regulatory Board (AERB)** to streamline the approval process for nuclear projects without compromising safety standards.
- Establishing an **independent National Nuclear Energy Authority (NNEA)** with clear mandates for reactor approvals, safety monitoring, and collaboration with state governments would reduce bureaucratic delays.
- This aligns with India's broader **regulatory ease reforms** under the **Gati Shakti National Master Plan** to boost infrastructure efficiency.
- **Boosting Financial Support through Sovereign Green Bonds:** To address the high capital costs of nuclear projects, India should allocate funds through **Sovereign Green Bonds** under its climate financing strategy.
- Green bonds can attract international climate-focused investors, aligning nuclear projects with India's **Net Zero by 2070** goals.
- Creating a **Nuclear Energy Development Fund** under green financing frameworks would help mitigate financial constraints and ensure timely project execution.
- **Fostering Skill Development in the Nuclear Sector:** Developing a skilled workforce for India's nuclear sector requires integrating **Skill India Mission** with specialized training programs led by **BARC** and other institutions.
- Programs focusing on advanced nuclear technologies, reactor operations, and waste management would address workforce shortages and enhance safety compliance.
- Collaborations with international institutions under agreements like **IAEA (International Atomic Energy Agency)** partnerships could further bolster technical expertise.
- **Developing Long-Term Radioactive Waste Management Solutions:** India must establish a comprehensive **Radioactive Waste Management Framework**, focusing on permanent disposal facilities and advanced waste processing technologies.
- Collaborating with countries that have operational waste management solutions, such as **Finland and Sweden**, could accelerate the adoption of best practices.
- Linking this effort with India's **Circular Economy Framework** can enhance sustainability by focusing on safe reuse of byproducts, like in the thorium fuel cycle.
- **Incentivizing Local Manufacturing in Nuclear Supply Chains:** India should integrate the nuclear sector into the **Make in India** and **PLI (Production Linked Incentive)** schemes to boost domestic manufacturing of nuclear components.
- Incentives for MSMEs and startups in nuclear equipment manufacturing could reduce costs and reliance on imports.
- This model, similar to the **Belagavi Aerospace Cluster**, can expand India's industrial base while enhancing self-reliance in critical technologies.
- **Improving Public Awareness and Addressing Opposition:** The government should launch extensive public awareness campaigns about nuclear safety, benefits, and environmental sustainability.

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- Engaging local communities through consultations, **sharing safety records (e.g., Kudankulam's safety track record)**, and providing benefits like free electricity or local development initiatives can reduce opposition.
- Transparent communication and community partnerships are key to fostering trust and expediting project approvals.
- **Promoting Small Modular Reactors:** India should focus on developing **Small Modular Reactors (SMRs)** to meet the decentralized energy needs of remote and rural areas.
  - These reactors are cost-effective, safer, and easier to deploy compared to large reactors.
  - By integrating SMRs with the **Deendayal Upadhyaya Gram Jyoti Yojana (DUGJY)**, India can provide sustainable energy to underserved regions while reducing transmission losses.
- **Strengthening International Technology Transfer Agreements:** India should aggressively pursue technology transfer agreements with countries like the USA, Japan, and South Korea to gain access to cutting-edge reactor designs and fuel cycle technologies.
  - For example, **leveraging the 123 Agreement with the US** can boost light-water reactor capabilities.
  - Such collaborations can expedite the deployment of advanced reactors while aligning with **India's Vision 2047 energy roadmap**.
- **Leveraging AI and Digital Twins for Reactor Operations:** India can integrate **Artificial Intelligence (AI)** and **Digital Twin** technology to monitor and optimize reactor performance in real time.
  - AI can predict **maintenance needs, detect anomalies**, and improve operational safety, reducing risks of human error. **Digital Twins—virtual models of reactors**—can simulate operations, allowing for predictive analysis and efficient training of operators.

### Conclusion:

India's nuclear energy sector holds **immense potential to drive energy security, climate goals, and economic growth**, but structural and regulatory challenges persist. By amending outdated policies, fostering **private sector participation, enhancing indigenous capabilities, and**

**streamlining regulatory frameworks**, the sector can be revitalized. Innovative approaches like small modular reactors, AI integration, and sustainable waste management are crucial to overcoming current bottlenecks.



## AI: Transforming India's Workforce and Economy

*This editorial is based on "[Getting to a new level in India's online gaming sector](#)" which was published in The Financial Express on 27/01/2025. The article brings into picture how GenAI is reshaping the global job market, challenging India's skilled IT workforce. It emphasizes the need to reform education, focusing on practical skills to align with emerging AI-driven opportunities and harness the demographic dividend.*

**Tag:** GS Paper-3, Robotics, Artificial Intelligence, Scientific Innovations & Discoveries, IT & Computers, GS Paper-2, Government Policies & Interventions

India stands at a pivotal moment as **artificial intelligence**, particularly **GenAI**, reshapes the global job market. While economic growth has struggled to create **quality jobs beyond traditional sectors**, the AI revolution brings both challenges and opportunities. India's historical emphasis on theoretical knowledge over practical skills requires urgent **rethinking**, as GenAI could replace many cognitive tasks. However, emerging fields driven by **climate change**, **aging populations**, and **advanced technology** demand **medium-skilled workers like technicians and healthcare professionals**. To fully capitalize on its demographic dividend, India must reform education and training systems to **develop skills that complement AI, ensuring future-ready employment**.

### What are the Key Recent Breakthroughs in Artificial Intelligence?

- **Generative AI:** Models like **OpenAI's GPT-4** and **Google's Bard** have revolutionized content generation, enabling human-like text, image, and code creation. Applications span across education, healthcare, and creative industries.

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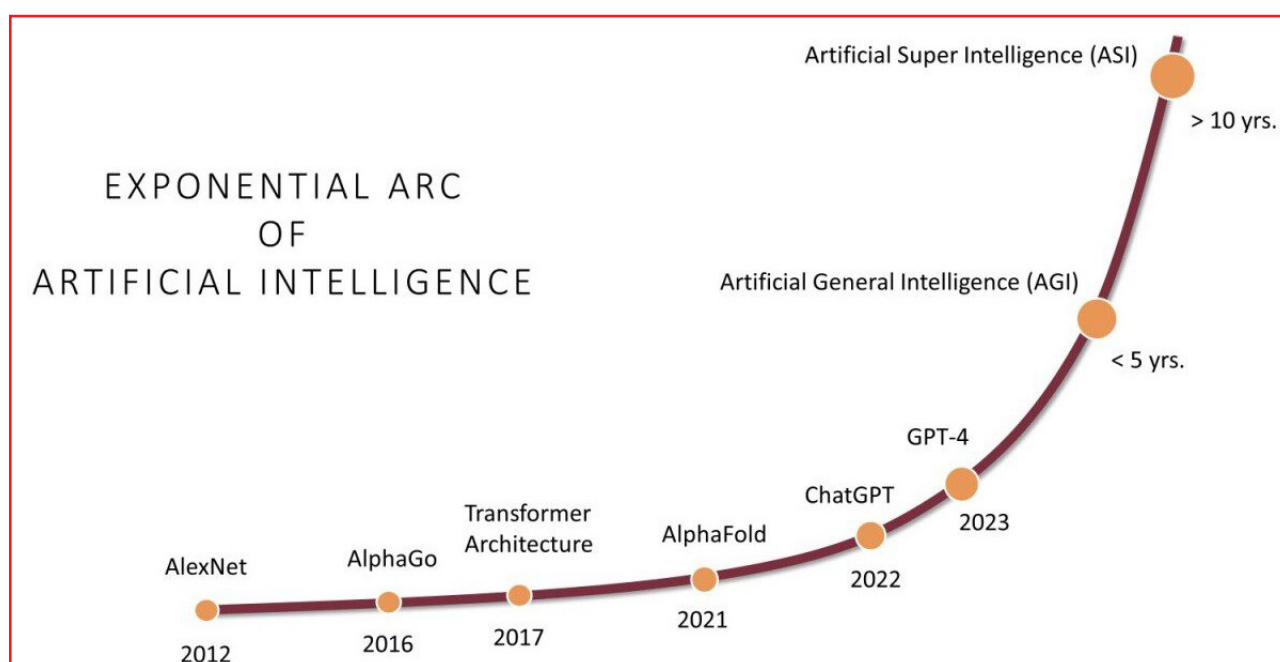
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- **Multimodal AI:** Meta's LLaMA and OpenAI's DALL-E 3 combines text, image, and video processing, enabling AI systems to understand and generate outputs across multiple formats.
- **AI in Drug Discovery:** AI-based platforms like DeepMind's AlphaFold have predicted the structure of nearly every protein known to science (as of 2023), accelerating medical research and drug development.
- **Generative AI for Code:** Tools like GitHub's Copilot X (2023) and OpenAI's Codex automate software development, increasing developer productivity and coding efficiency.
- **Generative AI in Speech:** ElevenLabs and VALL-E (Microsoft, 2023) enable high-quality voice synthesis, revolutionizing applications in virtual assistants, audiobooks, and customer service.
- **Autonomous Agents:** AI models like AutoGPT and BabyAGI perform multi-step autonomous tasks without human intervention, advancing the capabilities of AI beyond single-task focus.
- **AI in Creative Industries:** Runway Gen-2 and Adobe Firefly empower AI-generated video and image editing, transforming digital content creation.
- **AI in Climate Modeling:** Tools like Google's GraphCast predict weather conditions up to 10 days in advance more accurately and much faster than the industry gold-standard weather simulation system.



