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Content

A Call for Reform in Judicial Appointments

This editorial is based on "Reforming the process of judicial appointments" which was published in The Hindu on 02/08/2024. The article brings into picture the debate over India's collegium system reveals its transparency and accountability issues, with the 2015 NJAC dissolution emphasizing the difficulties in reform.

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

The ongoing debate over judicial appointments in India, governed by the Constitutional provisions of **Articles 124(2) and 217(1),** underscores the limitations of the **current collegium system**. While designed to safeguard judicial independence, the system's lack of transparency, accountability, and susceptibility to nepotism have drawn significant criticism. The **National Judicial Appointments Commission (NJAC),** which aimed to address these concerns through a multi-stakeholder approach, was unfortunately struck down by the **Supreme Court** in 2015.

Examining judicial appointment systems in other countries, such as the **UK, South Africa, and France,** which involve commissions comprising various stakeholders, reveals that India could benefit from a similar model. A revamped NJAC, **incorporating input from all relevant parties,** could strike a balance between judicial independence and accountability, leading to faster and more transparent appointments. This would be instrumental in addressing the chronic issue of delayed justice in India and restoring public confidence in the judiciary.

How the Collegium System has Evolved over Time?

➢ **First Judges Case (1982):** In the case of *S.P. Gupta vs. Union of India,* a seven-judge Constitutional Bench of the Supreme Court ruled that "**consultation**" with the Chief Justice of India (CJI) in judicial appointments does not equate to "**concurrence**," meaning that the **CJI's opinion does not hold primacy as per the Constitution.**

○ The judgment further clarified that proposals for appointments to High Courts could be initiated by any of the four constitutional authorities mentioned in **Article 217,** not exclusively by the Chief Justice of the High Court.

○ This ruling shifted the **balance in favor of the executive's role** in judicial appointments, a practice that remained in place for 12 years.

➢ **Second Judges Case (1993):** In the case of Supreme Court *Advocates-on-Record Association vs. Union of India*, a nine-judge Bench of the Supreme Court, by a 7:2 majority, **overruled the First Judges Case.**

○ The court held that the Chief Justice of India should play the primary role in the appointment of judges.

   ● It interpreted **"consultation" to mean "concurrence,"** thereby establishing the collegium system.

○ This system relies on the **collective opinion of the CJI and the senior-most judges,** rather than an individual opinion, in the judicial appointment process.

➢ **Third Judges Case (1998):** In the context of a Presidential reference under **Article 143 of the Constitution**, a nine-judge Bench of the Supreme Court reaffirmed the decision made in the Second Judges Case.

○ The court held that the recommendation for judicial appointments should be **made by the Chief Justice of India (CJI)** in consultation with the **four senior-most judges of the Supreme Court.**

○ This ruling firmly established the collegium system, where the **collective opinion of the CJI and senior judges** became binding on the government in matters of judicial appointments.

➢ **Memorandum of Procedure (MoP):** Like the collegium system, the Memorandum of Procedure (MoP) is a judicial innovation, **drafted by the Ministry of Law and Justice** as directed by the Supreme Court in the Second and Third Judges Cases.

○ It outlines the process for appointing judges to the higher judiciary, with separate MoPs for Supreme Court and High Court judges.

○ In 2015, the **Supreme Court directed the government to revise the MoP to increase transparency** in the collegium's proceedings.

   ● However, this led to a **year-long deadlock between the executive and judiciary** over certain MoP clauses.

   ● The government has since sent proposals to supplement the MoP, which is currently under the Supreme Court's consideration.

➢ **National Judicial Appointments Commission (NJAC):** The NJAC was proposed following recommendations

from the **National Commission to Review the Working of the Indian Constitution (2002)**.

- ○ The UPA government introduced the **NJAC Bill in 2013,** but it lapsed due to the dissolution of the Lok Sabha.
- ○ The NDA government reintroduced the **NJAC Bill in 2014**, leading to the passage of the **NJAC Act, 2014**, under the **Ninety-ninth Constitutional Amendment.**
  - The NJAC was to consist of the **CJI as the Chairperson, two senior Supreme Court judges,** the **Union Minister for Law and Justice**, and two eminent persons nominated by a committee comprising the **Prime Minister, CJI, and Leader of the Opposition.**

➢ **Fourth Judges Case (2015):** The constitutional validity of the NJAC Act and the Ninety-ninth Constitutional Amendment was **challenged in the Supreme Court,** which, in a **4:1 decision,** declared both the Act and the amendment unconstitutional.

- ○ The court cited concerns over **inadequate judicial representation in the NJAC** and the involvement of executive members, arguing that these factors **violated the principle of judicial independence** and the **basic structure of the Constitution.**
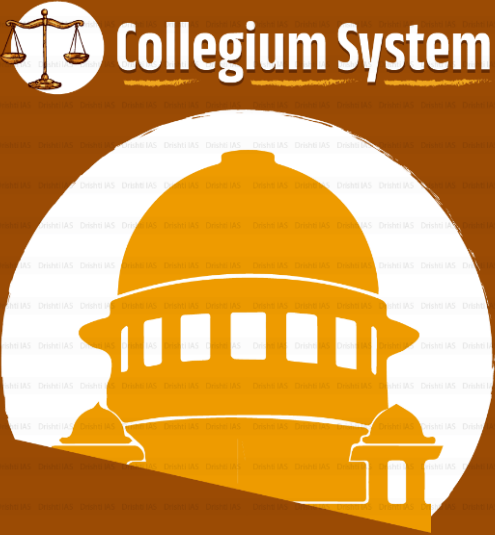
What are the Arguments in Favor of the Collegium System in India?

➢ **Upholding Judicial Independence**: The Collegium system ensures that judges appoint their peers, maintaining the j**udiciary's independence from the executive branch.**

- ○ This prevents **political interference in judicial decisions**, safeguarding the rule of law and ensuring fair justice.

➢ **Prioritizing Merit and Experience**: Judges are selected based on their **qualifications, experience, and judicial acumen**.

- ○ The collegium system allows for a more nuanced assessment of candidates, considering factors **beyond academic credentials.**
- ○ This ensures that the most competent and experienced individuals are appointed to the bench.

➢ **Promoting Diversity and Inclusivity:** The collegium system has been instrumental in **promoting diversity within the judiciary.**

- ○ It has led to the appointment of judges from various backgrounds, including **women, marginalized communities, and regions.**

- ○ This ensures that the judiciary reflects the diverse nature of Indian society and fosters public trust.
- ○ For instance, the appointment of **Justice Leila Seth** as the first **woman Chief Justice of a High Court in India** is a testament to the system's commitment to inclusivity.
  - Also, **Justice BV Nagarathna** poised to be first woman Chief Justice of India in 2027.

➢ **Ensuring Institutional Memory and Continuity:** The Collegium System, with its reliance on senior judges, **allows for the preservation of institutional memory** and the continuity of judicial practices and precedents.

- ○ This can be particularly important in a **complex legal system like India,** where the interpretation and application of laws often evolve over time.
- ○ The Collegium's ability to maintain a consistent approach to judicial appointments has helped to ensure a **smooth transition of power within the judiciary,** even during periods of political instability or changes in government.

What are the Arguments Against Collegium System in India?

➢ **Lack of Transparency:** The Collegium System has been criticized for its opaque decision-making process, with **little to no public scrutiny** or **justification for the appointments made.**

- ○ This lack of transparency can undermine public trust in the judiciary and raise concerns about the fairness and integrity of the selection process.
- ○ One of the most notable failures of the collegium system was the appointment of **Soumitra Sen** as a **Calcutta High Court Judge** in December, 2003, despite allegations of **fund misappropriation during his time as a court-appointed lawyer** in a dispute between two public sector undertakings.

➢ **Uncle Judges' Syndrome:** The Collegium System, with its closed-door deliberations and **reliance on senior judges**, has been accused of fostering an **insular culture that can lead to nepotism and cronyism.**

- ○ There are concerns that p**ersonal connections and loyalty**, rather than merit, may play a role in the selection of judges.
- ○ The **Law Commission of India** criticized the collegium system in its **2008 report**, highlighting issues of nepotism and lack of checks and balances.

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 **99ᵗʰ** 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

Drishti IAS

➢ **Lack of Diversity and Representation** The Collegium System has been criticized for its **failure to promote greater diversity** within the judiciary, particularly in terms of gender, caste, and regional representation.
  - ❍ The dominance of **senior judges from certain backgrounds** may result in a judiciary that does not adequately reflect the diversity of the Indian population.

➢ **Lack of External Oversight and Input:** The Collegium System operates without any external oversight or input from other stakeholders, such as the **public, legal experts, or civil society organizations.**
  - ❍ This can result in a decision-making process that is insulated from broader societal perspectives and concerns.
  - ❍ **Parliamentary Standing Committee** on Law and Justice 2016 Report expressed concern over **delays in filling judicial vacancies and recommended that judicial appointments should be a participatory function** jointly performed by the judiciary and the executive.

How do Judicial Appointment Mechanisms Differ Across Countries?

➢ **United States of America**
  - ❍ **Appointment Process:** Federal judges are appointed by the President with the advice and consent of the Senate.
    - Candidates undergo assessment by a committee of the **American Bar Association** and are reviewed by the **Senate Judiciary Committee** before a Senate vote.
  - ❍ **Tenure**: There is **no fixed retirement age for judges;** they hold office for life, contingent upon "good behavior."

➢ **United Kingdom**
  - ❍ **Appointment Process:** Following the establishment of the UK Supreme Court in 2005, the appointment process shifted **from the Lord Chancellor to the Judicial Appointments Commission.**
    - This commission includes barristers, judges, laypeople, solicitors, and magistrates.
    - Despite this shift, the L**ord Chancellor retains the residual power to reject candidates based on merit.**

> ➤ **Other Countries**
> - ○ **Canada, South Africa, and Various U.S. Jurisdictions:** These countries utilize an **independent Judicial Appointment Commission system**, which is well-regarded for its effectiveness.
> - ○ **Ireland, Israel, New Zealand, and the Netherlands**: These countries have established judicial appointment committees to oversee the selection of judges.

What Changes Could Enhance the Existing Collegium System?

➤ **Enhanced Transparency and Accountability:** The Collegium system should be made more transparent to increase public trust.
  - ○ **Clear guidelines and procedures for judicial appointments** should be established, and public consultations should be incorporated into the process.
  - ○ This would ensure that the judiciary is accountable to the people it serves.

➤ **Balanced Role for the Executive:** While the judiciary should maintain its independence, the executive branch should have a greater role in judicial appointments.
  - ○ A **revised NJAC,** incorporating representatives from the judiciary, executive, and civil society, could strike a balance between judicial independence and accountability.
  - ○ This would **prevent the judiciary from becoming overly powerful** and ensure that appointments are based on merit and public interest.

➤ **Merit-Based Appointments:** The Collegium system should strictly adhere to **merit-based criteria for judicial appointments.**
  - ○ **Qualifications, experience, and judicial acumen** should be the primary considerations.
  - ○ This would ensure that the most competent and qualified individuals are appointed to the bench, enhancing the judiciary's efficiency and effectiveness.

➤ **Time-Bound Appointments:** To address delays in judicial appointments, **strict timelines should be established for the Collegium process.**
  - ○ This would prevent vacancies from persisting for extended periods, ensuring that the judiciary is fully staffed and able to handle the caseload efficiently.

➤ **Public Participation:** The judiciary should actively seek public input in the judicial appointment process.
  - ○ This could be achieved through **public consultations, online forums, and feedback mechanisms.**
  - ○ Public participation would help to ensure that the judiciary is responsive to the needs and expectations of the people it serves.

Conclusion:

The debate over India's judicial appointments highlights the need for reform in the collegium system to address issues of transparency, accountability, and delays. **Revising the NJAC or adopting similar reforms** could help resolve these challenges and improve the overall functioning of the judiciary.

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India-ASEAN: Partners in Progress

This editorial is based on "India, Singapore set to unveil MoU on cooperation in semiconductor ecosystem" which was published in Hindustan Times on 02/09/2024. The article discusses Indian Prime Ministers upcoming visits to Singapore and Brunei, highlighting the strengthening of bilateral ties with ASEAN and the identification of new areas for cooperation in fields like defense, technology, and sustainability.

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

Indian Prime Minister's upcoming visit to **Singapore**, marks a significant moment in the evolving India-Singapore partnership. India and Singapore are set to unveil about half a dozen agreements, including a crucial one on creating a **semiconductor ecosystem.** Building on the **"new anchors"** identified during the recent **India-Singapore Ministerial roundtable**, the relationship is poised for a major leap forward. Singapore's position as **India's largest trade partner in ASEAN** and its status as the leading source of foreign direct investment underscores the **economic significance of this relationship.**

India's engagement with Singapore serves as a crucial gateway to strengthening its broader relations with **ASEAN**. As India seeks to deepen its **'Act East' policy**

and expand its influence in the Indo-Pacific region, enhancing ties with Singapore - a key ASEAN member - becomes strategically vital.

ASEAN GROUPING

What is the Significance of ASEAN for India?

➢ **Historical Context and Elevation of Partnership:**

○ **1992**: India became a **Sectoral Dialogue Partner** with ASEAN, marking the start of formal engagement.

○ **1995**: Elevated to a **Dialogue Partner**, increasing interactions to the Foreign Minister level.

○ **2002**: The relationship was further upgraded to **Summit level**, with the first Summit taking place in 2002.

○ **2012**: At the **20-year Commemorative Summit in New Delhi**, the Dialogue Partnership was upgraded to a **Strategic Partnership**.

○ **2018**: During the **25-year Commemorative Summit**, India and ASEAN agreed to focus on cooperation in the **maritime domain**.

○ **2022**: The **30-year anniversary** of ASEAN-India relations was celebrated, designated as **ASEAN-India Friendship Year**, culminating in the elevation of the Strategic Partnership to a **Comprehensive Strategic Partnership**.

➢ **Economic Powerhouse-Gateway to Southeast Asian Markets:** ASEAN represents a crucial economic bloc for India, offering access to a market of over **650 million people** with a combined GDP of **USD 3.2 trillion.**

○ The ASEAN-India Free Trade Area has boosted bilateral trade to **USD 110.39 billion in 2021-2022**.

○ ASEAN is one of the major trade partners of India with a share of **11% in India's global trade.**

○ **Singapore is India' largest trade partner in ASEAN and 6th largest trade partner worldwide** and it

was the largest source of FDI during the last financial year valued at **USD 11.77 billion.**

➢ **Strategic Counterbalance:** In the context of rising geopolitical tensions, particularly with China, **ASEAN** serves as a crucial strategic partner for India.

○ **India's 'Act East Policy' and ASEAN's 'Outlook on the Indo-Pacific'** share complementary visions for regional stability.

○ The elevation of India-ASEAN ties to a **Comprehensive Strategic Partnership in 2022** underscores this alignment.

○ India's engagement with ASEAN in forums like the **East Asia Summit** and **ASEAN Regional Forum** provides platforms to assert its role as a net security provider in the region, countering Chinese influence and promoting a rules-based international order.

➢ **Connectivity Catalyst**: ASEAN is pivotal in India's vision of enhanced regional connectivity.

○ Projects like the **India-Myanmar-Thailand Trilateral Highway** and the **Kaladan Multi-Modal Transit Transport Project,** despite delays, represent India's commitment to physical integration with Southeast Asia.

○ Digital connectivity initiatives, including the **recent focus on 5G and cybersecurity cooperation**, further strengthen these links.

○ These connectivity projects are not just about infrastructure but are strategic investments in creating an **integrated economic and cultural space that can rival China's Belt and Road Initiative** in the region.

➢ **Cultural Confluence:** The deep-rooted historical and cultural ties between India and Southeast Asia provide a unique foundation for soft power diplomacy.

○ Initiatives like the **ASEAN-India Artists' Camp** and **Music Festival** celebrate this shared heritage.

○ The establishment of the **ASEAN-India Network of Universities in 2022** further strengthens academic and cultural exchanges.

○ These cultural links are increasingly important in an era where public diplomacy plays a crucial role in international relations, helping India build goodwill and influence in the region.

➢ **Technological Synergy:** ASEAN's rapidly digitalizing economies present significant opportunities for India's IT sector and start-up ecosystem.

○ The inaugural **ASEAN-India Start-up Festival** showcases the potential for collaboration in areas like fintech, e-commerce, and artificial intelligence.

○ The **ASEAN-India Science and Technology Development Fund,** with its recent **USD 5 million boost,** supports joint research in cutting-edge fields.

➢ **Maritime Security Collaboration:** ASEAN is a key partner in India's maritime security strategy, particularly in the context of the Indo-Pacific region.

○ Collaboration on issues like piracy, illegal fishing, and disaster management in bodies like the **ASEAN Regional Forum** and the **Expanded ASEAN Maritime Forum** aligns with **India's SAGAR (Security and Growth for All in the Region) doctrine.**

○ The inaugural **ASEAN India Maritime Exercise** was held in the **South China Sea** in **May 2023.**

➢ **Energy Security and Sustainability:** ASEAN's energy-rich members offer opportunities for India to diversify its energy sources, crucial for its growing economy.

○ Simultaneously, **India's expertise in renewable energy,** particularly solar power, aligns with ASEAN's sustainability goals.

○ The recent ASEAN-India High-Level Conference on Renewable Energy exemplifies this synergy.

○ Cooperation in **semiconductors, clean energy technologies** and **sustainable development practices** positions both India and ASEAN at the forefront of global efforts to combat climate change while ensuring energy security.

➢ **Supply Chain Resilience**: In the **post-Covid era,** ASEAN has emerged as a key partner in India's efforts to build resilient supply chains.

○ The pandemic exposed vulnerabilities in global supply networks, prompting a **rethink of over-dependence on single sources.**

○ India-ASEAN cooperation in sectors like pharmaceuticals, electronics, and automobiles is crucial for creating diversified, robust supply chains.

○ This collaboration aligns with broader initiatives like the **Supply Chain Resilience Initiative (SCRI) involving India, Japan, and Australia**, aimed at reducing dependence on China and creating more secure regional value chains.

What are the Key Concerns in India-ASEAN Relations?

➢ **Trade Imbalance:** India's trade deficit with the ASEAN has surged, more than **doubling since the implementation of the Free Trade Agreement (FTA)** in 2010.

○ This imbalance is particularly pronounced in sectors like **electronics and machinery.**

○ For instance, in the fiscal year **2022-2023**, India's exports to ASEAN countries amounted to **USD 44.04 billion,** while imports significantly outpaced this, reaching **USD 87.58 billion** during the same period.

➢ **Infrastructure Connectivity:** While India and ASEAN have made progress in digital and cultural connectivity, physical infrastructure links remain underdeveloped.

○ The **India-Myanmar-Thailand Trilateral Highway,** a flagship project, has faced significant delays and is yet to be completed.

○ Similarly, the **Kaladan Multi-Modal Transit Transport Project** has encountered challenges.

○ These delays hamper trade flows and people-to-people connections.

➢ **Geopolitical Balancing- Navigating the China Factor:** China's growing influence in Southeast Asia poses a complex challenge for India-ASEAN relations.

○ ASEAN member states are increasingly caught between Chinese economic inducements and security concerns.

○ India's efforts to **position itself as a counterbalance to China**, such as through the **Quad Alliance,** have met with mixed responses from ASEAN countries wary of taking sides.

○ The **South China Sea** dispute further complicates this dynamic.

● For instance, while **Vietnam and the Philippines** welcome India's more active role in the **South China Sea,** other members are more cautious

➢ **Regulatory Hurdles:** Differences in regulatory standards and procedures between India and ASEAN countries create significant non-tariff barriers to trade and investment.

○ For example, **divergent food safety standards and certification** processes hinder agricultural trade.

○ The **lack of mutual recognition agreements in professional services** limits the movement of skilled professionals.

Why does India Continue to Face Trade Deficit with ASEAN?

➢ **Tariff Asymmetry:** The ASEAN-India Free Trade Agreement (AIFTA) has led to asymmetric tariff reductions, disadvantageing India.

○ While India has reduced tariffs on about **74% of its tariff lines for ASEAN** countries, the latter have

reciprocated for **only about 56% of their tariff lines.**

○ This imbalance is particularly pronounced in sectors like agriculture and textiles.

○ This tariff structure has contributed to the surge in imports from ASEAN, widening the trade deficit which reached **USD 25.76 billion in 2021-22.**

➢ **Non-Tariff Barriers:** ASEAN countries employ various non-tariff barriers (NTBs) that hinder Indian exports.

○ These include **complex regulatory requirements, stringent sanitary and phytosanitary measures**, and technical barriers to trade.

○ For example, Indian pharmaceutical exports face lengthy and costly registration processes in several ASEAN countries.

○ Similarly, Indian agricultural products often struggle to **meet ASEAN's strict food safety standards.**

➢ **Manufacturing Competitiveness**: Many ASEAN countries, particularly **Vietnam and Thailand**, have developed robust manufacturing sectors with higher productivity levels than India.

○ This is evident in sectors like **electronics and machinery**.

○ For instance, **India exports to Vietnam** reached **USD5.47 billion** (down 7.43%) while Indian imports from Vietnam amounted to **USD 9.34 billion** (up 6.26%).

○ India's **relatively lower labor productivity** and higher logistics costs (14% of GDP compared to **5-10% in ASEAN)** contribute to this competitiveness gap.

➢ **Missing Link Regional Value Chain:** India's limited integration into ASEAN-centric regional value chains exacerbates the trade imbalance.

○ ASEAN countries have successfully positioned themselves as key nodes in global supply chains, particularly in electronics and automotive sectors.

○ For example, **Thailand is a major auto parts supplier for Japanese car** manufacturers, while **Vietnam is a crucial link in the electronics supply chain.**

○ India's participation in these regional production networks remains limited, **reducing its ability to capture value-added exports** to ASEAN and beyond.

➢ **Services Trade Barriers:** While India has a comparative advantage in services, particularly in IT and ITeS, barriers to services trade in ASEAN due to language

and other factors **limit India's ability to offset goods trade deficit.**

○ Restrictions on the movement of professionals, lack of mutual recognition agreements for qualifications, and data localization requirements in some ASEAN countries hinder India's services exports.

➢ **Rules of Origin Exploitation:** Weak rules of origin in the AIFTA have allowed non-ASEAN countries, **particularly China, to route their exports to India through ASEAN, exacerbating the trade deficit.**

○ This '**trade deflection**' has been particularly problematic in sectors like electronics and machinery.

○ This issue not only inflates the trade deficit with ASEAN but also undermines India's efforts to reduce dependence on Chinese imports.

What Measures can be Adopted to Enhance India-ASEAN Relations?

➢ **Recalibrating the ASEAN-India Free Trade Agreement (AIFTA):** India should push for a comprehensive review and recalibration of AIFTA to address the trade imbalance.

○ This could include **negotiating for more balanced tariff reductions**, particularly in sectors where India has a competitive advantage such as **pharmaceuticals, textiles, and IT services.**

○ For instance, India could propose a phased reduction of tariffs on sensitive agricultural products while seeking greater market access for its services sector.

➢ **Enhancing Infrastructure Connectivity:** India needs to accelerate the completion of key connectivity projects like the **India-Myanmar-Thailand Trilateral Highway and extend it to Cambodia, Laos, and Vietnam.**

○ India could propose a comprehensive **"Connectivity Master Plan"** aligned with **ASEAN's Master Plan on Connectivity 2025.**

○ This could include digital connectivity initiatives, such as the proposed **India-ASEAN submarine cable project,** which would significantly boost digital trade and services.

○ Timely completion of these projects could potentially increase India-ASEAN trade by 20-30% in the medium term.

➢ **Boosting Manufacturing Competitiveness:** To address the manufacturing competitiveness gap, India should focus on sector-specific interventions.

- The **Production Linked Incentive (PLI) scheme,** which has shown promise in sectors like electronics, should be extended to cover more industries relevant to ASEAN trade.
- India could also propose **joint manufacturing initiatives with ASEAN countries,** leveraging each other's strengths.
- For example, a **joint India-Vietnam electronics manufacturing hub** could combine India's software capabilities with Vietnam's hardware expertise.
  - Such initiatives could help India integrate better into regional value chains.

➢ **Enhancing Energy Cooperation:** India should propose a comprehensive "ASEAN-India Energy Partnership" focusing on **energy security, clean energy transition, and technology cooperation.**

- This could include joint exploration and development of renewable energy technologies, semiconductors and knowledge sharing on energy efficiency.
- Joint research on emerging areas like **green hydrogen and energy storage could also be initiated**. Enhanced energy cooperation could help India diversify its energy sources while supporting ASEAN's sustainable development objectives.

➢ **Enhancing Strategic and Defense Cooperation:** India should deepen its strategic engagement with ASEAN, particularly in maritime security.

- India could offer increased **capacity building assistance** to ASEAN countries in areas like maritime domain awareness, anti-piracy operations, and **humanitarian assistance and disaster relief (HADR).**
- The **Information Fusion Centre - Indian Ocean Region (IFC-IOR)** could be leveraged to enhance maritime cooperation.
- India should also consider joint defense production initiatives with technologically advanced ASEAN countries like **Singapore and Indonesia,** which could enhance interoperability and strategic trust.

➢ **Aligning on Climate Change and Sustainability:** India should propose an "**ASEAN-India Green Partnership**" focusing on climate change mitigation, renewable energy, and sustainable development.

- This could include technology transfer in areas like **solar energy,** where India has made significant strides with initiatives like the **International Solar Alliance.**

- Joint research projects on **climate-resilient agriculture**, given the shared vulnerability to climate change, could be initiated.
- Such initiatives could position India as a responsible partner in addressing shared environmental challenges.

How India Can Leverage Singapore to Enhance Its Relations with ASEAN?

➢ **Economic Gateway:** Singapore's strategic location and its status as a **major financial hub make** it an ideal economic gateway for India into the ASEAN region. India can:

- Use Singapore as a **base for Indian companies**, especially startups and tech firms, to expand into Southeast Asian markets
- Leverage the **Comprehensive Economic Cooperation Agreement (CECA)** to boost trade and investment flows with other ASEAN countries
- Collaborate with Singapore to promote digital financial inclusion across ASEAN, building on successes like the **UPI-PayNow linkage.**

➢ **Maritime Security Cooperation:** Given Singapore's strategic location at the **Malacca Strait** and its support for India's role in regional maritime security, India can:

- Expand joint naval exercises like **SIMBEX** to include other ASEAN nations, enhancing regional maritime cooperation
- Collaborate with Singapore to promote maritime security initiatives within ASEAN, such as the **ASEAN-India Maritime Exercise**

➢ **Technology and Innovation Hub:** Singapore's emphasis on innovation and technology aligns well with India's digital ambitions. India can:

- Partner with Singapore to develop joint initiatives in emerging technologies like **blockchain, AI, and cybersecurity**, which can be extended to other ASEAN countries
- Use Singapore as a testbed for Indian tech innovations before scaling them across ASEAN

➢ **Supply Chain Resilience:** Building on the collaboration during the COVID-19 pandemic, India can:

- Use **Singapore's expertise in logistics and supply chain management** to enhance connectivity with other ASEAN nations
- Collaborate on initiatives to ensure the free flow of essential goods and services across the region during crises

Conclusion:

India's strategic engagement with ASEAN, highlighted by the evolving partnership with Singapore, underscores a pivotal shift towards deeper economic, technological, and security collaborations. As India leverages Singapore's position and expertise to enhance its regional footprint, the ongoing commitment to strengthening ASEAN ties promises substantial mutual benefits. Addressing **trade imbalances and expanding cooperation** in key sectors will be crucial for realizing the full potential of this dynamic relationship.

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Turning Agriculture into a Growth Engine for India

This editorial is based on "How agriculture can be an engine for growth" which was published in The Indian Express on 04/09/2024. The article highlights how Indian agriculture, despite its current low-tech and subsistence nature, has the potential to drive economic growth and job creation by addressing ecological, technological, and institutional challenges. It emphasizes the need for advancements in irrigation, crop diversity, and institutional innovations to enhance productivity and sustainability.

Tag: GS Paper - 3, Direct & Indirect Farm Subsidies, Public Distribution System (PDS), Buffer Stocks & Food Security, Agricultural Marketing

The Indian agriculture sector, traditionally seen as **low-tech and subsistence-oriented**, has the potential to become a driver of growth and job creation. While agriculture currently employs **46% of the workforce and contributes 18% to GDP**, its growth is inconsistent and environmentally costly. To make agriculture a key engine for growth, it is essential to overcome **ecological, technological, and institutional challenges.** This includes regenerating water resources, expanding irrigation, embracing crop diversity, and adopting high-tech solutions like **micro-irrigation** and climate-resilient farming methods.

Moreover, the focus should be on creating synergy between **agriculture and the rural non-farm sector,** encouraging group farming models, and enhancing allied sectors like **fisheries and livestock.** Institutional innovations, such as **promoting smallholder cooperation through group farming,** have shown promising results, increasing productivity and empowering farmers,

especially women. By embracing these changes, Indian agriculture can become more **technologically advanced, environmentally sustainable, and economically viable**, attracting educated youth and driving the country's growth.

What is the Current Status of the Indian Agriculture Sector?

➢ **Status:**

○ **Economic Contribution:** Agriculture and allied sectors contributed **18.8% to India's Gross Value Added (GVA) in 2021-22.**

  ● The sector grew by **3.9% in 2021-22**, up from 3.6% in 2020-21, showing resilience during the pandemic.

○ **Employment:** Agriculture employs about 42% of India's workforce.

  ● However, the sector's share in employment has been gradually declining, down from **81% in 1983.**

○ **Production:** India's foodgrains production touched a record **315.7 million tonnes** in 2021-22 despite climate change challenges. **(Economic Survey 2022-23)**

○ **Exports**: Agricultural exports grew by 19.92% in 2021-22, reaching **USD 50.21 billion.**

  ● Major export items include **rice, wheat, cotton, and spices.**

○ **Organic farming:** The total area under organic certification process (registered under **National Programme for Organic Production**) is 7.3 mha (2023-24)

➢ **Recent Government Initiatives:**

○ Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)

○ Pradhan Mantri Fasal Bima Yojana (PMFBY)

○ Soil Health Card Scheme

○ Pradhan Mantri Krishi Sinchai Yojana (PMKSY)

○ e-National Agriculture Market (e-NAM)

○ National Mission on Sustainable Agriculture

○ Paramparagat Krishi Vikas Yojana (PKVY)

○ Digital Agriculture Mission

○ Unified Farmer Service Platform (UFSP)

○ National e-Governance Plan in Agriculture (NeGP-A)

○ Mission Organic Value Chain Development for North Eastern Region (MOVCDNER)

➤ **Recent Technological Developments:**

○ **Drone Technology:** In 2021, the government approved subsidies up to 100% of the cost of agriculture drones for drone purchase by farm machinery training institutes.

- The **Namo Drone Didi scheme** aims to provide drones to **15,000** selected women SHGs during the period **2023-24** to **2025-2026.**

○ **Satellite Imaging and Remote Sensing:** ISRO's **RISAT-1A satellite,** launched in 2022, is being used for agricultural assessment and improvement.

○ **Happy Seeder** Technology: Designed to address stubble burning in **rice-wheat systems**, it enables wheat sowing without removing paddy straw, reducing air pollution and improving soil health.

○ **PUSA Decomposer**: Developed by the **Indian Agricultural Research Institute (IARI),** this microbial solution rapidly decomposes crop residues when sprayed on stubble.

○ **Nano Urea**: Introduced by **IFFCO in 2021**, this liquid fertilizer with nanoscale nitrogen particles boosts nutrient use efficiency and reduces environmental pollution.

Why is Indian Agriculture Underperforming Despite Employing the Majority?

➤ **Fragmented Land Holdings:** India's agricultural land is highly fragmented, with the average farm size decreasing from **2.3 hectares in 1970-71 to 1.08 hectares in 2015-16.**

○ As per **India's Agriculture Census 2015-16**, 86.1% of Indian farmers are small and marginal (SMF) i.e., have a landholding size smaller than **2 hectares**

- More than half of these live in five Indian states of **Uttar Pradesh, Bihar, Madhya Pradesh, Maharashtra and Andhra Pradesh.**

- This fragmentation limits economies of scale, mechanization, and access to credit.

○ Such small plots make it challenging to implement modern farming techniques or invest in technology, leading to lower productivity and income for farmers.

➤ **Irrigation Challenges in a Changing Climate:** Despite having 18% of the world's population, India has only **4% of global water resources**.

○ Over Reliance on **monsoon rain**s, coupled with inefficient irrigation practices, hampers agricultural productivity.

○ As of 2022-23, only **52% of cultivated land** has access to irrigation.

○ The **Economic Survey 2017-18** estimated that climate change could reduce annual agricultural incomes by **15-18% on average**, and up to **25% in unirrigated areas.**

- The **recent heat waves in 2022 and 2023, w**hich damaged wheat crops in several states, exemplify the vulnerability of Indian agriculture to climate variability.

➤ **Technological Lag, Innovation Gap:** While the Green Revolution significantly boosted productivity in the 1960s and 70s, Indian agriculture has since **struggled to keep pace with technological advancements.**

○ The adoption of **precision farming, drone technology, and AI-driven solutions** remains low.

○ This technological lag contributes to lower yields compared to global standards - **India's rice yield is less compared to China's.**

➤ **Market Inefficiencies:** The **Agricultural Produce Market Committee (APMC) system,** while intended to protect farmers, has often led to exploitation by intermediaries.

○ Farmers t**ypically receive only 15-20% of the retail price of their produce.**

○ The **recent farm laws of 2020 (now repealed)** attempted to address this issue but faced significant opposition.

○ **E-NAM (Electronic National Agriculture Market)** launched in 2016 aims to create a unified national market, but as of **February 2024,** only about **1.77 crore** farmers were registered on the platform.

➤ **Credit Crunch- The Debt Trap:** Limited access to formal credit forces many farmers to rely on informal lenders who charge exorbitant interest rates.

○ According to **NABARD's All India Rural Financial Inclusion Survey 2017**, only 30.3% of agricultural households availed credit from institutional sources.

○ According to the latest **'Situation Assessment of Agricultural Households and Land Holdings of Households in Rural India, 2019'**, over **half** of India's agricultural households were in debt, with an average outstanding amount of ₹74,121.

○ This debt burden often leads to a cycle of poverty and, **in extreme cases, farmer suicides.**

➤ **Policy Paralysis-The Subsidy Conundrum**: India's agricultural policy has long been dominated by subsidies, which often distort market dynamics and resource allocation.

○ The Government recently estimated that total subsidy on fertilizer could touch **₹2.25-lakh crore during FY24.**

○ While these subsidies aim to support farmers, they often lead to o**veruse of inputs like water and fertilizers**, causing environmental degradation.

○ The **Minimum Support Price (MSP) system**, while providing a safety net, has led to overproduction of certain crops like **wheat and rice** at the expense of more nutritious and environmentally suitable alternatives.

● This policy-induced cropping pattern **mismatch affects both agricultural sustainability and farmers' incomes.**

➢ **Post-Harvest Losses:** India loses a significant portion of its agricultural produce due to inadequate storage and transportation infrastructure.

○ According to the **ICAR-Central Institute of Post-Harvest Engineering and Technology**, annual post-harvest losses are estimated at **₹92,651 crore**.

○ The cold storage capacity in India can **only accommodate about 11% of the country's total produce.**

○ This leads to distress sales by farmers during harvest seasons, further reducing their income potential.

➢ **The Knowledge Deficit:** Despite employing a large workforce, Indian agriculture suffers from a significant skill gap.

○ This lack of formal training hampers the adoption of modern agricultural practices and technologies.

○ For example, the **improper use of pesticides** not only reduces crop yields but also poses health risks.

○ The **Pradhan Mantri Kaushal Vikas Yojana (PMKVY)** has tried to address this, but its impact on the agricultural sector remains limited.

➢ **Diversification Dilemma:** Indian agriculture remains heavily focused on staple crops like rice and wheat. This lack of diversification not only affects soil health but also limits farmers' income potential.

○ High-value crops like **fruits and vegetables**, which can potentially increase farmers' incomes. However, **only 17% of arable land** is being utilized for the cultivation of horticultural crops

○ The recent push for **millets (2023 being the International Year of Millets)** is a step towards diversification, but widespread adoption remains a challenge.

➢ **Gender Disparity-The Invisible Female Farmer: Women constitute 42% of the agricultural labor force in India**, yet they own only 14% of agricultural land.

○ This gender disparity in land ownership affects access to credit, inputs, and decision-making power.

○ According to an **FAO report of 2011-12,** women farmers could increase farm yield by **20-30%** , which could raise agricultural output in developing countries by 2.5-4% and reduce hunger by **12-17%** if they had the same access to productive resources and training as men.

○ Initiatives like the **Mahila Kisan Sashaktikaran Pariyojana** aim to empower women farmers, but progress has been slow.

Key Case Studies Related to Agriculture Across the Globe

➢ **United Kingdom: GrowUp Farms** excels in **vertical farming,** offering year-round fresh produce in controlled environments.

➢ **The Netherlands: Rijk Zwaan** utilizes advanced **greenhouses** with climate control and LED lighting for high-quality vegetable production, and the Dutch government promotes circular agriculture through **biogas energy and recycled materials.**

➢ **China: Zhongguancun Science Park (Z-Park) in Beijing,** China is a growing hub of innovation in many areas including bio-medicine.

What Measures can be Adopted to Enhance the Productivity of the Agricultural Sector?

➢ **Precision Agriculture-Farming by the Numbers:** Implementing precision agriculture techniques can significantly boost productivity.