### What are the Key Opportunities AI Revolution Brings for India's Economic Growth?

- **Boosting Productivity Across Sectors:** AI can revolutionize traditional industries such as **agriculture**, **manufacturing**, and **logistics** by optimizing processes, reducing waste, and improving supply chain efficiency.
  - For instance, **precision farming** using AI-powered drones and sensors can enhance crop yields and reduce input costs.
  - **AI-enabled automation in manufacturing** can bridge gaps in India's lagging industrial productivity.
  - **NITI Aayog** estimates AI has the potential to add **\$957 billion to India's GDP by 2035**.
    - A December 2024 report states that as many as **78% of small and medium-sized businesses (SMBs)** in India using artificial intelligence (AI) have reported revenue growth

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| Business function                   | % Adoption (2020-21) | % Adoption (2022-23) |
|-------------------------------------|----------------------|----------------------|
| Human resources                     | 43%                  | 68%                  |
| Risk, legal, compliance             | 23%                  | 62%                  |
| Finance and tax                     | 28%                  | 67%                  |
| Sales and marketing                 | 61%                  | 86%                  |
| Customer service                    | 68%                  | 87%                  |
| Manufacturing and operations        | 36%                  | 75%                  |
| Research and development/innovation | 40%                  | 67%                  |
| Supply chain and logistics          | 26%                  | 69%                  |
| IT and cybersecurity                | 60%                  | 87%                  |

- **Expanding the IT and Knowledge Services Sector:** India, already a global leader in **IT services**, can harness AI to move up the value chain by offering **advanced AI-based services** such as **cloud computing, generative AI applications, and cybersecurity solutions**.
  - This positions **Indian IT firms** to capture a greater share of the **\$297 billion global AI services market projected by 2027**.
  - Indian companies like **TCS** are investing heavily in artificial intelligence (AI) and generative AI, with a **project pipeline exceeding \$1.5 billion**.
- **Enhancing Healthcare Delivery:** AI applications in diagnostics, predictive health, and personalized medicine can revolutionize healthcare in India by making it more **accessible, affordable, and efficient**.
  - AI-powered tools like telemedicine platforms and diagnostic algorithms are critical in bridging gaps in rural healthcare infrastructure.
  - For instance, **Karnataka's AI-based lung cancer screening** has detected **133 cases of high lung nodule malignancy** and identified nearly 3,000 TB-presumptive cases
- **Fostering Financial Inclusion:** AI is driving financial inclusion by enabling **digital banking, fraud detection, and micro-lending platforms** that use AI to assess creditworthiness for underserved populations.
  - It has significantly improved access to formal financial services in rural areas through mobile-based platforms and AI-driven chatbots.
  - For instance, **Aye Finance**, an Indian fintech company, **uses AI to analyze alternative data like phone usage, social media, and transactions** to assess creditworthiness, enabling financial inclusion for small businesses.
    - This approach has helped extend credit to thousands of enterprises across India.
- **Enabling Smart Governance and Public Service Delivery:** AI can make governance **more efficient by aiding decision-making**, predicting policy outcomes, and ensuring better targeting of welfare schemes.
  - AI-powered tools like **grievance redressal systems** and real-time data analytics can enhance public service delivery and transparency.

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- For instance, **Unique Identification Authority of India (UIDAI)** launched an AI-based chatbot, “Aadhaar Mitra”, which is trained to respond to resident’s queries.
- **Accelerating Climate Resilience and Renewable Energy Growth:** AI tools for **climate modeling**, **renewable energy forecasting**, and energy grid optimization can bolster India’s climate resilience efforts and aid in achieving its ambitious renewable energy targets.
  - AI is already used in solar and wind energy optimization for maximizing output.
    - For instance, **Tata Power uses AI to predict solar energy production** from its factory’s solar power plant. This helps the company better manage its grid and ensure it has enough power to meet demand.
  - A recent report from McKinsey reveals that **AI-driven technologies can help businesses reduce their CO2 emissions by up to 10%** and cut energy costs by 10-20%.
- **Catalyzing the Startup Ecosystem:** India’s burgeoning startup ecosystem is a key beneficiary of the AI revolution, with startups leveraging AI in **fintech, edtech, healthtech, and agritech**.
  - This has enabled the creation of **innovative, scalable solutions** that attract significant venture capital investments.
  - India is home to more than **100 GenAI startups** and these startups have raised more than **\$600 million since 2019**.
  - Unicorns like **Fractal Analytics** are examples of Indian startups thriving in the global AI market.
- **Driving Innovation in Defense and National Security:** AI can transform India’s defense sector by **enabling autonomous systems**, real-time threat detection, and predictive intelligence.
  - AI-based tools are also strengthening cybersecurity infrastructure to counter emerging threats in the digital domain.
  - For instance, launched in March 2024, the **Acing Development of Innovative Technologies with IDEX (ADITI) scheme** aims to foster innovations in critical defence technologies essential for national security.

- **DRDO has developed “Divya Drishti,”** an AI tool that combines face recognition with immutable physiological parameters like gait and skeleton.

### What are the Key Challenges AI Poses to India’s Traditional Economy?

- **Job Displacement in Low-Skill and Routine Jobs:** AI-driven automation poses a significant threat to jobs in sectors like **manufacturing, agriculture, and low-skill services**, where routine, repetitive tasks are dominant.
  - Traditional industries relying on **manual labor may face redundancies**, exacerbating unemployment in India’s informal sector, **which already employs over 90% of the workforce**.
  - **Automation threatens 69% of jobs in India over the next 20 years**, posing a significant challenge to employment. This shift could reshape the workforce landscape significantly.
- **Widening Skill Gap:** The rapid rise of AI creates a demand for high-skilled workers in **coding, machine learning, and data science**, while traditional workers lack access to the necessary skilling resources.
  - The education system’s focus on theoretical learning, with **limited emphasis on vocational and AI-relevant training**, further deepens the skills mismatch.
  - This imbalance could marginalize millions of workers from India’s demographic dividend.
  - The **India Skills Report 2023** highlights that **only 48.7% of Indian graduates are considered employable**, with demand for AI skills outpacing supply.
- **Erosion of Traditional Business Models:** AI-driven platforms and digitalization are disrupting traditional businesses, particularly in **retail, agriculture, and small-scale manufacturing**.
  - Local traders and artisans are losing **ground to e-commerce giants (especially quick commerce)** and automated supply chains that leverage AI to optimize costs and reach larger markets.
  - This disruption risks eroding small businesses, which are the backbone of India’s economy.
- **Cybersecurity Threats to Traditional Businesses:** As traditional sectors integrate AI to remain competitive, they face increased **vulnerability to cyberattacks and data breaches**.

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- Many small businesses lack the expertise to secure AI systems, putting their operations and customer data at significant risk.
  - This hampers the trust and reliability of AI integration in traditional industries.
- For instance, in 2023, India experienced over **79 million cyberattacks**, ranking it third globally in terms of the number of such incidents and the escalation continued into 2024.
- **Digital Exclusion of Rural Areas:** India's rural economy, which relies on agriculture and local enterprises, risks being sidelined as AI adoption remains concentrated in urban areas.
  - **Poor digital infrastructure and low digital literacy** prevent rural entrepreneurs and workers from leveraging AI, widening the urban-rural divide.
  - For instance, **only 45% of the Indian population**, or about 665 million citizens, do not access the internet as of 2023, according to a joint study by the Internet and Mobile Association of India (IAMAI) and Kantar released on Tuesday.
- **Dependence on Foreign AI Technologies:** India's reliance on imported AI technologies from global tech giants like **Google, Microsoft, and OpenAI** poses risks to **technological sovereignty and economic security**.
  - This dependency also drains foreign exchange and limits the development of indigenous AI capabilities needed to support traditional industries.
  - India's **Personal Data Protection Act 2023** emphasizes **data localization**, requiring data to be stored within the country.
    - However, **AI-driven global data flows challenge this approach**, as data increasingly transcends borders. The tension between local data control and global data movement presents a complex issue.
- **Environmental Costs of AI Adoption:** AI technologies are **energy-intensive, requiring significant computing power** that contributes to carbon emissions.
  - Large-scale AI deployment in traditional industries could exacerbate India's environmental challenges, especially as many industries still rely on non-renewable energy sources.
- A study by **MIT** found that **training a single AI model can emit as much carbon as five cars in their lifetime**.
  - A more recent study reported that training **GPT-3 with 175 billion parameters consumed 1287 MWh of electricity**, and resulted in carbon emissions of 502 metric tons of carbon
- **Ethical and Regulatory Concerns:** AI adoption in traditional sectors raises ethical challenges, including **algorithmic bias, data privacy issues, and lack of transparency**.
  - Unregulated use of AI in agriculture pricing, healthcare diagnostics, or credit assessments could harm vulnerable groups, undermining trust in these systems.
  - For instance, the **RBI has warned that the increasing reliance on AI in India's banking sector** could lead to concentration risks, systemic vulnerabilities.
    - While AI is being used for customer service and loan screening, these tools may also introduce **unpredictable consequences due to their opacity**.

### What Steps Can India Take to Harness the AI Revolution for Economic Growth?

- **Build a National AI Skilling Ecosystem:** India must establish a national AI skilling framework to address the massive skill gap in AI-related fields.
  - By integrating the **Skill India Mission** with the **FutureSkills Prime initiative**, the government can deliver **scalable AI training programs targeting medium-skilled workers**.
  - Focus should also be given to practical training in areas like **data analytics, machine learning, and robotics** to prepare workers for mid-level AI-enabled jobs.
- **Incentivize AI Adoption by SMEs and Startups:** The government can offer tax incentives, subsidies, and access to AI platforms for small and medium enterprises (SMEs) to encourage AI integration.
  - Combining the **Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE)** with subsidized AI toolkits can lower the entry barrier for SMEs.

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- This will allow traditional businesses to automate routine tasks, optimize supply chains, and improve productivity.
- **Promote Indigenous AI Research and Innovation:** India must invest heavily in indigenous AI research to reduce dependency on foreign AI technologies.
  - This can be achieved by strengthening the **National AI Portal** to support AI startups in sectors like healthcare, education, and defense. Additionally, government-backed AI innovation hubs should be set up in **tier-2 and tier-3 cities** to nurture local talent and foster innovation.
- **Integrate AI into Agriculture for Rural Economic Growth:** AI-driven solutions can help optimize farming by **enabling precision agriculture, crop disease detection, and efficient water usage.**
  - The government should integrate the **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)** with AI-powered tools like satellite-based soil monitoring and weather forecasting.
  - Additionally, **deploying AI-based agri-marketplace platforms** can help farmers get better prices by connecting them directly with buyers.
- **Strengthen AI in Healthcare and Public Welfare:** AI can revolutionize healthcare delivery by improving diagnostics, personalized medicine, and early disease prediction.
  - India should expand initiatives like **Ayushman Bharat Digital Mission** to incorporate AI tools for **real-time patient monitoring and telemedicine in underserved rural areas.**
  - AI can also be integrated into vaccination campaigns and maternal health programs to ensure targeted outreach.
- **Create AI-Powered Climate Resilience Programs:** India can leverage AI to mitigate the effects of climate change by enabling real-time monitoring of air quality, managing water resources, and optimizing renewable energy production.
  - Integrating AI into the **National Action Plan on Climate Change (NAPCC)** will improve India's ability to forecast and adapt to extreme weather events.
  - AI can also enhance energy efficiency in urban areas through smart grids and resource management.
- **Establish Ethical and Regulatory Frameworks:** India must develop robust ethical and regulatory frameworks to govern AI use, ensuring transparency, accountability, and data privacy.
  - Building on the **Digital Personal Data Protection Act (2023)**, India should establish sector-specific AI regulations for **healthcare, finance, and defense** to address ethical challenges like bias and misuse.
    - This will ensure trust in AI systems and prevent monopolistic practices.
  - The **EU AI Act**, establishes guidelines to ensure AI systems are safe, transparent, and uphold fundamental rights. **India can draw valuable lessons from this framework.**
- **Integrate AI into Smart Governance:** AI can transform governance by enabling predictive analytics, improving public service delivery, and optimizing welfare schemes.
  - The government should integrate AI into existing programs like the **Aspirational Districts Programme** to identify gaps in education, health, and infrastructure and address them efficiently.
  - AI-powered grievance redressal systems can improve accountability and citizen satisfaction
- **Facilitate AI-Driven Export Growth:** India can position itself as a global hub for **AI-enabled services by promoting AI innovation** in export-oriented sectors like IT, pharmaceuticals, and textiles.
  - The government can integrate **Make in India** with AI-based design and production tools to enhance quality and cost-effectiveness in exports.
  - AI-backed platforms for supply chain management can further improve India's competitiveness in global markets
- **AI-Powered Regional Language Ecosystem:** Develop AI tools to support regional language processing and translation, making AI solutions accessible to non-English speakers in India.
  - This can **boost digital inclusion and allow small businesses, artisans, and rural entrepreneurs** to use AI-driven tools for marketing, production, and customer engagement in their native languages.
  - AI-powered multilingual platforms can also help bridge the digital literacy gap in rural India.

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- **AI-Driven Village-Level Microfactories:** Establish AI-integrated microfactories at the village level to enhance productivity in small-scale industries like **textiles, pottery, or agro-processing**.
  - These microfactories can use AI for design, production optimization, and quality control, reducing inefficiencies in rural manufacturing.
  - The government can provide subsidies under **MSME Cluster Development Programs** to promote AI-based microfactories in rural hubs.
- **AI-Integrated Tourism Infrastructure:** Leverage AI to develop smart tourism platforms that personalize travel experiences, manage tourist flows, and promote cultural heritage.
  - AI can be used to create **immersive experiences using AR/VR**, such as virtual tours of historic sites, while also optimizing tourist services like transport and hospitality.
  - The **Dekho Apna Desh initiative** could integrate AI tools to boost domestic tourism.

### Conclusion:

The AI revolution presents a transformative opportunity for India to **accelerate economic growth, enhance productivity, and foster innovation across sectors**. However, to harness its potential, India must address challenges like **job displacement, skill gaps, and digital exclusion**. By investing in **AI-driven skilling, indigenous research, and ethical frameworks**, the country can align AI adoption with inclusive development. Strategic integration of AI in agriculture, healthcare, and governance will ensure equitable growth.



## Strengthening India's Environmental Governance

*This editorial is based on "**Burrow tragedy: On the coal mining tragedy in Assam's Dima Hasao**" which was published in The Hindu on 16/01/2025. The article brings into focus the persistent issue of illegal coal mining in Assam, exemplified by the recent Dima Hasao tragedy, which highlights the gap between environmental regulations and their enforcement in India.*

**Tag:** GS Paper-3, Conservation, Environmental Pollution & Degradation, GS Paper-2, Important International Institutions, Government Policies & Interventions

The recent **Dima Hasao coal mining tragedy in Assam** starkly illustrates India's persistent **challenge with illegal and hazardous rat-hole mining** despite its ban by the **National Green Tribunal in 2014**. The ongoing exploitation, driven by industrial demands for coal in cement manufacturing and thermal power plants, reflects the **gap between environmental regulations and their enforcement**. This constant struggle between development and environmental protection demands immediate attention, particularly as **India aims to achieve its ambitious climate goals while sustaining economic growth**.

### What are the Key Environmental Regulations Currently in Place in India ?

- **Constitutional Provisions:** The Indian Constitution provides the foundation for environmental protection.
  - **Article 48A:** Directs the State to protect and improve the environment and safeguard forests and wildlife.
  - **Article 51A(g):** Imposes a fundamental duty on citizens to protect the environment and have compassion for living creatures.
  - **Article 21:** Right to life includes the right to a clean and healthy environment (interpreted by the Supreme Court in **MC Mehta Case**).
- **Pollution Control Laws:**
  - **Water (Prevention and Control of Pollution) Act, 1974:** Aims to prevent and control water pollution by regulating effluent discharge into water bodies.
    - Establishes Central and State Pollution Control Boards (CPCB and SPCBs) to monitor and enforce compliance.
  - **Air (Prevention and Control of Pollution) Act, 1981:** Seeks to curb air pollution by regulating emissions from industries and vehicles.
  - **Environment (Protection) Act, 1986:** An umbrella act empowering the central government to take measures for environmental protection.
  - **E-Waste (Management) Rules, 2016:** Regulates the management and disposal of electronic waste through **Extended Producer Responsibility (EPR)**.

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- **Plastic Waste Management Rules, 2016:** Bans single-use plastics and mandates the recycling and proper disposal of plastic waste.
- **Forest and Wildlife Protection**
  - **Indian Forest Act, 1927:** Regulates the conservation and sustainable use of forest resources.
    - Provides for the classification of forests into reserved, protected, and village forests (complemented by **Supreme Court's Godavarman Judgement**)
  - **Forest (Conservation) Act, 1980:** Restricts the diversion of forest land for non-forest purposes without central government approval.
  - **Wildlife (Protection) Act, 1972:** Focuses on the conservation of wildlife and biodiversity.
    - Establishes protected areas like National Parks, Wildlife Sanctuaries, and Biosphere Reserves.
  - **Compensatory Afforestation Fund Act, 2016:** Mandates developers to pay for compensatory afforestation if they divert forest land for non-forest use.
  - **Biological Diversity Act, 2002:** Protects India's biological diversity and regulates access to genetic resources and their sustainable use.
- **Environmental Impact Assessment (EIA) Notifications:** Requires prior environmental clearance for projects with significant environmental impacts.
  - Mandates public consultations and environmental management plans before granting approvals.
- **National Green Tribunal (NGT) Act, 2010:** Establishes the NGT as a specialized judicial body to handle environmental disputes.
  - Provides speedy resolution of cases and strict penalties for environmental violations.
- Regulatory bodies like the **Pollution Control Boards (PCBs)** are **underfunded and understaffed**, leading to inadequate monitoring and lack of accountability for violators.
  - A recent report stated that most Indo-Gangetic state pollution boards are **understaffed and under-equipped**, despite generating surplus funds annually.
- **Conflicts Between Development and Conservation:** The prioritization of economic growth often leads to **dilutions in environmental regulations**, undermining their effectiveness.
  - Policies such as **relaxing the Environment Impact Assessment (EIA)** norms for certain industries reflect this trend.
  - For example, the diversion of forest land under the **Forest (Conservation) Amendment Act, 2023**, prioritizes development while compromising ecological preservation.
  - India has been placed at the bottom on a list of 180 countries judged for their environmental performances by US-based institutions. (**though the Indian government has not acknowledged the report**)
- **Inadequate Public Participation: Environmental governance** in India often overlooks the role of local communities in decision-making.
  - Public consultations under laws like the **EIA** are **either superficial or bypassed entirely**.
  - Marginalized communities, **especially tribal populations**, face displacement and loss of livelihood without adequate compensation or rehabilitation.
    - For instance, the **Hasdeo Arand coal mining project in Chhattisgarh** faced resistance from tribal communities, but mining continued despite environmental and social concerns.
  - Over the past 5 years, the MoEFCC has made **110 changes to the 2006 EIA notification via office memorandums**, bypassing public consultation as they are **not considered legal amendments**.
- **Underutilization of Technology in Regulation:** The adoption of advanced monitoring technologies like **IoT-based sensors, remote sensing, and AI** remains **limited**, leading to delayed detection of environmental violations.

### Why are the Key Issues Associated with India's Environmental Regulations?

- **Weak Enforcement Mechanisms:** India's environmental laws are stringent on paper, but enforcement is marred by weak institutional capacity, corruption, and bureaucratic inefficiency.
- **Over 6% of India's 4,40,989 operational industries** fail to meet environmental standards, posing risks to air, water, and soil through pollutant emissions and effluent discharge.

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- Reliance on manual inspections further reduces the effectiveness of enforcement agencies.
- For instance, out of 4,041 cities and towns, **only 476 have air quality monitoring stations (either manual or real-time)**, with the majority-267 cities relying on manual stations.
- **India's average AQI in 2023 exceeded WHO limits by over 10 times**, yet regulatory response remained reactive.
- **Judicial Overreach and Delayed Litigation:** While India's judiciary has played a **proactive role in environmental protection**, excessive reliance on courts leads to delays in action.
  - Judicial intervention often creates **uncertainty in project execution**, and the **absence of timely judgments stalls both environmental conservation and development goals**.
  - The **ongoing litigation on sand mining bans in Tamil Nadu** has led to unchecked illegal mining in the absence of clear policy enforcement.
  - In 2022, over **88,400 environment-related cases** were pending trial in India, some pending for over a decade..
- **Lack of Adequate Focus on Climate Adaptation:** India's environmental policies heavily emphasize mitigation (e.g., **renewable energy**, emissions reduction) but often **neglect adaptation measures like ecosystem restoration, community resilience, and disaster preparedness**.
  - This imbalance worsens the impact of climate-related disasters.
  - The **2023 floods in Himachal Pradesh** highlighted the absence of climate-resilient infrastructure.
  - The **Economic Survey 2023-24** reveals that India's climate adaptation expenditure was **5.6% of GDP in 2021-2022**, emphasizing the need for increased adaptation finance to support sustainable development and economic growth.
- **Rise of Unsustainable Urbanization:** Rapid urbanization has overwhelmed urban planning frameworks, leading to environmental degradation in cities.
  - **Unregulated construction, poor waste management, and insufficient green cover** have exacerbated issues like air and water pollution.
- For instance, a 2019 MoEFCC's report stated a **47% reduction in Haryana's Natural Conservation Zones (NCZs)**, including significant exclusions in Gurugram and Faridabad, despite concerns from environmentalists that this will **expose the Aravallis to real estate development**, negatively impacting air quality and groundwater recharge.
- India's e-waste has surged by **73% over the last five years, yet the country lacks effective management and recycling policies** for electronic waste. The E-Waste Management Rules, 2016, remain under implementation.
- **Lack of Strict Actions Against Illegal Mining:** Illegal mining continues to be a **major challenge, undermining and bypassing environmental regulations** and causing severe ecological degradation.
  - This unregulated activity leads to deforestation, loss of biodiversity, soil erosion, and groundwater depletion, while also threatening the livelihoods of local communities.
  - For instance, **illegal sand mining in rivers like Yamuna and Ganga** has caused extensive damage to riverbeds and aquatic ecosystems, **leading to disrupted water flow and loss of habitats**.
  - In 2022, **just 6% of illegal mining cases led to the filing of FIRs**. This highlights the limited legal action against such activities.