○ This involves using **GPS-guided machinery, IoT sensors, and data analytics** to optimize resource use.

○ A pilot project in Maharashtra using precision agriculture techniques reported significant increase in crop yield and a significant reduction in water usage.

○ Scaling this nationwide could potentially save billions of liters of water and increase overall agricultural output.

➢ **Crop Diversification-Beyond Wheat and Rice:** Encouraging farmers to diversify crops can increase income and improve soil health.

○ The government's recent push for millets is a step in this direction.

○ States like **Odisha** have successfully implemented crop diversification programs. This not only improved farmer incomes but also enhanced nutritional security.

○ Expanding such programs nationwide, with a focus on **region-specific high-value crops, can transform agricultural productivity.**

➢ **Farmer Producer Organizations (FPOs):** Promoting and strengthening FPOs can help small and marginal farmers achieve economies of scale.

○ The **Sahyadri Farmers Producer Company in Maharashtra** has increased farmer incomes by 25-30% through collective bargaining and direct market access.

○ Replicating this model across India, with **adequate support and capacity building,** can significantly enhance farmer incomes and agricultural productivity.

➢ **Climate-Smart Agriculture**: Implementing climate-smart agricultural practices is crucial for long-term sustainability.

○ This includes promoting drought-resistant crop varieties, water conservation techniques, and climate forecasting tools.

○ For example, the flood-tolerant rice variety **Swarna-Sub1** has shown yield advantages.

○ The Indian Prime Minister recently unveiled **109 varieties of 61 crops**, comprising 34 field crops and 27 horticultural crops, is a step in the right direction.

➢ **Agri-Tech Startups:** Fostering a vibrant agri-tech startup ecosystem can drive innovation in the sector.

○ Startups like DeHaat, which provides end-to-end services to farmers, have shown promising results.

○ Creating a **supportive ecosystem for such startups** through incubation centers, funding, and policy support can accelerate technological adoption in agriculture.

➢ **Minimizing Waste, Maximizing Value:** Investing in post-harvest infrastructure, including **cold storage, food processing units, and efficient transportation,** can significantly reduce losses and increase farmer incomes.

○ For instance, the **mega food park in Rayagada, Odisha**, has benefited a large number of farmers by providing processing facilities for their produce.

○ Establishing similar infrastructure across the country, especially in major producing regions, can help **reduce the estimated annual post-harvest losses of ₹92,651 crore.**

➢ **Agricultural Education and Extension:** Strengthening agricultural education and extension services can bridge the knowledge gap in farming communities.

○ The **PRAGATI** (Promoting Risk Aware Governance and Technology Infusion) scheme aims to revamp agricultural extension services.

○ Scaling such innovative extension models, coupled with modernizing agricultural universities, can create a **more skilled and knowledgeable farming workforce.**

Conclusion:

To transform **Indian agriculture into a robust engine of growth**, it is crucial to address the sector's multifaceted challenges. Embracing precision agriculture, expanding crop diversification, and investing in post-harvest infrastructure are essential steps. **Strengthening farmer cooperatives and leveraging advancements in agri-tech** can enhance productivity, sustainability, and economic viability, ensuring that agriculture becomes a more dynamic contributor to India's economic development.

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India's Ethanol Revolution: Energy and Agriculture

This editorial is based on "[Ethanol push turns India into corn importer, shaking up global market](#)" which was published in The Economic Times on 04/09/2024. The article highlights India's shift from a leading corn exporter to a net importer due to its push for corn-based ethanol production, causing domestic shortages and impacting various sectors, while also reshaping global supply chains.

Tag: GS Paper - 3, Environmental Pollution & Degradation, Renewable Energy

India's ambitious push for **ethanol blending** in **gasoline** has led to an unexpected shift in its agricultural landscape and global trade position. Once **Asia's top corn exporter,** India has now become a **net importer for the first time in decades,** primarily due to the government's decision to promote **corn-based ethanol production.** This policy change, aimed at reducing carbon emissions and ensuring **ample sugar supply for domestic**

consumption, has created a significant corn shortage, compelling the country to import a record **1 million tons in 2024, mainly from Myanmar and Ukraine.**
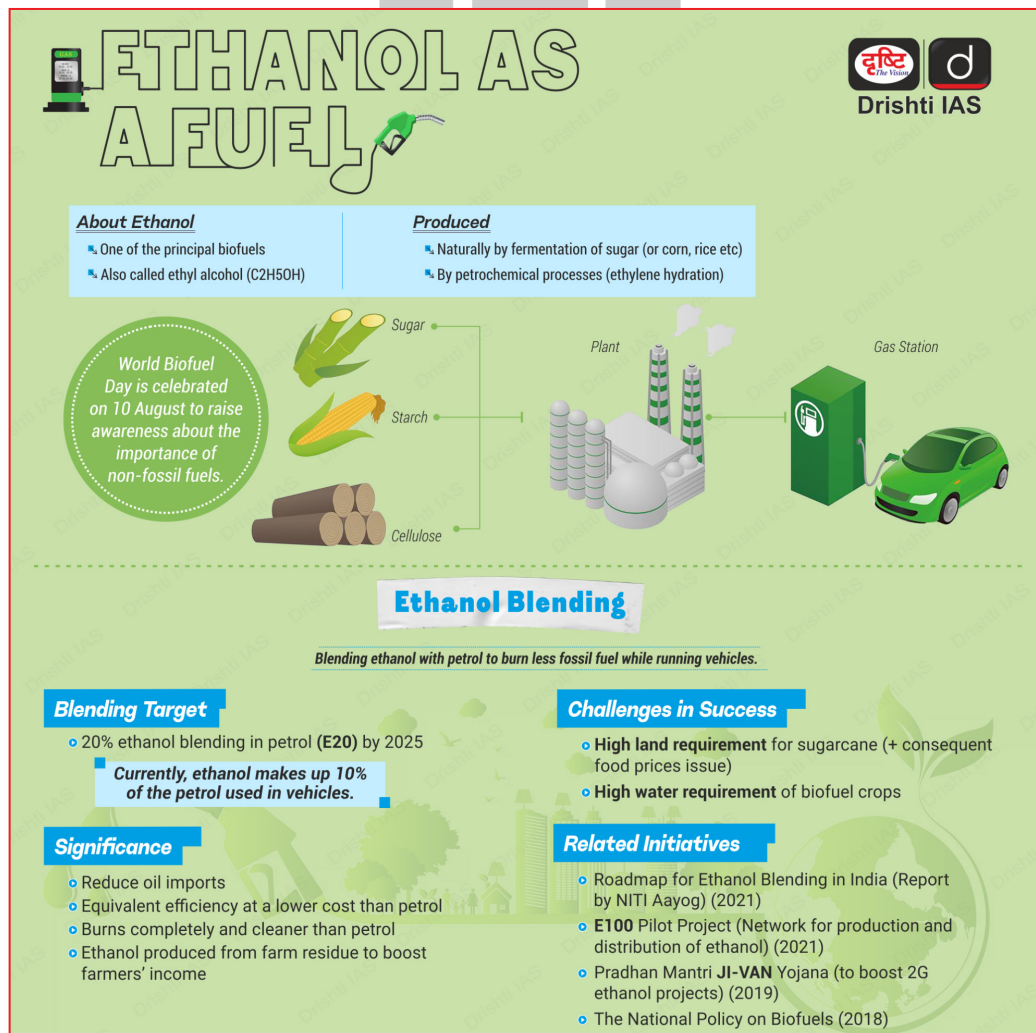
The ripple effects of this transition are being felt across multiple sectors. While the move supports India's climate goals and aims to decrease reliance on sugarcane for ethanol, it has inadvertently **squeezed local poultry producers** and **starch manufacturers** who are now grappling with soaring feed costs. The corn prices in India have risen far above global benchmarks, leading industry associations to **demand duty-free corn imports** and even a **reconsideration of the ban on genetically modified corn.** As India appears set to become a permanent net importer of corn, this shift is not only reshaping domestic agricultural priorities but also scrambling global supply chains, with traditional export markets now turning to South America and the United States for their corn needs.

What is Ethanol?

➢ **About**: Ethanol is a **colorless, flammable liquid organic compound** with a chemical formula C_2H_5OH.

  ○ It is a primary alcohol produced naturally by the fermentation of sugars by yeasts, and is also produced industrially.

  ○ Ethanol is a **volatile, colorless, and flammable liquid** with a characteristic alcoholic odor.

➢ **Production of Ethanol**

  ○ **Fermentation:** Yeast converts sugars (from grains, fruits, or other sources) into ethanol and carbon dioxide.

  ○ **Distillation:** The fermented mixture is heated, and the ethanol vapor is separated from the other components.

   ● The ethanol vapor is condensed, resulting in a higher concentration of ethanol.

  ○ **Dehydration:** To produce anhydrous ethanol (ethanol with a water content of less than 1%), a dehydration process is often used.

➢ **Major Ethanol Blends**

  ○ **E10:** Contains 10% ethanol and 90% gasoline.

  ○ **E20**: Contains 20% ethanol and 80% gasoline.

  ○ **Flex Fuel Vehicles:** Vehicles designed to run on a range of ethanol-gasoline blends, including E85.

ETHANOL AS A FUEL

Drishti IAS

About Ethanol
- One of the principal biofuels
- Also called ethyl alcohol (C2H5OH)

Produced
- Naturally by fermentation of sugar (or corn, rice etc)
- By petrochemical processes (ethylene hydration)

World Biofuel Day is celebrated on 10 August to raise awareness about the importance of non-fossil fuels.

Sugar — Starch — Cellulose — Plant — Gas Station

Ethanol Blending

Blending ethanol with petrol to burn less fossil fuel while running vehicles.

Blending Target
- 20% ethanol blending in petrol (E20) by 2025
  Currently, ethanol makes up 10% of the petrol used in vehicles.

Significance
- Reduce oil imports
- Equivalent efficiency at a lower cost than petrol
- Burns completely and cleaner than petrol
- Ethanol produced from farm residue to boost farmers' income

Challenges in Success
- **High land requirement** for sugarcane (+ consequent food prices issue)
- **High water requirement** of biofuel crops

Related Initiatives
- Roadmap for Ethanol Blending in India (Report by NITI Aayog) (2021)
- **E100** Pilot Project (Network for production and distribution of ethanol) (2021)
- Pradhan Mantri **JI-VAN** Yojana (to boost 2G ethanol projects) (2019)
- The National Policy on Biofuels (2018)

What is the Significance of Ethanol Production for India?

➢ **Energy Security and Import Reduction:** India's push for **ethanol production** is a strategic move to reduce its <u>heavy dependence on oil imports.</u>

 ○ By blending ethanol with petrol, India aims to cut its oil import bill, which could widen to USD 101-104 billion in the current fiscal from **USD 96.1 billion in 2023-24.**

 ○ The government's target of **20% ethanol blending by 2025-26** could potentially save the country **USD 4 billion** annually in foreign exchange.

 • This shift not only improves energy security but also provides a **buffer against volatile global oil prices,** enhancing India's economic stability.

➢ **Agricultural Diversification and Rural Economy Boost:** Ethanol production offers a significant opportunity to diversify India's agricultural sector and boost rural incomes.

 ○ The recent policy shift to promote **corn-based ethanol** alongside sugarcane has created a new market for farmers.

 ○ In 2024, about 3.5 million tons of corn were used to produce **1.35 billion liters of ethanol,** quadrupling from 2023.

 ○ This diversification not only **provides alternative income sources** for farmers but also helps in **managing crop surpluses,** potentially stabilizing agricultural commodity prices and improving farm incomes.

➢ **Environmental Impact and Climate Change Mitigation:** Ethanol blending is a key component of **India's strategy to reduce** <u>greenhouse gas emissions</u>.

 ○ A study on **E20 (20% ethanol blending in petrol)** showed that carbon monoxide emissions decreased by about 50% in two wheelers an**d about 30% in four wheelers by using E20 compared to E0.**

➢ **Technological Innovation and Industrial Growth:** The ethanol production drive is spurring technological innovation in India's biofuel sector.

 ○ Companies are investing in advanced biofuel technologies, including <u>**second-generation (2G) ethanol production**</u> from agricultural residues.

 ○ For instance, Indian Oil Corporation has set up the **country's first 2G ethanol plant in Panipat** with a capacity of 100 kiloliters per day.

 ○ This push is **not only creating a new industrial sector** but also promoting research and

development in biotechnology and chemical engineering, potentially positioning India as a leader in sustainable fuel technologies.

➢ **Geopolitical Leverage and Global Positioning:** India's ethanol program has significant geopolitical implications.

 ○ By **reducing oil imports**, India can potentially decrease its vulnerability to global oil politics. Furthermore, **as one of the world's largest ethanol producers,** India is positioning itself as a key player in the global biofuel market.

 ○ Also, the ethanol blending program saved **Rs 24,300 crore foreign exchange in 2022-23.**

 ○ This not only enhances India's trade position but also aligns with its aspirations for global leadership in sustainable development.

➢ **Waste Management and Circular Economy:** Ethanol production is becoming a crucial component of **India's waste management strategy** and circular economy initiatives.

 ○ The use of agricultural residues and food waste for ethanol production addresses the critical issue of stubble burning, particularly in northern India.

 ○ The government's <u>**GOBAR-DHAN scheme**</u>, which aims to convert biodegradable waste into biogas and ethanol, exemplifies this approach.

What are the Key Issues Related to Ethanol Production?

➢ **The Corn Conundrum**: India's shift to corn-based ethanol has dramatically altered its corn trade dynamics.

 ○ Once **Asia's top corn exporter**, India is now set to import a record **1 million tons in 2024.**

 ○ This reversal has caused domestic corn prices to soar above global benchmarks, severely impacting poultry and starch industries.

 ○ For instance, in 2024, India's corn exports are expected to plummet to **450,000 tons from the usual 2-4 million tons.**

 ○ This shift not **only affects domestic industries** but also disrupts established trade relationships with countries like **Vietnam and Bangladesh,** forcing them to seek alternative suppliers.

➢ **Food vs. Fuel Debate:** The diversion of food crops like corn and sugarcane for ethanol production has reignited the **food vs. fuel debate**.

 ○ With ethanol distilleries now competing for corn supplies, there's a projected shortfall of **5 million tons for traditional users.**

○ This competition is **driving up food prices** and potentially threatening food security.

○ For example, the farm gate price of **broiler chickens has risen to about 75 rupees**, while production costs have **surged to 90 rupees,** pushing poultry farmers into losses.

○ This scenario raises **critical questions about prioritizing fuel over food** in a country still grappling with malnutrition.

➢ **Water Woes:** Ethanol production, particularly from water-intensive crops like sugarcane, is exacerbating India's water crisis.

○ Sugarcane, which covers only **3% of India's cropland,** consumes about **70% of irrigation water in some states.**

● The push for increased ethanol production could further strain water resources in already water-stressed regions.

○ For instance, Maharashtra, a major sugarcane-producing state, faced severe droughts in recent years, **with over 20,000 villages requiring water tankers in 2018.** The continued expansion of sugarcane cultivation for ethanol could worsen this situation.

➢ **Green Fuel with a Gray Lining:** While ethanol is promoted as a cleaner fuel, its production process raises environmental concerns.

○ The **intensive use of fertilizers and pesticides** in sugarcane and corn cultivation leads to soil degradation and water pollution.

● Moreover, the **conversion process of crops to ethanol is energy-intensive,** potentially offsetting some of the emissions benefits.

○ A study by the **Institute for Energy Economics and Financial Analysis (IEEFA)** suggests that the **lifecycle emissions of corn ethanol could be 24% higher than gasoline** when considering land-use changes and production emissions.

➢ **Economic Ripple Effects:** The ethanol push is causing significant disruptions across various industries.

○ The **poultry sector**, which relies heavily on corn for feed, is facing a crisis due to skyrocketing costs.

○ The All India Poultry Breeders Association has demanded the import of 5 million tons of **duty-free corn to alleviate the situation**.

○ Similarly, the **starch industry,** another major corn consumer, is grappling with supply shortages and price hikes.

● This **economic reshuffling is leading to job losses** and potential food price inflation, impacting the broader economy.

➢ **Policy Patchwork:** The rapid push for ethanol production has led to a patchwork of policies that sometimes conflict with other agricultural and environmental goals.

○ For instance, the **abrupt curb on using sugarcane for fuel f**ollowing a drought has led to confusion and supply chain disruptions.

○ The **ban on genetically modified (GM) corn** severely limits import options, exacerbating supply shortages.

○ These policy inconsistencies create an uncertain regulatory environment, potentially deterring long-term investments in the sector and hampering sustainable growth.

➢ **Infrastructure Inadequacies:** India's ambitious ethanol blending targets are outpacing the development of necessary infrastructure.

○ The **country lacks adequate blending facilities, storage capacities, and transportation networks** to handle increased ethanol production and distribution.

○ This infrastructure gap could lead to inefficiencies, increased costs, and potential supply disruptions, **challenging the feasibility of meeting the 20% blending target by 2025-26.**

What Steps can be Taken to Ensure Ethanol Production is More Sustainable and Economically Viable?

➢ **Diversifying Feedstock:** To reduce pressure on food crops, India should aggressively **promote the use of alternative feedstocks for ethanol production.**

○ This includes scaling up second-generation (2G) ethanol production from agricultural residues and **third-generation (3G) ethanol from algae.**

○ The government could set targets for 2G and 3G ethanol production and provide incentives for private sector investment in these technologies.

➢ **Maximizing Yield, Minimizing Impact:** Implementing precision agriculture techniques can significantly **improve the sustainability of ethanol feedstock cultivation**.

○ This involves using **IoT sensors, drones, and AI-driven analytics** to optimize water usage, fertilizer application, and pest control.

○ For example, the **Maharashtra government's project to use drones for precision farming in sugarcane cultivation** has shown water savings of up to 25%.

○ Scaling such initiatives nationally could dramatically reduce the environmental footprint of ethanol production while improving yields.

➤ **Water-Smart Policies:** Introducing strict water management policies in ethanol production is crucial.

○ This could include **mandating water recycling in distilleries**, promoting drip irrigation in sugarcane cultivation, and incentivizing water-efficient crops for ethanol production.

○ The **success of Madhya Pradesh's 'Kapildhara' scheme,** which has helped install drip irrigation systems, could be replicated in other states.

➤ **Flex-Fuel Vehicle Push:** Accelerating the adoption of **flex-fuel vehicles (FFVs) can create a stable, long-term demand for ethanol.**

○ The government could think of mandating that all new vehicles sold after a target year be flex-fuel compatible.

○ **Brazil's successful FFV program,** where over 80% of new cars sold are flex-fuel, serves as a model.

○ This shift would not only **ensure consistent ethanol demand but also provide consumers with fuel choice flexibility,** potentially stabilizing ethanol prices.

➤ **Zonal Ethanol Production:** Implementing a **zonal approach to ethanol production** can optimize resource use and reduce transportation costs.

○ This involves **identifying ideal eco-regions** for specific feedstocks and encouraging localized production and consumption.

○ For instance, **promoting sorghum-based ethanol in drought-prone regions** of Maharashtra and Karnataka, while focusing on rice residue-based ethanol in Punjab and Haryana.

➤ **Integrated Biorefinery Complexes:** Developing **integrated biorefinery complexes** can significantly enhance the economic and environmental viability of ethanol production.

○ These complexes would **combine ethanol production with other value-added processes like biogas generation, bioplastics manufacturing,** and CO2 capture for industrial use.

○ The **Godavari Biorefineries in Maharashtra,** which **produces ethanol along with specialty chemicals and electricity,** exemplifies this model.

➤ **Smart Blending Infrastructure:** Investing in **smart blending infrastructure** is crucial for achieving higher blending targets efficiently.

○ This includes deploying **automated blending systems at fuel depots** and implementing blockchain-based tracking of ethanol from production to retail.

➤ **Crop Insurance for Ethanol Feedstocks:** Introducing specialized crop insurance schemes for ethanol feedstocks can encourage farmers to shift to these crops.

○ This could include **weather-indexed insurance products tailored for sugarcane, sorghum, and other ethanol feedstocks**.

○ The success of the Pradhan Mantri Fasal Bima Yojana could be leveraged to design a sub-scheme specifically for ethanol crops.

➤ **Circular Economy in Distilleries:** Promoting a circular economy approach in ethanol distilleries can significantly enhance their sustainability.

○ This involves mandating the **use of distillery waste for biogas production,** using the r**esulting slurry as organic fertilizer,** and **capturing CO2 for industrial use.**

○ The **Dalmia Bharat Sugar and Industries' zero liquid discharge plant** in Uttar Pradesh, which converts all its waste into valuable products, serves as an excellent model.

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Addressing Urbanization Challenges for a Sustainable Future

This editorial is based on "Making transit-oriented urban development work" which was published in Hindustan Times on 03/09/2024. This article highlights that the Transit-oriented development (TOD) is frequently discussed in Union budgets but struggles with implementation. Despite its promise of improving accessibility and reducing carbon emissions by concentrating urban development around transit hubs, TOD faces several challenges.

Tag: GS Paper-1, Urbanization, Population and Associated Issues, Poverty and Developmental Issues.

Urbanization is a dynamic and complex process involving the **transition of populations from rural to**

urban areas, profoundly transforming land use, economic activities, and social structures.

This phenomenon, recognized by the **United Nations** as one of the key demographic trends alongside population growth, aging, and migration, entails more than just a shift in numbers. It includes the expansion of city boundaries, economic diversification, cultural changes, and the evolution of governance systems.

The **2011 Census** recorded India's urbanization rate at **31.2%**, an increase from **27.8%** in 2001. By 2030, it is projected that approximately 590 million people will reside in urban areas. With rapid urbanization underway, it is crucial to analyze the growth trends and their impact on the population.

Urbanization manifests in various forms, including planned settlements designed by government agencies to foster **sustainable development** and unplanned settlements that emerge spontaneously, often resulting in informal and sometimes precarious living conditions. In India, urbanization is accelerating, with significant impacts on **city infrastructure, economic output, and social dynamics**.

Despite the promise of urban growth projected to drive a substantial portion of GDP and job creation by 2030, challenges such as **inadequate infrastructure, transit issues, safety problems, environmental degradation, and socio-economic inequalities persist**. Understanding urbanization's multifaceted nature and addressing these challenges is crucial for fostering **resilient and sustainable urban environments**.

What is Urbanisation?

➢ **About:** Urbanization is the complex, multifaceted process of population shift from rural to urban areas, accompanied by changes in land use, economic activities, and social structures.

   ○ It encompasses **demographic transformation**, spatial expansion of cities, economic diversification, cultural shifts, and evolving governance systems, resulting in increased urban population density and the development of built environments.

   ○ The **United Nations** identifies urbanisation as one of four major demographic trends, alongside population growth, aging, and international migration.

➢ **Types of Urban Settlements:**

   ○ **Planned Settlements:** These are urban areas developed by **government agencies or housing societies** based on official plans.

   • With the aim to create **sustainable and livable environments**, such plans take into account various factors, including physical, social, and economic considerations, to ensure organized development.

   ○ **Unplanned Settlements:** These develop without official sanction, often on government or private land, in a disorganized manner.

   • These areas typically feature a **mix of permanent, semi-permanent, and temporary structures** and are commonly located near city drains, railway tracks, flood-prone areas, or on **agricultural land and green belts**.

➢ **Trends in Urbanisation:**

   ○ In **global liveability index 2023** of the **Economist Intelligence Unit**, **New Delhi and Mumbai** are at **141st position** and **Chennai at 144th**.

   • This ranking reflects that Indian cities have low scores in five key parameters: **stability, healthcare, culture and environment, education, and infrastructure.**

   ○ In India, urbanisation has steadily increased, with the urban population rising from 27.7% in 2001 to 31.1% in 2011.

   • The focus has shifted from large **Tier 1 cities** to medium-sized towns, driven by factors like employment, education, and security.

   ○ According to the **Confederation of Indian Industry (CII)**, by 2030, urban areas are projected to contribute approximately 70% to the GDP, 85% of total tax revenue, and 70% of new jobs.

➢ **Reasons for Urbanisation:**

   ○ **Trade and Industry:** The growth of **trade and industry** attracts labor, fosters infrastructure development, and creates access to markets and innovation hubs.

   ○ **Economic Opportunities:** Cities offer a greater number of **job opportunities** compared to rural areas, hosting businesses, factories, and other institutions.

   ○ **Education:** Urban areas generally provide superior educational facilities, including schools and universities, which draw people seeking to enhance their education and career prospects.

   ○ **Better Lifestyle:** Cities offer improved services such as **hospitals and libraries** and provide a vibrant lifestyle with abundant social and cultural opportunities.

○ **Migration:** Migration significantly fuels urbanisation in India, leading to the expansion of informal settlements.

● Migrants often move to unplanned areas due to the high cost of living in more established urban regions, resulting in numerous **informal settlements**, such as **slums and unauthorized colonies**, that lack essential amenities like clean water and sanitation.

What are the Challenges Related to Urban Development?

➢ **Urban Flooding:** It is a major challenge for urbanization, driven by **inadequate drainage systems and encroachment on natural water bodies**.

○ For instance, flooding events in Delhi (2024 & 2023), Nagpur (September 2023), Bengaluru and Ahmedabad (2022), Chennai (November 2021), and Hyderabad (2020 and 2021), revealed severe infrastructure shortcomings and highlighted the urgent need for better **flood management** and **urban planning**.

➢ **Gurugramisation of Cities:** Gurugramisation refers to the transformation of cities through rapid urbanization, characterized by **extensive commercial and residential developments, modern infrastructure, and urban sprawl**.

○ This trend, evident in Gurugram's expansion, often leads to **socioeconomic divides, environmental strain**, and challenges in maintaining balanced urban growth and sustainability.

➢ **Highway-Oriented Development:** Urbanization faces challenges from competitive disadvantages, such as cities favoring **highway development** for higher profits, leading to **Transit-oriented development's (TOD)** reduced appeal and increased **congestion in peripheral areas**.

○ Coordination issues between **transit and city planning agencies** result in inefficiencies, while rigid planning practices and cultural resistance hinder TOD.

○ For example, there is a **lack of coordination** between **transit agencies** (like the Delhi Metro Rail Corporation) and **city planning authorities** (like the Delhi Development Authority). This results in disputes over revenue-sharing and inefficient TOD implementation.

➢ **Traffic Congestion and Mobility Challenges:** Rapid urbanisation, lack of transit options and an increase in private vehicles have caused severe traffic congestion, extending commute times and reducing productivity.

➢ **Air Pollution and Environmental Degradation:** Urban areas in India are experiencing severe air pollution due to vehicle emissions, industrial activities, and construction.

○ For instance, the **World Air Quality Report 2023** reveals that nine of the ten most polluted cities globally are in India and with **Delhi** emerging as the world's most polluted capital city for the fourth consecutive time.

➢ **Urban Heat Island Effect and Lack of Green Spaces:** The rapid **expansion of urban areas and the reduction of green spaces** have intensified the urban heat island effect, leading to higher temperatures and increased energy consumption.

○ For example, **Delhi** experienced an extreme heatwave in May 2024, pushing the city's power demand to over 8,000 megawatts.

➢ **Water Scarcity and Inadequate Water Management:** Many cities face severe water shortages due to rapid urban growth, rising populations, and declining groundwater levels.

○ For instance, Delhi water crisis in 2024 and Chennai's water crisis in 2019, forced residents to rely on water tankers and desalination plants, and Bengaluru's recent water issues, underscore the severity of the problem.

➢ **Inadequate Housing and Slum Proliferation:** The **Ministry of Housing and Urban Affairs** estimates a shortage of around 18.78 million housing units in India from 2012 to 2027, with over 65 million people living in slums or informal settlements.

○ This situation strains infrastructure, exacerbates poverty, and hampers planned development, affecting overall livability and social cohesion.

➢ **Inadequate Solid Waste Management:** Indian cities face difficulties in **managing solid waste**, resulting in garbage accumulation and health risks.

○ The **Central Pollution Control Board** reports that Indian cities generate approximately 62 million tons of municipal solid waste annually, with only about 20% being processed or treated adequately.

How TOD Promotes Sustainable Urban Development?

➢ **Reduction in Traffic Congestion:** TOD helps **alleviate traffic congestion** by integrating high-density, mixed-use neighborhoods with efficient public transit systems.

- ❍ By prioritizing **public transit and walkable designs**, TOD r**educes the reliance on private vehicles**, thereby easing traffic flow and shortening commutes. This shift not only enhances mobility but also minimizes the environmental impact associated with vehicular emissions.

- ➤ **Mitigation of Suburban Sprawl:** TOD addresses the issues of suburban sprawl by focusing on compact, well-planned urban areas.
  - ❍ This approach **promotes the efficient use of land, reduces environmental degradation, and fosters vibrant, sustainable communities**.
  - ❍ By creating neighborhoods where residential, commercial, and recreational spaces are in close proximity, TOD counters the spread of low-density, car-dependent developments.

- ➤ **Enhanced Urban Lifestyle:** TOD enhances urban living by integrating diverse land uses within a short walking distance of transit stations.
  - ❍ This design supports a high quality of life, allowing residents to **easily access workplaces, amenities, and recreational areas**. The focus on walkability and mixed-use development contributes to a more engaging and healthier urban environment.

- ➤ **Environmental and Economic Benefits:** TOD contributes to sustainability by **reducing pollution and fossil fuel dependency**. It supports environmental goals through lower emissions and decreased sprawl.
  - ❍ Economically, TOD **boosts local businesses, reduces transportation costs, and attracts investment, enhancing overall economic competitiveness**. This integrated approach to urban planning supports long-term sustainable development goals.

Examples of Successful TOD Implementation

- ➤ **Metro Rail Projects:** India has been expanding metro rail networks in major cities to address urban congestion and provide efficient public transportation.
  - ❍ Around **15 cities** like Delhi, Mumbai, Kolkata, Bangalore, Hyderabad, Jaipur and Chennai etc have operational metro systems, with many more under construction or planned in other urban centers.

- ➤ **Urban Transport Policies:** With the aim to reduce congestion and pollution while improving mobility, several **Regional Rapid Transit System (RRTS)** projects are in the pipeline.

- ❍ For example,in 2005, a government task force developed the **Integrated Transport Plan for NCR 2032**, identifying a need for a RRTS to connect major cities in the Delhi NCR. It prioritized three corridors: **Delhi-Meerut, Delhi-Panipat, and Delhi-Alwar**.

- ➤ **Mumbai: Lower Parel** in Mumbai has evolved into a **TOD hub** with high-rise residential and commercial buildings around local train stations, reflecting increased integration of transit and urban spaces.

- ➤ **Noida's cycle zones:** It features dedicated tracks, **cycle-sharing programs**, and integrated urban design to promote sustainable transport. By separating bike lanes from traffic, offering rental options, and enhancing safety with signage, these initiatives aim to reduce pollution, improve public health, and support a greener, more pedestrian-friendly city.

- ➤ **No Emission Zones:** No Emission Zones are urban areas restricting access for **high-emission vehicles to reduce pollution**. They promote cleaner transport options and improve air quality.
  - ❍ **For example: London, UK – Ultra Low Emission Zone (ULEZ)** aims to reduce air pollution by restricting access to high-emission vehicles. The zone promotes the use of electric and hybrid vehicles and integrates well with public transit, supporting TOD by enhancing the environmental quality and encouraging sustainable transportation.

- ➤ **Hong Kong's Property + Rail Model:** This model **integrates real estate development with transit funding**.
  - ❍ Authorities buy land development rights before rail construction, sell them post-construction at higher prices, and **use the revenue to finance transit operations.**
  - ❍ This model **generates substantial income from property**, reduces urban sprawl and pollution, and enhances ridership through increased density.

What are the Steps Taken for Urban Development?

- ➤ **Government Initiatives:**
  - ❍ **Budget 2024-25:** The **budget 2024-25** has announced the creation of **Transit Oriented Development (TOD) plans** for **14 major cities** with a population above 30 lakh.
    - • Also, central assistance of **Rs 2.2 lakh crore** for **urban housing** over the next five years as well

as an interest subsidy scheme to facilitate loans at affordable rates for urban housing works, was announced in the budget.

○ **Smart Cities Mission:** This program aims to develop **100 cities** across India by applying smart solutions to **improve infrastructure and services**.

  ● It focuses on areas like water supply, sanitation, waste management, urban mobility, and **e-governance**.

○ **AMRUT (Atal Mission for Rejuvenation and Urban Transformation):** **AMRUT** targets 500 cities, focusing on ensuring basic infrastructure services like water supply, sewerage, urban transport, and development of green spaces.

  ● It aims to improve the quality of life in these cities through better amenities and infrastructure.

○ **Pradhan Mantri Awas Yojana (Urban):** This scheme aims to provide "**Housing for All**". It offers financial assistance to urban poor for house construction or renovation.

  ● The program includes **credit-linked subsidies** and partnerships with private developers to increase affordable housing stock.

○ **Swachh Bharat Mission (Urban):** This mission focuses on **eliminating open defecation**, improving solid waste management, and generating awareness about sanitation.

  ● It includes **constructing individual and community toilets**, and implementing modern **waste management practices**.

○ **Digital India:** In urban areas, this initiative focuses on providing digital infrastructure and promoting e-governance.

  ● It includes projects like **public Wi-Fi hotspots, digital delivery of government services**, and encouraging **cashless transactions** to create 'smart' urban ecosystems.

○ **Scheme for Special Assistance to States for Capital Investment 2022-23 (Rs. 6000 Cr):** It focuses on **urban planning** reforms including Modernization of Building Bylaws, Adoption of Transferable Development Rights (TDR), Implementation of Local Area Plans (LAP) and Town Planning Schemes (TPS), Implementation of Transit-oriented Development (TOD), Creation of Sponge Cities, Removing Taxation for running the Buses for Public Transport.

○ **Scheme for Special Assistance to States for Capital Investment 2023-24 (Rs. 15000 Cr):** It emphasizes enhancing urban planning through human resource augmentation, town planning schemes, modernization of building bylaws, in-situ slum rehabilitation, TOD, and strengthening urban ecosystems.

➢ Constitutional and Legal Frameworks:

  ○ **Articles 243Q and 243W:** Grant powers to local governments (municipalities) for urban planning and development within their regions.

  ○ **74th Constitutional Amendment Act, 1992:** Granted constitutional status to urban local bodies and introduced Part IX-A to the Constitution.

  ○ **12th Schedule:** Outlines the powers, authority, and responsibilities of municipalities.

What Other Measures can be Taken for Sustainable & Resilient Urban Development?

➢ **Leveraging Municipal Bonds for Urban Development:** **Municipal bonds** present a promising method for urban development by enabling cities to secure funding for critical infrastructure projects.

  ○ This approach not only provides immediate financial resources but also supports long-term urban modernization and resilience.

  ○ To maximize their impact, cities should enhance investor confidence through transparent processes and effective project management, ensuring that funds are used efficiently and lead to tangible benefits for residents.

➢ **Integration of Inclusive Urban Development:** Adopt a holistic approach by integrating various development sectors and prioritizing **inclusivity in urban planning**.

  ○ This means **engaging diverse stakeholders** and ensuring that development benefits all segments of society, fostering equitable growth and addressing disparities.

➢ **Harnessing Technology:** These **tech-driven solutions** not only improve operational effectiveness but also contribute to more **resilient and environmentally friendly** urban environments.

  ○ For instance, **Indore's innovative waste management system** utilizes smart bins and automated segregation to enhance efficiency.

  ○ Similarly, **integrating renewable energy technologies**, such as solar power and wind turbines, can reduce cities' carbon footprints and enhance sustainability.

➢ **Utilization of Scientific Data Methods:** Implement advanced **data analytics and evidence-based methods** to assess and monitor urban development schemes.

  ○ This approach ensures that decisions are informed by accurate data, leading to more effective and efficient urban planning outcomes.

➢ **Enhancement of Citizen Participation:** Boost citizen engagement through both physical and digital platforms, ensuring their voices are heard in governance.

  ○ This involvement helps align urban policies with **community needs and priorities**, enhancing the quality and responsiveness of urban services.

➢ **Strategic Investment and Coordination:** Promote **strategic investments and coordinated actions** involving both public and private sectors.

  ○ Effective urban development requires a unified approach across agencies to address challenges and leverage resources efficiently.

➢ **Environmentally Focused Initiatives:** Implement sustainable urban practices such as the **Sponge City concept**, distributed **waste-to-energy** systems, and smart water management.

  ○ These initiatives aim to improve **environmental resilience and sustainability** within urban landscapes.

➢ **Adoption of Smart Technologies:** Deploy smart city infrastructure, including digital twins for predictive modeling and **IoT-enabled services**, to enhance urban efficiency and quality of life.

  ○ Invest in robust cybersecurity measures to protect critical digital infrastructure from emerging threats.

➢ **Improved Accessibility and Awareness:** Enhance accessibility to urban services and increase awareness through effective communication and participative governance.

  ○ This will ensure that urbanization efforts are inclusive and address the diverse needs of urban populations.

Conclusion

Urbanization represents a critical juncture in global and national development, offering both opportunities and challenges. As cities grow and evolve, embracing comprehensive planning and reform is essential to ensure that urbanization contributes positively to economic prosperity and quality of life.

In India, initiatives like the **Smart Cities Mission and AMRUT** aim to address **infrastructure deficits and enhance urban livability**. However, effective implementation of **transit-oriented development, better coordination among agencies, and modernization of planning practices** are necessary to overcome obstacles. By focusing on **sustainable growth**, enhancing infrastructure, and improving governance, cities can harness the benefits of urbanization while mitigating its challenges, paving the way for a more inclusive and resilient urban future.