### What Measures can India take to Strengthen Environmental Regulations while Balancing Economic Growth?

- **Strengthening Enforcement Mechanisms:** India needs to empower regulatory bodies like the **Central and State Pollution Control Boards with adequate funding, skilled manpower**, and advanced technology for real-time monitoring.
  - The introduction of **AI-based sensors for pollution tracking, drone surveillance for forest encroachment**, and **GIS mapping for industrial zones** can improve compliance.
  - Accountability mechanisms such as **independent audits and periodic performance reviews** of regulatory bodies are essential.

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- **Popularisation of Carbon Credit Markets:** India can develop a robust domestic **carbon credit trading market** that incentivizes industries to adopt low-carbon technologies.
  - By making **carbon offsets mandatory for high-polluting sectors** like steel, cement, and thermal power, emissions can be reduced without stifling industrial growth.
  - Revenue generated from these credits can be **channeled into renewable energy projects and community-led afforestation programs**.
  - Strengthen the **Perform, Achieve, Trade (PAT) scheme** under the National Mission for Enhanced Energy Efficiency and align it with the Green Credit Programme introduced in the 2023-24 budget for greater impact.
- **Promoting Climate-Resilient Infrastructure:** To balance development with environmental sustainability, India must enforce **stringent environmental audits for infrastructure projects** and invest in eco-friendly alternatives.
  - Using **permeable pavements, green roofing, and energy-efficient building designs** can minimize ecological damage.
  - Projects should prioritize disaster-resilient infrastructure in vulnerable regions, especially in the Himalayan and coastal areas.
- **Revamping the Environmental Impact Assessment (EIA) Process:** The EIA framework must be made **more transparent, participatory, and evidence-based**.
  - **Public consultations should be conducted rigorously at every stage**, with provisions to include marginalized communities.
  - Instead of diluting the norms, **India should implement cumulative impact assessments** to account for multiple projects in ecologically sensitive zones.
  - Link **EIA reforms with digital platforms like PARIVESH (Pro-Active Responsive facilitation by ICT)** for faster but thorough clearance processes.
- **Incentivizing Clean Energy Transitions:** To balance economic growth and environmental goals, India should **expand subsidies for renewable energy adoption in industries and households**.
  - Decentralized renewable energy solutions like **solar rooftops, biomass-based power, and mini-grids** can reduce reliance on fossil fuels, especially in rural and semi-urban areas.
  - A phased reduction in fossil fuel subsidies and incentives for electric mobility can accelerate the transition.
  - Strengthen synergy between the **Green Hydrogen Mission** and the **Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME)** scheme to decarbonize key sectors like transport and energy.
- **Integrating Circular Economy Principles:** Adopting circular economy principles can reduce waste generation and resource extraction while **creating economic opportunities**.
  - India should incentivize industries to adopt **resource-efficient practices such as recycling, reusing, and upcycling**.
  - Initiatives like **extended producer responsibility (EPR)** for e-waste, plastics, and packaging materials should be strictly enforced.
- **Expanding Urban Green Spaces:** Promoting urban forestry and creating dedicated **green zones in cities** can mitigate the urban heat island effect, improve air quality, and enhance community well-being.
  - Cities should be **mandated to maintain a fixed percentage of their area as green cover under municipal regulations**. Such spaces can also serve as carbon sinks in densely populated urban areas.
  - Integrate **AMRUT 2.0 (Atal Mission for Rejuvenation and Urban Transformation)** with the **National Afforestation Programme** for enhanced urban ecological restoration.
- **Mainstreaming Public-Private Partnerships in Conservation:** India should promote public-private partnerships for environmental protection projects like **afforestation, waste management, and clean energy initiatives**.
  - This can ensure resource mobilization, efficient project execution, and technology transfer from private players. PPP models can also play a key role in **rejuvenating rivers, cleaning water bodies, and conserving wetlands**.

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- **Fostering Community-Led Conservation:** Local communities should be empowered to participate in environmental governance by **decentralizing decision-making under the Forest Rights Act (2006)**.
  - Community-led afforestation programs, watershed management, and conservation projects can ensure **inclusive development**.
  - Tribal and marginalized groups must be compensated fairly for conserving biodiversity hotspots.
  - Integrate **Van Dhan Vikas Kendras under the TRIFED initiative with the National Afforestation Programme** to support both conservation and tribal livelihoods.
- **Restoring Degraded Ecosystems:** India must prioritize the restoration of degraded forests, rivers, wetlands, and grasslands by adopting a **watershed approach**.
  - Large-scale reforestation with indigenous species, removal of invasive species, and wetland restoration projects can improve biodiversity and ecosystem services.
  - These efforts can also help meet India's **Nationally Determined Contributions (NDCs)** under the Paris Agreement.
- **Strengthening Judicial and Dispute Resolution Mechanisms:** India must expand the jurisdiction and capacity of the National Green Tribunal (NGT) to **ensure quicker resolution of environmental disputes**.
  - Specialized benches for climate change, biodiversity, and pollution can address complex cases more effectively.
  - **Alternative dispute resolution mechanisms like mediation and arbitration** should be introduced for industrial conflicts over environmental violations.
  - **The NGT's proactive role in air pollution cases in Delhi-NCR** could be replicated for water pollution and forest diversion disputes.
- **Strengthening Monitoring Mechanisms in Mining:** Deploy advanced technologies such as **satellite imagery, drones, and GPS-based tracking systems** to monitor mining activities in real-time.
  - Integrating digital tools with centralized data systems can help authorities detect and prevent illegal mining operations.

- States like Maharashtra have implemented **drone-based monitoring for sand mining**, and can be replicated in other states as well.

### Conclusion:

India faces significant challenges in enforcing its robust environmental regulations due to **weak institutional capacity, conflicts between development and conservation, and insufficient public participation**. Strengthening regulatory frameworks through technology adoption, transparent EIAs, and empowering local communities is critical. A balanced approach that **integrates sustainable development, climate adaptation, and ecosystem restoration** is essential to align economic growth with environmental protection.



## India-ASEAN: Partners for Progress

*This editorial is based on “**India with Indonesia: on ancient ties to a new phase**” which was published in The Hindu on 27/01/2025. The article brings into picture the deepening cultural and strategic ties between India and ASEAN, with Indonesia’s Republic Day participation reflecting enhanced cooperation in maritime security and regional stability amid growing geopolitical challenges.*

**Tag:** GS Paper-2, India and its Neighbourhood, Regional Groupings, Groupings & Agreements Involving India and/or Affecting India’s Interests, Look East to Act East

Indonesia’s participation in India’s Republic Day celebrations reflects the deep-rooted cultural and strategic ties between **India and ASEAN**. As ASEAN’s largest economy and a key G20 member, Indonesia exemplifies India’s broader engagement with the region, particularly in maritime security and economic cooperation. From the **Bandung Conference to BRICS**, India-ASEAN ties have evolved from **anti-colonial solidarity to a strategic partnership** aimed at ensuring regional stability in the face of shifting geopolitical dynamics, including **China’s Indo-Pacific assertiveness**.

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### How India-ASEAN Relations Have Evolved Over Time?

#### ➤ Early Engagement: Historical and Cultural Ties

- **Ancient Trade and Cultural Links:** Indian influence on Southeast Asia through **Buddhism, Hinduism, and Sanskrit** (e.g., Angkor Wat, Ramayana traditions).
  - Flourishing trade routes linked India with Southeast Asian kingdoms.
- **Colonial Era and Anti-Colonial Struggles:** Shared struggle against colonial rule; **India supported Indonesia's independence.**

- **Bandung Conference (1955):** Marked India's engagement with newly independent Asian and African nations.

#### ➤ Post-Independence Period: Limited Interaction (1950s–1980s)

- **Non-Alignment and Regional Priorities:** India's focus on domestic issues and **Cold War non-alignment policy** led to limited ASEAN engagement.
- **Minimal Economic and Strategic Cooperation:** India's inward-looking economy restricted trade and investment.
  - **ASEAN prioritized engagement with Western economies** majorly the United States.

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- **Post-Cold War: Economic and Strategic Engagement (1990s–2000s)**
  - **Look East Policy:** Launched after economic liberalization to strengthen ties with Southeast Asia.
    - India became a **Sectoral Dialogue Partner** of ASEAN in 1992, **Full Dialogue Partner** in 1996 and Summit-level Partner in 2002.
  - **Early Trade and Security Agreements:** **ASEAN Trade in Goods Agreement (2009)** boosted trade and investment.
    - **India-ASEAN Trade in Services Agreement (2015)** further boosted economic ties.
- **Strengthening Strategic Partnership (2011–Present)**
  - **Act East Policy (2014):** Expanded **Look East** to focus on deeper political, economic, and security ties.
    - India upgraded relations with ASEAN to a **Strategic Partnership** in 2012.
    - Also, in November 2022, they upgraded their relationship to a **Comprehensive Strategic Partnership (CSP)**.
  - **15th ASEAN-India Summit (2017):** Security and economic cooperation in the maritime domain was prioritized.
    - Proposal for joint naval exercises and fleet review with ASEAN navies.
    - Announcement of ASEAN-India Startup Festival and Pravasi Bharatiya Divas..
  - **India-ASEAN Plan of Action (2016-2020):** Signed at the 3rd ASEAN-India Summit in 2004; the **current iteration was adopted in 2015**.
    - 70 out of 130 activities implemented, covering trade, security, and cultural cooperation.
  - Financial Mechanisms Supporting India-ASEAN Cooperation
    - **ASEAN-India Fund (2016):** \$50 million to support the Plan of Action.
    - **ASEAN-India Science & Technology Fund (2015):** Increased to \$5 million.
    - **ASEAN-India Green Fund (2007):** \$5 million for climate change adaptation projects.
    - **ASEAN-India Project Development Fund:** Rs. 500 crore SPV to facilitate investments.

### What are the Key Areas of Convergence Between India and ASEAN ?



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- **Maritime Security & Indo-Pacific Cooperation:** India and ASEAN share concerns over **China's assertiveness in the South China Sea**, making maritime security a key area of cooperation.
  - India supports **ASEAN centrality in the Indo-Pacific** and has increased joint naval exercises and capacity-building initiatives.
  - India's **Indo-Pacific Oceans Initiative (IPOI)** aligns with **ASEAN's Outlook on the Indo-Pacific (AOIP)**, focusing on freedom of navigation and regional stability.
  - **India's SAGAR (Security and Growth for All in the Region)** doctrine also complements ASEAN's maritime objectives.
- **Trade and Economic Integration:** ASEAN is India's **fourth-largest trading partner**, and India-ASEAN trade has grown significantly in the last decade.
  - The **India-ASEAN Free Trade Agreement (FTA)** is being reviewed to address trade imbalances and enhance supply chain resilience.
  - **India's Act East Policy** focuses on deeper integration with ASEAN economies through **digital trade, fintech, and regional value chains**.
    - India's **Unified Payments Interface (UPI)** and Singapore's **PayNow** are now officially connected allowing for "real-time payment linkage".
  - ASEAN also benefits from India's emerging role as a **manufacturing hub amid China+1 strategies**.
- **Connectivity & Infrastructure Development:** India and ASEAN seek **greater physical and digital connectivity** to enhance economic ties and regional integration.
  - In 2017, India committed **\$1 billion in credit** for ASEAN connectivity and maritime projects.
  - The **India-Myanmar-Thailand Trilateral Highway** and **Kaladan Multimodal Transit Project** aim to link India's Northeast with Southeast Asia.
  - **Digital infrastructure and 5G collaboration** are also emerging areas of focus
- **Defense and Counterterrorism Cooperation:** India and ASEAN have intensified **defense cooperation through military training, joint exercises, and intelligence sharing**.
  - Terror threats from **radical extremism in Southeast Asia** and India's concerns over **cross-border militancy in the Northeast** make counterterrorism a shared priority.
  - Defense exports, including **BrahMos missiles to the Philippines**, signal a shift towards deeper military ties.
  - India's defence exports **surged by 78% in the first quarter of FY 2024-25**, with **ASEAN as a key market**.
- **Energy Security & Green Transition:** Both India and ASEAN are pushing for **renewable energy cooperation, reducing fossil fuel dependency, and expanding clean energy investments**.
  - India's **International Solar Alliance (ISA)** aligns with **ASEAN's Clean Energy Pathway**.
  - ASEAN nations are also exploring **nuclear energy**, where India can offer expertise in **thorium-based reactors**.
- **Space & Technology Collaboration:** India's advancements in **space technology, AI, and digital governance** present a strong area of cooperation with ASEAN.
  - ASEAN nations are keen on leveraging **ISRO's satellite capabilities** for disaster management and telecommunication.
    - ISRO is helping ASEAN set up a **Regional Satellite Tracking Station in Vietnam**.
  - India's **Digital Public Infrastructure (DPI)** model, including **Aadhaar and UPI**, offers a template for ASEAN's fintech expansion.
- **Tourism & Cultural Diplomacy:** India and ASEAN share **centuries-old cultural and religious linkages**, including **Buddhism and Hinduism**.
  - Strengthening people-to-people ties through **visa liberalization, spiritual tourism, and cultural exchanges** can boost engagement.
  - Increased direct flights and tourism infrastructure development can further enhance connectivity.
  - **Indonesia's Ramayana Ballet and Thailand's Ayutthaya city** which is known as the "**Ayodhya of Thailand**" celebrate shared heritage.
- **Geopolitical Cooperation & Multipolarity:** India and ASEAN are key players in **regional stability, balancing US-China tensions**.
  - Both emphasize a **rules-based order in the Indo-Pacific**, avoiding military bloc politics while **strengthening multilateralism** through **BRICS, EAS, and G20**.

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- India also backed ASEAN's **Five-Point Consensus on the Myanmar Crisis**.

### What are the Key Areas of Friction Between India and ASEAN ?

- **Trade Imbalance & RCEP Withdrawal:** India has a **trade deficit of over \$43 billion with ASEAN**, raising concerns over market access and unfair trade practices.
  - India withdrew from the **Regional Comprehensive Economic Partnership (RCEP)** in 2019, citing concerns over **Chinese goods flooding its market through ASEAN nations**.
  - India has called for **FTA renegotiation** to address tariff asymmetry and non-tariff barriers, but progress remains very slow.
- **Slow Progress in Connectivity Projects:** Despite strategic importance, India's connectivity projects with ASEAN face delays due to **funding issues, political instability, and bureaucratic bottlenecks**.
  - The **India-Myanmar-Thailand Trilateral Highway** has been repeatedly postponed due to slow execution and **unrest in Myanmar**.
  - Similarly, the **Kaladan Multimodal Project**, crucial for India's Northeast connectivity, has suffered from security concerns and lack of progress.
    - These delays impact **India's credibility in regional infrastructure development**.
- **Limited Defense Cooperation & ASEAN's China Tilt:** While India and ASEAN conduct military exercises, ASEAN's **divergent security priorities and reluctance to counter China directly** limit deeper defense engagement.
  - Most ASEAN nations are hesitant to align with India's Indo-Pacific vision due to **economic dependence on China**.
  - ASEAN has not strongly supported India's stance on **freedom of navigation in the South China Sea**.
  - In 2023, **trade between ASEAN and China reached a record high of USD 702 billion**, while ASEAN-India bilateral trade stood at merely USD 122.67 billion during 2023-24, highlighting ASEAN's economic reliance on China.
- **Differences in Indo-Pacific Strategy:** India promotes an **open and inclusive Indo-Pacific** with a focus on

**ASEAN centrality**, but ASEAN countries remain divided on openly endorsing India's strategic goals.

- While **Vietnam and the Philippines** support India's stronger Indo-Pacific presence, others like **Cambodia** prefer **neutrality to avoid antagonizing China**.
- This limits India's ability to build a unified Indo-Pacific strategy with ASEAN as a whole.
- **Myanmar Crisis and Divergent Political Stances:** India and ASEAN differ on their **approach to Myanmar's political crisis** following the 2021 military coup.
  - ASEAN has pushed for **diplomatic engagement through its Five-Point Consensus**, while India has maintained **pragmatic ties with Myanmar's junta** due to **border security and connectivity interests**.
  - This has created friction, as some ASEAN members view India's approach as **inconsistent with democratic principles**.
  - India handed over **military hardware to Myanmar's junta in 2022**, while ASEAN imposed restrictions.
- **Digital Trade & Data Protection Issues:** India and ASEAN differ on **data localization, cybersecurity, and digital trade regulations**, slowing fintech and e-commerce expansion.
  - ASEAN prefers a **liberal digital trade regime**, while India enforces **data sovereignty rules** (e.g., **restrictions on cross-border data flow under India's Digital Personal Data Protection Act, 2023**).
  - This has created **regulatory mismatches** affecting businesses in **fintech, e-commerce, and AI collaborations**.
    - India's **UPI linkage with Singapore (2023)** is an exception but remains **limited to bilateral agreements**.

### What Measures can be Adopted to Strengthen India-ASEAN Relations ?

- **Fast-Track Connectivity Projects for Economic Integration:** Accelerating the completion of the **India-Myanmar-Thailand Trilateral Highway** and **Kaladan Multimodal Project** will improve physical connectivity and trade.
  - Establishing **special economic zones (SEZs) along the corridor** can attract investment and manufacturing, reducing ASEAN's overdependence on China.

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- India should engage ASEAN in **Public-Private Partnership (PPP) models** to overcome delays in execution.
- Strengthening air and maritime links, especially with **Indonesia, Vietnam, and the Philippines**, will further boost trade and tourism.
- **Strengthen the India-ASEAN Free Trade Agreement (FTA):** Revising the **India-ASEAN FTA** to address India's **trade deficit and non-tariff barriers (NTBs)** will enhance economic cooperation.
- India should push for **sector-specific agreements** in **electronics, pharmaceuticals, and green energy** where it has a competitive edge.
- ASEAN nations must ensure **better market access for Indian goods**, particularly in **services, agriculture, and digital trade**.
- Mutual recognition agreements (MRAs) for skilled professionals will facilitate **greater labor mobility** and knowledge exchange.
  - India must ensure ASEAN removes **discriminatory palm oil import tariffs** hurting Indian exporters
- **Co-Develop Critical and Emerging Technologies:** Instead of relying on tech imports, India and ASEAN should focus on **joint development in AI, quantum computing, and semiconductor fabrication**.
  - India's **Digital Public Infrastructure (DPI) model** (Aadhaar, UPI) can be adapted for ASEAN fintech ecosystems, ensuring digital sovereignty.
  - ASEAN can be pursued to invest in India's **semiconductor mission**, reducing dependence on China-Taiwan supply chains.
  - India should push for **joint space collaborations** through ISRO for disaster management and communication satellites.
- **Expand Maritime Security and Defense Collaboration:** India should deepen maritime security cooperation through **expanded naval exercises, intelligence sharing, and joint patrolling**.
  - Strengthening India-ASEAN **Coast Guard Cooperation** can help counter piracy, illegal fishing, and drug trafficking in the Indo-Pacific.
  - ASEAN nations should be encouraged to buy **Indian defense equipment** (e.g., BrahMos missiles) under **favorable financing models**.
- Establishing an **India-ASEAN Indo-Pacific Security Forum** can create a structured mechanism for strategic dialogue.
- **Foster Supply Chain Resilience through Co-Manufacturing:** India should integrate ASEAN into its **Production-Linked Incentive (PLI) scheme**, encouraging ASEAN firms to set up **manufacturing bases in India**.
  - Co-developing **alternative supply chains in semiconductors, rare earth elements, and pharmaceuticals** will reduce China's dominance.
  - ASEAN nations can be part of India's **Supply Chain Resilience Initiative (SCRI)** with Japan and Australia, creating diversified trade networks.
- **Expand Renewable Energy and Climate Cooperation:** India should lead ASEAN in **green hydrogen, solar power, and biofuels**, reducing dependence on fossil fuels.
  - Establishing **India-ASEAN Green Energy Parks** will promote joint investments in **solar and wind power generation**.
  - Facilitating technology transfers for **EV battery production and carbon trading mechanisms** will align with ASEAN's net-zero goals.
- **Promote Cultural and People-to-People Exchanges:** Enhancing cultural diplomacy through **mutual visa liberalization, direct flight connectivity, and educational collaborations** will strengthen ties.
  - Establishing **India-ASEAN scholarships, student exchange programs, and Buddhist tourism circuits** will foster greater socio-cultural engagement.
  - India can support ASEAN's **digitization of ancient manuscripts and historical archives** to preserve **shared civilizational heritage**.
  - The **Nalanda University ASEAN Fellowship** can be expanded for cultural research programs.