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New Pathways in India-Africa Collaborations

This editorial is based on "Africa can make India's 'critical mineral mission' shine" which was published in The Hindu on 06/09/2024. The article highlights Africa's critical importance to India's strategic interests, particularly in securing critical minerals for its supply chain. It emphasizes India's deep-rooted ties with Africa while addressing challenges from China's dominance and Africa's focus on value addition and industrialization.

Tag: GS Paper - 2, Groupings & Agreements Involving India and/or Affecting India's Interests, India and its Neighbourhood, Effect of Policies & Politics of Countries on India's Interests

Africa, often described as the **"land of the future,"** holds immense importance for **India's strategic and economic interests,** particularly in the realm of critical minerals. Housing **30% of the world's known critical mineral reserves,** the continent presents a crucial opportunity for India to secure its supply chain. India's deep-rooted political, economic, and historic connections with Africa, bolstered by a three-million-strong diaspora and **USD 75 billion in investments,** provide a solid foundation for enhancing cooperation in this sector.

However, India faces significant challenges in leveraging this potential. **China's established control over the critical minerals value chain in Africa** poses economic and security risks. Moreover, African nations are actively implementing policies to move beyond the **'pit-to-port' model,** focusing on value addition and minerals-based industrialization. By aligning its Critical Minerals Mission with African priorities for value addition and responsible practices, India can forge mutually **beneficial partnerships while supporting Africa's developmental agenda and securing its own supply chain.**

Legend:
- Northern Africa
- Western Africa
- Central Africa
- Eastern Africa
- Southern Africa

What is the Significance of Africa for India?

➢ **Economic Powerhouse:** Africa's economic potential presents significant opportunities for Indian businesses and investors.

  ○ With a projected **GDP growth of 4% in 2023** and **4.3% in 2024**, the continent is becoming an increasingly attractive market.

  ○ India-Africa bilateral trade reached **USD 98 billion in 2022-23**, with **USD 43 billion** attributed to the mining and mineral sectors.

  ○ The **African Continental Free Trade Area** **(AfCFTA),** operational since 2021, creates a single market of 1.3 billion people, offering immense potential for Indian exports and investments.

  ○ Africa's population is projected to **reach 2.5 billion by 2050,** presenting a significant market for Indian goods and services.

➢ **Geopolitical Ally:** Africa's 54 nations represent a significant bloc in international forums, making the continent a crucial geopolitical ally for India.

  ○ **India's support for African representation in the UN Security Council** and other global bodies demonstrates its commitment to a more equitable world order.

  ○ The **African Union** **(AU)** has been made a permanent member of the **G20 during India's 2023 G20 Presidency.**

❍ As global power dynamics shift, a strong India-Africa partnership can help balance other influential players in the region, particularly **China.**

➤ **Energy Security**: Africa plays a vital role in India's energy security strategy by offering diverse energy resources.

❍ **India currently sources about 15% of its oil demand** (approximately 34 million tonnes) from Africa.

● Countries like **Nigeria and Angola** are key oil suppliers to India.

❍ Also, Africa's vast mineral reserves, **particularly critical minerals,** are crucial for India's energy transition and technological advancement.

❍ The **International Solar Alliance,** spearheaded by India, has earmarked **USD 2 billion for solar projects in Africa.**

● This energy partnership not only secures India's energy needs but also supports Africa's electrification goals, **creating a win-win situation.**

➤ **Maritime Security:** Africa's eastern coast is crucial for India's maritime security interests in the **Indian Ocean Region (IOR)**.

❍ India has signed defense agreements with several African nations, including **Mozambique and Madagascar.**

❍ The **Indian Navy's anti-piracy operations off the coast of Somalia** since 2008 have protected not just Indian but global maritime trade.

❍ In 2022, the first edition of **India-Mozambique-Tanzania Trilateral Exercise (IMT TRILAT),** a joint maritime exercise among the Indian, Mozambique and Tanzanian navies was held.

➤ **Diaspora Dynamics:** The **3 million-strong Indian diaspora in Africa** serves as a bridge between the two regions.

❍ Historically, Indian-origin communities have played significant roles in African economies.

❍ India is leveraging this connection through initiatives like the **Pravasi Bharatiya Divas**, which in 2019 focused on the Indian diaspora in Africa, aiming to strengthen economic and cultural ties.

What Role can Africa Play in India's Critical Minerals Need?

➤ **Lithium Lifeline:** Africa's vast lithium reserves, particularly in countries like **Zimbabwe, Namibia, and Ghana,** are crucial for India's electric vehicle (EV) ambitions.

❍ Zimbabwe is the sixth-largest producer of lithium.

❍ With India aiming for **30% EV penetration by 2030**, securing African lithium could be game-changing.

● For instance, if India could secure even 5% of Zimbabwe's estimated lithium reserves, **it could potentially power over 500,000 electric cars.**

➤ **Rare Earth Elements:** Africa hosts significant deposits of **rare earth elements (REEs),** crucial for high-tech industries.

❍ Countries like **South Africa, Malawi, and Kenya** have untapped REE potential.

❍ India's REE imports are expected to rise with increasing demand in electronics and defense sectors.

❍ For example, **one F-35 fighter jet requires 417kg of REEs**.

➤ **Platinum Group Metals:** South Africa holds over **90% of the world's platinum reserves** and is a major producer of other platinum group metals (PGMs) like palladium and rhodium.

❍ These metals are essential for **catalytic converters and fuel cells.**

❍ With India pushing for hydrogen fuel cell vehicles, securing PGM supplies from Africa is crucial.

➤ **Copper Conduit:** African nations like **Zambia and the DRC** are major copper producers. India's copper demand is expected to be **1.433 million tonnes by 2026**, driven by renewable energy and EV sectors.

❍ Securing African copper could be vital for India's ambitious renewable energy target of 500 GW by 2030.

➤ **Graphite Goldmine:** Madagascar and Mozambique are established flake and powder graphite producers**, essential for EV batteries and energy storage systems.**

❍ A typical **EV battery requires about 50-100 kg of graphite.**

❍ Partnerships with African nations could help India achieve its goal of **50% cumulative electric power installed capacity** from non-fossil fuel-based energy resources by 2030

What are the Key Areas of Friction Between India and Africa?

➤ **Investment Inertia:** Despite India's growing economic engagement with Africa, Indian investments on the

continent lag behind those of China and Western countries.

- ○ Indian companies often struggle with **risk perception, lack of local market knowledge,** and competition from established players.

- ○ For instance, in 2020, **ArcelorMittal,** an Indian-owned company, exited a **USD 2.2 billion iron ore project in Senegal** due to various challenges.

  - ● This investment gap limits India's economic footprint and influence in Africa.

➢ **Perception Issues of Indian Products** There's a persistent perception in some African markets that Indian products are of inferior quality compared to Western or Chinese alternatives.

- ○ This issue affects various sector**s, from pharmaceuticals to machinery.**

- ○ **Tainted syrup medicine** imported from India was the cause of an outbreak of **kidney failure** that killed more than 60 children in th**e West African nation of Gambia in 2022.**

- ○ These incidents, though not representative of all Indian products, **damage India's reputation and market share in Africa.**

➢ **Diplomatic Dilemma**: India's engagement with Africa has been criticized for **being too focused on East and Southern Africa,** neglecting other regions.

- ○ This imbalance is reflected in trade figures: India's exports to South Africa alone stood at **USD 8.47 billion in 2022-23.**

- ○ West African countries, **despite their economic potential,** receive comparatively less attention.

- ○ This uneven engagement can lead to **missed opportunities and perceptions of neglect in certain African regions.**

➢ **Project Execution Predicament:** India's development projects in Africa have often faced delays and implementation challenges.

- ○ The **Rivatex textile factory** revival project in Kenya, funded by India, faced significant delays.

- ○ These issues can erode trust and make African countries hesitant to engage in future projects with India, especially when compared to the often faster **(though sometimes criticized)** project execution by **Chinese companies**.

➢ **Resource Rivalry**: As both India and China seek to secure resources in Africa, competition has intensified, sometimes leading to friction.

- ○ This is particularly evident in the **oil and gas sector.**

- ○ For example, i**n 2006, India lost out to China in a bid for oil assets in Angola.**

- ○ This competition can lead to inflated prices and strained diplomatic relations, as African countries balance relationships between these Asian giants.

What Measures can India Adopt to Enhance its Relations with Africa?

➢ **Trade Treaty Transformation-Crafting Win-Win Agreements:** Negotiate and implement comprehensive economic partnership agreements with key African regional blocs like the **African Continental Free Trade Area (AfCFTA).**

- ○ Focus on **reducing tariffs on African goods**, particularly in sectors where Africa has a comparative advantage, such as agriculture and minerals.

- ○ For example, **India could offer preferential access for African coffee, cocoa, and rare earth minerals** in exchange for greater access for Indian pharmaceuticals and IT services.

➢ **Skill Share Surge:** Expand and modernize India's capacity-building programs in Africa, like the **Indian Technical and Economic Cooperation (ITEC).**

- ○ Launch a **"Digital Skills for Africa"** initiative, targeting to train African youth in IT, AI, and data science.

- ○ Establish **Indian Institutes of Technology (IIT) and Indian Institutes of Management (IIM) branches** in key African countries.

➢ **Resource Reciprocity:** Develop a strategic minerals partnership program, focusing on joint ventures between Indian and African companies in critical mineral extraction.

- ○ Establish an **India-Africa Mineral Development Fund** to finance these projects.

- ○ Target key resources like **lithium in Zimbabwe, cobalt in DRC, and rare earth elements in South Africa**.

➢ **Infrastructure Impetus:** Create a dedicated **"India-Africa Infrastructure Commission"** to oversee and expedite Indian infrastructure projects in Africa.

- ○ Set clear timelines and accountability measures for project completion.

- ○ Focus on **high-impact, quick-turnaround projects like solar power installations,** water treatment plants, and digital connectivity initiatives.

➢ **Modernizing African Agriculture:** Develop an **"India-Africa Agriculture Innovation Corridor**" to transfer

Indian agricultural technologies and practices to Africa.

- ❍ Set up Indo-African model farms across the continent by 2026, showcasing Indian agricultural techniques and equipment.

- ❍ Launch a **"Digital Farmer" app in partnership with African governments,** aiming to reach 10 million African farmers with crop advisory and market linkage services.

    - ● For example, replicate the success of **India's e-NAM (electronic National Agriculture Market)** platform in key African agricultural markets.

Conclusion:

Africa's strategic significance for India is underscored by its vast reserves of critical minerals, economic potential, and geopolitical importance. By **forging comprehensive trade agreements,** enhancing skill development, and investing in infrastructure and agriculture, India can strengthen its ties with Africa and **secure its critical mineral needs.**

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India's Telecom Sector: Key Drivers & Challenges

This editorial is based on "Telecom sector must get a fair share" which was published in Financial Express on 07/09/2024. The article highlights the debate over fair-share contributions from large traffic-generating platforms (LTGs) to telecom service providers (TSPs). It argues that LTGs, despite profiting from telecom infrastructure, should contribute to network costs to ensure affordable and sustainable digital connectivity.

Tag: GS Paper - 3, Industrial Growth, IT & Computers, GS Paper - 2, Government Policies & Interventions

India's telecom sector is at a crucial juncture, grappling with the challenge of balancing network infrastructure costs and the explosive growth of data traffic. This surge is largely driven by **Large Technology Giants (LTGs)** whose services consume a significant portion of network bandwidth. The sector argues that while these **LTGs reap substantial profits from Indian users,** they contribute little to the underlying infrastructure that makes their services possible.

Telecom Service Providers (TSPs) are advocating for a fair-share mechanism, where LTGs would contribute

to network costs proportionate to their data usage. This proposal has **gained traction globally,** with countries like **South Korea** seeing settlements between content providers and network operators, and the US considering legislation to address similar issues. As India aims to ensure **affordable digital connectivity for all,** it needs to work towards significant reforms in its telecom sector. These reforms should focus on creating a **balanced ecosystem where all players**, including LTGs, contribute fairly to the growth and sustainability of digital infrastructure, ultimately benefiting the Indian economy and its citizens.

What are the Major Growth Drivers of the Telecom Sector in India?

➢ **Digital India Initiative**: The government's **Digital India program** has been a significant catalyst for telecom growth.

- ❍ Launched in 2015, it aims to **transform India into a digitally empowered society.** This initiative has led to increased demand for internet services across urban and rural areas.

- ❍ For instance, the number of internet subscribers in India surged from **88.1 crore in March 2023** to **95.4 crore by March 2024**.

- ❍ Projects like **BharatNet**, which aims to connect all **250,000 gram panchayats** with broadband, have further boosted rural connectivity, driving telecom expansion into previously underserved areas.

➢ **Affordable Smartphone Penetration:** The availability of low-cost smartphones has significantly boosted telecom sector growth.

- ❍ India's smartphone market shipped **146 million smartphones in 2023.** This growth has been fueled by **budget-friendly devices.**

- ❍ Initiatives like **Google's Android One program** and the government's push for locally manufactured devices have further accelerated this trend, expanding the customer base for telecom services, **especially in tier 2 and tier 3 cities.**

➢ **5G Revolution:** The rollout of 5G services in India, which began in October 2022, is a game-changer for the telecom sector.

- ❍ India has seen one of the fastest 5G rollouts in the world with the latest telecom technology reaching **738 districts and around 100 million as of December 2023.**

- ❍ This technology is expected to enable new use cases in areas like **IoT**, **smart cities, and industrial automation**.

- Global telecom industry body **GSMA** expects India to have **920 million unique mobile subscribers by 2025** which will include **88 million 5G** connections, creating new revenue streams for telecom companies.

➢ **Rise of Digital Payments:** The surge in digital payments has become a key driver for telecom growth.

  ○ **Unified Payments Interface (UPI)** transactions have grown **from 92 crore in FY 2017-18 to 8,375 crore in FY 2022-23**.

  ○ This shift towards digital transactions has increased the dependency on mobile internet, driving data consumption.

    ● **Telecom companies** have capitalized on this trend by offering specialized data plans for financial services and partnering with fintech companies, creating new revenue streams and enhancing customer stickiness.

➢ **Over-the-Top (OTT) Content Boom**: The explosive growth of **OTT platforms** in India has significantly boosted data consumption.

  ○ The **Indian OTT streaming industry** is expected to grow to **USD 13-15 billion** over the next decade at a **CAGR of 22-25%.**

  ○ This growth has led to a surge in high-bandwidth activities like video streaming.

    ● For example, **Hotstar reported 50.5 crore views during the IPL 2023 season.**

  ○ Telecom operators have responded by **offering bundled services with OTT subscriptions**, driving both customer acquisition and data usage, thus creating a **symbiotic relationship between content providers and telecom companies.**

➢ **Remote Work and Education:** The Covid-19 pandemic accelerated the adoption of **remote work and online education**, becoming an unexpected growth driver for the telecom sector.

  ○ This shift led to a **30-40% increase in data consumption across India**. Telecom companies responded by upgrading network capacities and offering **specialized work-from-home plans.**

  ○ The trend has **persisted post-pandemic,** with many companies adopting **hybrid work models**, ensuring sustained high demand for reliable, high-speed internet connectivity.

What are the Major Challenges Related to the Telecom Sector in India?

➢ **Financial Stress:** As per ICRA, the telecom industry's total debt has shot up to **~Rs. 6.4 lakh crore** by 31st March, 2023.

  ○ This financial stress stems from **high spectrum costs, intense competition leading to tariff wars**, and substantial infrastructure investments.

    ● For instance, Vodafone Idea owes **Rs 2.1 lakh crore debt to the government**.

  ○ The situation has led to **reduced capital expenditure, delayed 5G rollouts, and in extreme cases, market exits**.

➢ **Adjusted Gross Revenue (AGR) Dispute:** The AGR issue has been a persistent thorn in the side of Indian telecom operators.

  ○ The Supreme Court's 2019 ruling, which **broadened the definition of AGR to include non-telecom revenues,** resulted in a cumulative liability of ₹**1.69 lakh crore for telecom companies.**

  ○ While the government has offered a moratorium and the option to convert dues into equity, the issue continues to strain balance sheets.

    ● For example,The **Department of Technology** has calculated Airtel's historical AGR dues at **Rs 43,980 crore**, of which **only Rs 18,004 crore** has been paid.

  ○ This ongoing financial burden hampers the sector's ability to invest in new technologies and infrastructure.

➢ **Infrastructure Gaps:** Despite significant progress, India's telecom infrastructure still faces a substantial urban-rural divide.

  ○ As of March 2023, **urban tele-density** stood at **133.81%**, while rural tele-density **reached only 57.71%.**

  ○ The challenges in rural areas include **difficult terrain, lack of consistent power supply, and lower return on investment**.

➢ **Spectrum Pricing:** High spectrum prices have been a significant hurdle for Indian telecom operators.

  ○ In the 2022 **5G spectrum auction,** while the government **earned ₹1.5 lakh crore**, operators argue that these **high costs impede network expansion and quality improvement.**

  ○ India's spectrum prices are among the highest globally. This issue not only affects the financial

health of telecom companies but also **potentially slows down the adoption of new technologies like 5G,** impacting India's digital transformation journey.

➤ **Quality of Service:** Despite improvements, quality of service remains a persistent issue in India's telecom sector.

  ○ Recent TRAI data shows that major operators failed to meet benchmarks in areas like **call drop rates and connection success rates** in several circles.

  ○ Poor service quality leads to **customer dissatisfaction and churn**, impacting operator revenues.

➤ **Cybersecurity Threats**: As India's digital footprint expands, cybersecurity has become a critical concern for the telecom sector.

  ○ In 2022, India witnessed **over 13.91 lakh cybersecurity incidents**, as reported by **CERT-In.**

  ○ Telecom networks, being the backbone of digital infrastructure, are prime targets. The introduction of 5G technology, while promising, also expands the attack surface.

  ○ Such incidents not only lead to financial losses but also **erode customer trust.**

➤ **Regulatory Challenges:** The telecom sector in India grapples with a complex and sometimes unpredictable regulatory environment.

  ○ Issues like **frequent policy changes, multiple levies (license fees, spectrum usage charges, etc.)** create operational uncertainties.

  ○ For instance, the **long-pending issue of defining Over-The-Top (OTT) services** and their **regulation vis-à-vis traditional telecom services** remains unresolved.

  ○ In 2023, the debate intensified with telecom operators pushing for **'same service, same rules' principle**, arguing that OTT players benefit from telecom infrastructure without equivalent regulatory obligations.

    ● This regulatory ambiguity affects long-term planning and investment decisions in the sector.

What are the Major Government Initiatives Related to the Telecom Sector?

➤ Prime Minister Wi-Fi Access Network Interface (PM-WANI)

➤ Bharat Net Project

➤ One Nation Full Mobile Number Portability (MNP)

➤ **The Telecommunications Act 2023:** The newly enforced sections focus on optimal spectrum utilization through sharing, trading, and flexible use, along with **prohibiting unauthorized equipment that blocks telecommunications**.

  ○ It also updates criteria for appointing TRAI members, ensuring better governance and efficiency in the telecom sector.

What Measures can be Adopt to Revamp India's Telecom Sector?

➤ **Rationalizing Spectrum Pricing:** Implement a more balanced spectrum pricing model to **reduce financial burden on telcos.**

  ○ For instance, adopt a **revenue-sharing model for spectrum fees** instead of upfront payments.

  ○ Introduce longer payment periods, like **20 years instead of the current 10-16 years.**

  ○ This could **free up capital for infrastructure investment.** For example, if implemented, this could potentially **reduce the spectrum cost burden by 30-40%** for operators, enabling them to invest more in network expansion and quality improvement.

➤ **Infrastructure Sharing Incentives:** Introduce stronger policy incentives for infrastructure sharing among telcos.

  ○ Implement a **tax rebate system for companies engaging in active infrastructure sharing.**

  ○ Create a centralized database of **shareable assets to facilitate easier collaboration.**

  ○ For instance, the **Tower and Infrastructure Providers Association (TAIPA)** estimates that infrastructure sharing can reduce capital expenditure **by up to 60%.** This approach could significantly accelerate 5G rollout, especially in semi-urban and rural areas.

➤ **Rural Connectivity Fund:** Establish a dedicated **Rural Connectivity Fund**, similar to the **Universal Service Obligation Fund**, but with more efficient utilization.

  ○ Allocate **a % of AGR from telcos specifically for rural infrastructure development.**

  ○ Implement a public-private partnership model where the government provides **land and right-of-way, while telcos deploy infrastructure.**

➤ **Regulatory Sandbox for Innovation**: Create a regulatory sandbox to allow telcos and tech companies t**o test innovative services and business models with regulatory flexibility.**

○ Set up a committee comprising **TRAI, DoT, and industry representatives to oversee this sandbox.**

○ Allow trials for emerging technologies like **network slicing, edge computing, and IoT applications** without immediate regulatory constraints.

○ For example, this could facilitate the **testing of localized 5G applications in manufacturing or agriculture**, potentially leading to new revenue streams for telcos and innovative solutions for various sectors.

➤ **Skill Development Initiative:** Launch a comprehensive skill development program in collaboration with the telecom industry to address the talent gap.

○ Partner with universities to introduce **specialized courses in 5G, IoT, and AI for telecom**.

○ Introduce tax incentives for companies investing in employee upskilling. This initiative could help bridge this gap and boost innovation in the sector.

➤ **Green Telecom Policy:** Implement a comprehensive Green Telecom Policy to promote sustainable practices in the sector.

○ Set targets for **renewable energy adoption in telecom infrastructure** – aim for significant % of tower energy consumption from renewable sources by a target year.

○ Mandate energy-efficient equipment in networks. For example, **Airtel** has already committed to reducing its carbon footprint by **50% by 2031.**

○ A sector-wide push could lead to significant environmental benefits and operational cost savings for telcos in the long run.

➤ **Simplified Licensing Regime:** Streamline the current multi-license system into a unified license framework.

○ Implement an online single-window clearance system for all telecom-related approvals.

○ This could **potentially reduce operational costs for telcos by 15-20%** and attract more foreign investment in the sector.

○ For instance, countries like **Singapore with simplified licensing** have seen higher FDI in telecom.

➤ **Data Localization Support:** Develop a supportive framework for data localization in the telecom sector.

○ Offer **tax incentives for telcos setting up local data centers.** Collaborate with the IT Ministry to create a network of tier-2 and tier-3 city data centers.

○ This initiative could not only **enhance data security but also create new revenue streams for telcos.**

○ For example, **Jio's partnership with Microsoft for data centers** could be a model for other telcos to follow, potentially generating additional revenue.

Conclusion:

India's telecom sector stands at a pivotal moment, requiring comprehensive reforms to address financial challenges, regulatory complexities, and infrastructure gaps. By **rationalizing spectrum pricing, promoting infrastructure sharing, and fostering innovation** through regulatory sandboxes, the sector can unlock its full potential. Government initiatives like the **Telecommunications Act 2023**, along with a focus on green practices and rural connectivity, will ensure sustainable growth.

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India-UAE Ties: From Tradition to Transformation

This editorial is based on "Leverage historical ties for new areas of cooperation" which was published in Hindustan Times on 09/09/2024. The article highlights that UAE-India partnership has strengthened significantly in recent years, with notable growth in trade, investment, and cultural ties. The Comprehensive Economic Partnership Agreement (CEPA) and new initiatives like the UAE-India Start-up Bridge signal a promising future for this strategic relationship.

Tag: GS Paper - 2, India and its Neighbourhood, Bilateral Groupings & Agreements, GS Paper - 3, Growth & Development

The **India-UAE bilateral relationship** has experienced significant growth and deepening of historical bonds in recent years. The **visit of Abu Dhabi's Crown Prince** to India underscores the importance of this **strategic partnership.** The relationship has seen remarkable progress across **political, economic, and cultural spheres,** with the UAE becoming India's second-largest export destination, third-largest trading partner, and fourth-largest investor. The **Comprehensive Economic Partnership Agreement (CEPA)** implemented in **May 2022** has been a game-changer, boosting total trade by nearly 15% and **significantly increasing non-oil trade by 20% in 2023-24.**

Both nations are committed to expanding their partnership beyond traditional power centers to

emerging cities across India. Initiatives like the **UAE-India Cultural Council and the UAE-India Start-up Bridge** aim to strengthen cultural ties and foster entrepreneurship. This multifaceted approach promises a bright future for UAE-India relations, with potential for building a **resilient, inclusive, and prosperous partnership.**

What is the Significance of UAE for India?

➤ **Economic Powerhouse- Gateway to the Gulf:** The UAE serves as India's economic **springboard to the Middle East and North Africa (MENA) region.**

  ○ As **India's third-largest trading partner**, bilateral trade reached **USD 84.5 billion** in FY 2022-23.

  ○ The **Comprehensive Economic Partnership Agreement**, implemented in May 2022, has been a game-changer, eliminating tariffs on 80% of Indian exports to the UAE.

    ● This has led to a **5.8% increase in non-oil trade in the first half of 2023,** with projections to reach **USD 100 billion** by 2030.

  ○ The UAE's strategic location and world-class infrastructure make it an i**deal re-export hub** for Indian goods to Africa and Europe.

➤ **Energy Security:** As **India's fourth-largest crude oil supplier,** the UAE plays a crucial role in India's energy security.

  ○ Oil imports from the UAE **surged by 81% in January, 2024.**

  ○ Beyond traditional hydrocarbons, the two nations are collaborating on renewable energy projects.

  ○ This partnership aligns with India's ambitious goal of achieving **500 GW of renewable energy capacity by 2030**, showcasing the UAE's significance in India's energy transition.

➤ **Investment Catalyst: Foreign Direct Investment (FDI)** from the UAE to India jumped over three-fold to **USD 3.35 billion from USD 1.03 billion** in 2021-22.

  ○ The **UAE-India High-Level Joint Task Force on Investments** has been instrumental in facilitating investments.

  ○ Abu Dhabi Investment Authority has invested **Rs 4,966.80 crore** into Reliance Retail Ventures Limited.

➤ **Strategic Partner:** The UAE has become a crucial strategic partner for India in the **Middle East,** particularly in countering terrorism and ensuring maritime security.

  ○ The two countries conducted their **bilateral naval exercise, "Zayed Talwar,"** in 2021, emphasizing their growing defense cooperation.

  ○ **India's access to the UAE's Al Dhafra air base** for refueling has enhanced its strategic reach.

➤ **Remittances and Soft Power:** The **3.5 million-strong** Indian diaspora in the UAE is a significant source of remittances and soft power for India.

  ○ India received close to **USD 111 billion** in remittance flows from around the world in 2022, with the **UAE being one of the largest sources of remittances.**

  ○ Beyond economic contributions, the diaspora enhances cultural ties and people-to-people connections.

  ○ The construction of the **BAPS Hindu Temple in Abu Dhabi,** symbolizes the UAE's religious tolerance and strengthens bilateral cultural bonds.

  ○ Indian tourists in the **UAE** and those living in the Emirates who have bank accounts in India can use the **UPI network.**

➤ **Tech and Innovation Hub:** The UAE-India partnership is increasingly focusing on technology and innovation.

  ○ The **I2U2 (India, Israel, UAE, USA) group,** formed in 2021, aims to drive technological cooperation, particularly in areas like clean energy and food security.

  ○ The UAE's **USD 2 billion investment** in food parks across India, announced in 2022, exemplifies this collaboration.

  ○ Additionally, the **UAE-India Artificial Intelligence Bridge, launched in 2018**, facilitates knowledge exchange and joint research in AI, positioning both countries at the forefront of the Fourth Industrial Revolution.

What are the Major Areas of Friction Between India and UAE?

➤ **Labor Rights Tightrope:** Despite improvements, labor rights issues persist for Indian workers in the UAE.

○ Reports of **passport confiscation, wage theft, and poor living conditions** continue to surface.

○ Indian workers in the **Gulf** file 1 labor complaint a day on average. While the UAE has implemented reforms like the **Wage Protection System**, enforcement remains a challenge.

○ India's delicate balancing act **between protecting its citizens and maintaining strong economic ties with the UAE creates tensions in bilateral relations.**

➢ **Geopolitical Juggling Act:** India's deepening ties with **Israel and the UAE's normalization** with Israel through the **Abraham Accords** create a complex geopolitical landscape.

○ While this opens opportunities for trilateral cooperation (as seen in the I2U2 initiative), it also risks **entangling India in regional rivalries, particularly with Iran.**

○ The UAE's growing ties with China, **exemplified by the deal for Chinese L-15 aircraft,** pose potential strategic challenges for India.

○ Balancing these relationships while maintaining its strategic autonomy remains a delicate task for Indian diplomacy.

➢ **Energy Transition Turbulence:** As both India and the UAE commit to **net-zero targets (2070 and 2050 respectively)**, their **traditional hydrocarbon-based relationship** faces challenges.

○ India's push for renewable energy, aiming for **50% of its energy mix by 2030, potentially conflicts with the UAE's oil export interests.**

○ Navigating this transition while maintaining energy security and economic ties requires careful calibration.

➢ **Trade Imbalance Tangle:** Despite growing trade volumes, a significant imbalance persists in India-UAE trade relations.

○ In **FY 2022-23**, India's trade deficit with the UAE stood at **USD 16.78 billion**. This imbalance, largely due to oil imports, creates economic vulnerabilities for India.

○ While the CEPA aims to address this by boosting Indian exports, challenges remain in diversifying trade beyond hydrocarbons.

➢ **Maritime Security Maneuvering:** India and the UAE share concerns over maritime security in the **Arabian Sea,** crucial for their trade and energy flows.

○ However, **coordinating responses to threats like piracy and terrorism** while respecting each other's strategic autonomy poses challenges.

○ The **UAE's growing naval presence,** exemplified by its base in Somaliland, and **India's expanding maritime footprint in the region** necessitate careful coordination to avoid potential conflicts of interest and **ensure complementary rather than competitive strategies.**

What Measures can India Adopt to Enhance its Relations with UAE?

➢ **Digital Diplomacy Drive:** India can harness its IT prowess to create a dedicated digital platform for India-UAE collaboration.

○ This could include a **real-time trade portal, a joint innovation hub,** and a digital skills exchange program.

○ India could work with the UAE to expand its **cross-border digital payment system in other Gulf countries.**

○ This initiative could **reduce transaction costs, enhance financial inclusion, and facilitate easier remittances**.

➢ **Green Energy Corridor:** India should propose a comprehensive **"India-UAE Green Energy Corridor"** to align with both countries' climate goals.

○ This could involve **joint investments in renewable energy projects, technology transfer in areas like green hydrogen,** and collaborative research on sustainable desalination techniques.

○ This initiative could also include setting up a **joint climate change research center**, focusing on desert ecology and sustainable urban development, leveraging India's scientific expertise and the UAE's financial resources.

➢ **Skill Bridge Program**: Implement a targeted **"Skill Bridge Program"** to upskill Indian workers for the UAE job market, **focusing on emerging sectors like AI and sustainable technologies.**

○ For instance, partnering with the **UAE's National Program for Coders**, India could offer specialized courses in areas like blockchain and machine learning.

○ This initiative **would not only enhance the employability of Indian workers** but also **contribute to the UAE's knowledge economy goals**.

➢ **StartUp Synergy Scheme:** Develop a **"StartUp Synergy Scheme"** to foster collaboration between Indian and UAE startups.

○ This could include a joint incubation program, a bilateral startup fund, and reciprocal market access facilitation.

○ For instance, **leveraging India's vibrant startup ecosystem and the UAE's financial heft**, the scheme could aim to nurture ample of India-UAE joint ventures.

○ Specific focus areas could include **fintech, healthtech, and agritech**, aligning with both countries' development priorities.

○ The scheme could also include a **"Startup Visa" program**, allowing easier movement of entrepreneurs between the two countries.

➢ **Maritime Cooperation Blueprint:** Formulate a comprehensive **"India-UAE Maritime Cooperation Blueprint"** to enhance collaboration in maritime security, blue economy initiatives, and port development.

○ This could include **shared maritime domain awareness systems**, and collaborative marine research projects.

○ For example, building on the bilateral naval exercise **"Zayed Talwar,"** India and the UAE could aim to conduct joint patrols in the Arabian Sea as well.

○ The blueprint could also include developing **two joint deep-sea ports**, **one each in India and the UAE,** to enhance trade connectivity and maritime presence in the Indian Ocean region.

How can the UAE can Help India to Enhance its Ties with the Middle East?

➢ **Diplomatic Bridge-Builder:** The UAE, with its **strategic position and diplomatic clout,** can act as a bridge between India and other Middle Eastern nations.

○ Its role in facilitating **back-channel talks between India and Pakistan in 2021** demonstrates this potential.

○ The UAE could help **organize a regional summit, including India,** focusing on shared challenges like climate change and food security.

○ This could build on frameworks like the I2U2 (India, Israel, UAE, USA) group, **expanding it to include other Gulf Cooperation Council (GCC) countries,** potentially creating an **"Extended I2U2"** forum for regional cooperation.

➢ **Economic Integration Catalyst:** Building on the success of the India-UAE Comprehensive Economic Partnership Agreement (CEPA), the **UAE could advocate for similar agreements between India and other GCC nations.**

○ The UAE's position as a **re-export hub could facilitate India's economic integration with the broader Middle East.**

○ This could aim to increase India's trade with the GCC.

➢ **Energy Security Facilitator:** The UAE can play a crucial role in enhancing India's energy security by facilitating broader energy partnerships in the region.

○ This could involve joint investments in oil fields, collaborative research in renewable energy, and creation of regional energy grids.

○ For example, the **UAE could accelerate discussions on the undersea pipeline project connecting the Middle East to India**, potentially including countries like Oman.

➢ **Cultural Diplomacy Hub:** Leveraging its multicultural society and India's large diaspora, the UAE can serve as a **hub for Indo-Arab cultural exchange**.

○ It could host **annual cultural festivals showcasing Indian and Middle Eastern arts, literature, and cuisine.**

○ The UAE could also facilitate the establishment of Indian cultural centers across the Middle East, similar to the BAPS Hindu Temple in Abu Dhabi.

Conclusion:

The **India-UAE partnership** has evolved significantly, blending historical ties with modern strategic cooperation. The **Comprehensive Economic Partnership Agreement (CEPA)** and initiatives in **energy, trade, and technology** have strengthened relations. Both nations are poised for continued growth, leveraging shared cultural connections and emerging global opportunities for a resilient and prosperous future.

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India's Deep Tech Vision

This editorial is based on "India's march towards deep tech" which was published in The Hindu on 11/09/2024. The article highlights India's shift from traditional software to deep tech, driven by the need for solutions to global challenges like climate change and healthcare. With strong government support and advanced startups, India is positioning itself for leadership in the global deep-tech landscape.

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

India's tech story has traditionally focused on **software and consumer internet.** However, a growing

need for solutions to global challenges like **climate change** and **healthcare** has driven a shift towards **deep tech.** These cutting-edge startups leverage scientific discovery and engineering to create groundbreaking solutions.

This new wave of Indian innovation is tackling complex problems with advanced technologies like **AI, robotics, and biotechnology.** Startups like **Skyroot Aerospace (space launch)** and ideaForge (drones) are pioneering solutions that were once dominated by established international players. The government is also playing a key role, with initiatives like the **National Deep Tech Startup Policy** and increased funding for research institutions. This supportive ecosystem, coupled with **India's strong STEM education** and vibrant startup culture, positions the country for **leadership in the global deep-tech race**. While challenges remain, such as navigating regulations and attracting talent, India's deep-tech push has the potential to propel the nation to the forefront of innovation.

What is Deep Tech?

➢ **About**: Deep tech is driven by **scientific discoveries** **and engineering breakthroughs,** turning theoretical concepts into real-world applications.

○ Unlike conventional tech, which focuses on i**ncremental improvements,** deep tech ventures leverage **novel technologies for competitive advantage**, often through long and uncertain R&D processes.

➢ **Key Characteristics of Deep Tech:**

○ **Scientific Intensity:** Rooted in fundamental scientific discoveries or engineering innovations.

○ **Long R&D Cycles**: Typically require extended periods of research and development.

○ **High Capital Intensity:** Often need significant investment in specialized equipment and talent.

○ **Potential for Disruptive Impact:** Capable of creating new markets or significantly transforming existing ones.

➢ **Core Areas of Deep Tech:** Artificial Intelligence and Machine Learning, Robotics and Automation, Quantum Computing, Biotechnology and Synthetic Biology, Advanced Materials Science, Nanotechnology, Blockchain and Distributed Ledger Technologies etc.
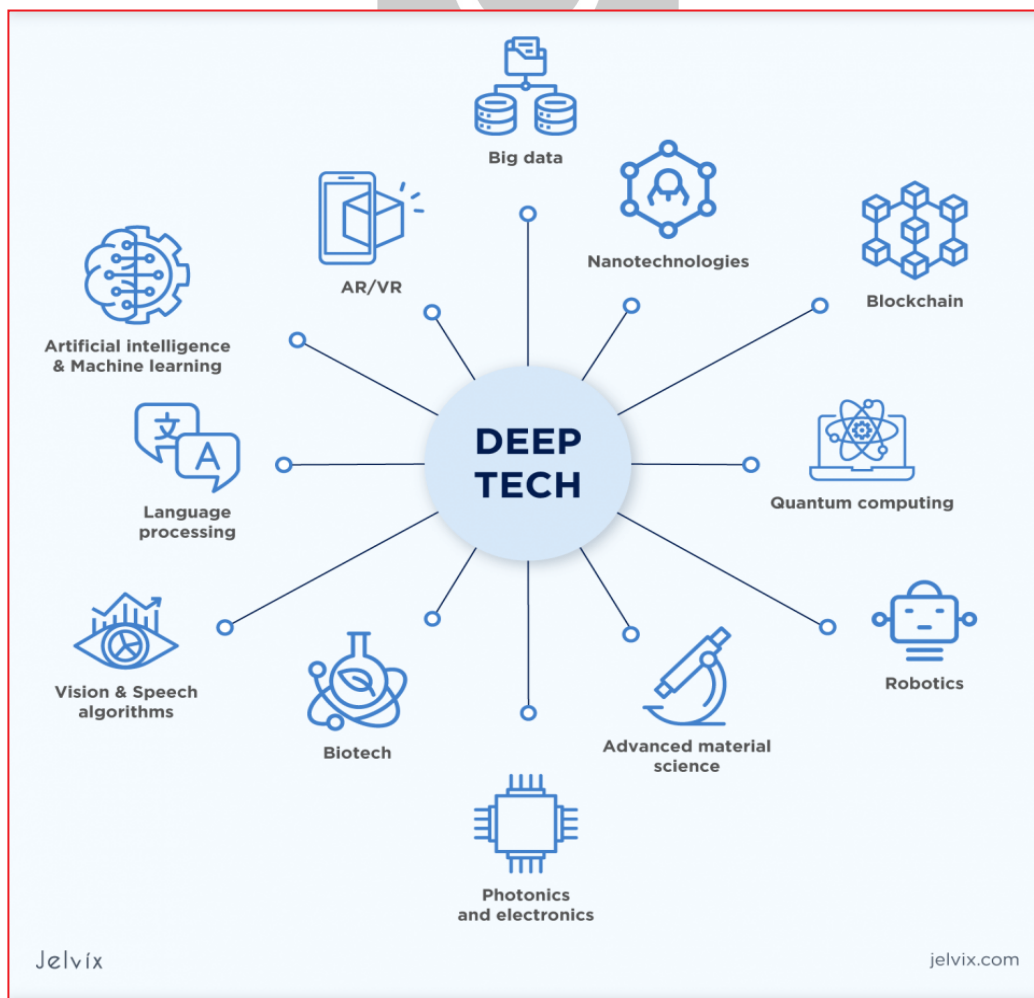
- ➤ **Status of India in Deeptech:** India now ranks **6th among the top 9 deeptech ecosystems** globally with 3,600 such startups, which received **USD 850 million funding in 2023.**
  - ○ **Artificial intelligence (AI)** is the top focus for founders and investors, with **74% of new deep tech startups in 2023** centered on AI and **86% of funded startups having an AI focus**.
    - ● AI also dominates patent filings, making up 41% of all deep tech patents.

What are the Growth Drivers of Deep Tech in India?

- ➤ **Government Policy Push**: The Indian government's proactive policies have been instrumental in fostering deep tech growth.
  - ○ The **National Mission on Quantum Technologies and Applications**, with its **₹8,000 crore budget**, exemplifies this commitment.
  - ○ The **draft National Deep Tech Start-up Policy 2023** aims to accelerate technological growth and enhance global competitiveness.
  - ○ The **Anusandhan National Research Foundation,** with its ₹1 lakh-crore corpus, is investing heavily in research across various fields.
  - ○ These initiatives create a **conducive environment for deep tech innovation,** providing both financial support and regulatory frameworks that encourage experimentation and risk-taking.
- ➤ **Surge in Venture Capital Investments**: Deep tech now accounts for about **20% of annual venture capital investments** worldwide, up from **10% a decade ago.**
  - ○ In 2023 alone, deep tech start-ups globally raised nearly **USD 40 billion,** despite economic slowdowns.
  - ○ This trend is mirrored in India, with companies like **Observe.AI raising over USD 214 million** for its conversational intelligence platform.
  - ○ The **increasing willingness of investors to back long-gestation**, high-risk deep tech projects indicates a maturing ecosystem and growing confidence in India's innovative capabilities.
- ➤ **Rising Demand for Indigenous Solutions:** India's push for self-reliance, particularly in **strategic sectors like defense and space,** is driving demand for homegrown deep tech solutions.
  - ○ **Skyroot Aerospace's** successful launch of the **Vikram-S rocket** in 2022 demonstrates this trend.

- ○ **ideaForge Technology's** advanced **drones for defense and homeland security** applications further illustrate how deep tech start-ups are meeting critical national needs.
- ○ This demand not only provides a ready market for deep tech innovations but also **encourages the development of cutting-edge technologies** tailored to India's unique requirements.
- ➤ **Robust STEM Talent Pool:** India's strong foundation in **Science, Technology, Engineering, and Mathematics (STEM)** education provides a rich talent pool for deep tech innovation.
  - ○ With over **1.5 million engineering graduates annually**, India has a vast reservoir of technical expertise.
  - ○ The challenge now lies in **retaining this talent and channeling it towards deep tech entrepreneurship**, a trend that's gaining momentum with increased industry-academia collaborations.
- ➤ **Focus on Solving Grand Challenges**: Deep tech start-ups in India are increasingly focusing on solving grand challenges in areas like **healthcare, climate change, and sustainable energy**.
  - ○ **Biotech firms** such as Biocon and Syngene are leading in **genomics and personalized medicine research.**
  - ○ **Cell Propulsion's work on electric mobility solutions** addresses both transportation and environmental challenges.
  - ○ This focus on **high-impact, long-term solutions not only attracts talent and investment** but also positions Indian deep tech start-ups as global problem solvers, enhancing their relevance and market potential.

What are the Major Roadblocks in Development of the Deep Tech Sector in India?

- ➤ **The Long Gestation Conundrum**: Deep tech innovations often require extended periods of **research and development before commercialization.**
  - ○ This long gestation period clashes with the **typical 3-5 year investment horizons of most venture capital firms,** creating a funding gap for deep tech start-ups.
  - ○ This mismatch between **development timelines and investor expectations** can **stifle innovation,** particularly in capital-intensive sectors like biotech and advanced materials.

- **The Talent Tug-of-War:** While India produces a large number of STEM graduates, there's a significant shortage of specialized talent in deep tech fields.
  - Only **3% of engineers** have new-age technological skills in areas such as **artificial intelligence, machine learning, data science and mobile development.**
    - The employability in new-age jobs is pegged at an average **1.7%.**
  - The brain drain to global tech hubs exacerbates this issue. Indians formed the largest cohort of global tech industry workers **who flocked to Canada between April 2022 and March 2023,**
    - This talent crunch slows down R&D efforts and increases the cost of innovation for deep tech start-ups.
- **Regulatory Labyrinth:** Deep tech often operates at the **cutting edge of technology,** where regulations are either **non-existent or rapidly evolving.**
  - For example, **drone manufacturers** had to navigate shifting regulations as India formulated its drone policy between **2018 and 2021.**
  - In emerging fields like **gene editing or AI,** the lack of clear regulatory frameworks creates uncertainty for start-ups.
  - This regulatory ambiguity can deter investment and slow down the adoption of innovative technologies.
- **Market Readiness Mismatch**: Many deep tech innovations are so advanced that they **outpace market readiness,** creating an adoption challenge.
  - For example, while quantum computing start-ups like **BosonQ Psi** are making strides, the market for quantum solutions in India remains nascent.
  - This lag between innovation and adoption can lead to a **"chicken and egg" problem,** where lack of market traction deters further investment, and lack of investment slows down market development.
- **Infrastructure Deficits:** Deep tech research often requires specialized infrastructure and testing facilities.
  - India has under **2% of the world's USD 1 trillion worth of computer infrastructure,** which is several times less than countries like the US and China which together have **nearly 60%.**
  - The lack of such infrastructure **not only increases costs for start-ups** but also **slows down the pace of innovation.**

- While initiatives like the **National Supercomputing Mission** are addressing some gaps, the infrastructure deficit remains a significant roadblock for many deep tech sectors.
- **Intellectual Property Challenges:** Securing and defending intellectual property (IP) is crucial for deep tech start-ups, but it remains a complex challenge in India.
  - The **World Intellectual Property Organization's** 2023 report ranked India 40th globally in innovation, highlighting the need for stronger IP protection.
  - Th**e high costs of global patent filing and enforcement,** coupled with a relatively slower patent grant process in India (average **58 months compared to 23 months in the US),** can put Indian deep tech start-ups at a disadvantage in the global innovation race.
- **Funding Crunch**: The **NASSCOM and Zinnov** report reveals a 77% drop in funding for Indian deep tech startups in 2023, with total investments falling to **USD 850 million and deal numbers decreasing by 25%.**
  - Key challenges include securing funding for scaling, attracting talent, and global expansion.
  - The **investor pool has diminished by 60%** compared to June 2022, with large global investors notably absent, leading to a preference for lower-risk seed-stage ventures.

What Measures can be Adopted to Accelerate the Development of Deep Tech?

- **Establishing Deep Tech Clusters:** Create specialized deep tech clusters in major cities, modeled after successful global examples like **Boston's Kendall Square.**
  - These clusters would bring together **start-ups, research institutions, and industry partners.**
  - For instance, **Bengaluru could host an AI and robotics cluster,** while Hyderabad could focus on **aerospace and defense tech.**
  - The government could offer tax incentives and subsidized infrastructure to attract key players.
  - This approach would foster collaboration, reduce infrastructure costs for start-ups, and create a critical mass of talent and resources.
- **Deep Tech-Focused Venture Funds:** Establish government-backed venture funds specifically for deep tech, with **longer investment horizons (7-10 years)** to match the extended R&D cycles.

- The **₹10,000 crore Fund of Funds for Startups** could allocate a % specifically to deep tech ventures.
- Partner with **private VC firms** to create **blended finance models**, where government funds de-risk private investments.
- This approach would **address the funding gap for capital-intensive, long-gestation deep tech projects**, enabling more start-ups like Skyroot Aerospace to bring their innovations to market.

➢ **Regulatory Sandboxes:** Implement regulatory sandboxes across various deep tech sectors, allowing start-ups to test innovations in **controlled environments with relaxed regulations.**
- The RBI's regulatory sandbox for **fintech** could be replicated to areas like **AI, biotechnology, and quantum computing.**
- For instance, a sandbox for autonomous vehicles could allow companies like **Ather Energy** to test advanced self-driving features in designated areas.
- This approach would provide regulatory clarity, accelerate the development and adoption of new technologies, and help regulators formulate informed policies.

➢ **Deep Tech Education Initiative:** Collaborate with top IITs and private institutions to create specialized **deep tech curricula at undergraduate and postgraduate levels.**
- Introduce **industry-sponsored PhD programs** in emerging technologies, similar to the **Prime Minister's Research Fellows scheme**.
- This initiative would aim to increase the pool of deep tech specialists, addressing the talent shortage faced by companies like QNu Labs in quantum computing.

➢ **Open Innovation Platforms**: Develop n**ational open innovation platforms** for key deep tech sectors, facilitating collaboration between start-ups, corporates, and academia.
- Model these after successful initiatives like the **Global South Covid-19 Digital Innovation Challenge.**
- For instance, an AI for Healthcare platform could bring together start-ups like **Niramai (using AI for breast cancer detection)** with major hospital chains and medical research institutes.
- This approach would help align deep tech innovations with real-world problems and create a market pull for advanced technologies.

➢ **Deep Tech Commercialization Fund**: Establish a Deep Tech Commercialization Fund to support the transition of research from labs to marketable products.
- Allocate funds focusing on areas like **advanced materials, biotechnology, and energy storage.**
- Model this after successful programs like the **US Department of Energy's Technology Commercialization Fund**.
- For example, this fund could support a **start-up spinning out of IISc Bangalore** to commercialize its breakthrough solid-state battery technology.

➢ **Global Deep Tech Alliances:** Forge strategic deep tech alliances with global innovation hubs like **Silicon Valley, Tel Aviv, and Singapore**.
- Establish **bilateral innovation funds, joint research programs, and talent exchange initiatives.**
- For instance, **the Indo-Israel Bilateral Workshop on Quantum Technologies (I2QT-2022)** is a significant development in the **advancements in quantum computing and cryptography.**

Conclusion:

India's tech landscape is witnessing a paradigm shift from **traditional software to deep tech,** driven by global challenges like **climate change and healthcare.** To address evolving challenges and accelerate growth of the sector, **NASSCOM recommends a multipronged strategy strengthening innovation clusters**, enhancing access to patient capital and computing infrastructure, expediting the **National Deep Tech Startup Policy, improving IP frameworks, and developing a robust talent pipeline.** Despite challenges, India's STEM talent and entrepreneurial spirit, bolstered by these measures, position it well to lead in deep tech innovation.

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Startup Surge: Fueling India's Growth

This editorial is based on "[Making India a start-up nation](#)" which was published in The Hindu on 12/09/2024. The article highlights India's rapidly growing startup ecosystem and emphasizes the need for a synergistic integration of education, entrepreneurship, and employment to achieve exponential growth and the vision of a developed India by 2047.

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

India now boasts the **world's third-largest startup ecosystem**, with over **140,000 registered startups and a unicorn emerging every 20 days.** This growth has been supported by top-tier higher education institutions, government capital expenditure, and widespread internet penetration. However, to sustain this momentum and achieve the vision of a developed India by 2047, there's a need to integrate **education, entrepreneurship, and employment** more effectively.

The potential for growth is significant, especially when comparing India's startup ecosystem to those of the **US and UK. If 5% of Indian graduates opted for entrepreneurship,** matching global trends, it could lead to the creation of **50,000 new startups annually**, potentially generating millions of jobs. To achieve this, India needs to **rethink its higher education metrics,** emphasizing entrepreneurship alongside traditional placement rates. By transitioning from a linear approach to a synergistic paradigm integrating education, entrepreneurship, and employment, India can aim for **exponential economic growth during its Amrit Kaal period.**

What is the Current Status of India's Startup Sector?

➢ **Ecosystem Size and Growth:** India boasts a robust startup ecosystem, **ranking third globally with over 1.4 lakh registered startups** under the **Department for Promotion of Industry and Internal Trade (DPIIT).**

  ○ This dynamic ecosystem is characterized by its rapid growth, consistently adding more startups per day than any other country.

  ○ Furthermore, the e**mergence of one unicorn every 20 days over the past seven to eight years** highlights the immense potential and entrepreneurial spirit within the Indian startup landscape.

➢ **Job Creation:** The Indian startup ecosystem has been a significant driver of job creation, with DPIIT-recognized startups generating more than 15.5 lakh direct job opportunities.

  ○ In 2023 alone, **these startups created an impressive 3.9 lakh jobs,** representing a remarkable 46.6% year-on-year increase and a substantial **217.3% growth over the past five years.**

  ○ This trend underscores the startups' pivotal role in providing employment opportunities and contributing to the country's economic development.

➢ **Economic Contribution:** The impact of startups extends beyond job creation, as they have made a substantial contribution to the Indian economy.

  ○ In FY23, startups and their corporate counterparts **injected a significant USD 140 billion,** representing nearly 4% of India's GDP. This substantial contribution highlights the startups' role as key drivers of economic growth and innovation.

How India's Startup Sector is Booming?

➢ **Digital Infrastructure Revolution:** The widespread adoption of digital technologies, spearheaded by initiatives like **Digital India**, has created a fertile ground for startups.

  ○ The **Unified Payments Interface (UPI)** has been a game-changer, with transaction values surpassing **Rs 20 lakh crore in August 2024.**

  ○ This digital backbone, coupled with the world's lowest data costs (averaging **₹6.7 per GB in 2023**), has enabled startups to reach a vast customer base efficiently.

➢ **Supportive Government Policies** The Indian government's proactive stance through initiatives like **Startup India** and **Stand Up India** has been instrumental.

  ○ As on **30th June 2024**, Department for Promotion of Industry and Internal Trade has recognized **1,40,803 entities as startups** with tax benefits and easier compliance norms.

  ○ As on 31st December 2022, under the **Fund of Funds Scheme (FFS)** for startups, **Rs. 7,980 crore** has been committed to **99 Alternative Investment Funds (AIFs).**

➢ **Burgeoning Talent Pool:** India's demographic dividend, with **65% of its population under 35,** provides a vast talent pool for startups.

  ○ The country produces over **1.5 million engineering graduates annually,** with a growing focus on emerging technologies.

  ○ The **National Education Policy 2020's** emphasis on vocational education and entrepreneurship is further enhancing this talent pipeline.

➢ **Maturing Funding Ecosystem:** Despite global economic uncertainties, India's startup funding ecosystem has shown resilience.

  ○ While **2023 saw a funding winter, 2024 has witnessed a resurgence.** Indian tech startups raised USD 4.1 billion in H1 2024, 4% higher than H2 2023, **remaining fourth-highest funded country globally.**

○ The rise of domestic venture capital firms and the entry of global investors have diversified funding sources.

➢ **Sector-Specific Opportunities**: Emerging sectors like **cleantech, spacetech, and deeptech** are driving the next wave of innovation.

　○ The **Indian spacetech sector,** bolstered by the government's decision to open up the space sector to private players, saw investments of **USD 124.7 million in 2023 (for Space Start-Ups).**

　○ **Skyroot Aerospace's** successful launch of India's first privately developed rocket, **Vikram-S,** in November 2022, marked a milestone in this sector.

➢ **Growing Domestic Market:** With a steady GDP growth rate, India will have 140 million **new middle-class households by 2030** according to the World Economic Forum, presenting a massive opportunity for startups.

　○ The increasing disposable income and changing consumer behaviors are driving demand across sectors.

　○ According to Grant Thornton, e-commerce in India is expected to be worth **USD 188 billion by 2025.**

➢ **Corporate-Startup Synergies**: Increased collaboration between established corporates and startups has created win-win situations.

　○ Many large Indian conglomerates have **set up startup accelerators** or venture funds.

　○ For instance, **Reliance Industries' JioGenNext has supported over 170 startups.**

　○ The acquisition of **online pharmacy 1mg by Tata Digital in 2021**, illustrates the potential of such collaborations.

What are the Roadblocks to the Growth of Indian Startups ?

➢ **Regulatory Hurdles:** The complex and sometimes ambiguous regulatory environment poses significant challenges for startups.

　○ For instance, the recen**t debate over the categorization of app-based cab services like Ola and Uber under the Motor Vehicles Act** has created operational uncertainties.

　○ The recent **Digital Personal Data Protection Act, 2024** while necessary, adds compliance burdens on startups.

➢ **Talent Retention Hurdle:** While India produces a large number of graduates, retaining top talent remains a challenge.

○ The startup sector **faces competition from established MNCs** and the lure of overseas opportunities.

○ A 2023 study by Randstad revealed that **60% of Indian tech professionals** are willing to relocate abroad for better career prospects.

○ High-profile exits, like that of **Paytm's Amit Nayyar in 2021**, highlight the talent retention issue.

➢ **Market Saturation and Hyper-Competition:** Certain sectors in the Indian startup ecosystem are becoming increasingly crowded, leading to intense competition and **reduced profit margins.**

　○ The **edtech sector**, once booming, faced a downturn post-pandemic, forcing players like BYJU's and Unacademy laying off employees.

　　● This hyper-competition often leads to **unsustainable cash burn and market consolidation.**

➢ **Infrastructure Gaps and Uneven Funding**: While India has made significant strides in digital infrastructure, substantial gaps remain.

　○ Even in urban areas, internet penetration stands at **71%**, leaving a significant portion of the population unreached.

　○ The **urban-rural digital divide is stark,** with rural internet density at **37%** compared to **69%** in urban areas.

　○ This disparity **limits the addressable marke**t for many digital startups. For instance, agritech startup **DeHaat**, despite its success, faces challenges in scaling due to limited internet access among rural farmers.

　○ Also, despite growth in funding it remains largely uneven for instance, India's more than **6000 women-led startups remain unfunded.**

➢ **Scaling Challenges:** Many Indian startups struggle to scale beyond their initial success. Issues range from **operational inefficiencies** to difficulties in expanding to new markets.

　○ Despite this robust growth, data shows that about **90% of Indian start-ups** fail within the **first five years**, primarily due to scaling issues

➢ **Lack of Deep Tech Innovation:** While India excels in creating innovative business models, it lags in deep tech innovations.

　○ R&D spending in India remains low at **0.7% of GDP in 2023,** compared to **3.5% in the US**.

❍ This gap is evident in areas like **semiconductor design,** where India has few startups despite the government's **USD 10 billion** incentive scheme announced in 2021.

❍ The lack of industry-academia collaboration further exacerbates this issue. Out of the approximately **40,000 higher education institutions in India,** less than 1% actively participate in **high-quality research.**

➤ **Exit Challenges:** The Indian startup ecosystem still struggles with providing viable exit options for investors.

❍ There have been **46 IPOs in 2023**, raising a cumulative Rs 41095.36 crore. This marks a **30% decline from Rs 59301.7 crore** raised through **40 IPOs in 2022**

❍ The lackluster performance of some listed startups has made both investors and founders cautious.

What Measures can be Adopted to Enhance the Startup Sector in India?

➤ **Streamlined Regulatory Sandbox:** Implement a comprehensive regulatory sandbox across sectors, **expanding on the success of RBI's fintech sandbox.**

❍ This would allow startups to test innovative products in a controlled environment without full regulatory burden.

❍ Extend this model to sectors like **healthtech, edtech, and cleantech.**

➤ **Targeted Skill Development Programs:** Launch sector-specific skill development initiatives in collaboration with industry leaders and academia.

❍ Focus on emerging technologies like **AI, blockchain, and IoT.** The government's Skill India program can be leveraged and expanded for this purpose.

➤ **Decentralized Startup Hubs:** Develop **tier-2 and tier-3 cities as startup hub**s through targeted infrastructure and incentives.

❍ This can be modeled on the **success of Mohali's startup ecosystem**, which saw a significant increase in startup registrations between 2021 and 2023.

❍ Implement a **hub-and-spoke model** where each major city (hub) supports surrounding smaller cities (spokes).

➤ **Enhanced Tax Incentives:** Extend and expand tax benefits for startups beyond the **current three-year limit to five years** for all recognized startups.

❍ Introduce additional tax breaks for **deep-tech startups and those addressing critical national priorities.**

❍ For example, **Israel's tax benefits for tech companies**, which include a reduced corporate tax rate of **12%,** have significantly boosted their startup ecosystem.

● There is a need to Implement a similar model in India.

➤ **Robust IP Protection Framework:** Streamline the patent filing and approval process, reducing the average time.

❍ Introduce **fast-track examination for startups in critical sectors**. Implement an IP awareness program targeting a large number of startups annually.

❍ **Japan's accelerated examination system,** which reduced patent examination time to an average of 14 months, can serve as a model.

➤ **Government Procurement Boost:** Mandate a certain percentage of government procurement from startups, similar to the existing **25% procurement requirement from MSMEs.**

❍ The **US Federal Government's goal to award 23% of prime government contracts** to small businesses can be a benchmark.

❍ This could potentially open up a market worth billions for Indian startups.

➤ **Sector-Specific Incubation Centers**: Establish sector-specific incubation centers in collaboration with industry leaders.

❍ Focus on areas like s**pacetech, biotech, and cleantech.** For instance, the success of **T-Hub in Hyderabad** can be replicated with a sector-specific focus.

➤ **Startup-Academia Collaboration Platform**: Create a national platform to facilitate collaboration between startups and academic institutions.

❍ This can be modeled on successful programs like the **UK's Knowledge Transfer Partnerships.**

❍ Set a target to facilitate 1,000 such collaborations annually by 2025.

➤ **Enhanced Funding Access:** Expand the Fund of Funds for Startups (FFS) and create sector-specific funds.

❍ Introduce a credit guarantee scheme for startup loans, similar to the **UK's Enterprise Finance Guarantee.**

➤ **Digital Infrastructure Push**: Accelerate the implementation of initiatives like **BharatNet** to

ensure high-speed internet connectivity across all villages by 2025. This is crucial for startups to reach untapped markets.

  ○ The success of **Estonia's e-Residency program** in fostering a digital business environment can be a model.

Conclusion:

India's startup ecosystem has shown immense potential, contributing significantly to economic growth and job creation. However, to sustain and accelerate this momentum, it is essential to **address regulatory hurdles, foster deeper collaboration between academia and industry,** and ensure equitable access to funding and infrastructure. By integrating education, entrepreneurship, and employment, **India can unlock its entrepreneurial potential and move closer to becoming a developed nation by 2047.**

■■■

Tackling Sickle Cell Disease in India

This editorial is based on "India's Sickle Cell Challenge" which was published in The Hindu on 12/09/2024. The article highlights the key challenges associated with sickle cell disease in India and proposes strategies to address these issues effectively.

Tag: GS Paper - 2, Government Policies & Interventions, Health, Issues Related to SCs & STs

Last year, the Prime Minister of India launched the **National Sickle Cell Anaemia Elimination Mission** from Shahdol, Madhya Pradesh, setting an ambitious target to eradicate **sickle cell disease (SCD)** as a public health threat by 2047. SCD disproportionately impacts India's tribal and rural communities, where it remains a longstanding and urgent challenge.

Despite advancements in SCD healthcare, sickle cell disease continues to be significantly underdiagnosed and poorly managed in many regions, underscoring the need for more comprehensive action.

What is Sickle-Cell Disease (SCD)?

➢ **About:**

  ○ **Sickle Cell Disease (SCD)** is an inherited hemoglobin disorder characterized by a genetic mutation that causes **red blood cells (RBCs)** to assume a sickle or crescent shape rather than their normal round shape.

  ○ The lifespan of patients with sickle cell disease is significantly reduced, averaging around **40 years**.

  ○ Their quality of life is severely affected by a range of health complications, including sickle cell anemia, recurrent infections, persistent pain, swelling, and damage to vital organs

  ○ Individuals with SCD suffer from both acute and chronic complications, which include recurring episodes of pain commonly called **vaso-occlusive crisis (VOC)** - **acute chest syndrome (ACS)**, aseptic necrosis of bone, micro infarction of spleen, brain, and kidney, infections, stroke, and organ damage affecting every organ in the body.

➢ **Causes :**

  ○ SCD is a **genetic condition** that is present at birth. It is inherited when a child receives two genes—one from each parent—that code for abnormal hemoglobin.
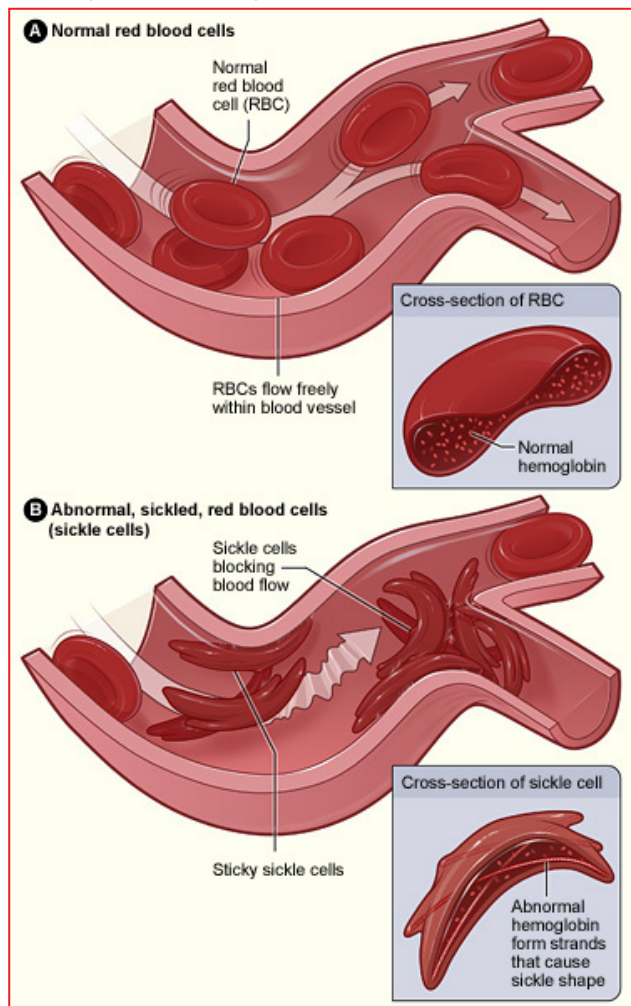
➢ **Common Types :**

  ○ The specific type of SCD a person has depends on the genes they inherited from their parents. People with SCD inherit genes that contain instructions, or code, for abnormal hemoglobin.

    ● **HbSS:** People who have this form of SCD inherit two genes, one from each parent, that code for hemoglobin "S."

    ● **HbSC:** People who have this form of SCD inherit a hemoglobin S gene from one parent and a gene for a different type of abnormal hemoglobin called "C" from the other parent. This is usually a milder form of SCD.

    ● **HbS beta thalassemia:** People who have this form of SCD inherit a hemoglobin S gene from one parent and a gene for beta thalassemia, another type of hemoglobin abnormality, from the other parent.

    ● **HbSD, HbSE, and HbSO :** People who have these forms of SCD inherit one hemoglobin S gene and one gene that codes for another abnormal types of hemoglobin ("D," "E," or "O").

➢ **Symptoms:** Symptoms of sickle cell disease can vary, but some common symptoms are-

  ○ **Chronic anaemia** which leads to fatigue, weakness, and paleness.

  ○ Painful episodes (also known as sickle cell crisis) cause sudden and intense pain in the bones, chest, back, arms, and legs.

  ○ Delayed growth and puberty.

- **Treatment Processes:**
  - **Blood Transfusions:** These can help relieve anaemia and reduce the risk of pain crises.
  - **Hydroxyurea:** This medication can help reduce the frequency of painful episodes and prevent some of the disease's long-term complications.
  - **Gene Therapy:** It can also be treated by bone marrow or stem cell transplantation by methods like Clustered regularly interspaced short palindromic repeats (CRISPR).

A Normal red blood cells
Normal red blood cell (RBC)
Cross-section of RBC
RBCs flow freely within blood vessel
Normal hemoglobin
B Abnormal, sickled, red blood cells (sickle cells)
Sickle cells blocking blood flow
Cross-section of sickle cell
Sticky sickle cells
Abnormal hemoglobin form strands that cause sickle shape

What is the Prevalence of Sickle Cell Disease in India ?

- **Public Health Concern**: The Ministry of Health and Family Welfare (MoHFW) has recognized sickle cell disease (SCD) as **one of the ten major health issues** disproportionately impacting India's tribal population.
- **Global Burden**: India bears the world's **second-largest burden** of SCD, with over **1 million people** affected by the disease.
- **SCD Birth Rates**: India ranks **third** globally in the number of SCD births, following **Nigeria** and the **Democratic Republic of the Congo**.

- **Carrier Rate:** The prevalence of sickle cell carriers among different tribal groups varies from 1 to 40%.
- **Geographical Distribution**:
  - The majority of SCD patients are concentrated in the **tribal belt** that spans across **Odisha**, **Jharkhand**, **Chhattisgarh**, **Madhya Pradesh**, and **Maharashtra**.

What are the Key Challenges Encountered by the SCD Healthcare System in India?

- **No Permanent Cure :** There is currently **no permanent cure for sickle cell disease**.
  - While ongoing research into gene therapy shows promise, it is likely to remain unaffordable for most of the affected population even once it becomes available.
- **Misdiagnosis :** Getting an accurate diagnosis is challenging because many individuals are reluctant to seek help due to the stigma surrounding the condition.
  - As a result, they often turn to traditional healers, who frequently misdiagnose the disease.
- **Inadequate Healthcare Infrastructure:** Many rural and tribal areas lack specialised healthcare facilities and trained medical personnel for managing SCD.
  - This hampers timely intervention and effective disease management.
- **Inadequate Screening Programs:** The absence of systematic newborn screening and early detection initiatives results in missed opportunities for early intervention and genetic counseling.
  - There is mistrust of public healthcare in tribal areas, leading to low testing rates.
- **Limited Access to Medications:** Medicines like **Hydroxyurea** are effective but access to medications is inconsistent, with stockouts and long travel distances for patients.
  - Only **18%** of the people affected by sickle cell disease in India are receiving consistent treatment.
- **High Treatment Costs:** The long-term management of SCD can be financially burdensome for many families due to the cost of medications, regular check-ups, and potential hospitalizations.
  - Treatments like **CRISPR** cost $ 1-2 million, and it's difficult to find bone marrow donors.
- **Inadequate Research and Data**: Limited research on SCD, particularly in the context of India's diverse populations, hinders the development of effective treatment strategies and public health interventions tailored to local needs.

➤ **Cultural and Social Barriers**: Stigma and social attitudes toward SCD can discourage individuals from seeking treatment or participating in screening programs, affecting overall health outcomes.

What are the Government Initiatives Regarding SCD?

➤ <u>**National Sickle Cell Anaemia Elimination Mission:**</u>
- ❍ Aimed at enhancing the care for all Sickle Cell Disease (SCD) patients and reducing the disease's prevalence through an integrated approach encompassing screening and awareness campaigns.
- ❍ Targeting complete elimination of sickle cell disease as a public health concern by 2047.
  - • Under the Sickle Cell Anaemia Mission, the <u>Council of Scientific and Industrial Research (CSIR)</u> is developing gene-editing therapies for SCD.
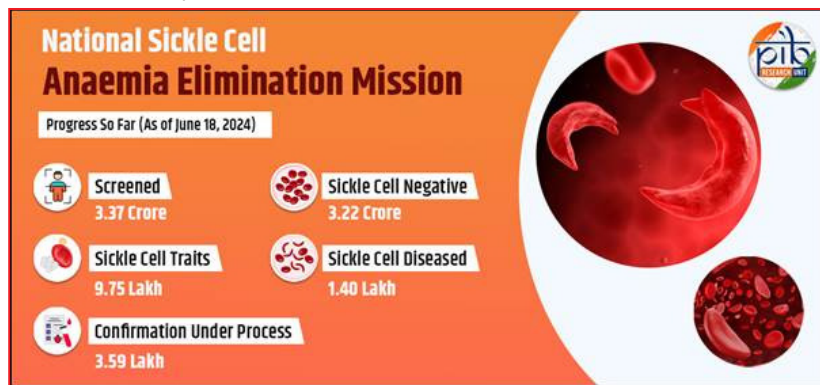
➤ <u>**National Health Mission (NHM) 2013:**</u>
- ❍ It is, a flagship programme of the Indian government, that encompasses provisions for disease prevention and management, with a specific focus on hereditary anomalies such as sickle cell anaemia.
- ❍ Dedicated programs within NHM focus on raising awareness, facilitating early detection, and ensuring timely treatment of sickle cell anaemia.
- ❍ NHM facilitates drugs like hydroxyurea to treat SCD in its "essential medicines List".

➤ **The National Guidelines for Stem Cell Research 2017:**
- ❍ It restricts the commercialisation of stem cell therapies to clinical trials, except for Bone marrow transplantation (BMT) for SCD.
- ❍ Gene editing on stem cells is permitted only for in-vitro studies.

➤ **National Guidelines for Gene Therapy Product Development and Clinical Trials 2019:** It provides guidelines for the development and clinical trials of gene therapies for inherited genetic disorders.
- ❍ India has also approved a five-year project to develop CRISPR techniques for sickle cell anaemia treatment.

➤ **State Haemoglobinopathy Mission of Madhya Pradesh:**
- ❍ It aims to address the challenges in screening and management of the disease.

➤ <u>**Rights of Persons with Disabilities (RPwDs) Act, 2016:**</u>
- ❍ SCD is included in the 21 disabilities that provide for benefits such as reservation in higher education (minimum 5%), government jobs (minimum 4%), and allocation of land (minimum 5%), for persons with benchmark disabilities and those with high support needs.
- ❍ Free education is guaranteed for every child with a benchmark disability between 6 and 18 years.

Note
➤ Recently, the US Food and Drug Administration (FDA) approved two gene therapies designed for sickle cell disease.
➤ The approved therapies include <u>**Lyfgenia**</u> and Casgevy.
- ❍ Both treatments received clearance for individuals aged 12 years and above.
- ❍ <u>**Casgevy also approved in the U.K**</u>., is the first CRISPR-based therapy to have received regulatory approval.
- ❍ Lyfgenia doesn't use CRISPR but depends on a viral vector to change blood stem cells.
➤ Both treatments entail collecting a patient's blood stem cells, modifying them, and administering high-dose chemotherapy to destroy the damaged cells in the bone marrow.
➤ The modified cells are then infused into the patient through a hematopoietic stem cell transplant.

What Steps Should be Taken to Effectively Combat the Disease?

➤ **Reduce Stigma and Foster Trust :**
- ❍ To combat sickle cell disease effectively, it is essential to reduce stigma and foster trust in public health institutions.
- ❍ India can leverage its successful strategies from past

health campaigns, such as those against polio and HIV, to raise awareness and educate the public.

➢ **Early Detection and Screening:**
  ❍ Given that cases are often missed and diagnoses delayed, increasing newborn screening could be crucial.
  ❍ Strengthen and expand genetic counseling and testing programmes.
  ❍ Prioritising basic treatments like hydroxyurea is essential for urgent needs.

➢ **Enhancing Accessibility to Care :**
  ❍ Drugs and adherence support must be readily available at local health and wellness centers.
  ❍ To manage complications, interdisciplinary centers of excellence should be established and operational at the district or divisional level.

➢ **Implementing Catch-Up Vaccination Programs :**
  ❍ Ensuring that all known patients receive approved vaccines is crucial and may necessitate the implementation of catch-up vaccination programs.