### Conclusion:

India-ASEAN relations have evolved significantly from **historical and cultural ties to a comprehensive strategic partnership**. Despite challenges such as trade imbalances and differences in defense priorities, both sides have strengthened cooperation. Moving forward, **addressing connectivity gaps, boosting trade, and fostering people-to-people exchanges** will be crucial. India's proactive engagement with ASEAN offers opportunities for deeper collaboration.



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## Public-Private Synergy in Cybersecurity

*This editorial is based on “[Handling cybercrimes through public-private partnership model](#)” which was published in The Hindu on 29/01/2025. The article brings into picture the rising threat of cybercrime in India and the challenges faced by law enforcement. While initiatives like CCITR are commendable, India must focus on stronger policies, capacity building, and collaboration to enhance cyber resilience.*

**Tag:** GS Paper-2, Government Policies & Interventions, GS Paper-3, Cyber Security, Cyber Warfare, Challenges to Internal Security Through Communication Networks

**Cybercrime** is a growing global threat, with costs projected to hit \$10.5 trillion annually by 2025. In India, law enforcement faces a surge in cyber threats, including fraud, hacking, online harassment, and investment scams. Recognizing the need for a collective effort, Karnataka's CID launched the Centre for Cybercrime Investigation Training & Research (CCITR) in 2019 through a public-private partnership with Infosys Foundation and DSCI. While initiatives like CCITR are promising, India must focus on strengthening cyber resilience through enhanced policies, capacity building, and collaboration between government, industry, and academia.

### What are the Key Cyber Threats India is Facing?

- **Rising Cyber Espionage from State Actors:** India faces growing threats from foreign state-sponsored groups targeting critical sectors like defense, energy, and government institutions.
  - **Advanced Persistent Threats (APTs)** from China and Pakistan conduct surveillance, steal sensitive data, and disrupt strategic projects.
  - The lack of robust indigenous cybersecurity infrastructure makes India vulnerable to such attacks.
    - A 2021 report suggested that Chinese state-sponsored actors may have targeted Indian power grids and seaports with malware amid rising tensions along the LAC.

- **Growing Ransomware Attacks on Critical Infrastructure:** **Ransomware** groups are increasingly targeting India's financial, healthcare, and IT sectors, crippling essential services.
  - Hackers use sophisticated malware to lock systems and demand ransom payments, often in **cryptocurrency**, making tracking difficult.
  - Indian enterprises often lack the **necessary cyber hygiene**, making them easy prey for these attacks.
    - AIIMS Delhi servers were compromised in November 2022, with reports suggesting a possible cyberattack linked to foreign actors.
    - According to a recent report, India has emerged as a major target for ransomware attacks, **ranking second in the Asia Pacific and Japan (APJ) region**.
- **Increasing Cybercrime Targeting Financial Sector:** India's rapid digital banking expansion has led to a surge in phishing, UPI frauds, and **digital payment scams**.
  - Fraudsters take advantage of loopholes in digital payment gateways and exploit unsuspecting users through social engineering tactics.
  - Weak cybersecurity awareness and the use of outdated software in banking networks make financial institutions vulnerable.
  - **UPI, with over 400 million unique users**, has seen a surge in financial frauds, rising by **166% in 2023-24** compared to the 2022-23, as per the RBI annual report.
- **Deepfake and AI-Driven Misinformation:** The rise of **AI-driven misinformation** and deepfake videos threatens India's electoral process, social harmony, and public perception.
  - **Political parties, foreign actors, and malicious groups** are weaponizing AI to spread propaganda, manipulate public sentiment, and defame opponents.
  - For instance, a **deepfake of actress Rashmika Mandanna** went viral in 2023, highlighting the tech's dangers.
  - According to experts surveyed for the **World Economic Forum's 2024 Global Risk Report**, India was ranked **highest for the risk of misinformation and disinformation**.

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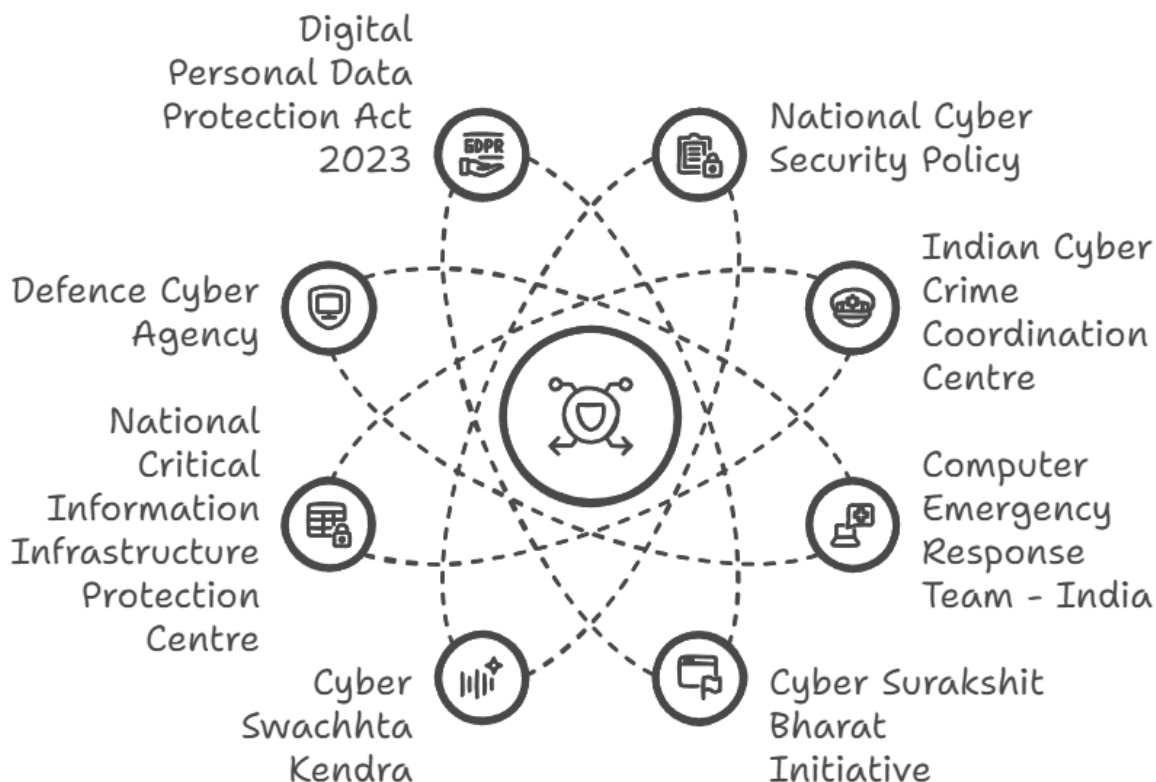
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## India's Cybersecurity Framework



- **Supply Chain Cyber Attacks on Indian Enterprises:** Hackers increasingly target **third-party vendors and software supply chains** to gain entry into larger Indian corporations.
  - The interconnected nature of digital ecosystems means one weak link can compromise multiple firms.
    - **Lack of stringent cybersecurity policies among MSMEs**, who serve as vendors to big firms, further exacerbates risks.
  - India's growing reliance on foreign software and cloud solutions also makes it vulnerable to backdoor exploits.
  - An example of this is **SolarWinds Supply Chain Attack** discovered in December 2020, where hackers compromised **SolarWinds' Orion software**—a widely used IT management tool.
- **Cyberterrorism and Dark Web Activities:** Terror groups are leveraging the dark web, **encrypted messaging platforms**, and cryptocurrency transactions to fund operations and coordinate attacks.
  - Radicalization through **social media and online hate groups** is a growing national security threat.
  - **Cyberterrorists exploit India's weak surveillance mechanisms** and VPN networks to remain anonymous. Many sleeper cells are using these platforms for recruitment and planning without detection.
    - **Security agencies have reported that ISIS-affiliated groups use Telegram and dark web forums for recruiting Indian youth.**
- The NIA arrested over 35 ISIS operatives in 2016, uncovering **encrypted extremism**, where Indian youth were being recruited on communication apps like Telegram and Signal.
- **IoT and Smart City Vulnerabilities:** The rapid adoption of **smart city technology**, including **surveillance cameras**, **traffic management**, and **public utilities**, has created new cybersecurity risks.

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- Many IoT devices deployed in India lack proper encryption and are vulnerable to hacking.
- Compromised IoT networks can lead to large-scale disruptions, including blackouts, traffic gridlocks, and privacy breaches.
- Hactivist groups and hostile nations have already been probing these vulnerabilities.
  - For instance, **Mumbai's power outage in 2020** was linked to a cyberattack from China.

### What Role can the Private Sector Play in Enhancing India's Cybersecurity Infrastructure?

- **Strengthening Cybersecurity R&D and Indigenous Solutions:** The private sector can drive innovation in cybersecurity by **investing in indigenous research and developing advanced security solutions** tailored to India's needs.
  - **Dependence on foreign cybersecurity firms** increases vulnerability to geopolitical risks and potential backdoors in imported technologies.
  - **Indigenous solutions, supported by private players**, can ensure data **sovereignty** and reduce risks from external dependencies.
  - For instance, **C3iHub, a cybersecurity Technology Innovation hub at IIT Kanpur** has partnered with **Tata Advanced Systems to advance cybersecurity solutions**
- **Collaborating with the Government on Cyber Threat Intelligence:** Private companies can work with government agencies to **share real-time threat intelligence** and **prevent cyberattacks on national infrastructure**.
  - Although CERT-In has introduced initiatives like **mandatory breach reporting**, intelligence-sharing remains fragmented with limited coordination between private firms and law enforcement.
  - A robust public-private threat intelligence network can enhance proactive threat detection and incident response.
    - This is crucial to counter cyber threats from state-sponsored actors.
    - For instance, **IBM's X-Force Threat Intelligence** collaborates with Indian authorities to identify and mitigate cyber threats.
- **Enhancing Cybersecurity in the Financial Sector:** With the rapid **digitization of banking, fintech, and UPI payments**, private players must strengthen security frameworks to prevent fraud and financial cybercrime.
  - Private-sector-led innovations like **AI-driven fraud detection and blockchain-based security** can help secure financial transactions.
    - For instance, **ComplyAdvantage offers AI-driven fraud** and AML risk detection for financial institutions.
- **Building a Skilled Cybersecurity Workforce:** Private-sector investment in **cybersecurity education and skill development** is crucial to address India's acute shortage of trained cybersecurity professionals.
  - Many **Indian firms struggle to find skilled experts**, leading to weak cybersecurity postures in enterprises and government institutions.
    - In May 2023, nearly **40000 cybersecurity professional job vacancies** in India were not filled due to talent shortages.
  - Corporate entities can partner with universities, **offer cybersecurity boot camps, and provide in-house training to bridge this skill gap**. The private sector can also help establish global certification programs to upskill IT professionals.
- **Developing Secure Cloud and Data Protection Infrastructure:** As India moves towards **data localization**, private companies can help in building secure cloud and data storage solutions to safeguard national data assets.
  - Currently, **a significant portion of Indian data is hosted on foreign cloud platforms**, posing risks of surveillance and unauthorized access.
    - Private firms can invest in **AI-driven encryption and zero-trust security frameworks to strengthen data protection**.
    - For instance, **Reliance Jio launched its indigenous JioCloud platform** to offer secure cloud storage solutions.
- **Regulating Deepfake and AI-Driven Cyber Threats:** With AI-generated **deepfake scams**, misinformation, and cyber fraud rising, private firms can help to develop detection tools to counter these threats.