➢ **Research and Development:**
  ❍ Allocate more resources for ongoing medical research.
  ❍ Gain deeper insights into the genetic and molecular aspects of SCD to develop more effective treatment options and potential cures.
  ❍ For this, philanthropists and civil society members must take on a catalytic role, collaborating closely with Central and State governments.

Conclusion

Addressing sickle cell disease in India by enhancing early detection, healthcare infrastructure, and public education supports **SDG 3 (Good Health & Well Being)** and **SDG 10 (Reduced Inequality)**. Through sustained commitment and coordinated efforts, it is possible to transform the landscape of sickle cell disease management in India, ultimately improving health outcomes and reducing the suffering associated with this debilitating condition.

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AI's Role in India's Health Ecosystem

This editorial is based on "Health care using AI is bold, but much caution first" which was published in The Hindu on 13/09/2024.The article highlights the potential of AI to address India's healthcare challenges, while emphasizing the need to balance technological advancements with ethical considerations, human empathy, and foundational improvements in the healthcare system.

Tag: GS Paper - 2, Health, Government Policies & Interventions, GS Paper - 4

India's healthcare system faces significant challenges, including **inadequate infrastructure, shortage of healthcare professionals, and uneven access to quality care** across its vast and diverse population. In recent years, there has been growing interest in leveraging **artificial intelligence (AI)** to address some of these persistent healthcare gaps. AI technologies promise to increase efficiency, improve access to medical expertise, and potentially revolutionize healthcare delivery in a country where resources are often stretched thin.

However, the integration of AI in healthcare, particularly in a country as complex as India, raises critical questions about **feasibility, sustainability, and ethical implications**. While AI excels at **processing data and automating repetitive tasks**, it lacks crucial human qualities essential for healthcare, such as **empathy, cultural understanding, and the ability to navigate nuanced patient conditions**. As India explores the potential of AI in healthcare, it must carefully weigh the potential benefits against the need to address foundational healthcare issues and develop comprehensive regulations to ensure AI tools adhere to the **core medical ethic of "Do No Harm."**
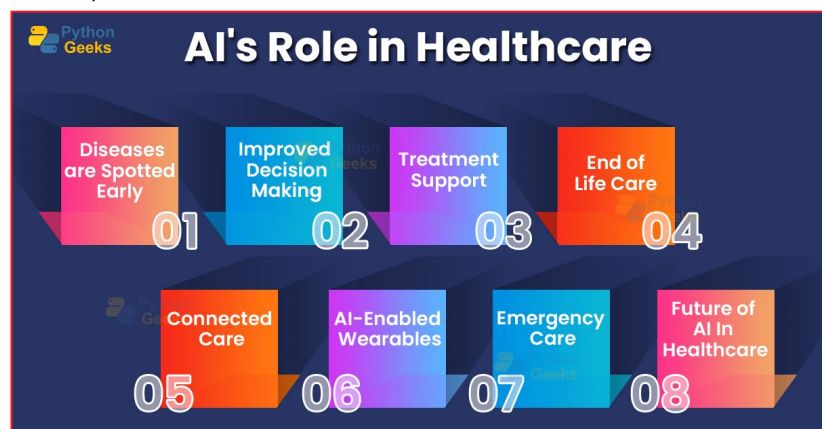
What is the Significance of AI in Healthcare?

➢ **Revolutionizing Diagnostics:**Artificial Intelligence is transforming medical diagnostics with unprecedented accuracy and speed.
  ❍ In radiology**, AI algorithms can detect subtle abnormalities** in medical images that might escape the human eye.
  ❍ For instance, a study published in Nature in 2020 showed that AI systems resulted in absolute reductions of **1.2% and 2.7% in the rates of false-positive and false-negative detection** of biopsy-confirmed breast cancer.
  ❍ As AI continues to evolve, it promises to enhance diagnostic accuracy across various medical fields, from **ophthalmology to pathology.**

➢ **Personalized Treatment Plans:** AI is ushering in an era of precision medicine by **analyzing vast amounts of patient data** to create personalized treatment plans.

○ By considering an individual's **genetic makeup, lifestyle factors, and medical history,** AI can recommend targeted therapies with higher efficacy and fewer side effects.

○ **IBM Watson Oncology**, for example, has been used in over **230 hospitals** worldwide, assisting oncologists in developing personalized cancer treatment plans.

○ This tailored approach not only improves patient outcomes but also optimizes resource allocation in healthcare systems.

➤ **Drug Discovery and Development**: AI is dramatically **accelerating the drug discovery and development process,** potentially bringing life-saving medications to market faster and at lower costs.

○ Machine learning algorithms can analyze **biological data, predict drug-target interactions, and optimize molecular structures**, significantly reducing the time and resources required for early-stage drug discovery.

○ In 2020, **Insilico Medicine** used AI to design, synthesize, and validate a novel drug candidate for fibrosis in just **46 days,** a process that traditionally takes years.

➤ **Enhancing Clinical Workflows**: AI is streamlining clinical workflows, reducing administrative burdens, and allowing healthcare professionals to focus more on patient care.

○ **Natural Language Processing (NLP) algorithms** can automatically transcribe and summarize doctor-patient conversations, update electronic health records, and generate clinical notes.

○ Additionally, **AI-driven scheduling systems can optimize patient flow,** reduce wait times, and improve resource allocation in hospitals.

➤ **Remote Monitoring and Telemedicine:** AI is playing a pivotal role in expanding the reach of healthcare through remote monitoring and telemedicine solutions.

○ **AI-powered wearables and IoT devices** can continuously monitor patient vital signs, detect anomalies, and alert healthcare providers to potential issues before they become critical.

○ During the Covid-19 pandemic, the use of AI in telemedicine surged, with platforms like **Babylon Health using AI chatbots** to triage patients and provide initial consultations.

○ This technology is particularly **significant for rural and underserved areas,** where access to specialists is limited.

○ **WHO's Sarah** is a prototype of a **digital health promoter**, available 24/7 in eight languages via video or text.

● She can provide tips to destress, eat right, quit tobacco and e-cigarettes, as well as give information on several other health topics.

● However, she is not designed to give medical advice.

➤ **Enhancing Medical Education and Training:** AI is revolutionizing medical education and training by providing personalized learning experiences and simulating complex clinical scenarios.

○ **Virtual reality (VR) and augmented reality (AR) platforms** powered by AI can create immersive training environments for medical students and professionals.

○ For instance, companies like **FundamentalVR offer AI-driven haptic VR systems** that allow surgeons to practice procedures with realistic feedback.

○ AI-powered adaptive learning systems can also **tailor medical curricula to individual students' needs,** potentially accelerating the learning process and producing more competent healthcare professionals.

AI's Role in Healthcare

Diseases are Spotted Early — 01
Improved Decision Making — 02
Treatment Support — 03
End of Life Care — 04
Connected Care — 05
AI-Enabled Wearables — 06
Emergency Care — 07
Future of AI In Healthcare — 08

What are the Major Challenges of AI in Healthcare in India?

➤ **Infrastructure Limitations:** India's healthcare infrastructure faces significant constraints that challenge the widespread adoption of AI technologies.

○ Many healthcare facilities, particularly in rural and semi-urban areas, lack the basic technological infrastructure required to support AI systems.

○ A recent study stated that of the 7,821 Health and Wellness Centres in rural India, only 3,496 (45%) have an electricity back-up facility.

○ This infrastructure gap makes it difficult to implement and maintain sophisticated AI systems

➢ **Data Challenges:** India faces a major hurdle in the availability and quality of healthcare data required for training effective AI models.

○ The fragmented healthcare system, comprising both public and private providers, results in inconsistent data collection practices.

○ While many healthcare facilities in India maintain electronic health records (EHRs), there are no provisions for integrating this data for analysis, nor clear guidelines on how long health records should be retained.

○ This issue is further exacerbated by problems related to data quality, standardization, and interoperability.

➢ **Digital Divide:** The digital divide in India poses a significant barrier to the equitable implementation of AI in healthcare.

○ While urban centers may benefit from AI-driven healthcare solutions, rural areas often lack the necessary digital infrastructure.

○ 45% of the Indian population do not access the internet as of 2023, according to a joint study by the Internet and Mobile Association of India (IAMAI) and Kantar.

○ This disparity in digital access means that AI healthcare solutions may primarily benefit urban populations, potentially widening the existing healthcare gap.

➢ **Regulatory Hurdles:** The absence of comprehensive regulations specifically addressing AI in healthcare presents a significant challenge in India.

○ While the Digital Information Security in Healthcare Act (DISHA) was proposed in 2017 by the Ministry of Health & Family Welfare, to regulate digital health data, it has yet to be enacted.

○ This regulatory vacuum creates uncertainty for AI developers and healthcare providers, potentially slowing innovation and adoption.

○ The lack of clear guidelines on issues such as AI algorithm validation, liability in case of AI errors, and patient data protection poses risks to both patients and healthcare providers.

➢ **Ethical and Cultural Considerations**: Implementing AI in healthcare in India raises complex ethical and cultural challenges due to the country's vast diversity.

○ Issues such as **algorithmic bias, informed consent, and privacy** take on additional dimensions in a multicultural, multilingual society with varying levels of health literacy.

○ AI algorithms used in Indian healthcare settings trained on datasets primarily from Western countries, raises concerns about their applicability to the Indian population.

○ **Cultural sensitivities around health issues and data** sharing also pose challenges.

➢ **Cost and Resource Allocation:** The high costs associated with developing, implementing, and maintaining AI systems in healthcare pose a significant challenge for India's resource-constrained health sector.

○ While AI promises long-term cost savings, the initial investment can be substantial.

○ The average cost to implement AI in healthcare ranges between USD 20,000 and USD 1,000,000, a significant sum for many healthcare providers.

○ This cost barrier is particularly challenging given that India's healthcare spending was only 1.8% of its GDP in 2020-21.

➢ **Language and Localization Issue:** India's linguistic diversity presents a unique challenge for AI implementation in healthcare.

○ With **22 official languages and hundreds of dialects**, creating AI systems that can effectively communicate with and understand patients across the country is a complex task.

○ This language barrier can lead t**o misdiagnosis, miscommunication, and reduced effectiveness of AI tools**.

ICMR Guidelines for AI Use in the Health Sector

In March 2023, the **Indian Council of Medical Research (ICMR)** released "**The Ethical Guidelines for Application of AI in Biomedical Research and Healthcare,**" outlining 10 key patient-centric ethical principles for AI use in healthcare.

10 Guiding Principles:

➢ **Accountability and Liability:** Regular audits ensure optimal AI functioning, made available to the public.

➢ **Autonomy:** Human oversight is essential, with patient consent required, informing them of risks.

➢ **Data Privacy:** AI must safeguard privacy and personal data at every stage.

➢ **Collaboration:** Promotes interdisciplinary, international partnerships.

➢ **Safety and Risk Minimization:** Prevents misuse, ensures data security, and requires ethical committee assessments.

➢ **Accessibility, Equity, and Inclusiveness:** Aims to bridge the digital divide by ensuring AI infrastructure access.

➢ **Data Optimization:** Addresses biases and errors due to poor data quality or representation.

➢ **Non-Discrimination and Fairness:** Ensures universal, bias-free AI technology.

➢ **Trustworthiness:** AI must be valid, reliable, ethical, and lawful to gain user confidence.

➢ **Transparency:** Clinicians need systematic methods to test AI's validity and reliability.

 Frameworks: India's frameworks supporting AI in healthcare include the Digital Health Authority under the **National Health Policy (2017), DISHA 2018, and Medical Device Rules, 2017.**

How India can Effectively Implement AI in Healthcare?

➢ **Strengthen the National Health Resources Database:** India can enhance its **National Health Resources Repository (NHRR)** by incorporating advanced AI technologies.

  ○ By integrating the **National Digital Health Mission** with AI-ready data protocols through NHRR, India could build a robust AI Healthcare Model.

  ○ The **success of Estonia's e-Health system**, which covers 95% of the population's health data, demonstrates the **feasibility of this approach.**

➢ **Develop India-specific AI Models:** To address the challenge of AI models not being suitable for the Indian population, the government **can collaborate with academic institutions and tech companies to develop India-specific AI models.**

  ○ These models should be trained on diverse Indian datasets, considering factors like **genetic diversity, regional disease patterns, and socio-economic determinants of health.**

  ○ For instance, **IIT-Delhi researchers** developed AI-based detectors for **malaria, TB, cervical cancer**.

  ○ The government could establish an **"AI for Indian Healthcare"** challenge, similar to the successful **Google AI for Social Good program**, inviting researchers and startups to develop solutions tailored to India's unique healthcare challenges.

➢ **Create a Tiered AI Implementation Strategy**: To address the digital divide, India can adopt a tiered AI implementation strategy.

  ○ In urban areas with better infrastructure, **advanced AI systems for diagnostics and treatment planning** can be implemented in tertiary care hospitals.

  ○ For rural areas, initially focus on **deploying simpler, more robust AI tools** that can work with limited connectivity, such as AI-powered mobile apps for basic health screenings or telemedicine platforms with offline capabilities.

  ○ For example, the **'NITI Aayog AI for All' initiative** could be expanded to include **healthcare-specific programs** for rural areas.

  ○ The success of the **Aarogya Setu app**, demonstrates the potential for widespread adoption of mobile health technologies in India.

➢ **Establish a Regulatory Sandbox for Healthcare AI:** To navigate regulatory hurdles, India can create a **'Regulatory Sandbox' for healthcare AI**, allowing controlled testing of AI solutions in real-world settings under regulatory supervision.

  ○ This approach would help develop appropriate regulations while fostering innovation.

  ○ The sandbox could be modeled after the **Reserve Bank of India's fintech sandbox,** which has successfully incubated several innovative financial solutions.

  ○ For healthcare AI, the sandbox could initially focus on **non-critical areas like administrative processes or low-risk diagnostic tools**.

    ● The Indian Council of Medical Research (ICMR) could oversee this sandbox, collaborating with tech companies and hospitals to test AI solutions before wider deployment.

➢ **Integrate AI Education in Medical Curriculum:** To address the skills gap, India should integrate AI and data science modules into medical and nursing education curricula.

  ○ This could include **mandatory courses on AI in healthcare**, hands-on training with AI tools, and internships with health-tech companies.

○ Additionally, the government could partner with online learning platforms to offer **certified AI in healthcare courses for practicing professionals.**

○ The success of initiatives like the **Stanford University's AI in Healthcare online course,** demonstrates the potential of this approach.

➢ **Establish Ethical Guidelines for AI in Healthcare**: To address ethical concerns, India should develop comprehensive ethical guidelines for AI in healthcare, considering its unique cultural and social context.

○ These guidelines should cover issues like **data privacy, algorithmic bias, and the role of AI in clinical decision-making.**

○ The government could establish an **AI Ethics Committee under the Ministry of Health and Family Welfare,** comprising medical professionals, ethicists, AI experts, and patient advocates.

○ This committee could draw inspiration from the **European Commission's Ethics Guidelines for Trustworthy AI**, adapting them to the Indian context.

➢ **Create AI-Ready Healthcare Infrastructure:** India needs to focus on creating AI-ready infrastructure in healthcare facilities.

○ This involves ensuring stable electricity supply, robust internet connectivity, and necessary hardware in healthcare centers. T

○ The government could leverage existing schemes like the **National Rural Health Mission** to include digital infrastructure upgrades.

● For instance, the **successful implementation of solar-powered primary health centers in Chhattisgarh,** which ensured 24/7 electricity could be replicated and expanded to include digital infrastructure.

➢ **Launch Public Awareness Campaigns:** To address the challenge of patient trust and acceptance, India should launch comprehensive public awareness campaigns about AI in healthcare.

○ These campaigns should focus on **explaining the benefits and limitations of AI in simple, relatable terms.**

○ Use various **media channels, including social media, television, and community outreach programs.**

● For instance, the success of the **Pulse Polio campaign,** which used celebrity endorsements and grassroots mobilization could be a model for AI awareness.

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Urban Flooding: A Looming Threat

This editorial is based on "[Mitigating risks, impact of flooding in the cities](#)" which was published in Hindustan Times on 07/05/2024. The article highlights the pressing issue of urban flooding in India, exacerbated by climate change and poor urban planning. It emphasizes the need for proactive, risk-informed flood management to safeguard cities from increasing flood threats.

Tag: GS Paper - 3, Disaster Management, Environmental Pollution & Degradation

Urban flooding has become a pressing issue in India, with many states experiencing heavy rainfall and flooding that exceeds normal averages by over **20% this monsoon season**. This increase in extreme weather events is primarily attributed to the climate crisis, with over **64% of Indian sub-districts** witnessing more heavy rainfall days in the last decade compared to the previous 30 years. However, human activities exacerbate the problem through **poor land-use policies, inadequate solid waste management,** and **insufficient stormwater drainage systems**, all of which contribute to increased water runoff and waterlogging in urban areas.

To address this growing challenge, Indian cities must shift from **reactive measures to proactive flood risk management.** This involves regularly reassessing rainfall patterns and updating stormwater infrastructure accordingly, identifying **flood "hotspots"** through comprehensive risk assessments, and implementing a range of short, medium, and long-term interventions. By adopting a year-round, risk-informed approach to water planning, Indian cities can better protect lives, livelihoods, and urban infrastructure from the increasing threat of floods.

What is Urban Flooding?

➢ Urban flooding refers to the **inundation of land or property in densely populated areas** due to **heavy rainfall, overflowing rivers, poor drainage systems**, or other water-related incidents.

➢ Unlike traditional floods that occur in rural or natural settings, urban flooding is exacerbated by the impervious surfaces in cities (**such as roads, pavements, and buildings)** which prevent water from being absorbed into the ground.

○ It leads to **waterlogging,** disrupting transportation, **damaging infrastructure,** and posing health hazards to urban populations.

URBAN FLOODING

MEANING

- Flooding of land/property in a built environment, particularly in cities
- Caused not just by higher precipitation but also **unplanned urbanisation**

CAUSES OF EXACERBATION

- **Encroachments** on drainage channels (lakes, wetlands, riverbeds)
- **Climate change** (increased frequency of short duration heavy rainfall)
- Uninformed **release of water from dams** (e.g. Chennai Floods 2015)
- **Mining** activities (depletes natural riverbed and water retention capacity)
- Urban heat island effect
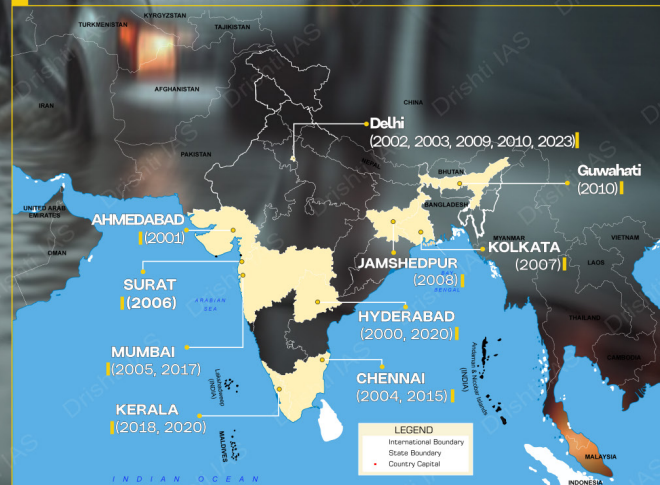- **Storm surges** affecting coastal cities/ towns

IMPACTS

- Loss of life and property
- Spread of diseases
- Disruptions in supply of power & water and communication
- Ecological impacts

SUGGESTIONS TO MITIGATE

- Creating a unified **flood control implementing agency**
- **Blue-Green Infra** for urban and climatic challenges
  - Blue - Water bodies such as rivers and tanks
  - Green - Trees, Parks, and Gardens
- Mapping of Flood Vulnerability
- Construction of **flood walls, raised platforms** along basins

Some of the Most Notable Urban Floods in India

- Delhi (2002, 2003, 2009, 2010, 2023)
- Guwahati (2010)
- AHMEDABAD (2001)
- KOLKATA (2007)
- JAMSHEDPUR (2008)
- SURAT (2006)
- HYDERABAD (2000, 2020)
- MUMBAI (2005, 2017)
- CHENNAI (2004, 2015)
- KERALA (2018, 2020)

LEGEND
International Boundary
State Boundary
• Country Capital

Drishti IAS

Why are Indian Urban Cities Increasing Prone to Flooding?

➢ **The Impermeable Menace:** Rapid urbanization has led to extensive **concretization of Indian cities,** replacing natural permeable surfaces with impervious ones.

- This drastic **reduction in water absorption capacity** overwhelms drainage systems during heavy rainfall.
- For instance, Mumbai saw a **99.9% increase in built-up area** in the last 27 years. The result is **amplified surface runoff,** with some areas experiencing up to **30 times more runoff compared to natural landscapes,** significantly increasing flood risk.

➢ **Drain Pain:** Many Indian cities rely on **drainage systems designed decades ago,** ill-equipped to handle current population densities and rainfall intensities.

- These outdated systems frequently become clogged with debris and waste, further reducing their capacity.
- Delhi has retained the **same archaic structure for 42 years,** even as the population has increased four-fold.
  - The last drainage master plan for Delhi was created in **1976**, leading to frequent flooding.

➢ **Extreme Weather Events on the Rise:** Climate change is intensifying rainfall patterns, with **more frequent and severe extreme weather events**.

- Indian cities are experiencing unprecedented downpours that overwhelm existing infrastructure.
- Chennai, for example, received **1,218.6mm of rainfall in November 2015**, the highest in over a century, causing catastrophic flooding.
- Widespread extreme rain events across central India have **tripled since 1950.**

○ This trend is expected to continue, with projections indicating a **20-40% increase in monsoon rainfall intensity by the end of the century.**

➢ **Loss of Natural Water Bodies:** Urbanization has led to the **encroachment and destruction of natural water bodies** that once acted as flood buffers.

○ **Lakes, ponds, and wetlands** are being filled in for construction, eliminating crucial water storage and infiltration areas.

○ Bengaluru, once known for its numerous lakes, has **lost 79% of its water bodies,** reducing its flood resilience.

➢ **Unplanned Development in Ecologically Sensitive Areas:** Uncontrolled construction **on hillsides and in eco-sensitive zones** has increased landslide risks and altered natural water flow patterns.

○ Cities like **Dehradun and Shimla** have seen rapid expansion into surrounding hills, disrupting natural drainage systems.

○ The 2013 Kedarnath floods, exacerbated by unplanned development, resulted in massive destruction, highlighting the dangers of such encroachment.

● Over 300 multi-storey buildings, hotels, and businesses, **illegally built on ecologically-sensitive areas near the Ganga and its tributaries**, were swept away or severely damaged by flash floods.

➢ **Solid Waste Spillover- Choking the Urban Arteries**: Inadequate solid waste management in Indian cities leads to **clogged drains and reduced water flow capacity.** With rapid urbanization, **waste generation has skyrocketed,** overwhelming existing disposal systems.

○ India generates over **1.5 lakh tonnes** of municipal solid waste (MSW) per day, but only 83% of waste is collected and less than 30% is treated, illustrating the magnitude of the problem.

➢ **Coastal Conundrum:** Many of India's major cities, such as **Mumbai, Chennai, and Kolkata**, are situated along the coast, making them vulnerable to both sea level rise and land subsidence.

○ **Climate change-induced sea level rise** is exacerbating flood risks in these areas.

○ In February 2021, McKinsey India had said in a report that by **2050**, Mumbai will witness **a 25% increase in the intensity of flash floods** accompanied by a **half-meter rise in the sea-level.**

What are the Major Impacts of Urban Flooding?

➢ **Financial Devastation in Urban Centers:** Urban flooding inflicts severe economic damage, disrupting businesses, destroying infrastructure, and causing long-term financial setbacks.

○ The 2005 Mumbai floods resulted in estimated economic losses of **USD 2 billion**, while the 2015 Chennai floods caused damages worth **USD 3 billion**.

○ Beyond immediate losses, urban floods can lead to **reduced foreign investment and tourism.**

○ The World Bank estimates that by 2050, flood damage in urban areas could cost **USD 1 trillion** annually worldwide if no preventive actions are taken.

➢ **Public Health Crisis:** Floodwaters in urban areas often mix with sewage and industrial waste, creating a **breeding ground for waterborne diseases.**

○ In the aftermath of the 2019 Patna floods, there was a **huge outbreak of malaria and diarhorria in almost all villages of Patna**.

○ The 2005 Mumbai floods led to a **leptospirosis outbreak.**

○ The long-term health impacts can be severe, with studies showing a 50% increase in the **risk of gastrointestinal illnesses** in children exposed to urban floodwaters.

➢ **Urban Mobility Paralysis:** Urban floods bring cities to a standstill**, crippling transportation networks** and causing massive economic losses due to reduced productivity.

○ During the 2022 Bengaluru floods, IT companies reported losses of **₹225 crore per day** due to employees being unable to reach work.

➢ **Disproportionate Impact on Urban Poor:** Urban floods disproportionately affect slum dwellers and low-income communities, exacerbating existing socio-economic inequalities.

○ In Mumbai, about **41-42% of the population lives in slums,** many of which are located in low-lying areas or along flood-prone creeks.

● During the 2005 floods, these areas were among the worst affected.

○ The long-term impacts on these communities include **increased debt, reduced access to education, and perpetuation of the poverty cycle.**

➢ **Psychological Toll of Recurring Floods:** The psychological impact of urban flooding is profound and often underappreciated.

  ○ A study found a **67% increase in mental health issues** among urban residents in flood-affected areas.

  ○ **Post-Traumatic Stress Disorder** (PTSD) rates in flood-affected urban populations can be as high as 30-40%, persisting for years after the event.

  ○ This psychological toll has broader societal impacts, affecting productivity, social cohesion, and overall quality of life in urban areas.

➢ **Cultural Heritage Havoc:** Urban flooding poses a significant threat to cultural heritage sites, many of which are integral to a city's identity and tourism economy.

  ○ The **2019 floods in Hampi**, a UNESCO World Heritage Site and popular urban tourist destination, caused massive damage.

  ○ Beyond physical damage, the loss or degradation of cultural sites can have long-lasting impacts on urban identity and tourism.

What are the Government Initiatives Related to Urban Flooding?
➢ **Jal Shakti Abhiyan (JSA)**
➢ **Amrit Sarovar Mission**
➢ **Atal Bhujal Yojana**
➢ **Atal Mission for Rejuvenation and Urban Transformation (AMRUT) 2.0**

What Measures can be Adopted to Enhance the Flood Resilience of Indian Cities?

➢ **Sponge City Revolution**: Implementing the "**Sponge City**" concept can significantly enhance urban flood resilience by mimicking natural water cycles.

  ○ This approach involves creating permeable surfaces, rain gardens, and bioswales to absorb and filter rainwater.

  ○ China's Sponge City program has shown promising results, with pilot cities **retaining 70–90% of average annual rain water**.

  ○ Implementing sponge city principles across **30% of urban areas could reduce peak runoff by up to 50%,** significantly mitigating flood risks. This approach not only manages floods but also recharges groundwater and improves urban biodiversity.

➢ **Smart Stormwater Systems:** Integrating Internet of Things (IoT) technology into stormwater management can revolutionize flood prediction and response.

  ○ **Smart sensors** in drainage systems can provide real-time data on water levels and flow rates, enabling proactive flood management.

  ○ **Singapore's Smart Water Assessment Network (SWAN)** uses sensors to monitor water quality and flooding, reducing flood-prone areas.

  ○ Implementing similar systems across major Indian cities could improve flood prediction accuracy and reduce flood damage costs.

➢ **Urban Wetland Revival**: Restoring and protecting urban wetlands can significantly enhance a city's capacity to absorb excess water during heavy rainfall.

  ○ Wetlands act as natural sponges, absorbing up to 1 million gallons of water per acre.

  ○ **Kolkata's East Kolkata Wetlands**, naturally **treat 750 million liters of wastewater daily** and provide flood protection.

  ○ Implementing comprehensive wetland restoration programs in the top 10 flood-prone Indian cities could provide flood protection for millions of urban residents and save crores annually in flood damages.

➢ **Skyscrapers as Green Flood Barriers:** Incorporating vertical forests into urban architecture can significantly reduce stormwater runoff while improving air quality and biodiversity.

  ○ These green buildings can absorb up to **70% of rainwater that falls on them**, reducing pressure on drainage systems.

  ○ Milan's Bosco Verticale, with 800-900 trees on two residential towers**, absorbs tons of CO2 annually and significantly reduces runoff.**

➢ **Flood-Resilient Architecture:** Adopting flood-resilient architectural principles can transform urban areas from flood victims to flood adapters.

  ○ This includes **elevated structures, amphibious buildings, and water-permeable designs.**

  ○ The **FLOAT House in New Orleans** showcases how architecture can adapt to flood risks.

  ○ Implementing these principles in new constructions in flood-prone urban areas could protect millions of households from flood damage annually, saving billions in reconstruction costs.

➢ **Community-Led Micro-Interventions:** Engaging communities in micro-level flood management can significantly enhance urban flood resilience.

○ This approach involves training local groups to implement small-scale interventions like **rainwater harvesting and permeable pavements.**

○ For instance, to address flooding issues, **Rotterdam has designed multifunctional public spaces called "water squares."**

● These spaces collect and store excess rainwater during heavy downpours, mitigating flood risks while providing recreational areas for residents.

○ The success story of **Nagdarwadi, Maharashtra,** showcases the potential of this approach. This small village transformed from water-scarce to water-sufficient through comprehensive rainwater harvesting

Conclusion:

Urban flooding in India, **driven by rapid urbanization and climate change**, causes significant economic, health, and infrastructure damage. Effective measures include adopting **"Sponge City" concepts,** integrating smart stormwater systems, reviving urban wetlands, and implementing flood-resilient architecture. Community-led initiatives can further enhance resilience and protect urban areas.

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Revitalizing Multilateralism: Pathways to Global Reform

This editorial is based on "Summit of the Future: The UN at a crossroads" which was published in The Hindu on 16/09/2024. The article highlights the upcoming UN Summit of the Future as a pivotal moment for global governance, with the "Pact for the Future" aiming to address UN reforms. While challenges remain, the summit offers a chance for meaningful change if member states commit to concrete actions beyond superficial agreements.

Tag: GS Paper - 2, Effect of Policies & Politics of Countries on India's Interests, Important International Institutions, International Treaties & Agreements

The upcoming **United Nations Summit of the Future** on **22nd-23rd September**, **2024**, comes at a critical juncture for global governance. With faith in multilateralism at a low point following crises like the **Covid-19 pandemic** and conflicts in **Ukraine and Gaza**, the summit's centerpiece—the **Pact for the Future**—aims to outline a vision for UN reform and global cooperation.

However, skeptics question whether this summit can truly address the UN's long standing structural issues, particularly the **Security Council's outdated power structure.**

Despite the challenges, the summit offers a rare opportunity for collective action on global issues and could catalyze **real reform within the UN system.** The inclusion of civil society and private sector actors in discussions may breathe new life into **multilateralism**. However, the summit's success will ultimately **depend on member states' willingness to move beyond superficial consensus** and **make concrete commitments**. While the Pact for the Future may not bring immediate transformative change, it could serve as a starting point for **rejuvenating global governance and demonstrating that multilateralism, though weakened, is far from dead.**

What is the Significance of Multilateral Institutions?

➢ **Conflict Resolution and Peacekeeping**: Multilateral institutions play a crucial role in conflict prevention and resolution.

○ Since 1948, **UN peacekeeping operations have been deployed 71 times**, helping to end conflicts and foster stability in many regions.

○ As of May 2023, 87,000 women and men are serving as peacekeepers in **12 conflict zones across Africa, Asia, Europe, and the Middle East**.

➢ **Economic Stabilization**: Institutions like the **International Monetary Fund** (IMF) and World Bank are pivotal in maintaining global economic stability.

○ During the 2008 financial crisis, the IMF committed over **USD 250 billion in loans to help stabilize economies.**

○ More recently, the IMF is currently lending close to **USD 200 billion** to over 35 countries, notably: **Argentina, Ecuador, Egypt, Iraq, Jordan, Tunisia, Ukraine** and 16 countries in Sub-Saharan Africa.

➢ **Global Health Management:** The **World Health Organization (WHO)** stands at the forefront of global health crises.

○ During the **Covid-19 pandemic**, the WHO coordinated the largest vaccine distribution in history through **COVAX.**

○ The organization's efforts in **eradicating smallpox (declared in 1980)** and **reducing polio cases by 99% since 1988** demonstrate its long-term impact on global health.

- ○ The **WHO's International Health Regulations** provide a framework for **196** countries to work together on containing health threats.
- ➤ **Climate Change Mitigation:** Multilateral environmental agreements, facilitated by institutions like the **UN Framework Convention on Climate Change (UNFCCC),** are crucial in addressing climate change.
  - ○ The **Paris Agreement,** adopted by 196 parties in 2015, set a global framework to limit global warming to well below 2°C.
  - ○ The **Montreal Protocol** has proven to be innovative and successful, and it is the **first treaty to achieve universal ratification** by all countries in the world
- ➤ **Human Rights Advocacy:** The **UN Human Rights Council** and other multilateral bodies play a vital role in promoting and protecting human rights globally.
  - ○ The **Universal Periodic Review** process has assessed the human rights records of all 193 UN member states since its inception in 2008.
  - ○ These institutions provide mechanisms for global accountability and standard-setting in human rights.
- ➤ **Sustainable Development:** The **UN's Sustainable Development Goals (SDGs),** adopted by all member states in 2015, provide a shared blueprint for peace and prosperity.
  - ○ The goals have mobilized efforts to end extreme poverty, with the **global extreme poverty rate falling from 36% in 1990 to 8.4% in 2019.**
  - ○ Multilateral development banks like the World Bank Group committed **USD 157 billion in 2020-2021** to help developing countries address **health, economic, and social impacts of the Covid-19 pandemic,** showcasing their role in global development efforts.
- ➤ **International Standard Setting:** Multilateral institutions are instrumental in establishing global norms and standards.
  - ○ The **International Labour Organization (ILO)** has adopted various conventions setting labor standards.
  - ○ The International Civil Aviation Organization (ICAO) sets standards that have **made air travel one of the safest modes of transport.**
- ➤ **Scientific and Educational Advancement:** Organizations like **UNESCO** play a crucial role in promoting international collaboration in education, science, and culture.

- ○ As of **July 2024**, a total of **1,199 World Heritage Sites** (933 cultural, 227 natural, and 39 mixed properties) exist across **168 countries.**
  - ● The organization's efforts in education have contributed to global literacy rates rising from 12% in 1820 to 87% in 2020.
  - ● **CERN (European Organization for Nuclear Research)**, a prominent example of scientific multilateralism, led to groundbreaking discoveries like the **Higgs boson in 2012.**

Why the Role of Multilateral Institutions Are Diminishing?

- ➤ **Shifting Global Power Dynamics:** The post-World War II order that gave birth to many multilateral institutions is crumbling **as power shifts from West to East.**
  - ○ **China's rise as an economic powerhouse,** India's growing influence, and the **resurgence of Russia** have challenged the dominance of Western-led institutions.
  - ○ The **BRICS group** (Brazil, Russia, India, China, and South Africa) has expanded, now representing **37.3% of global GDP.**
    - ● This shift has led to the creation of alternative institutions like the **Asian Infrastructure Investment Bank (AIIB),** which now has 109 members.
- ➤ **Rise of Sovereignty Prioritization:** There's a growing trend of nations prioritizing sovereignty over multilateral commitments.
  - ○ **Brexit, with the UK leaving the EU after 47 years**, exemplifies this shift.
  - ○ The rise of populist and nationalist leaders worldwide has **fueled skepticism towards global institutions.**
  - ○ For instance, the former US President's **"America First" policy** led to withdrawals from the **Paris Climate Agreement.**
- ➤ **Institutional Decision-Making Paralysis:** Multilateral institutions often struggle with decision-making paralysis due to their consensus-based approach.
  - ○ The **UN Security Council's inability** to act decisively on conflicts like **Syria** (with over 300,000 deaths since 2011) due to veto power illustrates this problem.
    - ● Since 2011, Russia has cast 19 vetoes, **14 of which were on Syria.**

○ The **World Trade Organization's Doha Round negotiations,** launched in 2001, **remain unresolved** after two decades, showcasing the difficulty in reaching agreements on complex global issues.

○ This inefficiency has led countries to **pursue bilateral or regional agreements** instead.

➢ **Technological Adaptation Lag:** Traditional multilateral institutions are struggling to keep pace with rapid technological advancements.

○ Issues like **cryptocurrency** regulation, **artificial intelligence governance, and cybersecurity threats** require agile responses that bureaucratic institutions often can't provide.

○ The lack of a **cohesive global approach to AI regulation**, despite its potential to reshape economies and societies, further underscores this challenge.

➢ **Declining Public Trust:** Public trust in multilateral institutions has been declining, fueled by **perceptions of elitism and lack of transparency**.

○ The World Bank's controversial **"Doing Business" report scandal in 2021**, which led to its discontinuation, further eroded trust in international financial institutions.

○ This trust deficit makes it **harder for multilateral bodies to garner support for their initiatives and policies.**

➢ **Financial Constraints:** Many multilateral institutions face chronic underfunding, limiting their ability to address global challenges effectively.

○ The **UN's regular budget for 2022** was just **USD 3.12 billion,** less than the annual revenue of many multinational corporations.

○ This financial constraint forces institutions to **rely more on voluntary contributions,** potentially compromising their independence and ability to set long-term agendas.

➢ **Representation Imbalances**: Many multilateral institutions still reflect the power dynamics of the mid-20th century, **leading to questions about their legitimacy.**

○ The **UN Security Council's permanent members** have not changed since 1945, despite significant shifts in global power.

- Countries like **India, Brazil, Germany, and Japan,** which are prominent contenders for permanent seats, still remain excluded from the panel.

○ The IMF's voting share still favors Western countries. African countries still have very little say in decision-making in the World Bank and the IMF with **less than a 10 percent vote share in the IMF board**.

○ This lack of representation fuels resentment and pushes emerging powers to seek alternative forums for global engagement.

➢ **Siloed Approach to Global Issues:** The compartmentalized nature of many multilateral institutions makes it difficult to address complex, interconnected global challenges.

○ **Climate change**, for example, requires coordination between environmental, economic, and social bodies.

○ Yet, the fragmented approach often leads to ineffective responses.

○ The UN system alone has **over 15 separate agencies** working on aspects of climate change, often with **overlapping mandates and competing priorities, hampering a cohesive global strategy.**

What Strategies can be Implemented to Reform Multilateral Institutions?

➢ **Rebalancing the Power Equation:** Reform voting structures to better reflect current global economic and demographic realities.

○ For instance, **updates are needed in the UN Security Council composition** to include emerging powers like **India, Brazil, Japan and African representation.**

○ Implement **weighted voting systems in institutions like the IMF and World Bank** that dynamically adjust based on GDP, population, and other relevant factors.

○ The African Union's push for Security Council reform and the **G20's inclusion of the AU as a permanent member in 2023** demonstrate growing momentum for such changes.

➢ **Embracing Digital Democracy:** Implement secure digital platforms for more inclusive global decision-making processes.

○ Use **blockchain technology** to ensure transparent voting and decision-tracking in multilateral forums.

○ Develop **AI-powered translation services** to break language barriers in real-time during international meetings.

○ **Estonia's e-governance model**, which allows citizens to vote and access government services online, could serve as inspiration for digital integration in global institutions.

➤ **Adaptive Coalition Formation:** Encourage the formation of issue-specific coalitions within multilateral frameworks to address urgent global challenges. These coalitions can act more swiftly than larger, consensus-based bodies.

○ The **High Ambition Coalition for Nature and People, which successfully pushed for the 30x30 target in the Global Biodiversity Framework**, demonstrates the effectiveness of such flexible arrangements.

➤ **Localization of Global Goals:** Develop mechanisms to translate global agreements into local action more effectively.

○ **Create direct funding channels from multilateral institutions to local governments** and civil society organizations for implementing global initiatives.

○ Expand programs like the **UN Global Compact Cities Programme** to enhance urban participation in global governance.

➤ **Enhanced Transparency Measures:** Implement comprehensive open data policies across all multilateral institutions.

○ Establish **audit committees with rotating membership** from different countries to oversee institutional operations.

○ The **International Aid Transparency Initiative (IATI),** which makes data on aid spending openly available, could be expanded to cover all aspects of multilateral operations.

○ Develop user-friendly dashboards and regular public reporting mechanisms to enhance accountability.

➤ **Multi-Stakeholder Engagement:** Formalize mechanisms for private sector and civil society participation in multilateral decision-making processes.

○ The **World Economic Forum's model of multi-stakeholder engagement** could be adapted for formal multilateral institutions.

○ Expand initiatives like the **UN Global Compact** to create more binding commitments for corporate participation in global governance.

➤ **Crisis Response Readiness**: Develop dedicated rapid response units within multilateral institutions with pre-approved funding and authority to act in emergencies.

○ Create a global emergency coordination platform that integrates data and resources from various agencies and countries.

○ Implement **regular global crisis simulation exercises** involving multiple institutions and countries.

➤ **Comprehensive Digital Governance:** Develop a comprehensive global digital governance framework addressing issues like **cybersecurity, data privacy, and AI ethics.**

○ Create a dedicated agency for digital affairs to coordinate international efforts.

○ The **Budapest Convention on Cybercrime,** the first international treaty on crimes committed via the Internet, could serve as a foundation for broader digital governance efforts.

What Role can India play in Reforming Multilateral institutions?

➤ **Bridging Developed and Developing Worlds:** India, with its unique position as both a developing country and an emerging economic powerhouse, can serve as a crucial bridge between the Global North and South.

○ As the **world's most populous country and fifth-largest economy**, India's perspective is invaluable in ensuring equitable global governance.

○ India's leadership of the **G20 in 2023,** where it championed issues like **digital public infrastructure** and **climate finance** for developing countries, exemplifies this bridging role.

○ The country's "**One Earth, One Family, One Future**" **G20 theme** resonated with both developed and developing nations, showcasing India's potential to foster global unity.

➤ **Strengthening Global Democratic Processes:** As the world's largest democracy, India can play a pivotal role in strengthening democratic processes within multilateral institutions.

○ India's experience in **managing diverse opinions and interests in a democratic framework** can inform reforms in global decision-making processes.

○ The **2024 Indian general election** is a massive democratic exercise unmatched in scale globally and historically, offers lessons for enhancing transparency and efficiency in global governance mechanisms.

➢ **Digital Innovation Leadership:** India's prowess in information technology and its successful implementation of **large-scale digital initiatives position it as a leader in leveraging technology for global governance.**

  ❍ **India's Aadhaar system,** the world's largest biometric ID program offers a model for digital identity solutions globally.

  ❍ In 2023, India's **Unified Payments Interface** handled 117 billion financial transactions totalling 2.19 trillion dollars in value.

    ● India can lead efforts to create similar platforms for international cooperation.

➢ **Climate Action Catalyst:** As both a **major emitter** and a country highly vulnerable to climate change, India can play a crucial role in shaping equitable climate action within reformed multilateral frameworks.

  ❍ India's commitment to achieve net-zero emissions by 2070, coupled with its ambitious renewable

  ❍ The **International Solar Alliance,** initiated by India, now has **110 member countries** and exemplifies India's capacity to create new multilateral mechanisms for sustainable development.

➢ **Peacekeeping Operations Expertise**: India's extensive experience in UN peacekeeping operations positions it to play a key role in reforming global security mechanisms.

  ❍ As one of the largest contributors to UN peacekeeping, having deployed over **200,000 troops in 49 missions,** India can advocate for more effective and responsive peacekeeping strategies.

    ● India has a long history of supporting female peacekeeping and was the first country to send an **all-female contingent to a UN force**, in **Liberia in 2007.**

  ❍ India's concept of "**human-centric**" **peacekeeping**, which focuses on capacity building and community engagement, can inform broader reforms in conflict resolution approaches.

➢ **Vaccine Diplomacy Leader:** India's role as the **"pharmacy of the world"** and its vaccine diplomacy efforts position it to lead reforms in global health governance.

  ❍ During the Covid-19 pandemic, India supplied vaccines to over 150 countries, demonstrating its capacity for global health leadership.

  ❍ India can advocate for reforms in the WHO to **enhance epidemic preparedness** and ensure equitable access to medicines and vaccines globally.

➢ **Cultural Diplomat:** India's rich cultural heritage and its philosophy of **"Vasudhaiva Kutumbakam" (the world is one family)** provide a unique foundation for fostering global cooperation.

  ❍ In reformed multilateralism, India can champion initiatives that promote cultural exchange and mutual understanding, crucial for effective global governance.

  ❍ India's proposal for a **UNESCO Heritage Site** **dedicated to the shared heritage of democracy** worldwide is an example of how it can use cultural diplomacy to strengthen multilateral cooperation.

Conclusion:

While multilateral institutions face numerous challenges in adapting to the shifting global order, the upcoming **UN Summit of the Future** provides a crucial opportunity for revitalizing global governance. The success of reform efforts will hinge on the **willingness of member states to embrace meaningful change. India**, with its growing global stature, is well-positioned to lead and bridge divides, pushing for a more inclusive and effective multilateral system that addresses contemporary challenges.

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India's Semiconductor Ambitions

This editorial is based on "Securing India's semiconductor future" which was published in The HinduBusiness Line on 18/09/2024. The article highlights India's strategic push to build a domestic semiconductor ecosystem to reduce reliance on imports and strengthen national security, driven by the Semiconductor Mission and PLI scheme. However, challenges like high investment costs and resource management issues persist, but the effort is crucial for securing a place in the global electronics value chain.

Tag: GS Paper - 3, Achievements of Indians in Science & Technology, IT & Computers, Nanotechnology, Robotics, Indigenization of Technology, Intellectual Property Rights (IPRs)Technology Missions, Scientific Innovations & Discoveries, Infrastructure

India is making a strategic push to establish a **domestic semiconductor ecosystem**, driven by the need to reduce reliance on imports and mitigate global supply chain vulnerabilities. The government launched the **Semiconductor Mission** in 2021 with **a USD 10 billion investment**. This move is crucial for national security, especially in sensitive sectors like defense and telecom. Recent geopolitical tensions and the **Covid-19 pandemic** have highlighted the risks of over-dependence on foreign semiconductor supplies, particularly from countries like **Taiwan, Japan, and South Korea.**

While India has made progress with initiatives like the **Production-Linked Incentive (PLI)** scheme, significant challenges remain. Establishing semiconductor fabs is **capital-intensive,** requiring billions of dollars in investment and presenting resource management challenges, particularly regarding water usage. Despite these hurdles, India's push into semiconductors is a long-term strategic effort aimed at securing a position in the global electronics value chain and enhancing technological self-reliance.

SEMICONDUCTORS

Semiconductors are materials having conductivity between conductors and insulators

EXAMPLES
- **Pure Elements:** Silicon and Germanium
- **Compounds:** Gallium Arsenide and Cadmium selenide

SIGNIFICANCE
- Essential to almost all sectors of the economy – **aerospace, automobiles, communications, clean energy, information technology** and **medical devices** etc.

SEMICONDUCTORS AND INDIA
- **India Imports from: China, Taiwan, USA** and **Japan**
- **Indian Semiconductor Market:** Expected to reach **USD 55 bn** by **2026**

SCHEMES
- **Production-Linked Incentive (PLI) scheme**
- **Design Linked Incentive (DLI) Scheme**
- Scheme for Promotion of Manufacturing of Electronic Components and Semi-conductors (SPECS)

OBJECTIVES
- Encourage semiconductor and display manufacturing in the country.
- Nurture >20 domestic companies in semiconductor design Achieve a turnover of > Rs.1500 crore in next 5 years
- Manufacture electronics components and semiconductors

INDIA'S SEMICONDUCTOR MISSION (ISM)

VISION
- Build a **vibrant semiconductor** and **display design** and **innovation ecosystem**

LAUNCHED
- 2021

NODAL MINISTRY
- Ministry of Electronics and Information Technology (MeitY)

TOTAL FINANCIAL OUTLAY
- Rs 76,000 crore

COMPONENTS
- Scheme for setting up of Semiconductor Fabs
- Scheme for setting up of Display Fabs
- Scheme for setting up of Compound Semiconductors/Silicon Photonics/ Sensors (including MEMS) Fabs/ Discrete Semiconductors Fab and Semiconductor ATMP/OSAT
- DLI Scheme

Drishti IAS

What is the Current Status of the Semiconductor Industry in India?

➤ **Current Status of the Semiconductor Industry in India**
  ○ **2022 Market Size: USD 26.3 billion**
  ○ **Projected Growth:** Expected to reach **USD 271.9 billion by 203**2, with a CAGR of 26.3%.

➤ **Import-Export Scenario**
  ○ **Imports:**
    ● **2021:** USD 5.36 billion
    ● India remains a net importer, although efforts are underway to reduce dependence.
  ○ **Exports:**
    ● **2022:** USD 0.52 billion (highest to date).

➤ **Government Initiatives**
  ○ **India Semiconductor Mission (ISM):** A dedicated division under Digital India Corporation to build a robust semiconductor and display ecosystem.
    ● Fiscal support of **50% of the project cost for semiconductor fabs and display fabs.**
  ○ **Semicon India Programme:** Launched in December 2021 with an allocation of ₹76,000 crore ($9.2 billion) to boost semiconductor and display manufacturing.
    ● Budget for FY24 increased to **₹6,903 crore ($833.7 million)** to support further development.
  ○ **International Collaborations:**
    ● MoU with the European Commission to strengthen semiconductor ecosystems as part of the **EU-India Trade and Technology Council.**
    ● MoC with Japan to bolster **semiconductor supply chain resilience** between the two nations.

What is the Significance of Semiconductors for India?

➤ **Economic Growth and Industrial Development:** Semiconductors are crucial for India's economic growth, particularly in the electronics manufacturing sector.
  ○ The global semiconductor market is projected to reach **USD 1 trillion by 2030,** and India aims to capture a significant share.
  ○ The government's **USD 10 billion Semiconductor Mission** launched in 2021 is expected to generate **35,000 high-quality jobs** and **indirect employment for 100,000 people.**

  ○ Successful implementation could boost India's electronics manufacturing to **USD 300 billion by 2026.**

➤ **National Security and Strategic Autonomy:** Semiconductors are vital for national security, especially in defense and telecommunications sectors.
  ○ The role of semiconductors in national security and strategic autonomy is increasingly vital as these tiny electronic components power everything from smartphones and computers to **advanced military systems and critical infrastructure.**
  ○ By developing domestic semiconductor capabilities, India can ensure a **stable supply for critical defense systems** and secure communication networks.

➤ **Technological Self-Reliance and Innovation:** Developing a robust semiconductor ecosystem can significantly enhance India's technological self-reliance.
  ○ Currently, India imports about **65-70% of electronic components,** mainly from China.
  ○ The semiconductor push, including initiatives like the **Design Linked Incentive (DLI) scheme,** aims to foster domestic innovation and reduce import dependence.
  ○ This is crucial for emerging technologies like **5G, artificial intelligence, and quantum computing.**

➤ **Global Supply Chain Integration:** India's semiconductor initiatives aim to position the country as a key player in the global electronics supply chain.
  ○ Currently, **India contributes only about 3% to the global electronics manufacturing** value chain.
  ○ The government's policies, including **Production-Linked Incentives (PLI)**, are designed to attract global players and integrate India into international supply networks.

➤ **Job Creation and Skill Development:** The semiconductor industry, while **capital-intensive,** has the potential to create high-quality jobs and drive skill development in India.
  ○ More importantly, it can spur the development of a skilled workforce in cutting-edge technologies.
  ○ The industry's requirements for specialized skills in areas like **chip design, nanofabrication, and advanced packaging** are likely to boost STEM education and research in Indian institutions.

What are the Key Roadblocks in India's Semiconductor Dream?

➢ **Infrastructure Challenges:** India's **vast geographical area and uneven development** have posed significant infrastructure challenges for the semiconductor industry.

  ❍ The **lack of reliable power supply, water scarcity, and inadequate transportation** facilities can hinder the establishment and operation of semiconductor manufacturing plants.

  ❍ For instance, during the **recent 2024 heatwave in India,** many regions experienced power shortages, affecting **industrial activities, including semiconductor manufacturing.**

➢ **Talent Gap:** The semiconductor industry requires highly skilled professionals with expertise in various domains, such a**s chip design, manufacturing, and testing.**

  ❍ India, despite its large pool of engineering talent, faces a shortage of semiconductor experts.

    ● A recent study found that India will face **a shortage of 250,000 to 300,000 semiconductor professionals** by 2027.

  ❍ This gap can hinder the development of a robust semiconductor ecosystem and limit the country's ability to attract global semiconductor manufacturers.

➢ **High Manufacturing Costs:** Semiconductor manufacturing is a capital-intensive industry with high operational costs.

  ❍ The cost of setting up and running a semiconductor fabrication plant in India can be significantly higher than in established manufacturing hubs like **Taiwan, South Korea, and the United States.**

    ● The import semiconductor manufacturing price index rose **4.9% in 2021** and increased a further **2.4% in 2022.**

  ❍ This cost differential can make India less attractive to global semiconductor companies, limiting their investments in the country.

➢ **Global Supply Chain Dynamics:** The semiconductor industry is highly interconnected and dependent on a global supply chain.

  ❍ Disruptions in this supply chain, such as those caused by **geopolitical tensions or natural disasters,** can have significant implications for India's semiconductor ambitions.

    ● The **Russia-Ukraine conflict's impact on neon supply**, essential for chip manufacturing, highlighted this vulnerability

  ❍ India's ability to secure a reliable supply of raw materials, components, and technology is crucial for its success in the semiconductor industry.

➢ **Environmental Concerns**: The semiconductor industry is energy-intensive and can have environmental impacts, such as water consumption and greenhouse gas emissions.

  ❍ Semiconductor manufacturing contributes to **31% of global greenhouse gas** emissions, and the increasing usage of electronic chips drives this upward trend.

    ● The production of **smart meters and other electronics** requires a substantial amount of electricity and fossil fuels.

  ❍ India's efforts to promote sustainable development and address environmental concerns can create additional challenges for the semiconductor sector.

➢ **Competition from Other Emerging Markets:** India faces competition from other emerging markets, such as **Vietnam, Malaysia, and Indonesia**, which are also seeking to attract semiconductor investments.

  ❍ Malaysia has secured a crucial place in the **first wave of semiconductor competition**, successfully attracting companies like **Infineon**.

  ❍ These countries may offer more favorable incentives, infrastructure, and talent pools, making them more attractive to global semiconductor companies.

What Steps can India Undertake to turn its Semiconductor Vision into a Reality?

➢ **Enhance Semiconductor Education and Training:**India should significantly expand and upgrade semiconductor engineering programs at universities and technical institutes.

  ❍ This could involve **partnerships with global semiconductor companies** to develop industry-relevant curricula and provide hands-on training.

  ❍ For example, the **Indian Institute of Science (IISc) in Bangalore could collaborate with Taiwan Semiconductor Manufacturing Company Limited** to create a specialized semiconductor fabrication program, complete with a state-of-the-art clean room facility for practical learning.

➢ **Develop Indigenous Chip Design Capabilities:** India should invest heavily in **chip design capabilities**, leveraging its existing software expertise.

○ The government could establish dedicated chip design centers in tech hubs like **Bangalore, Hyderabad, and Pune**, providing infrastructure and incentives for startups and established firms.

○ For instance, the **recent success of Shakti, an open-source RISC-V processor developed by IIT Madras,** demonstrates India's potential in this area. Expanding such initiatives could lead to the development of India-specific chip designs for various applications.

➢ **Create a Robust Semiconductor Supply Chain:** India needs to build a comprehensive semiconductor supply chain within the country.

○ This involves attracting investments in various segments, from **raw material production to advanced packaging.**

○ India could establish <u>Special economic zones</u> **(SEZs) dedicated to semiconductor ecosystem** development, offering tax breaks and streamlined regulations to attract global players like **Applied Materials or Lam Research.**

➢ **Establish a Sovereign Semiconductor Fund:** India could create a dedicated sovereign fund specifically for semiconductor investments.

○ This fund would provide **long-term capital for semiconductor projects,** reducing reliance on foreign investments.

○ This approach has been **successful in countries like South Korea**, where the government's active financial support has been crucial in building a robust semiconductor industry.

○ The fund could prioritize investments in **cutting-edge technologies like 3nm and 2nm chip fabrication**, positioning India at the forefront of semiconductor innovation.

➢ **Implement a "Chip Diplomacy" Strategy:** India should leverage its geopolitical position and large market to **negotiate technology transfers and partnerships with leading semiconductor nations**.

○ This could involve offering preferential market access or strategic partnerships in exchange for semiconductor technology and expertise.

○ For instance**, India could work with Japan to establish a joint semiconductor research center**, focusing on advanced packaging technologies.

○ This approach aligns with **India's recent efforts to strengthen ties with technologically advanced nations** and could help bypass some of the challenges in acquiring semiconductor technology independently.

➢ **Develop a "Green Semiconductor" Initiative:** India could position itself as a leader in environmentally sustainable semiconductor manufacturing.

○ This initiative would focus on developing and implementing technologies that **reduce water usage, lower energy consumption, and minimize chemical waste** in semiconductor production.

○ For instance, India could partner with companies like Applied Materials to set up a **pilot fab that uses recycled water and renewable energy sources**.

● This approach not only addresses environmental concerns but also **aligns with global trends towards sustainable manufacturing,** potentially attracting environmentally conscious investors and partners.

➢ **Establish a National Semiconductor Commons:** India should create a shared infrastructure model for semiconductor research and prototyping.

○ This "Semiconductor Commons" would provide **access to expensive equipment and facilities** that startup companies or institutions might not be able to afford.

○ For example, a national network of **nanofabrication facilities** could be established, similar to theThe National Nanotechnology Infrastructure Network (NNIN) in the US.

○ This would lower the barrier to entry for startups and researchers, fostering innovation in chip design and manufacturing processes.

○ The commons could also serve as **a platform for collaboration between academia, industry, and government,** accelerating the pace of semiconductor innovation in India.

Conclusion:

To realize its semiconductor ambitions, **India must enhance its education and training in chip design,** develop a robust domestic supply chain, and pursue strategic international collaborations. By addressing infrastructure and talent gaps, while also fostering sustainable practices, India can secure its place as a **key player in the global semiconductor industry and achieve technological self-reliance.**

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Rerouting Indian Railways' Future

This editorial is based on "Roadblocks to Indian Railways' 'Mission 3,000 MT" which was published in Economics and Political Weekly on 14/09/2024. The article highlights the significant decline in Indian Railways' freight transport share and its impact on India's net-zero ambitions. It emphasizes the need for strategic reforms and capacity enhancements to achieve the National Rail Plan's freight targets by 2030-31.

Tag: GS Paper - 3, Fiscal Policy, Government Budgeting, Mobilization of Resources, Investment Models, Inclusive Growth

Indian Railways, operating the **world's fourth-largest rail network,** has been facing significant challenges in maintaining its dominance in the country's transportation sector. Despite an increase in route kilometers and track length since 1950, **its share in freight transport has declined dramatically from 85% in 1951 to less than 30% in 2022.** This decline poses a serious challenge to India's net-zero ambitions and efforts to decarbonize the transport sector. The **National Rail Plan** aims to reverse this trend by targeting a **45% rail share in freight transport by 2030-31**, with an ambitious goal of 3,600 million tonnes of freight loading.

However, the railway's performance indicators reveal concerning trends. The growth rates of passenger and freight movement have slowed, particularly during the **Twelfth Five-Year Plan period (2012-13 to 2016-17)**, indicating a decoupling of GDP and traffic performance. To achieve its ambitious targets, Indian Railways needs to transform its business strategies, diversify revenue sources, and address capacity constraints and service quality issues.

What is the Significance of Railways for India?

➢ **Economic Backbone:** Indian Railways plays a pivotal role in India's economic development, acting as a crucial link in the supply chain.
  ○ It transported **1,512 million tonnes of freight in 2022-23,** contributing significantly to industrial and agricultural growth.
  ○ The establishment of **Dedicated Freight Corridors**, or DFCs, is expected to lower logistics costs through the use of higher axle load trains

➢ **Driver in Achieving India's Climate Goals:** As India strives to meet its **Nationally Determined Contribution (NDC)** target of reducing emission intensity of GDP by **45% from 2005 levels by 2030**, railways emerge as a key player in sustainable transportation.
  ○ Rail transport is significantly more energy-efficient than road transport, with rail freight **generating less than one-fifth of the greenhouse gas emissions of road transport per ton kilometer**
  ○ The shift from road to rail for freight transport could significantly contribute to India's climate goals.

➢ **Affordable Mobility:** Indian Railways serves as a great social equalizer by providing affordable transportation to millions of Indians.
  ○ The railways' revenue earnings were up by **73% in the passenger segment during April-January 2023.**
  ○ The railways' tiered pricing system ensures accessibility across economic strata.

➢ **Bolstering National Security and Integration:** Railways play a crucial role in national security and integration.
  ○ They are vital for **rapid mobilization of troops and equipment to border areas**. The strategic importance is evident in projects like the **Bilaspur-Manali-Leh rail line,** which will provide all-weather connectivity to the Ladakh region.
  ○ Additionally, railways foster national integration by facilitating cultural exchange and tourism.
    ● The recently launched **Bharat Gaurav trains, showcasing India's cultural heritage**, are an example of how railways contribute to national identity and tourism.

➢ **Urban Lifeline:** Railway-based urban transport systems are reshaping India's cities. Over the last 10 years, **700 km of new metro lines have been made operational,** bringing the total operational length to 945 km, and extending metro services to **21 cities across the country,**
  ○ These systems are crucial for sustainable urban development, reducing traffic congestion and air pollution.
  ○ For instance, Delhi Metro, **carrying about 6.5 million passengers daily, has** helped **reduce CO_2 emissions annually.**
  ○ The integration of metro systems with other modes of transport is creating efficient urban mobility ecosystems.

➢ **Bridging the Urban-Rural Divide:** Railways act as a catalyst for balanced regional development. Projects

like the **Northeast Frontier Railway's** expansion have opened up remote areas for economic activities.

- ❍ The **111 km Jiribam-Imphal railway line**, once completed, will be a game-changer for Manipur's connectivity and economy.
- ❍ Such projects not only improve connectivity but also bring ancillary development in **education, healthcare, and local industries,** helping bridge the urban-rural divide.

What are the Major Issues Related to Indian Railways?

- ➢ **Declining Modal Share in Freight Transport:** Indian Railways has experienced a significant decline in its share of freight transport, from **85% in 1951 to less than 30% in 2022.**
  - ❍ This shift poses challenges to India's environmental goals and transport sector efficiency.
  - ❍ The National Rail Plan aims to increase rail's freight share to **45% by 2030-31,** but current projections fall short.
    - ● For instance, even with an optimistic **7% CAGR,** annual freight loading is projected to reach **only 2,598 MT by 2030-31**, far below th**e 3,600 MT target.**
    - ● This decline reflects broader issues of competitiveness and adaptability in the face of changing economic structures and transportation needs.
- ➢ **Financial Performance and Operating Ratio:** The railway's financial health has been deteriorating, as evidenced by its **increasing operating ratio (OR).**
  - ❍ The OR has risen from a low of **78.7% in 2006-07** to **breaching the 100% threshold in 2021-22**.
    - ● This means **Indian Railways is spending more than it earns**, raising serious concerns about its financial sustainability.
  - ❍ The **Comptroller and Auditor General of India** has also flagged that the reported OR may not reflect the true financial performance.
    - ● For instance, in 2019-20, if actual pension expenditures were considered, the OR would have been **114.35%** instead of the reported **98.36%,** indicating a more severe financial strain than officially acknowledged.
- ➢ **Over-reliance on Coal for Revenue:** Indian Railways heavily depends on coal transport for its freight

revenue, **with coal contributing 47% of freight earnings in 2021-22.**

- ❍ This over-reliance poses a significant risk as India moves towards renewable energy sources.
- ❍ The Ministry of Power's recent directive (January 2023) to use **"Rail-Ship-Rail" mode for coal transport** to certain states may further reduce revenue from coal transport.
  - ● The lack of diversification in freight revenue sources makes Indian Railways vulnerable to shifts in energy policy and market demands, potentially impacting its long-term financial stability.
- ➢ **Capacity Constraints and Infrastructure Limitations:** Despite increasing its running track length from 51,315 km in 1950-51 to **102,831 km in 2021-22**, Indian Railways faces significant capacity constraints.
  - ❍ This limits its ability to meet growing transportation demands and compete with other modes.
  - ❍ The **pace of network expansion has not kept up with overall freight demand** growth in the economy.
  - ❍ This has contributed to the **declining share of railways in freight movement,** particularly for bulk commodities.
  - ❍ For example, despite price inelasticity, the **share of railways in cement transport declined from 2005-06 to 2019-20,** indicating that factors beyond pricing, such as capacity and service quality, are influencing shipper choices.
- ➢ **Technological Adaptation Lag:** Indian Railways faces challenges in adopting new technologies and modernizing its operations to meet evolving market demands.
  - ❍ The **container service, along with other goods,** contributes **only 12% to freight loading** and has remained stagnant.
  - ❍ This indicates **a lag in adapting to changing freight patterns**, especially in high-value sectors like automobiles.
  - ❍ **Kavach**, an automated train protection safety system aimed at preventing collisions on the same track, remains **largely unimplemented.**
    - ● It's been 4 years since the Indian Railways began deploying the device, yet by early August,2024 **Kavach** had been installed **only on 1,456 km of the South Central Railway,**

accounting for just **3% of the national rail network.**

➤ **Safety Concerns and Derailments:** Indian Railways continues to grapple with safety issues, particularly derailments.

  ○ There has been an average of **44 consequential train accidents every yea**r in the five-year period ending 2022-23.

    ● The **Balasore triple train crash** in **June 2023,**and **Sabarmati Express Derailment in August 2024** highlighted persistent safety vulnerabilities.

  ○ Factors contributing to derailments include **outdated track infrastructure, human error, and signal failures.**

    ● The **railways' target of "zero accidents" remains elusive**, necessitating continued focus on track renewals, modern signaling systems, and enhanced safety protocols.

➤ **Slow Progress in High-Speed Rail Projects:** India's ambitious high-speed rail projects, particularly the **Mumbai-Ahmedabad bullet train corridor,** have faced significant delays and cost escalations.

  ○ Originally planned to be operational by 2023, the project's completion date has been **pushed to 2028** due to land acquisition issues.

  ○ The slow progress in high-speed rail implementation **puts India behind global competitors** and delays the modernization of rail transport, affecting long-term competitiveness and economic growth.

➤ **Human Resource Management and Skill Gaps:** Indian Railways, one of the world's largest employers, faces challenges in human resource management and skill development.

  ○ There's a **growing skill gap** as the railway modernizes its operations. For instance, the introduction of **semi-high-speed trains like Vande Bharat** requires specialized skills in maintenance and operations.

  ○ Union Railway Minister stated in Rajya Sabha that more than **2.50 lakh posts** remain vacant in the Indian Railways as of **July, 2023.**

  ○ Addressing these vacancies while ensuring the workforce is equipped with relevant skills for modern railway operations is a significant challenge.

Key Committees Related to Reforms in Indian Railways

➤ **Vinod Rai Committee (2015):**

  ○ Establish an independent Railway Safety Authority with statutory powers.

  ○ Create a Railway Accident Investigation Board for impartial inquiries.

  ○ Form a separate Railway Infrastructure Company to manage assets.

  ○ Introduce a performance-linked incentive scheme for railway employees.

➤ **Rakesh Mohan Committee (2010):**

  ○ Revamp the accounting system to follow Indian GAAP.

  ○ Expand into FMCG, IT, containerized cargo, and automobile sectors.

  ○ Prioritize long-distance transport, speed upgrades, and high-speed rail corridors.

  ○ Enhance connectivity to industry clusters and major ports.

  ○ Develop logistics parks at key hubs.

What Measures can be Adopted to Revitalize Indian Railways?

➤ **Implement Advanced Traffic Management Systems:** Indian Railways should accelerate the deployment of advanced traffic management systems like **Kavach across its network.**

  ○ This automated train protection system can **significantly improve safety and operational efficiency.**

  ○ For example, expanding Kavach beyond the current 1,456 km to cover at least 20% of the network within the next two years could **drastically reduce collision risks.**

  ○ This implementation should be **prioritized on high-traffic corridors and accident-prone sections.**

    ● The system could be integrated with **AI-powered predictive maintenance** tools to proactively identify potential track or signal failures, further enhancing safety and reducing downtime.

➤ **Diversify Freight Portfolio and Enhance Logistics Services:** To reduce dependence on coal transport and adapt to changing market demands, **Indian Railways should aggressively diversify its freight portfolio.**

○ This could involve developing specialized services for **high-value, time-sensitive goods like pharmaceuticals, electronics, and perishables**.

○ For instance, creating a network of **temperature-controlled containers** and dedicated express freight corridors could attract new customers from these sectors.

○ Additionally, **partnering with e-commerce giants to create specialized rail-based logistics solutions** could tap into the growing online retail market.

➢ **Accelerate High-Speed Rail and Semi-High-Speed Projects:** While addressing the delays in the Mumbai-Ahmedabad bullet train project, Indian Railways should **simultaneously focus on expanding its network of semi-high-speed trains like Vande Bharat.**

○ This expansion should be complemented by upgrading existing tracks and signaling systems to support higher speeds.

○ For example, modernizing the **Golden Quadrilateral network** to consistently support speeds of **160-200 km/h** could significantly reduce travel times on key routes, making rail more competitive with air travel for intercity journeys.

➢ **Develop Sustainable and Energy-Efficient Operations:** Indian Railways should accelerate its transition to renewable energy and energy-efficient technologies.

○ This could involve **increasing the electrification of tracks from the current levels to 100%**, coupled with a significant expansion of solar and wind power generation along railway lines.

○ For example, **installing solar panels on station rooftops and unused railway land** could generate a substantial portion of the railways' energy needs.

➢ **Modernize Freight Terminals and Develop Multimodal Logistics Parks:** Indian Railways should focus on **modernizing existing freight terminals** and **developing new multimodal logistics parks** to improve efficiency and attract more freight traffic.

○ This could involve automating loading and unloading processes, implementing advanced inventory management systems, and creating seamless intermodal connections.

○ These parks should be equipped with **advanced container handling equipment, real-time tracking systems,** and integrated customs clearance facilities to offer end-to-end logistics solutions.

➢ **Enhance Station Redevelopment and Commercial Utilization:** Accelerate the station redevelopment program to transform major railway stations into world-class transit hubs and commercial centers.

○ This initiative should go beyond cosmetic improvements to include smart city features, mixed-use developments, and enhanced passenger amenities.

○ For example, the redevelopment of **Rani Kamlapati Railway Station in Bhopal,** with its **modern design, airport-like facilities,** and focus on sustainability, serves as a model.

Conclusion:

Revitalizing Indian Railways is crucial for its role in India's economy and sustainability. By tackling challenges like declining freight share and financial sustainability through modernization and innovative strategies, the railways can enhance efficiency and competitiveness. Initiatives such as **diversifying services and redeveloping stations** will significantly contribute to national integration and sustainable development, **positioning Indian Railways as a key driver of India's future growth.**

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Ambitions and Reality in Indian Diplomacy

This editorial is based on "India's foreign policy dilemma: Balancing global ambitions & domestic needs" which was published in Business Standard on 17/09/2024. The article highlights that India, classified as a developing nation, faces stark income inequalities despite being a $3.5 trillion economy ranked fifth globally. While it holds significant potential as the fastest-growing major economy and the world's largest population, India must navigate the challenges of improving domestic welfare while enhancing its role in global governance.

Tag: GS Paper - 2, Effect of Policies & Politics of Countries on India's Interests, India and its Neighbourhood, Groupings & Agreements Involving India and/or Affecting India's Interests, Look East to Act East.

India, the **world's largest democracy** and **fifth-largest economy**, stands at a crucial juncture in its quest for global prominence. As it navigates the complexities of international relations, India faces the challenge of **balancing ambitious global aspirations** with pressing

domestic needs, a dilemma central to its foreign policy strategy.

India seeks to assert itself as a major global player, aspiring for a **permanent seat** on the **UN Security Council (UNSC)** and aiming to expand its influence, particularly in the **Indo-Pacific region**. It aims to be a voice for the **Global South**, tackling transnational issues like **climate change and public health crises**. However, India also confronts significant domestic hurdles, including low per capita income and pressing development priorities that require substantial resources.

What Are India's Global Ambitions?

➢ **Permanent Membership in the UN Security Council**: India seeks to secure a permanent seat at the **UN Security Council** to exert greater influence over **global security matters and address international crises.**

➢ **Economic and Strategic Influence in the Indo-Pacific**: India is focusing on expanding its economic and strategic footprint, particularly in the **Indo-Pacific region**, to counterbalance China's growing dominance.

➢ **Leadership Among Developing Economies**: Establishing itself as a leader among developing and emerging economies is a priority, **positioning India as a voice for the Global South** in international forums.

➢ **Addressing Transnational Challenges**: India aims to play a proactive role in tackling **global challenges** such as **climate change, public health crises, and food security**, contributing to collective global efforts.

➢ **Representation in International Financial Institutions**: India advocates for greater representation and decision-making power in institutions like the **World Bank** and the **International Monetary Fund (IMF)** to reflect the interests of emerging economies.

➢ **Military and Technological Advancements**: Developing **military capabilities and technological prowess** is crucial for India, especially to position itself as a counterweight to China in Asia.

➢ **Enhancing Soft Power**: India seeks to **strengthen its cultural diplomacy** and leverage its democratic credentials, promoting its rich **cultural heritage** to gain global influence.

What are the Challenges to India's Global Ambitions?

➢ **Economic Constraints**:
  ○ With a **per capita income of USD 2,500**, India contends with significant income disparities that obscure the realities of widespread poverty and inequality.
  ○ India's contribution to global GDP stands at only **3.6%**, which is less in comparison to the U.S. (26.3%), EU (17.3%), and China (16.9%), **limiting its influence on the world stage.**
  ○ Moreover, China's **heavy investment** in India's neighboring countries, significantly impacting India's regional relations. As these nations deepen ties with China through **infrastructure and economic partnerships**, **India's traditional influence** is challenged.
  ○ It ranks **134th out of 193** countries on the **Human Development Index**, reflecting low human development levels.

➢ **Domestic Development Priorities**:
  ○ India must address pressing issues like **poverty alleviation**, **job creation**, and the **improvement of social indicators**, which require substantial resources and focus.
  ○ There is a need to **balance resources** between **domestic priorities and international commitments**, complicating foreign policy implementation.

➢ **Limited Global Economic Influence**:
  ○ Despite its status as the **fifth-largest economy**, India's relative economic weight remains modest, resulting in challenges when it comes to **influencing global economic rules and institutions**.