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- Big tech firms and cybersecurity startups can create AI-based detection models to flag and counter deepfake content.
  - For instance, **McAfee® Deepfake Detector alerts people in seconds if it detects AI-generated audio in a video**, helping Indian consumers discern real from fake.
- **Promoting a Cyber-Aware Corporate Culture:** Private organizations can foster a **cybersecurity-first mindset** among employees by conducting regular training, phishing simulations, and policy enforcement.
- **Human error remains one of the biggest cybersecurity vulnerabilities**, leading to **data breaches** and system compromises.
- Regular cyber hygiene drills and incident response plans can significantly reduce cyber risks.
  - This is especially critical for **IT, BFSI, and healthcare sectors** handling sensitive data.

### What are the Major Challenges in Onboarding Private Sector in Cybersecurity?

- **Lack of Clear Regulatory Framework and Policy Incentives:** The absence of a **well-defined cybersecurity framework** discourages private sector participation in national cyber defense initiatives.
  - Policies like the **National Cyber Security Strategy** remain largely unimplemented, and existing regulations are fragmented across multiple agencies.
  - Without **clear incentives, tax benefits, or liability protections**, private firms remain hesitant to invest in national cybersecurity efforts.
- **High Cost of Cybersecurity Investments:** Implementing robust cybersecurity infrastructure requires substantial financial investment, which **many private companies, especially MSMEs, struggle to afford**.
  - Advanced security solutions like **AI-driven threat detection, Zero Trust frameworks**, and cloud security demand continuous upgrades.
  - The **cost factor discourages private players** from proactively investing in cybersecurity, leaving them vulnerable to cyberattacks.
    - Indian organizations spend an average of just **\$2.8 million annually** on cybersecurity, which typically amounts to **less than 10% of their IT budgets**.

- **Weak Public-Private Threat Intelligence Sharing:** Effective cybersecurity requires **real-time intelligence-sharing between government agencies and private firms**, but India lacks a structured framework for this.
  - Private firms fear regulatory backlash and reputational damage if they disclose cyber incidents.
  - **CERT-In mandated 6-hour breach reporting**, but compliance remains low due to fear of penalties.
- **Dependence on Foreign Cybersecurity Solutions:** **Many private firms in India rely heavily on foreign cybersecurity tools and software**, increasing risks of geopolitical vulnerabilities and surveillance backdoors.
  - While private companies prefer cost-effective foreign solutions, this creates a **strategic risk for national security**.
    - The lack of indigenous cybersecurity products forces Indian firms to depend on global vendors for critical security infrastructure.
- **Weak Cybersecurity Standards for Supply Chain Vendors:** **Many private firms depend on third-party vendors**, but India lacks strong cybersecurity compliance requirements for supply chains.
  - Attackers increasingly target **weaker links in supply chains** to gain access to larger corporations, particularly in BFSI, telecom, and IT sectors.
    - For instance, **over half (55%) of smart manufacturing firms** in India reported more than **6 intrusions** in 2023.

### What Measures can be Adopted to Enhance Public-Private Partnership in Cybersecurity?

- **National Cybersecurity Coordination Body:** A unified **National Cybersecurity Council** with strong **private-sector representation** should be created to streamline public-private collaboration.
  - Currently, cybersecurity efforts are fragmented across **MeitY, CERT-In, NCIIPC, and RBI**, leading to **inefficiencies**. A centralized body can ensure seamless intelligence-sharing, coordinated incident response, and policy alignment.
- **Implementing a Secure Threat Intelligence-Sharing Platform:** A **National Cyber Threat Intelligence Exchange (NCTIX)** should be set up to facilitate real-time, automated intelligence-sharing between government agencies and private enterprises.

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- A structured, anonymized data-sharing framework with liability protections can encourage participation.
- Advanced AI-driven monitoring can help detect, analyze, and mitigate cyber threats more effectively.
- **Offering Tax Incentives for Cybersecurity Investments:** To encourage private companies, especially MSMEs, to adopt robust cybersecurity measures, **tax credits and subsidies** should be provided for investments in cyber defenses.
  - The government can offer **R&D incentives for indigenous cybersecurity solutions** to reduce dependence on foreign tech.
  - Special grants should be allocated to firms working on AI-driven cyber defense solutions.
- **Strengthening Cybersecurity Skill Development Programs:** Corporations can collaborate with **universities, IT training institutes, and government programs** like Skill India to offer specialized cyber training.
  - Cybersecurity should be integrated into engineering and management curricula. Regular **cyber drills, hackathons, and ethical hacking contests** can create a skilled talent pool.
- **Mandating Cybersecurity Standards for Private Enterprises:** A **Cybersecurity Compliance Index** should be introduced, categorizing businesses based on their security maturity levels.
  - Private firms, especially in critical sectors like **BFSI, telecom, and IT**, should be required to meet **minimum cybersecurity standards** under a risk-based compliance framework.
  - The government can **subsidize security audits** for MSMEs to improve adoption. Strengthening **enforcement of the Digital Personal Data Protection Act (DPDPA) 2023** will ensure accountability.
- **Indigenous Cybersecurity Technology Ecosystem:** The government should work with **private firms and startups to develop indigenous cybersecurity tools** to reduce dependence on foreign tech.
  - Incentives should be provided to **startups focusing on AI-driven threat detection, blockchain security, and cloud encryption**.
  - A dedicated **Cybersecurity Startup Fund** can accelerate innovation in this space.

## Conclusion:

Strengthening India's cybersecurity requires a **collaborative approach involving both the government and the private sector**. While initiatives like the CCITR show promise, India must **prioritize clear regulatory frameworks, enhanced policy incentives, and robust public-private partnerships**. Fostering indigenous cybersecurity solutions, sharing intelligence, and upskilling the workforce are crucial steps.



## Path to Quality and Inclusive Education

*This editorial is based on "[India's learning report card: ASER 2024 highlights big worries in literacy and numeracy skills](#)" which was published in The Hindu on 30/01/2025. The article brings into picture the regional disparities in India's education system, with Kerala excelling while states like Jharkhand lagging, highlighting the need for reforms in assessments and teacher training inspired by Finland.*

**Tag:** GS Paper-2, Education, Welfare Schemes, Issues Related to Children, Human Resource, Skill Development, Government Policies & Interventions

The **Annual Status of Education Report (ASER) 2024** reveals a complex landscape of India's education system, marked by significant regional disparities in foundational literacy and numeracy. While states like **Kerala, Himachal Pradesh, and Mizoram** lead with impressive reading levels above **64%** among Class 5 students, states like **Jharkhand, Rajasthan, and Chhattisgarh** continue to struggle with basic educational outcomes. The **persistence of rote learning, lack of teacher autonomy, and inadequate assessment systems** remain major challenges across the country. Drawing inspiration from international best practices, particularly **Finland's education model**, India needs urgent policy interventions to shift towards **skill-based, practical assessments** and enhanced teacher training programs.

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## What are the Key Developments in the Indian Education System?

- **Enhanced Enrollment and Declining Dropout Rates:** Enrollment in pre-primary education has steadily risen since 2018, with 3-year-old enrollment increasing from **68.1% to 77.4% by 2024 (ASER-2024)**.

- Female enrolment surged by **38.4%**, increasing from 1.57 crore to 2.18 crore, marking a significant stride toward gender equality in education.
- Dropout rates for 15-16-year-olds declined from **13.1% in 2018 to 7.9% in 2024**, with girls' dropout rates also decreasing to 8.1%.

- **Strengthened Foundational Literacy and Numeracy (FLN):** India has placed strong emphasis on **Foundational Literacy and Numeracy (FLN)** to improve early learning outcomes, with structured pedagogy and teacher training initiatives.

- The **NIPUN Bharat Mission** aims to ensure that all children attain FLN skills by Class 3 by 2026-27.
- **ASER 2024** shows Class 3 students' reading ability in government schools improved from 16.3% in 2022 to 23.4% in 2024.

- **Greater Emphasis on Multidisciplinary Education:** **NEP 2020** promotes flexible subject choices, arts-integrated learning, and interdisciplinary education.

- **Four-year undergraduate degrees, multiple entry-exit options**, and academic bank of credits provide more learning flexibility.
  - The National Curriculum Framework (NCF) 2023 is revamping school textbooks to encourage critical thinking.
- The **CUET (Common University Entrance Test)** ensures standardized access to over 250 universities.

- **Expansion of Higher Education Opportunities for Marginalized Communities:** The Indian government has significantly **expanded scholarships, reservations, and support programs** to make higher education more inclusive.

- Initiatives like **EWS reservations**, **increased SC/ST/OBC seats**, and **free coaching programs** have improved access for disadvantaged groups.
  - More **rural and first-generation learners** are now entering universities, bridging historical inequalities.

- As a result, Enrollment of SC/ST students in higher education increased by 44% from 2014 to 2023 (AISHE 2023).

- Targeted policies like **"Gender Advancement for Transforming Institutions" (GATI)** promote women's participation in STEM fields.

- The percentage of female students in STEM fields rose to more than **40%**.

- **Global Recognition and Improvement in University Rankings:** Indian universities are gaining **global recognition**, with more institutions featuring in **QS and Times Higher Education** rankings.

- IITs, IIMs, IISc, and AIIMS have strengthened their global standing due to research contributions, faculty collaborations, and international partnerships.
- The government's **"Institutions of Eminence" (IoE) initiative** has helped selected universities **improve autonomy and global competitiveness**.
- The **Indian Institute of Science (IISc) Bengaluru** ranked 96th in World University Rankings 2025, securing a spot among the top 100 institutions for computer science.