➢ **Regional Security Concerns**:
  ○ Ongoing tensions with **Pakistan** and unresolved border disputes with **China** continue to divert attention and resources from global engagement.
  ○ **Instability in neighboring countries** like **Bangladesh and Myanmar** exacerbates security challenges that India must navigate.

- For instance, **recent regime change in Bangladesh** has far reaching consequences related to security.

➢ **Competition with China**:
  ○ China's vastly **larger economic and military capabilities** pose a significant challenge, as does **China's growing influence** in South Asia and the Indian Ocean region.
  ○ India must balance **cooperation and competition** with China across various international forums.

➢ **Limited Hard Power Projection Capabilities**:
  ○ While India has undertaken military modernization efforts, it still **lags behind other major powers** in advanced military technology and force projection capabilities.

➢ **Balancing Multiple Strategic Partnerships**:
  ○ India must effectively manage relationships with diverse partners, including the **U.S., Russia, Japan, and European nations**, while navigating geopolitical tensions without compromising its strategic autonomy.
  ○ For instance, western countries have been pressuring India to vote on a **UN General Assembly** resolution condemning Russia's invasion of Ukraine, however, **India has obtained from voting**.

What Steps have been Taken to Achieve India's Global Ambitions?

➢ **Permanent Membership in the UN Security Council:**
  ○ India has been leveraging its **G20 presidency** and engagement in forums like **BRICS** to build consensus for UNSC reforms.
  ○ During the **2+2 Ministerial Dialogue** in November 2023, the US reaffirmed its support for **India's permanent membership** which was recently reiterated as its "longstanding support" for India, Japan, and Germany to attain permanent membership in the UNSC.

➢ **Economic Reforms and Initiatives**:
  ○ India has implemented economic liberalization policies to **attract foreign investment and stimulate growth**.
  ○ Programs like **"Make in India"** aim to boost domestic manufacturing and exports.
  ○ Initiatives such as **Digital India** promote digital transformation and infrastructure development.
    - For example, countries like **Bhutan, France, Mauritius, Nepal, Singapore, Sri Lanka, and UAE** accept **UPI payment**.

➢ **Diplomatic Outreach**:
  ○ India pursues a **policy of "multi-alignment,"** engaging with a range of global powers to strengthen its international position.
    - For example, India has helped countries through **vaccine diplomacy(Vaccine Maitri Maitrai)** during **COVID-19** and has also provided **humanitarian assitance** through operations like **Operation Sadbhav**- to provide aid to cyclone hit **Vietnam, Laos, and Myanmar** and **Operation Dost** -for **Turkey and Syria** earthquake relief.
  ○ Active participation in **"mini-lateral" forums** like the **Quad** (with the U.S., Japan, and Australia) and **I2U2** (with the U.S., UAE, and Israel) demonstrates its commitment to strategic collaboration.
  ○ Strengthening ties with **Indian diaspora** communities worldwide enhances India's global presence.

➢ **Enhancing Regional Influence**:
  ○ **The Indo-Pacific Economic Framework (IPEF)**, launched in May 2022, saw India joining as a founding member, enhancing its **regional economic engagement.**
  ○ **The India-Middle East-Europe Economic Corridor (IMEC)** announced in September 2023 aims to boost India's connectivity and trade in the region.
  ○ The **"Neighborhood First"** policy seeks to improve relations with **immediate neighbors** through development assistance and infrastructure projects.
  ○ The **"Act East"** policy aims to deepen economic and strategic ties with **Southeast Asian nations**, similarly **Look West Policy** is a strategy adopted by India to strengthen its relations with **West Asian countries** (which were ignored earlier).

➢ **Leadership Among Developing Economies:**
  ○ India hosted the **3rd Voice of Global South Summit** in August 2024 emphasizing various developmental priorities, including **climate change, health, and education**, while reaffirming India's commitment to enhancing cooperation and addressing shared challenges among developing nations.
  ○ During its G20 presidency, India successfully pushed for the **African Union's** inclusion as a permanent G20 member.

➢ Addressing Transnational Challenges:
  ○ At **COP28** in December 2023, India announced ambitious targets for **renewable energy** and launched the **Green Credit Initiative**.

- ❍ The launch of the **International Solar Alliance** promotes solar energy adoption globally.

- ❍ India launched the "**Vaccine Maitri**" initiative to supply "**Made-in-India**" COVID-19 vaccines to over 150 countries worldwide.

- ❍ Also India played a key role in the **G20 declaration on food security** and sustainable agriculture in September 2023.

➢ **Representation in International Financial Institutions:**

- ❍ India has been advocating for reforms in the **World Bank and IMF**, pushing for increased voting rights for emerging economies.

- ❍ India's growing economic weight has led to an increase in its **IMF Special Drawing Rights** quota to 2.75% (from 2.44%), making it the 8th largest quota holding country.

➢ **Military and Technological Advancements:**

- ❍ Recently, India conducted successful tests of **Agni-4** intercontinental-range ballistic missile further enhancing its strategic deterrence capabilities.

- ❍ According to the latest data from the **Ministry of Defence**, India's defence exports in 2023-2024 reached a record **Rs 21,083 crore**, reflecting a 32.5% increase from the previous fiscal year.

- ❍ India's space agency **ISRO** successfully landed the **Chandrayaan-3 mission** on the Moon's south pole in August 2023, demonstrating advanced space capabilities.

- ❍ Promoting India as a hub for **IT services** and emerging technologies like **Artificial Intelligence (AI)** bolsters its global competitiveness.

- ❍ India's **digital public infrastructure**, particularly **UPI**, has gained international recognition, with several countries exploring its adoption.

➢ **Enhancing Soft Power:**

- ❍ **International Yoga Day** has evolved into a platform for global diplomacy and cooperation, allowing India to showcase and promote its rich cultural heritage to the world.

- ❍ The country's **film industry** continues to gain global prominence, with Indian cinema celebrated at major international film festivals.

What Should be the Way Forward?

➢ **Strengthening Domestic Foundations:**

- ❍ Prioritize policies that **boost GDP growth** while **addressing income disparities**. This includes investing in **education, healthcare, and infrastructure** to enhance human development.

- ❍ Focus on **generating employment opportunities**, particularly for youth, through skill development programs and support for **small and medium enterprises (SMEs)**.

➢ **Strategic Autonomy with Flexible Partnerships**:

- ❍ Maintain strategic autonomy while deepening partnerships with like-minded countries, ensuring that India's interests are safeguarded.

- ❍ Continue diplomatic efforts to build a coalition of support for I**ndia's permanent membership in the UN Security Council**, utilizing **G20 and BRICS** platforms to amplify its case.

- ❍ Leverage India's unique position to bridge divides between developed and developing nations, promoting inclusive dialogue.

➢ **Enhance Diplomatic Capacity**:

- ❍ **Expand and professionalize** the diplomatic corps to better address global challenges and opportunities.

- ❍ Encourage **academic exchanges and international collaborations** to enhance India's intellectual engagement.

➢ **Economic and Strategic Initiatives:**

- ❍ Expand trade and security partnerships in the **Indo-Pacific**, enhancing participation in regional frameworks like the IPEF to **counter China's influence.**

- ❍ Increase f**unding for R&D** in emerging technologies, such as **AI and renewable energy**, to bolster India's competitiveness and leadership in the global tech landscape.

  - • For instance, recently India signed a **semiconductor ecosystem partnership** with **Singapore.**

➢ **Promoting Soft Power and Cultural Diplomacy:**

- ❍ Amplify **cultural diplomacy** through initiatives like **International Yoga Day and sister city initiative**; and global showcases of Indian art and cinema, fostering goodwill and recognition.

- ❍ Leverage the **Indian diaspora** to enhance **soft power** and serve as cultural ambassadors, strengthening ties with host countries.

➢ **Addressing Global Challenges:**

- ❍ Enhance **commitments to sustainable development and climate action**, positioning

India as a global leader in environmental initiatives, such as renewable energy adoption and climate resilience. Also, India has been proactive in addressing the **issue of terrorism**.

❍ Build on initiatives like **Vaccine Maitri** to strengthen global health partnerships and enhance India's role in international public health governance.

➢ **Strengthening Regional Relations:**

❍ Continuously refine the **Neighborhood First policy** to foster stability and cooperation through development aid and collaborative projects.

❍ Revitalize regional forums like **SAARC** and explore new mechanisms for South Asian cooperation to enhance connectivity and trade linkages.

❍ Advance relationships with West Asian countries by **enhancing trade, security, and cultural exchanges** to build a comprehensive regional strategy.

➢ **Reforming International Institutions:**

❍ Persist in advocating for reforms in **international financial institutions** to ensure greater representation for emerging economies, reflecting India's growing economic weight.

Conclusion

India's quest to become a global power is fraught with **challenges and opportunities**, balancing domestic development with international aspirations. While its growing economic strength and demographic advantages position it well globally, persistent issues like poverty and inequality demand attention.

The **balancing act** is complicated by regional security concerns, competition with China, and the need to manage diverse strategic partnerships without compromising autonomy. As India pursues economic reforms, diplomatic outreach, and military modernization, it must ensure that its **global ambitions do not overshadow critical domestic issues**.

As India navigates complex regional dynamics, it must enhance diplomatic **efforts and engage** diverse stakeholders. Hosting major summits like the **G20 and SCO** provides a platform to assert its influence while addressing regional instability. By leveraging its **market potential and innovation**, India can strengthen its global role and ensure domestic stability, ultimately shaping the future international order.

■■■

India's Quest for Solar Dominance

This editorial is based on "Solar strategies" which was published in The Hindu Business Line on 20/09/2024. The article highlights India's solar ambitions to achieve 570 GW capacity by 2030, surpassing global commitments, with significant investment and domestic manufacturing initiatives. To meet its full potential, India must accelerate solar capacity additions while reducing reliance on Chinese imports.

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

India's solar ambitions have reached new heights with the recent **REINVEST meet in Gandhinagar,** which garnered **renewable energy** investment proposals totaling **USD 386 billion** and aims to create 570 GW of solar power capacity by **2030**. This ambitious goal puts India on track to surpass its global commitment of **500 GW non-fossil fuel capacity by 2030.** However, to realize India's estimated solar potential of **749 GW**, the country must significantly accelerate its current annual capacity additions of **10-15 GW**.

The push for solar dominance is **not just about clean energy;** it's a strategic move with **geopolitical implications**. India's recent policy shifts, including production-linked incentives for solar cells and modules and the introduction of the **Approved List of Models and Manufacturers (ALMM),** aim to reduce dependency on Chinese imports and bolster domestic manufacturing. While this protectionist approach may lead to higher domestic power costs in the short term, it positions **India as a potential global hub for solar technology production**.

What is the Current Status of India's Solar Sector?

➢ **About**: India is the 3rd largest energy-consuming country in the world. And, India stands **5th in solar power capacity (REN21 Renewables 2024 Global Status Report).**

❍ At COP26, India pledged to achieve 500 GW of non-fossil fuel-based energy by 2030, **part of the Panchamrit initiative**—the world's largest renewable energy expansion plan.

➢ **Solar Energy Growth:**

❍ Installed solar energy capacity has increased **30-fold in the last 9 years, reaching 89.4 GW in August 2024.**

❍ India's solar potential is estimated to be **748 GWp (National Institute of Solar Energy, NISE).**

➢ **Investment and FDI:**
  ○ **100% Foreign Direct Investment (FDI)** is allowed under the automatic route for renewable energy generation and distribution projects, subject to **The Electricity Act 2003.**

What is the Significance of Solar Energy Dominance for India?

➢ **Energy Independence**: India's push for solar energy is a cornerstone of its quest for energy independence.
  ○ With the country importing over **80% of its oil needs**, solar power offers a path to reduce this dependency.
  ○ The ambitious target of **500 GW non-fossil fuel capacity by 2030,** with solar playing a major role.
  ○ The recent **REINVEST meet in Gandhinagar,** which attracted **USD 386 billion in investment proposals**, underscores the scale of this transition.
  ○ This shift not only bolsters energy security but also **insulates the economy from global oil price volatility,** as evidenced by the **relative stability of renewable energy price**s during recent **global energy crises**.

➢ **Economic Catalyst:** The solar sector is emerging as a significant economic multiplier for India.
  ○ Solar energy sector is projected to generate **3.26 million jobs by 2050**. As of 2021-22, over 29,000 people were employed in the solar sector.
  ○ The government's **Production Linked Incentive (PLI) scheme** for solar manufacturing, with an outlay of ₹24,000 crore, is expected to add significant manufacturing capacity for fully and **partially integrated solar PV modules.**
  ○ This not only creates jobs but also positions **India as a potential global manufacturing hub.**

➢ **Climate Change Mitigation:** Solar energy is at the forefront of India's climate change mitigation efforts.
  ○ Solar power installed capacity has increased from 2820 MW in March 2014 to **72002 MW in Oct 2023**, i.e. an increase of around 25.54 times, making it the **fifth-largest solar power producer globally.**
  ○ The recent introduction of **India's Carbon Credit Trading Scheme** further **incentivizes solar adoption,** potentially accelerating the transition and positioning India as a leader in climate action among developing nations.

➢ **Rural Electrification**: Solar power is revolutionizing rural electrification in India, bringing light to the country's most remote corners.

  ○ The **Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) scheme** aims to add 30.8 GW of solar capacity by **2026**.
  ○ Moreover, initiatives like the **Solar Charkha Mission** are empowering rural artisans. These programs n**ot only provide clean energy** but also boost rural economies, **demonstrating solar's potential to bridge the urban-rural divide.**

➢ **Technological Innovation**: India's solar ambitions are driving significant technological innovations.
  ○ Indian scientists have indigenously developed **highly stable, low-cost Carbon-based perovskite solar cells** with superior thermal and moisture stability.
  ○ The **establishment of the National Institute of Solar Energy (NISE)** as an autonomous R&D institution further underscores this commitment.
  ○ These innovations not **only enhance efficiency** but **also drive down costs**.
    ● Solar cells and modules have witnessed price drops of **65% and 50% respectively in 2022,** making solar increasingly competitive with conventional power sources.

What are the Major Issues Related to the Solar Sector in India?

➢ **Land Acquisition Challenges:** Land scarcity poses a significant hurdle for large-scale solar projects in India.
  ○ Solar Power Plants occupy at least 5 acres of land per 1 MW output; the country's 500 GW renewable energy target by 2030 could necessitate over 1.5 million acres for solar alone.
    ● This demand often conflicts with agricultural and habitation needs, leading to social tensions and project delays.
  ○ For instance, the 5000 MW Dholera Solar Park in Gujarat faced protests from local farmers, delaying its implementation.
    ● The land issue is further complicated by India's complex land ownership laws.

➢ **Grid Integration and Infrastructure Bottlenecks:** The intermittent nature of solar power poses significant challenges for grid stability and management.
  ○ India's grid infrastructure, designed primarily for conventional power sources, struggles to accommodate the variability of solar generation.
    ● The country's transmission losses stand at about 16.4% as of 2021-22, significantly higher than the global average.

- Recent grid failures, like the one in Mumbai in October 2020, highlight the vulnerability of the system.

➢ **Financing and Investment Hurdles:** Despite the recent influx of investment proposals, securing consistent financing for solar projects remains challenging.

   ❍ The outstanding dues of electricity discoms dropped by one-third to ₹93,000 crore by May,2023 following the implementation of the Late Payment Surcharge (LPS) Rules in June 2022, but still it is significant creating liquidity pressures and increasing investor risk perception.

   ❍ While green bonds and specialized financial instruments are emerging, with India's first sovereign green bonds raising ₹16,000 crore in 2023, scaling up these funding mechanisms to meet the sector's needs remains a crucial challenge.

➢ **Technological Dependence and Manufacturing Gaps:** India's solar sector heavily relies on imported technology, particularly from China.

   ❍ Despite recent policy pushes like increased import duties and the Production Linked Incentive (PLI) scheme, domestic manufacturing capacity remains limited.

   ❍ The lack of a robust domestic supply chain for critical components like wafers and ingots increases vulnerability to global supply disruptions.

      ● Post July 2020, polysilicon price in the global markets increased from USD 6.8/Kg to USD 43/Kg in November 2021(~6 times increment).

➢ **Storage and Round-the-Clock Power:** The lack of cost-effective energy storage solutions hinders the full potential of solar power in India.

   ❍ With solar generation limited to daylight hours, meeting evening peak demand remains a challenge.

   ❍ The current battery storage capacity in India is merely 20 MWh, against a projected requirement of 74 gigawatts by 2032.

   ❍ The high cost of battery storage makes round-the-clock solar power economically viable for many applications.

➢ **Environmental and Social Impacts:** While solar energy is clean, its large-scale deployment is not without environmental concerns.

   ❍ Solar parks can lead to habitat destruction and biodiversity loss.

   ❍ The Bhadla Solar Park in Rajasthan, one of the world's largest at 2245 MW, has raised concerns about its impact on local flora and fauna.

   ❍ Moreover, the end-of-life management of solar panels poses a significant challenge.

   ❍ India is expected to generate 34,600 tonnes of solar panel waste by 2030, yet lacks a comprehensive recycling policy.

What Steps can India Take to Enhance the Viability and Efficiency of Solar Energy?

➢ **Streamlined Land Acquisition and Innovative Land Use Policies:** Implement a centralized land bank system for solar projects**, identifying and pre-clearing suitable non-agricultural lands.**

   ❍ Introduce a **national policy on agrivoltaics,** incentivizing dual use of land for agriculture and solar generation.

   ❍ Simplify land leasing regulations for solar projects, **allowing for longer lease periods of up to 40 years.**

   ❍ Encourage the use of **brownfield sites,** such as **closed landfills and abandoned mines,** for solar installations.

➢ **Grid Modernization and Smart Integration Technologies:** Invest heavily in **smart grid technologies** and energy management systems to handle the variability of solar power.

   ❍ Implement **advanced forecasting tools and artificial intelligence** for better prediction and management of solar generation.

   ❍ Upgrade transmission infrastructure, focusing on **high-capacity interstate transmission** lines dedicated to renewable energy.

   ❍ Incentivize the deployment of **distributed energy resources (DERs)** and microgrids to reduce transmission losses and improve grid resilience.

➢ **Innovative Financing Mechanisms and Risk Mitigation Tools:** Establish a dedicated **Green Bank for renewable energy projects**, offering low-interest loans and credit enhancement tools.

   ❍ Introduce **solar-specific green bonds** and **climate bond**s to tap into global sustainable finance markets.

   ❍ Implement a **national payment security mechanism** to address the risk of delayed payments from DISCOMs.

   ❍ Create a standardized **solar asset-backed securities** market to improve liquidity for developers.

- ➢ **Domestic Manufacturing through Technology Transfer and R&D:** Implement a phased manufacturing program for the **entire solar value chain, from polysilicon to modules.**
  - ○ Establish joint ventures with global technology leaders for knowledge transfer and capacity building.
  - ○ Increase **R&D funding for next-generation solar technologies** like **perovskite cells and tandem modules**.
  - ○ The recent success of the **Indian Institute of Technology (IIT) Bombay** in developing **4T- silicon-perovskite tandem solar cells** with more than **26% efficiency** demonstrates the potential for indigenous innovation, which could be scaled up with targeted support.
- ➢ **Comprehensive Energy Storage Policy and Infrastructure:** Develop a **national energy storage mission** with clear targets and incentives for various storage technologies.
  - ○ Implement a regulatory framework that **recognizes and compensates the value of storage in grid stabilization.**
  - ○ Incentivize the co-location of storage facilities with solar plants through additional tariffs or capacity payments.
  - ○ Promote **pumped hydro storage** in suitable geographical locations as a cost-effective large-scale storage solution.
- ➢ **Skill Development and Workforce Training Programs:** Establish a **network of solar skill development centers across the country,** focusing on rural areas where large solar projects are typically located.
  - ○ Integrate solar technology courses into ITI and p**olytechnic curricula** to create a pipeline of skilled technicians.
  - ○ Implement a **national certification program for solar installers and maintenance** personnel to ensure quality standards.
  - ○ Introduce apprenticeship programs in collaboration with solar companies to provide hands-on training.
  - ○ The **Suryamitra Skill Development Programme** could be expanded and modernized to include advanced technologies and soft skills training.
- ➢ **Water-Efficient Cleaning Technologies and Practices:** Mandate the use of robotic dry-cleaning systems for large-scale solar installations in water-stressed areas.
  - ○ Invest in research and development of **hydrophobic coatings for solar panels** to reduce dust accumulation.
  - ○ Implement **rainwater harvesting systems at solar parks** for cleaning purposes.
  - ○ Promote the use of treated wastewater for panel cleaning in areas near urban centers.
- ➢ **Accelerating Rooftop Solar Adoption**: Revamp the rooftop solar ecosystem by implementing a unified, **nationwide net metering policy with consistent regulations across states.**
  - ○ Introduce innovative financing models like **solar leasing and on-bill financing** to reduce upfront costs for consumers.
  - ○ The **Pradhanmantri Suryoday Yojana** seeks to outfit 10 million households with rooftop solar panels.
    - ● For this, simplifying the approval and installation process through a single-window clearance system and standardized equipment ratings is necessary.

Conclusion:

India's ambitious solar goals are not only key to achieving energy independence but also critical for **driving economic growth, climate action, and technological innovation.** By focusing on grid modernization, innovative financing, domestic manufacturing, and sustainable practices, India can unlock the full potential of its solar energy sector and become a global leader in renewable energy production. A **comprehensive and balanced approach is necessary** to ensure long-term viability and efficiency in the solar domain.

■■■

QUAD: A Testbed for India's Strategic Autonomy

This editorial is based on "<u>The Quad's agenda may seem small, but its achievements are not</u>" which was published in The Indian Express on 23/09/2024. The article brings into picture the Quad's evolution into a multifaceted forum, offering India a platform for regional cooperation with key allies while managing its strategic autonomy. It highlights how the Quad helps counter China's assertiveness without formal military alliances, aligning with India's diplomatic preferences.

The **Quadrilateral Security Dialogue** (Quad), comprising **India**, **Australia, Japan, and the United States**, has evolved into a multifaceted forum addressing a wide range of regional issues beyond traditional security concerns. At its **recent summit in Wilmington, Delaware**, the Quad showcased initiatives ranging from **healthcare and cybersecurity** to infrastructure development and emerging technologies. This expansive approach has helped the Quad avoid being labeled as an **"Asian NATO"** while **gaining acceptance among ASEAN nations**.

For India, the Quad presents a unique opportunity to engage in **regional cooperation with the US and its Asian allies** without the constraints of formal military alliances. While the forum maintains that it is **not directed against any particular country**, it implicitly serves as a **counterbalance to China's growing assertiveness** in the Indo-Pacific. Importantly, the Quad's nuanced approach may be creating diplomatic space for India to manage its complex relationship with China, its strategic significance for India becoming increasingly apparent, offering a platform for engagement that aligns with **India's diplomatic preferences and strategic interests.**

What is QUAD?

➢ The Quad is an **informal diplomatic alliance between Australia, India, Japan, and the US,** aimed at promoting an open, stable, and prosperous Indo-Pacific.

➢ Initially proposed by **Japanese Prime Minister Shinzo Abe in 2007**, it became a formal **group in 2017** after overcoming challenges like Australia's earlier withdrawal under Chinese pressure.

FIGURE 1

Treaties and Partnerships Across the Quad
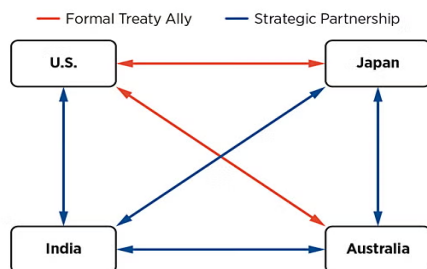
SOURCE: Heritage Foundation research.   BG3481 ☎ heritage.org

What is the Significance of QUAD for India?

➢ **Strategic Counterbalance to China:** The QUAD provides India with a strategic platform to counterbalance China's growing assertiveness in the Indo-Pacific region.

○ This is particularly crucial given India's ongoing border tensions with China, such as the **2020-2021 Galwan Valley clashes.**

○ The QUAD's joint naval exercises, like the **Malabar series**, enhance India's maritime capabilities and signal collective resolve.

● For instance, the 2023 Malabar exercise in Australia involved **advanced anti-submarine warfare drills,** directly addressing concerns about China's expanding **submarine fleet in the Indian Ocean**.

➢ **Economic and Technological Cooperation:** QUAD offers India access to advanced technologies and economic partnerships with developed economies.

○ The **Quad Critical & Emerging Technology Forum** focuses on areas like AI, quantum computing, and biotechnology.

○ This collaboration is vital for India's ambitious plans, such as the **National Quantum Mission**.

○ Additionally, initiatives like the **Indo-Pacific Economic Framework** (IPEF) **launched in 2022,** which includes all QUAD members, provide India with **alternatives to China-centric economic arrangements** in the region.

➢ **Infrastructure and Connectivity**: The QUAD's infrastructure initiatives provide India with opportunities to enhance its regional connectivity and influence.

○ The **QUAD Infrastructure Coordination Group**, aims to align the members' infrastructure efforts in the Indo-Pacific.

○ This complements India's own initiatives like the **International North-South Transport Corridor (INSTC).**

○ It not only counters China's "**String of Pearls**" strategy but also enhances India's **Diamond of Necklace strategy** and economic ties in its immediate neighborhood.

➢ **Maritime Security and Freedom of Navigation:** QUAD reinforces India's commitment to ensuring f**ree and open sea lanes in the Indo-Pacific**, crucial for its trade and energy security.

○ Approximately 95% of the country's trade by volume and 68% by value is moved through Maritime Transport, initiatives like the **Indo-Pacific Maritime Domain Awareness (IPMDA) partnership** launched in 2022 are significant.

○ This near-real-time, integrated maritime domain awareness picture helps combat **illegal fishing, piracy, and other maritime challenges.**

- ❍ The recent increase in **piracy incidents in the Arabian Sea** underscores the importance of such collaborative maritime security efforts.

➢ **Climate Change and Disaster Response:** QUAD provides India with a platform to address climate change and enhance disaster response capabilities, critical for a country vulnerable to climate impacts.

- ❍ The **QUAD Climate Change Adaptation and Mitigation Package (Q-CHAMP)** launched in 2022 focuses on **green shipping corridors, clean energy cooperation, and climate information services.**

- ❍ This aligns with India's ambitious renewable energy targets, such as achieving **500 GW of non-fossil fuel capacity by 2030.**

- ❍ Moreover, QUAD's disaster response mechanisms complement India's leadership in initiatives like the **Coalition for Disaster Resilient Infrastructure (CDRI).**

➢ **Cyber Security and Critical Technologies:** QUAD provides India with a framework for cooperation in cyber security and critical technologies, essential in an era of increasing digital threats.

- ❍ The **QUAD Cybersecurity Partnership announced in 2023** aims to improve cyber resilience and response capabilities of the member countries.

  - This is particularly relevant for India, which faced over **1.39 Million cybersecurity incidents in 2022 alone**, according to CERT-In data.

- ❍ In 2023, Quad partners announced the first-ever **Open Radio Access Networks (RAN)** in the Pacific, to support a secure, resilient, and interconnected telecommunications ecosystem.

  - Since then, the Quad has committed approximately **USD 20 million to this effort.**

- ❍ Collaboration in areas like **5G** deployment, **semiconductor supply chains**, and space-based maritime domain awareness enhances India's technological sovereignty and security.

What are the Major Challenges Related to QUAD for India?

➢ **Balancing Act with China**: India faces the challenge of participating in QUAD while maintaining a **delicate balance with China.**

- ❍ Despite QUAD's assertion that it's not anti-China, B**eijing views it as a containment strategy.**

  - This complicates India's efforts to manage its complex relationship with China, especially given ongoing border tensions.

- ❍ For instance, the **2023 China-India border talks**, while shown progress, still highlight the persistent tensions.

- ❍ In 2022, **bilateral trade between India and China hit a record USD 135.98 billion,,** emphasizing the **economic interdependence** that India must navigate while participating in QUAD initiatives that may be perceived as antagonistic by China.

➢ **Divergent Priorities within QUAD**: QUAD members often have different priorities and approaches, **which can create challenges for India.**

- ❍ While the US and Australia may push for a **more security-focused agenda,** India prefers a **broader, less militaristic approach.**

- ❍ The varying responses to **Russia's invasion of Ukraine** also highlighted these divergences, with **India maintaining a neutral stance** while **other QUAD members imposed sanctions.**

- ❍ This difference in priorities can **potentially limit the effectiveness of QUAD** initiatives from India's perspective.

➢ **Resource and Capacity Constraints:** Implementing various QUAD initiatives requires significant resources and capacity, which can be challenging for India given its domestic development priorities.

- ❍ For instance, the **QUAD Vaccine Partnership** aimed to leverage India's manufacturing capabilities, but the country faced **initial challenges in meeting domestic vaccine demands.**

- ❍ Similarly, India's commitment to invest in critical and emerging technologies as part of QUAD initiatives requires **substantial financial and human resources,** potentially straining its budget and technical capacity.

➢ **Potential Economic Costs:** Some QUAD initiatives, particularly those aimed at reducing economic dependence on China, could have short-term economic costs for India.

- ❍ For example, efforts to restructure supply chains away from China, as discussed in QUAD meetings, could disrupt India's current economic ties with China.

- ❍ India's electronics industry, which **heavily relies on Chinese components**. Transitioning away from this dependency would **require significant time and investment,** potentially impacting India's economic growth in the short term.

➢ **Regional Perceptions and Diplomatic Challenges:** India must manage perceptions of QUAD among

other regional players, **particularly ASEAN countries,** to avoid diplomatic isolation.

- ○ Some ASEAN members have **expressed concerns about QUAD potentially undermining ASEAN** centrality in regional affairs.
- ○ India's participation in QUAD while simultaneously engaging with other regional groupings like **BRICS (which includes China and Russia)** creates a complex diplomatic balancing act.

➤ **Operational and Interoperability Challenges:** Enhancing interoperability with other QUAD members, particularly in military and technological spheres, poses operational challenges for India.

- ○ The country's **diverse military equipment**, including significant **Russian-origin systems**, can create compatibility issues.
- ○ For example, **India's use of Russian S-400 missile systems** led to concerns about sanctions under the **US CAATSA act,** potentially complicating defense cooperation within QUAD.

What Measures can India take to Balance its QUAD Commitments while Maintaining Strategic Autonomy?

➤ **Issue-based Alignment within QUAD:** India should pursue a flexible, issue-based alignment within QUAD, focusing on areas of mutual interest without compromising on its core strategic interests.

- ○ For example, India can strongly **engage in technology cooperation,** as seen in the QUAD Critical and Emerging Technology Working Group, while maintaining a **more nuanced stance on explicit military cooperation.**

➤ **Enhancing Domestic Capabilities**: Investing in domestic capabilities, particularly in defense and technology sectors, can **reduce external dependencies and strengthen India's position within QUAD.**

- ○ The **'Make in India' i**nitiative in defense, which has seen domestic defense production rise to **Rs 1,08,684 crore** in 2022-23, is a step in this direction.
- ○ Similarly, India's push in **semiconductor manufacturing,** with a **USD 10 billion incentive scheme** announced in 2021, aligns with QUAD's technology goals while serving India's self-reliance objectives.

➤ **Proactive Agenda Setting**: India should take a more proactive role in setting the QUAD agenda, focusing on areas where it has strengths and which align with its strategic interests.

- ○ For instance, India's leadership in initiatives like the **International Solar Alliance (ISA)** can be leveraged to shape QUAD's climate action agenda.
- ○ The **QUAD Climate Change Adaptation and Mitigation Package (Q-CHAMP)** provides an opportunity for India to steer discussions towards its priorities in renewable energy and climate resilience.

➤ **Diversified Engagement Strategy**: India should continue to engage with multiple regional and global forums alongside QUAD. This includes active participation in **BRICS, SCO, and ASEAN-led mechanisms.**

- ○ For instance**, India's successful G20 presidency in 2023** despite assumptions that joint declaration is not possible.
- ○ By maintaining diverse engagements, **India can avoid over-dependence on any single grouping.**
- ○ This strategy was evident in India's balanced approach during the **2023 Russia-Ukraine conflict,** where it **maintained dialogue with both sides while participating in QUAD discussions** on regional stability.

➤ **Balanced Infrastructure Development**: India should leverage QUAD's infrastructure initiatives while **maintaining its own sovereign projects.**

- ○ The QUAD Infrastructure Coordination Group can be utilized to attract investments in **Indian infrastructure projects without ceding control.**
- ○ For instance, **India's involvement in developing the Colombo West Container Terminal in Sri Lanka, alongside Japan**, demonstrates how QUAD partnerships can be leveraged while maintaining strategic autonomy in the region.

➤ **Selective Defense Cooperation**: While engaging in QUAD defense initiatives, India should maintain selectivity in its military engagements.

- ○ The focus should be on **enhancing interoperability and capacity building** without entering into binding defense pacts.
- ○ India signed a Supply Arrangement (SOSA) with the US in 2024 that will provide **reciprocal priority support for goods and services that promote national defense,** exemplifying this balanced approach – enhancing cooperation without compromising sovereignty.

➢ **Economic Diversification:** India should use QUAD as a platform to diversify its economic partnerships while maintaining its economic sovereignty.

  ❍ The **Supply Chain Resilience Initiative** (SCRI) launched by **India, Japan, and Australia** in 2021 is a good example.

    ● It aims to reduce dependence on China without explicitly targeting any country.

  ❍ India's participation in the Indo-Pacific Economic Framework (IPEF), launched in 2022, further demonstrates this approach of economic engagement without compromising on policy autonomy.

➢ **Technology Partnerships with Safeguards:** Engage in QUAD technology initiatives while ensuring robust data protection and technology transfer agreements.

  ❍ **India's Personal Data Protection Act 2024,** can serve as a framework for data-sharing agreements within QUAD.

  ❍ The country's push for indigenous 5G technology aligns with QUAD's secure telecommunications goals while maintaining technological sovereignty.

Conclusion:

India's engagement with the Quad provides a strategic platform for regional cooperation and counterbalancing China, while allowing it to maintain strategic autonomy. By pursuing **issue-based alignment, enhancing domestic capabilities, and proactively shaping the Quad's agenda,** India can navigate its geopolitical interests effectively. Diversified partnerships and selective cooperation will further safeguard India's sovereignty while benefiting from Quad initiatives.

■■■

India's Strategic Leap in Defense Exports

This editorial is based on "India's defense exports and humanitarian law" which was published in The Hindu on 24/09/2024. The article brings into picture the legal and ethical gaps in India's defense exports, highlighting the absence of International Humanitarian Law (IHL) compliance reviews. It emphasizes the need for comprehensive legislation to ensure responsible arms exports and align India's defense ambitions with global standards.

Tag: GS Paper-2, Government Policies and Interventions, GS Paper - 3, Achievements of Indians in Science & Technology, Defence Technology, Indigenization of Technology

India's growing **defense sector**, driven by **indigenization and self-reliance**, has thrust the nation into the **global arms market**, raising important legal and ethical issues. The **Supreme Court's** dismissal of a case **against arms exports to Israel,** despite allegations of war crimes, exposed a gap in India's legal framework, as there is **no clear requirement to assess the International Humanitarian Law (IHL)** compliance of recipient nations. Unlike countries like the **Netherlands and the UK**, India's current regulations, including the **Foreign Trade Act,** lack provisions for IHL reviews, raising concerns about its commitment to international law.

As India aspires to be a major arms exporter, establishing comprehensive legislation that mandates IHL compliance reviews would not only safeguard India's reputation but also **support global efforts to prevent the misuse of weapons.** Clear guidelines for defense manufacturers would further ensure ethical standards in the indigenization process, aligning India's defense ambitions with its international obligations.

What is the Current Status of India's Defense Exports?

➢ **Recent Performance:** In the first quarter of **FY 2024-25** (April–June 2024), India's defense exports reached **₹6,915 crore**, marking a substantial **78% increase** compared to ₹3,885 crore during the same period in **FY 2023-24.**

➢ **Growth Trajectory:** India's defense exports have **grown more than 12 times** since FY 2017 and an impressive 31-fold since FY 2013-14.

  ❍ This rapid expansion **positions India as a rising player in the global arms market.**

  ❍ India now ranks among the **top 25 arms-exporting nations**, supplying defense products to approximately 85 countries.

➢ **Export Products:** India's export portfolio covers a diverse range of defense equipment, including aircraft like the **Dornier-228, artillery guns, BrahMos missiles, PINAKA rockets** and launchers, radars, simulators, armored vehicles, personal protective gear, and surveillance systems.

What are the Growth Drivers of India's Defense Exports?

➢ **Policy Reforms and Government Initiatives:** The Indian government has implemented significant policy reforms to boost defense exports, including the introduction of the **Defence Production and Export Promotion Policy (DPEPP) 2020**.

○ This policy aims to achieve a turnover of **USD 25 billion** in defense manufacturing by **2025**, including exports of **USD 5 billion.**

○ The government has also streamlined licensing procedures, increased **FDI limits to 74% under the automatic route,** and introduced schemes like '**Make in India**' and 'Atma Nirbhar Bharat' to promote indigenous manufacturing.

○ Record **75% of the defense capital procurement budget** was earmarked for domestic industry in FY 2023-24, up from **68% in 2022-23.**

○ Domestic defense production has also seen a strong performance, reaching **₹1.27 trillion in FY 2024**.