- India also boasts two institutions within the top 50 and seven in the top 100 of the **QS Asia Rankings 2025**

- **Growing Presence of Private Universities and Foreign Collaborations:** Private universities are playing a crucial role in **expanding access, modernizing curricula, and attracting international faculty**.

- Institutions like **Ashoka University and Shiv Nadar University**, are providing world-class education with a **focus on liberal arts, technology, and management**.
- India is also allowing **foreign universities to establish campuses**, which will bring global expertise to Indian students.
- **Deakin University and University of Wollongong from Australia** are setting up campuses in **Gujarat's GIFT city**.

- **Promotion of Multilingual Education:** NEP 2020 promotes **education in regional languages**, making courses accessible to students from non-English backgrounds.

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- AICTE has introduced engineering textbooks in 12 Indian languages, allowing students from rural areas to excel in technical education.
- New NCERT textbooks will be developed in 22 languages, enhancing accessibility.
- **Enhancement of Teacher Training:** India has launched multiple initiatives to train faculty in modern teaching techniques, digital pedagogy, and research skills.
  - Programs like **PM eVidya** and **ARPIT (Annual Refresher Programme in Teaching)**, are upskilling teachers across disciplines.
  - The **DIKSHA platform** is delivering digital teacher training courses to more than 2 crore educators.

### What are the Key Issues Associated with the Indian Education System?

- **High Dropout Rates in Secondary and Higher Education:** While primary enrollment is near universal, dropout rates increase sharply in secondary and higher education, particularly among girls and socio-economically weaker sections.
  - Factors such as financial constraints, lack of infrastructure, early marriages, and cultural biases contribute to this issue.
  - **ASER 2024** shows the dropout rate for 15-16-year-olds remains at 7.9%, with girls dropping out at a slightly higher rate (8.1%).
- **Teacher Shortages and Quality Issues:** India faces a severe shortage of qualified teachers, with many schools operating with untrained or underqualified educators.
  - Teacher absenteeism, outdated pedagogy, and excessive non-teaching duties (e.g., election work, census duties) further weaken the learning process.
  - As per MoE data, about 10 lakh teaching positions in government schools across elementary, primary, secondary and higher secondary levels are vacant.
- **Inequities in Access to Quality Education:** There is a stark divide between rural and urban education, as well as between government and private schools.
  - While urban areas have access to better infrastructure, digital tools, and qualified teachers, many rural schools lack basic amenities, such as libraries, labs, and internet access.
- **ASER 2024** highlights that government school enrollment dropped from 72.9% in 2022 to 66.8% in 2024, indicating a preference for private schools due to perceived quality differences.
  - Only 66% of schools have functional playgrounds, and usable girls' toilets improved but still stand at just 72%.
- **Rote Learning and Exam-Oriented System:** The Indian education system remains heavily focused on rote memorization rather than conceptual understanding and critical thinking.
  - The pressure of high-stakes exams (Board exams, JEE, NEET) discourages creativity and innovation, limiting skill-based learning.
  - The **National Curriculum Framework (NCF) 2023** aims to shift towards competency-based education, but implementation remains slow.
- **Inadequate Digital Infrastructure and Digital Divide:** While digital learning is expanding, many students, particularly in rural areas, lack access to devices and internet connectivity.
  - This creates an urban-rural divide in e-learning adoption, hybrid education, and digital literacy.
  - **ASER 2024** shows 90% of 14-16-year-olds have smartphone access, but only 57% use them for education, indicating a gap in digital literacy and guided learning.
    - The **BharatNet project** aims to connect 2.5 lakh gram panchayats with high-speed internet, but progress has been slow.
- **Skill Gap and Mismatch Between Education and Employability:** Despite increasing enrollment in higher education, many graduates remain unemployable due to a lack of practical skills.
  - The curriculum is often not aligned with industry needs, resulting in low workforce productivity.
  - **Economic Survey 2023-24** highlighted that only 51.25% of the country's youth is deemed employable.
- **Lack of Research and Development Investment:** India lags in university-driven research, with most R&D happening in government labs, not educational institutions.

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- The absence of collaboration between **universities and industries leads to low patents and innovation**. Funding is inadequate, and many PhD holders struggle with proper research support due to funding gaps.
- **India spends only 0.64% of its GDP on R&D**, lagging behind countries like South Korea (4.8%) and China (2.4%)

### What Measures to Strengthen India's Education System

- **Expanding Vocational and Skill-Based Education:** The education system must shift towards **industry-aligned skill development** to make students employable.
  - Introducing **mandatory vocational training from Class 6**, will bridge the skills gap.
  - Collaboration with **NSDC, ITIs, and private companies** can provide internships and real-world exposure.
  - A **national credit framework** should allow students to transition between academic and vocational pathways seamlessly.
- **Improving Teacher Training and Pedagogy:** Teachers must be empowered with **continuous professional development and autonomy** to design effective learning methods.
  - A **blended learning approach**, combining **digital resources with traditional teaching**, should be made mandatory in all schools.
  - National and state-level **teacher mentorship programs** should ensure experienced educators guide younger teachers.
    - The **DIKSHA platform** should be expanded with AI-driven personalized training modules.
- **Reducing Rote Learning and Reforming Assessments:** Shifting from **rote-based learning to conceptual and analytical thinking** will improve educational outcomes.
  - Board exams and entrance tests should focus on **application-based questions** rather than memorization.
    - A **modular assessment system**, where students are tested multiple times throughout the year, can reduce exam stress.
- Encouraging **open-book exams and problem-solving projects** will promote real-world learning.
- The **National Curriculum Framework (NCF) 2023** must be implemented effectively, emphasizing **experiential learning and multidisciplinary studies**.
- **Expanding Digital Infrastructure and Reducing the Digital Divide:** Expanding **BharatNet and PM e-Vidya initiatives** to provide high-speed internet to rural schools can bridge the digital divide.
  - Every school should be equipped with **smart classrooms, interactive boards, and digital libraries** for enhanced learning experiences.
  - **Public-private partnerships (PPPs)** can provide affordable tablets and laptops to students in government schools.
  - AI-driven **adaptive learning platforms** should be developed to offer personalized educational content.
    - Schools should conduct **digital literacy training for parents** to ensure technology is used effectively at home.
- **Making Higher Education More Accessible and Globally Competitive:** Universities should adopt **flexible, multi-disciplinary degree programs** as recommended by **NEP 2020** to provide students with diverse career options.
  - Expanding the **Academic Bank of Credits (ABC)** will allow students to transfer credits across institutions.
    - **Foreign universities** should be encouraged to set up campuses in India to improve global academic exposure.
  - More scholarships and **low-interest student loans** should be introduced to support students from weaker sections.
- **Increasing Public Investment in Education:** The government must raise **education spending to at least 6% of GDP**, as recommended by **NEP 2020**, to ensure quality improvements.
  - Funding should be **performance-linked**, ensuring states that show better learning outcomes receive additional resources.
  - More **corporate social responsibility (CSR) funds** should be directed toward education, especially for underprivileged students.

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- A transparent fund utilization tracking system should be introduced to monitor spending efficiency.
- **Strengthening Women's Education and Gender Equality:** Scholarships and financial incentives for female students, especially in STEM fields, should be expanded.
  - Schools should introduce gender-sensitive curricula to promote equality and break societal stereotypes.
  - Expanding hostel facilities and transportation services for girls in rural areas will improve secondary and higher education participation.
    - Menstrual hygiene awareness programs and free sanitary products should be provided in schools to ensure attendance.
- **Reducing Bureaucratic Hurdles and Political Interference in Education:** Education policies should be designed based on scientific research and evidence-based models, not political considerations.
  - Streamlining the approval process for private schools and universities can encourage innovation and competition.
    - State and central governments should work collaboratively, ensuring a long-term vision for education beyond electoral cycles.
- **Experiential and Community-Based Learning:** Moving beyond textbook-based education, schools should integrate experiential learning models where students engage with real-world problems.
  - Schools can adopt "learning by doing" approaches through farm-based education, heritage walks, financial literacy projects, and environmental conservation programs.
  - Community learning hubs where students interact with local artisans, entrepreneurs, and professionals can make education more practical and career-oriented.
- **Peer Teaching and Cross-Age Learning:** Introducing structured peer teaching programs, where older students mentor younger ones, can improve retention and foster leadership skills.
  - This not only reinforces learning for the mentors but also helps slow learners grasp concepts more effectively through simplified peer explanations.
  - Cross-age learning in multigrade classrooms has proven successful in countries like Japan and Denmark, where students learn collaboratively across age groups.
- **Reviving Local Knowledge Systems and Indigenous Learning:** India has a rich tradition of indigenous knowledge, which should be integrated into the formal education system.
  - Schools can introduce traditional Indian sciences like Ayurveda, organic farming, handloom techniques, and local architectural methods as part of practical learning.
  - Storytelling traditions from different Indian communities, including Panchatantra, Jataka Tales, and tribal folklore, can be used to teach moral and ethical lessons.

### What Can India Learn from Other Countries' Education Systems?

| Country     | Key Education Policies                                                                                                                                                                                                                                                | Takeaway                                                            |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| South Korea | <ul style="list-style-type: none"> <li>➤ School seven days a week</li> <li>➤ 5.3% of GDP spent on education</li> </ul>                                                                                                                                                | Build a strong foundation and pay educators well                    |
| Finland     | <ul style="list-style-type: none"> <li>➤ Formal schooling starts at age 7</li> <li>➤ No homework or standardized testing until high school</li> <li>➤ Free college education, including masters and doctoral</li> </ul>                                               | Delaying school entry and accessible higher education is beneficial |
| Switzerland | <ul style="list-style-type: none"> <li>➤ Multilingual education (4 national languages)</li> <li>➤ Emphasis on experiential learning (art, music from age 3)</li> <li>➤ Apprenticeship program after elementary school</li> <li>➤ Optional secondary school</li> </ul> | Flexible education system accessible to all                         |

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|                        |                                                                                                                                                                                                                   |                                                   |
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| <b>The Netherlands</b> | <ul style="list-style-type: none"> <li>➤ Minimal or no homework until age 10</li> <li>➤ No competition or grading against peers</li> <li>➤ Emphasis on hands-on learning and experience-based teaching</li> </ul> | Encourage mental well-being and hands-on learning |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|

### Conclusion:

To strengthen India's education system, a comprehensive approach is needed, **focusing on skill-based learning, teacher empowerment, and equitable access to resources**. Policy interventions must address **regional disparities, reduce rote learning, and embrace digital advancements**. By fostering inclusive, practical, and globally competitive education, India can unlock its true potential. **Prioritizing education is key to sustainable growth and a prosperous future for India.**



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