○ Recently, the Ministry of Defence has notified the **fifth Positive Indigenisation List (PIL)** consisting of **346 items,** further boosting domestic defense manufacturing.

○ The **Standard Operating Procedure (SOP) for the Defence Export Promotion** Scheme in India establishes guidelines and procedures for certification and testing of defense exports

➢ **Increased Private Sector Participation:** The opening up of the defense sector to private players has been a significant driver of export growth.

○ The government has encouraged private sector participation through various measures, including the **Innovations for Defence Excellence (iDEX) initiative.**

○ As a result, as against **215 Defence licenses issued till 2014**, the number of **Defense licenses issued went up to 440 by March 2019**.

○ Notable examples include **Tata Advanced Systems Limited's export of aerospace components to Boeing**.

● This increased participation has led to a more diverse and competitive defense manufacturing ecosystem, driving innovation and export growth.

○ India has also established two Defence Industrial Corridors - **one in Uttar Pradesh and another in Tamil Nadu.**

➢ **Focus on Research and Development:** India has significantly **increased its focus on R&D in the defense sector,** leading to the development of advanced indigenous technologies that are attractive in the global market.

○ The **Defence Research and Development Organisation** (DRDO) has been at the forefront of this effort, with its budget of **Rs 23,855 crore in FY 2024-25**

○ This investment has resulted in the development of exportable products like the **BrahMos missile system, Akash air defense system, and the Advanced Light Helicopter (ALH)**.

● For example, in January 2022, the **Philippines** concluded a $375 million deal with India for three batteries of shore-based anti-ship variant of the BrahMos supersonic cruise missiles

➢ **Strategic Partnerships and Government-to-Government Agreements**: India has been actively pursuing strategic partnerships and G2G agreements to boost defense exports.

○ These agreements provide a framework for collaboration in defense production and export to third countries.

○ A prime example is the **India-Japan Acquisition and Cross-Servicing Agreement (ACSA) signed in 2020,** which facilitates reciprocal provision of supplies and services between the armed forces of the two countries.

○ Similarly, India has defense cooperation agreements with **over 53 countries.,** opening up new markets for Indian defense products.

➢ **Competitive Pricing and Quality:** Indian defense products have gained a reputation for **offering good quality at competitive prices**, making them attractive to many developing and middle-income countries.

○ This is partly **due to lower manufacturing costs in India** and the focus on developing cost-effective solutions.

○ For instance, the Indian-made Akash surface-to-air missile system is priced **significantly lower than comparable systems from other countries**, making it an attractive option for countries like **Armenia.**

➢ **Offset Policies and Technology Transfer**: **India's offset policy,** which requires foreign defense companies to invest a **portion of their contract value in India**, has played a crucial role in promoting exports.

○ This policy has led to the establishment of **joint ventures and technology transfers,** enhancing India's manufacturing capabilities and export potential.

○ For example, the **Tata-Lockheed Martin joint venture to produce F-16 wing sets in India** has not only served the offset requirements but also positioned India as a part of the global supply chain.

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

➢ **Dependence on Imports**: Despite recent strides in indigenous production, **India remains one of the world's largest arms importers,** highlighting a persistent dependence on foreign technology and equipment.

○ According to the Stockholm International Peace Research Institute (SIPRI), between 2019 and 2023, the country accounted for a significant **9.8% of the total global arms imports.**

○ For instance, major import deals like the **USD 5.43 billion** contract for **S-400 air defense systems** from Russia in **2018** underscore this issue.

● This dependence **not only strains foreign exchange reserves** but also poses potential risks to national security in times of geopolitical tensions.

➢ **Slow Procurement Process**: India's defense procurement process is often criticized for being **lengthy, complex, and bureaucratic,** leading to delays in modernization efforts.

○ The **Defence Procurement Procedure (DPP),** despite periodic revisions, still involves multiple stages.

○ A notable example is the procurement of **126 Medium Multi-Role Combat Aircraft (MMRCA),** which began in 2007 but was **eventually scrapped in 2015** due to complications.

➢ **Limited Private Sector Participation:** While private sector participation in defense manufacturing has increased, it still faces significant challenges.

○ According to data from the Department of Defence Production, private sector companies contributed **only 22% in FY24.**

○ Barriers include **high entry costs, long gestation periods for returns on investment, and preference often given to public sector units** for major contracts.

○ The dominance of **Defense Public Sector Undertakings (DPSUs)** in major projects continues to limit opportunities for private players.

➢ **Inadequate Research and Development:** Despite increased budget allocations, India's defense R&D still lags behind global leaders.

○ India's defense **spending trajectory in 2023** reflected a 4.2% increase, yet it continues to lag behind major global powers like the **US, China, and Russia** in absolute terms.

○ This underfunding has led to **delays and cost overruns in critical projects**.

○ The **Kaveri engine,** a project conceived in the 1980s to propel India's indigenous **Light Combat Aircraft (LCA) Tejas**, remains unavailable even after decades of development.

➢ **Technology Gaps**: India faces significant technology gaps in critical areas such as **engine development, advanced materials,** and high-end electronics for defense applications.

○ This is evident in the continued reliance on foreign suppliers for key components.

○ For example, despite developing the Tejas fighter jet indigenously, India still imports its **engine (GE F404) from the United States**.

○ These technology gaps not only affect self-reliance but also limit India's ability to export advanced defense systems..

➢ **Offset Policy Implementation Challenges:** While the offset policy was designed to boost domestic defense manufacturing and technology absorption, its implementation has faced significant challenges.

○ The **Comptroller and Auditor General (CAG)** has reported poor performance of India's Defense Offset Policy.

● Of the **46 offset contracts** valued at **₹66,427 crore (2005–2018),** only **₹11,396 crore has been claimed**.

➢ **Lack of Robust Arms Export Control Legislation:** India's arms export control framework, primarily governed by the **Foreign Trade Act 1992 and the Weapons of Mass Destruction Act 2005**, lacks specific provisions for assessing the human rights records or IHL compliance of recipient countries.

○ This legislative gap was highlighted when the **Supreme Court dismissed a PIL seeking** to stop defense exports to Israel amid allegations of war crimes in Gaza.

○ India's laws do not mandate a comprehensive review of the end-use of exported arms.

● This absence of stringent checks could **potentially implicate India in international law violations** and damage its reputation as a responsible arms exporter.

What Measures can India Export to Revamp its Defence Sector?

➢ **Enhance International Collaborations and Joint Ventures:** India should actively **pursue more strategic partnerships and joint ventures** with leading global defense manufacturers to access **cutting-edge technologies** and expand its export potential.

○ This could involve **setting up co-production facilities in India**, technology transfer agreements, and collaborative R&D projects.

○ Such partnerships would not only boost India's technological capabilities but also **provide access to established global supply chains and markets.**

○ **A prime example is the recent agreement between Hindustan Aeronautics Limited (HAL) and General Electric (GE) to co-produce F414 engines in India**, which could potentially lead to exports of these engines or aircraft equipped with them.

➢ **Establish a Robust Export Financing Mechanism:** To compete effectively in the global arms market, India needs to develop a **comprehensive export financing mechanism specifically tailored for defense exports.**

○ This could includ**e government-backed loan guarantees,** competitive credit lines, and insurance coverage for political and commercial risks.

○ Such a mechanism **would make Indian defense products more attractive to potential buyers**, especially in developing countries.

➢ **Implement a Comprehensive IHL Compliance Framework:** India should establish a **robust International Humanitarian Law (IHL) compliance** framework for its arms exports.

○ This would involve creating a **dedicated body to assess the human rights records** and IHL compliance of potential recipient countries before approving arms exports.

○ The framework should include **regular monitoring of end-use and provisions** for suspending or canceling contracts in case of violations.

○ Implementing such a framework would **not only align India with international best practices** but also **enhance its reputation as a responsible arms exporter.**

➢ **Invest in Niche Technologies and Indigenous Innovation:** To carve out a unique position in the global arms market, India should **focus on developing niche technologies and promoting indigenous innovation.**

○ This could involve increased funding for defense startups, establishing defense innovation hubs, and incentivizing private sector R&D in emerging technologies like **AI, quantum computing, and hypersonic systems.**

○ For example, **India's success with the BrahMos supersonic cruise missile**, developed jointly with Russia, demonstrates the potential of focusing on advanced niche products.

➢ **Streamline Defense Production and Export Processes:** India needs to significantly streamline its defense production and export processes to enhance efficiency and competitiveness.

○ This could involve creating a **single-window clearance system for defense exports,** simplifying licensing procedures, and **establishing dedicated export promotion cells** within defense PSUs and major private sector companies.

○ Additionally, the government should work on reducing the time taken for testing and certification of defense products meant for export.

○ A successful example of streamlining defense acquisition procedures, which have reduced procurement timelines. Similar efficiency improvements in the export process could significantly boost India's competitiveness in the global market.

➢ **Develop a Strong Offset Management System:** India should revamp its offset policy and develop a robust offset management system to leverage defense imports for boosting exports.

○ This could involve creating a dedicated offset management agency, developing a transparent online platform for offset opportunities, and aligning offset requirements with export-oriented projects.

○ The system should focus on technology transfer and co-development projects that can enhance India's export capabilities. For instance, India could take inspiration from Israel's successful

offset program, which has significantly contributed to its defense industrial base and export capabilities.

➤ **Establish Regional Service and Maintenance Hubs:** To **enhance the attractiveness of Indian defense exports**, the country should establish regional service and maintenance hubs in strategic locations.

   ❍ These hubs would provide **after-sales support, maintenance, and upgrades** for Indian defense equipment sold to foreign countries.

   ❍ This approach would not only generate additional revenue but also build long-term relationships with customer countries.

   ❍ For example, **India could set up such hubs in friendly nations like Vietnam or the UAE,** which could serve as centers for maintaining and upgrading Indian-made equipment in Southeast Asia and the Middle East respectively.

Conclusion:

As India strives to become a significant player in the global defense market, addressing legal and ethical gaps, particularly **concerning International Humanitarian Law (IHL) compliance,** is crucial. By implementing comprehensive legislation and fostering innovation, India can enhance its reputation as a responsible arms exporter while ensuring that its defense ambitions align with global standards. This strategic approach will not **only bolster national security but also reinforce India's position as a leader in the international defense landscape.**

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Agriculture 4.0: The Next Farming Revolution

This editorial is based on "Agriculture 4.0: How urban farming is shaping the future of food security in smart cities" which was published in Hindu Business Line on 23/09/2024. The article brings into picture the role of Agriculture 4.0 in transforming urban and rural farming through smart technologies like IoT, vertical farming, and mobile apps. This innovation enhances food security, optimizes resource use, and boosts farmer incomes, positioning India as a leader in sustainable agriculture.
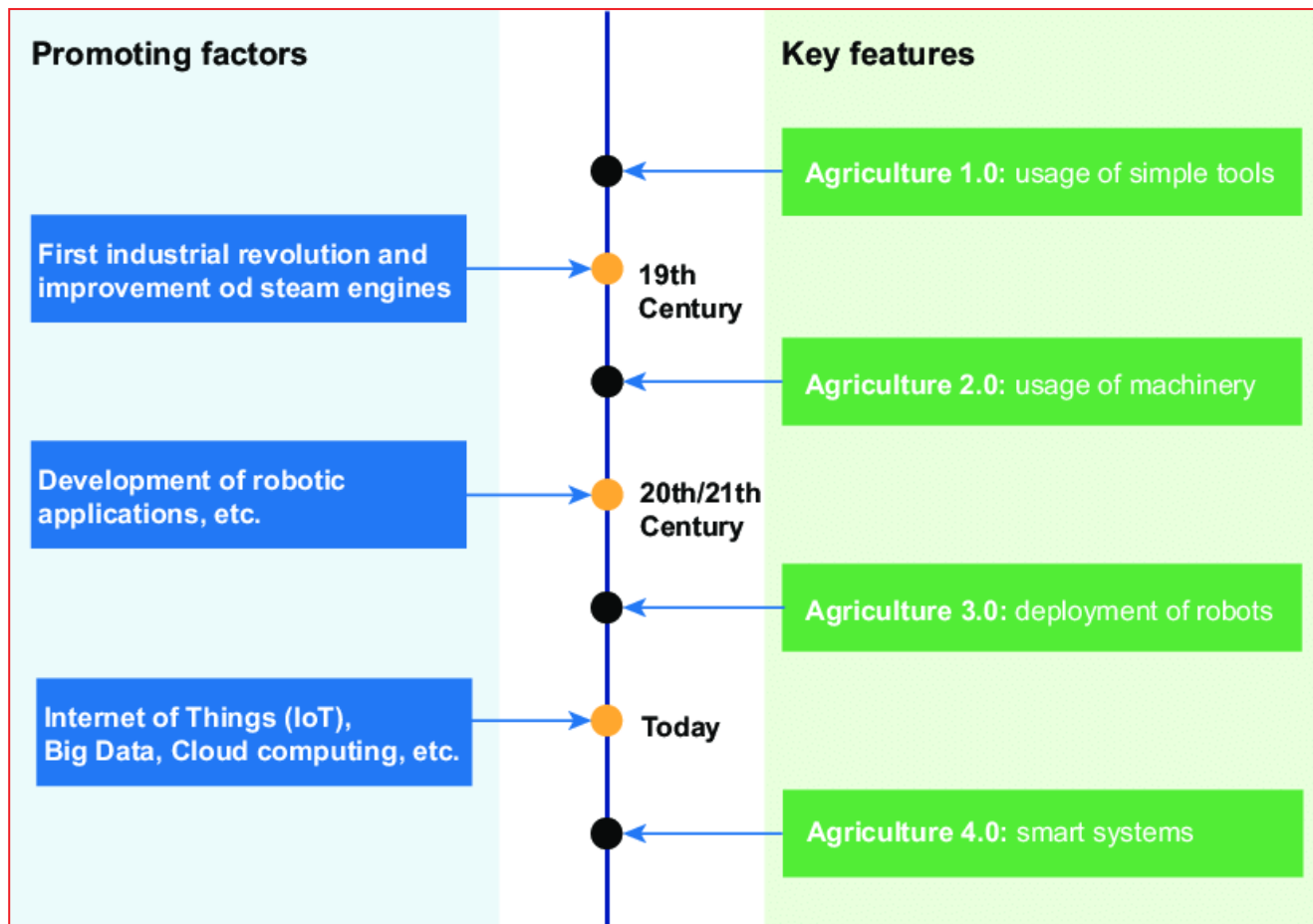
Tag: GS Paper - 3, Direct & Indirect Farm Subsidies, Public Distribution System, Buffer Stocks & Food Security, Agricultural Marketing

Agriculture 4.0 is revolutionizing **urban food production**, seamlessly **blending advanced technologies** with the growing demand for **local, sustainable food sources in cities**. This innovative approach transforms urban spaces into thriving agricultural hubs, utilizing smart technologies like the **Internet of Things** (IoT), **vertical farming, and hydroponics**.

In the Indian landscape, **Agriculture 4.0 is not just about high-tech urban farms**; it's about empowering farmers across the country with tools to make informed decisions, optimize resource use, and increase yields. As India aims to double farmers' income and ensure food security for its **1.4 billion people**, the adoption of Agriculture 4.0 practices **holds the potential to transform the agricultural sector**, making it more attractive to younger generations and **positioning India as a global leader in sustainable food production.**

What is Agriculture 4.0?

➤ **About:** Agriculture 4.0, also known as smart farming or digital farming, represents the **fourth major revolution in agricultural practices**, leveraging cutting-edge technologies to optimize food production and resource management.

   ❍ This innovative approach integrates advanced digital technologies such as the **Internet of Things (IoT), artificial intelligence (AI), machine learning, big data analytics, robotics, and precision farming techniques** into traditional agricultural practices.

➤ **Other Key Agricultural Revolutions:**

   ❍ **Agriculture 1.0:** The initial transition from hunting-gathering to settled agriculture, beginning around 10,000 BCE, marked by the domestication of plants and animals.

   ❍ **Agriculture 2.0:** The **Industrial Revolution in agriculture** (18th-19th centuries), characterized by mechanization, improved crop rotation, and the use of chemical fertilizers and pesticides.

   ❍ **Agriculture 3.0**: The **Green Revolution (mid-20th century),** featuring high-yielding crop varieties, expanded irrigation, and increased use of synthetic fertilizers and pesticides to boost food production.

      ● The mechanization of tasks like planting, harvesting, and irrigation during Agriculture 3.0 **laid the groundwork for future advancements in agricultural automation, including the use of robotics.**

Promoting factors

First industrial revolution and improvement od steam engines

Development of robotic applications, etc.

Internet of Things (IoT), Big Data, Cloud computing, etc.

19th Century

20th/21th Century

Today

Key features

Agriculture 1.0: usage of simple tools

Agriculture 2.0: usage of machinery

Agriculture 3.0: deployment of robots

Agriculture 4.0: smart systems

What are the Benefits of Agriculture 4.0?

➢ **Increased Crop Yields and Productivity:** Agriculture 4.0 technologies significantly boost crop yields through precision farming techniques.

 ❍ For instance, **the use of IoT sensors** and data analytics enables farmers to optimize inputs like **water, fertilizers, and pesticide**s based on real-time soil and plant conditions.

 ❍ In India, the adoption of precision agriculture techniques has led to yield increases of up to **30% in some crops.**

 ❍ A notable example is the partnership between **Microsoft and ICRISAT**, which developed an AI-powered sowing app that **increased groundnut yields by 30% in Andhra Pradesh**.

➢ **Resource Efficiency and Sustainability:** Agriculture 4.0 promotes **sustainable farming practices by optimizing resource use.**

 ❍ Smart irrigation systems, for example, can reduce water consumption by up to **50% compared to traditional methods.**

 ❍ In water-stressed regions of India, drip irrigation coupled with IoT sensors has shown remarkable results.

 ❍ The **Tamil Nadu Precision Farming Project** demonstrated water savings of 40-50%.

 • Furthermore, **precision application of fertilizers** guided by soil health data and crop requirements has led to a reduction in fertilizer use by 15-20%.

➢ **Climate Resilience and Risk Mitigation:** Advanced weather forecasting and early warning systems integral to Agriculture 4.0 help farmers adapt to climate change and mitigate risks.

 ❍ For instance, the **CRIDA's 'Meghdoot' app provides location, crop, and livestock-specific weather-based agro-advisories** to Indian farmers.

 ❍ This technology has been crucial in helping farmers make informed decisions about planting, harvesting, and pest control, reducing crop losses due to extreme weather events.

➢ **Supply Chain Optimization and Market Access:** Agriculture 4.0 technologies are **revolutionizing agricultural supply chains**, reducing post-harvest losses and improving market access for farmers.

 ❍ Blockchain-based supply chain solutions, for example, enhance traceability and transparency, building trust among consumers and fetching better prices for farmers.

○ In India, the **eNAM (Electronic National Agriculture Market) platform**, which leverages digital technology to connect farmers with buyers across the country, has enrolled over **1.69 crore farmers.**

➢ **Data-Driven Decision Making and Predictive Analytics:** The integration of big data and AI in agriculture enables predictive analytics, helping farmers and policymakers make informed decisions.

○ For instance, **satellite imagery** combined with **machine learning algorithms** can predict crop yields months before harvest with over **90% accuracy**.

○ In India, the **FASAL project (Forecasting Agricultural output using Space, Agrometeorology and Land based observations)** uses such technologies to provide pre-harvest crop estimates for major crops, aiding in national food security planning.

➢ **Democratization of Agricultural Knowledge:** Agriculture 4.0 is making expert **agricultural knowledge more accessible to smallholder farmers** through mobile apps and AI-powered chatbots.

○ In India, platforms lik**e Kisan Suvidha and IFFCO Kisan** have reached millions of farmers, providing them with personalized advice on crop management, pest control, and market prices.

○ Agritech startup **DeHaat's** revenue is likely to grow by over 80% on sales of farm inputs to farmers.

Key Case Studies Related to Agriculture 4.0:

➢ **Pramod Gautam:** A former automobile engineer, Pramod switched to farming on his 26-acre land in 2006.

○ Facing initial challenges with crops and labor, he adopted modern farm equipment and shifted to horticulture. Today, Pramod runs a successful dal mill and horticulture business, generating a turnover of Rs. 1 crore annually.

➢ **Sachin Kale**: A mechanical engineer turned farmer, Sachin left his high-paying job in 2013 to set up an innovative clean energy farm.

○ He now runs his own company, helping over 137 farmers with contract farming and generating a turnover of Rs. 2 crore.

➢ **Harish Dhandev:** Harish left a government job to pursue Aloe Vera farming in Rajasthan. Using digital platforms and market research, he scaled his business to 100 acres, now earning between Rs. 1.5 to 2 crore annually.

➢ **Vishwanath Bobade**: A farmer from drought-prone Beed, Maharashtra, Vishwanath earned Rs. 7 lakh from one acre through multi-cropping and efficient farming techniques like drip irrigation.

➢ **Rajiv Bittu**: A chartered accountant who turned to farming, Rajiv implemented modern techniques like drip irrigation and mulching. His diversified crop strategy on leased land now earns him Rs. 15-16 lakh annually.

These cases highlight how innovation, technology, and smart farming methods are transforming agriculture in India, aligning with the principles of Agriculture 4.0.

What are the Key Roadblocks to Implementation of Agri 4.0 in India?

➢ **Limited Digital Infrastructure and Connectivity:** Despite rapid improvements, India's **rural digital infrastructure** remains a significant barrier to Agriculture 4.0 adoption.

○ Out of approximately **5.97 lakh villages in India,** it is estimated that around **25,067 villages** lack mobile and internet connectivity.

○ The Digital India initiative has made strides, but the last-mile connectivity challenge persists.

○ This digital divide hinders the deployment of IoT devices and real-time data transmission crucial for precision agriculture.

○ In states like **Bihar and Jharkhand**, where connectivity is particularly poor, farmers struggle to access even basic digital agricultural services, limiting the potential impact of Agriculture 4.0 technologies.

➢ **Small and Fragmented Landholdings:** India's agricultural landscape is dominated by **small and marginal farmers**, with an **average landholding size of just 1.08 hectares.**

○ This fragmentation makes it challenging to implement large-scale technological solutions cost-effectively.

○ For example, precision farming equipment like **GPS-guided tractors or drones** for crop monitoring become economically unviable for individual smallholders.

○ This **fragmentation not only increases the per-acre cost of technology adoption** but also complicates data collection and analysis at scale, reducing the effectiveness of big data-driven agriculture solutions.

- ➢ **Limited Financial Resources and Access to Credit:** The high initial investment required for **Agriculture 4.0 technologies** poses a significant barrier for many Indian farmers.
  - ○ According to the **National Financial Inclusion Survey 2016-17,** The annual income of rural households was ₹ **96,708.**
  - ○ While schemes like the **Kisan Credit Card** have improved credit access, the adoption of high-tech farming solutions remains low.

- ➢ **Lack of Awareness and Digital Literacy:** Majority of Indian farmers lack awareness about Agriculture 4.0 technologies and the digital literacy required to use them effectively.
  - ○ As of 2023**, only 30% of Indian farmers** have adopted some form of digital technology in their agricultural practices.
  - ○ The **digital literacy rate in rural India stands at just 25%**.
  - ○ This knowledge gap hinders the adoption of even basic digital agricultural services.

- ➢ **Inadequate Data Infrastructure and Standards:** The lack of standardized, high-quality agricultural data is a major roadblock for Agriculture 4.0 in India.
  - ○ While initiatives like the **Soil Health Card scheme** have generated vast amounts of data, the integration and effective use of this data remain challenges.
  - ○ The **absence of a unified agricultural data platform** hampers the development of AI and ML models crucial for precision agriculture.

- ➢ **Environmental and Socio-Economic Disparities:** India's diverse agro-climatic zones and socio-economic disparities pose unique challenges to the uniform implementation of Agriculture 4.0.
  - ○ **Technologies that work well in irrigated regions of Punjab or Haryana** may **not be suitable for rain-fed areas in central India**.
  - ○ For instance, while precision irrigation technologies can show water savings of up to 50% in some areas, their applicability in rain-fed regions, which constitute **51% of India's net sown area**, is limited.
  - ○ Similarly, the **success of agri-tech startups is often concentrated in more developed agricultural belts**, creating a technology adoption gap between progressive and marginalized farming communities.

What are the Recent Government Initiatives Related to Digitalisation of Agriculture?

- ➢ **India Digital Ecosystem of Agriculture** (IDEA): A framework designed to create a federated farmers' database to enable innovative agri-focused solutions. It integrates scheme databases for effective planning to increase farmers' income and boost sectoral efficiency.

- ➢ **National e-Governance Plan in Agriculture (NeGP-A)**: Supports state projects using technologies like AI, ML, robotics, drones, data analytics, and blockchain to modernize agriculture.

- ➢ **Sub Mission on Agricultural Mechanization (SMAM)**: Focuses on providing farm mechanization to small and marginal farmers through custom hiring centers, high-tech equipment hubs, and capacity building.

- ➢ **e-NAM**: A pan-India digital trading portal connecting Agricultural Produce Market Committees (APMCs) to create a unified market for agricultural commodities, benefiting farmers, traders, and FPOs.

- ➢ **PM-KISAN Scheme**: Transfers funds directly to farmers' bank accounts via Direct Benefit Transfer (DBT). Farmers can self-register and access information through the PM-KISAN Mobile App.

- ➢ **AGMARKNET**: A G2C e-governance portal providing agricultural marketing-related information, including daily prices and arrivals of commodities in agricultural markets.

- ➢ **Agriculture Infrastructure Fund (AIF)**: Provides financial assistance for post-harvest management and community farming assets, offering interest subvention and credit guarantees.

- ➢ **National Mission on Horticulture (HORTNET)**: Promotes e-Governance in horticulture by offering a web-enabled system for financial assistance, ensuring transparency in the process.

- ➢ **National Project on Soil Health and Fertility**: Issues soil health cards through a digital portal for farmers to track nutrient deficiencies and improve fertilization practices.

- ➢ **Kisan Suvidha Mobile App**: Disseminates crucial information on weather, market prices, plant protection, input dealers, and more to help farmers make informed decisions.

What Strategies can be Adopted to Effectively Implement Agriculture 4.0 in India?

- ➢ **Public-Private Partnerships for Digital Infrastructure:** Leveraging public-private partnerships can accelerate

the development of digital infrastructure in rural areas.

- ○ The **BharatNet project** can be expedited by involving private telecom operators in last-mile connectivity and can be linked to **CSCs (Common Service Centres).**
- ○ Expanding this model can significantly improve rural internet connectivity.
- ○ These partnerships can focus on **creating Wi-Fi hotspots in village centers and providing subsidized data plans for agricultural use**, making digital agriculture services more accessible to farmers.

➢ **Farmer Producer Organizations (FPOs) for Technology Adoption:** Promoting and strengthening Farmer Producer Organizations can overcome the challenges posed by small landholdings.

- ○ The government's target to form **10,000 new FPOs by 2024** provides an excellent opportunity to introduce Agriculture 4.0 technologies at scale.
  - In the **Union budget 2024-25** the government proposed increasing the allocation for FPOs by about 30%**, from ₹450 crore for 2023-24 to ₹581.67 crore for 2024-25**
- ○ The success of **FPOs like Sahyadri Farms in Maharashtra**, which has helped small farmers adopt precision farming techniques, demonstrates the potential of this approach.

➢ **Customized Financial Products and Digital Literacy Programs:** Developing tailored financial products for Agriculture 4.0 technology adoption, coupled with digital literacy programs, can address both financial and knowledge gaps.

- ○ **Banks and fintech companies** can offer low-interest loans or pay-per-use models for agri-tech solutions.
- ○ Expanding programs like the **Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA)** with a specific focus on digital agriculture can enhance farmers' ability to use these technologies effectively.

➢ **Standardization of Agricultural Data and Open Data Platforms:** Establishing a standardized framework for agricultural data collection, storage, and sharing is crucial for the effective implementation of Agriculture 4.0.

- ○ The **India Digital Ecosystem of Agriculture (IDEA) framework** can be fast-tracked to create a unified, open-source platform for agricultural data.

- ○ Implementing **blockchain technology for data integrity and traceability,** as demonstrated by the **Coffee Board of India's** blockchain-based marketplace pilot, can enhance trust and transparency in the agricultural data ecosystem.

➢ **Regulatory Sandbox for Agri-Tech Innovations:** Creating a regulatory sandbox for agricultural technologies can foster innovation while ensuring safety and efficacy.

- ○ This approach allows for **controlled testing of new technologies in real-world conditions** before full-scale implementation.
- ○ For example, the **recent liberalization of drone regulations for agriculture** can be extended to create designated zones for testing advanced drone applications in precision agriculture.
- ○ The success of **India's regulatory sandbox for fintech** can serve as a model, allowing agri-tech startups to test their innovations in controlled environments.

➢ **Localized Agri-Tech Solutions through Krishi Vigyan Kendras (KVKs):** Leveraging the network of **Krishi Vigyan Kendras (KVKs)** to develop and disseminate localized agri-tech solutions can address the challenge of diverse agro-climatic conditions.

- ○ KVKs can serve as **hubs for demonstrating and customizing Agriculture 4.0** technologies for specific local needs.

➢ **Integration of Agriculture 4.0 in Agricultural Education:** Updating agricultural education curricula to include **Agriculture 4.0 technologies** can create a skilled workforce to drive innovation and adoption.

- ○ This can be achieved by integrating courses on precision agriculture, IoT in farming, and agricultural data analytics into existing agricultural degree programs.
- ○ Collaborations with tech companies, like the partnership between Microsoft and ICAR **can bring industry expertise into agricultural education,** preparing the next generation of tech-savvy agricultural professionals.

Conclusion:

Agriculture 4.0 is transforming Indian farming by integrating advanced technologies to **enhance productivity, sustainability, and resilience**. However, addressing challenges like limited digital infrastructure, small landholdings, and financial constraints is crucial for widespread adoption. With strategic public-private

partnerships and localized solutions, Agriculture 4.0 can revolutionize India's agricultural landscape, **ensuring food security and empowering farmers.**

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Nuclear Disarmament: India's Balancing Act

This editorial is based on "[Taking stock of global nuclear disarmament](#)" which was published in The Hindu on 26/09/2024. The article highlights the growing significance of the Treaty on the Prohibition of Nuclear Weapons (TPNW) amidst global challenges and India's delicate position as a nuclear power outside the NPT. It underscores India's need to balance national security interests with the potential of the TPNW to delegitimize nuclear weapons.

Tag: GS Paper - 2, GS Paper - 3, Nuclear Technology, Government Policies & Interventions, Effect of Policies & Politics of Countries on India's Interests

The **International Day for the Total Elimination of Nuclear Weapons** (26th September) brings renewed focus to global nuclear disarmament efforts, particularly the **Treaty on the Prohibition of Nuclear Weapons (TPNW).** As the **United Nations** grapples with divisive issues like the Ukraine war and climate change, the TPNW's agenda gains significance. The treaty, which came into force in 2021, goes beyond the **Non-Proliferation Treaty** (NPT) by comprehensively banning the development, testing, production, and use of nuclear weapons. With 70 states parties and 27 signatories as of July 2024, the TPNW represents a growing movement to delegitimize nuclear weapons.

India's stance on the TPNW is crucial, given its status as a nuclear power outside the NPT framework. While **India has historically opposed the NPT as discriminatory,** it has not actively undermined the treaty. As the global community reassesses nuclear risks in light of recent geopolitical tensions, India must navigate its national security interests **while considering the normative potential of the TPNW in delegitimizing nuclear weapons.**

How Global Nuclear Disarmament Efforts Evolved Over Time?

➢ **Early Nuclear Era and First Disarmament Attempts (1945-1960):** The modern nuclear age began with the **Trinity test** and the **bombings of Hiroshima and Nagasaki in 1945.**

○ By 1949, the Soviet Union had tested its first nuclear device, initiating the arms race.

○ The **1946 Baruch Plan** proposed international control of atomic energy but failed due to Cold War tensions.

○ In **1953**, Dwight Eisenhower's **"Atoms for Peace"** speech attempted to shift focus to peaceful nuclear applications.

○ The **International Atomic Energy Agency (IAEA) was established in 1957** to promote peaceful nuclear use and prevent military applications.

○ India, newly independent, initially advocated for complete disarmament but **began its own nuclear program in the 1950s under Homi Bhabha.**

➢ **Non-Proliferation Treaty and Partial Test Ban (1960-1970):** The **1963 Partial Nuclear Test Ban Treaty** prohibited above-ground nuclear tests.

○ The **Treaty on the Non-Proliferation of Nuclear Weapons (NPT)** was opened for signature in 1968, entering into force in 1970.

○ **The NPT recognized five nuclear weapon states (US, USSR, UK, France, China)** and aimed to prevent further proliferation.

● The treaty established a review process every five years.

● **India refused to sign the NPT,** viewing it as discriminatory, and continued its nuclear program under the guise of peaceful purposes.

➢ **SALT, START, and Regional Nuclear-Free Zones (1970-1990):** The **Strategic Arms Limitation Talks (SALT)** between the US and USSR resulted in the **Anti-Ballistic Missile Treaty (1972) and SALT I (1972).**

○ The first Nuclear-Weapon-Free Zone was established in Latin America **(Treaty of Tlatelolco).**

○ The **Intermediate-Range Nuclear Forces Treaty (1987**) eliminated an entire class of nuclear weapons.

○ **India conducted its first nuclear test, "Smiling Buddha," in 1974**.

➢ **Post-Cold War Disarmament Momentum (1990-2000):** The slowdown of the Cold War accelerated disarmament efforts.

○ The **Strategic Arms Reduction Treaty (START I)** was signed in 1991, reducing deployed nuclear warheads.

○ The **Comprehensive Nuclear-Test-Ban Treaty (CTBT)** was opened for signature in 1996.

● However, it has **not entered into force due to non-ratification by key states.**

○ **India and Pakistan both conducted nuclear tests in 1998,** declaring themselves nuclear powers outside the NPT framework.

➢ **Challenges to Disarmament and New Initiatives (2000-2010):** The US withdrew from the **Anti-Ballistic Missile Treaty in 2002**, citing new security threats.

○ The Global Threat Reduction Initiative was launched in 2004 to secure nuclear materials worldwide.

○ **India signed a civil nuclear agreement with the US in 2008, gaining de facto recognition of its nuclear status** while remaining outside the NPT.

➢ **Humanitarian Initiative and Ban Treaty (2010-2020):** The **Humanitarian Initiative, launched in 2010**, refocused disarmament efforts on the catastrophic humanitarian consequences of nuclear weapons.

○ This led to the negotiation of the **Treaty on the Prohibition of Nuclear Weapons (TPNW) in 2017**, which entered into force in 2021.

○ The **2015 Joint Comprehensive Plan of Action (Iran nuclear deal)** was a significant non-proliferation achievement, though challenged by US withdrawal in 2018.

● India maintained its policy of **"credible minimum deterrence"** and continued to advocate for universal nuclear disarmament.

➢ **New Challenges and Uncertain Future (2020-Present):** The **Covid-19 pandemic** disrupted disarmament diplomacy, with many meetings postponed or held virtually.

○ The US and Russia extended **New START for five years in 2021**, preserving the last remaining bilateral nuclear arms control treaty.

○ **Tensions over Ukraine** led to increased nuclear rhetoric, raising global concerns.

● Also, The recent escalation **between Israel and Hamas** has heightened concerns with the **risk of broader conflict raising questions about nuclear security in the Middle East.**

○ Emerging technologies like **hypersonic weapons and AI Supported Warfare** pose new challenges to strategic stability.

○ India continues to **modernize its nuclear arsenal while supporting disarmament in principle,** advocating for a time-bound framework for universal nuclear disarmament.

What are the Current Nuclear-Related Issues that India is Facing?

➢ **Balancing Nuclear Deterrence with Disarmament Advocacy:** India faces the challenge of maintaining its nuclear deterrent while advocating for global disarmament.

○ As of 2023, India is estimated to possess about **160 nuclear warheads.**

○ India continues to **modernize its nuclear arsenal**, including the development of **submarine-launched ballistic missiles (SLBMs)** like the **K-4.**

○ Simultaneously, India has been a vocal proponent of **universal nuclear disarmament,** calling for a time-bound framework at various international forums.

○ This dual stance creates diplomatic tensions, particularly as **India remains outside the Non-Proliferation Treaty (NPT)** while seeking greater integration into the global nuclear order.

➢ **Managing the China-Pakistan Nuclear Axis:** The strategic partnership between China and Pakistan poses a significant challenge to India's security calculus.

○ **China's support for Pakistan's nuclear program**, including the alleged transfer of missile technology and nuclear materials, has been a long-standing concern.

○ Recent developments, such **as China's construction of nuclear reactors in Pakistan (e.g., the Karachi Nuclear Power Plant Units 2 and 3)**, have heightened these concerns.

○ The potential for a **two-front nuclear threat scenario** complicates India's defense planning and nuclear posture.

● This has led to **India's development of longer-range missiles** like the **Agni-V,** capable of reaching targets across China, and investments in sea-based deterrence capabilities.

➢ **Nuclear Doctrine and No First Use Policy:** India's nuclear doctrine, centered around its **No First Use (NFU) policy,** faces scrutiny and debate in light of evolving regional dynamics.

○ Some strategists argue for a **revision of the NFU policy**, particularly given Pakistan's development of tactical nuclear weapons and China's nuclear expansion.

○ In August 2019, **India's Defence Minister's** statement that the future of NFU would depend

on circumstances sparked speculation about potential doctrinal shifts.

○ The debate continues on whether **India's NFU policy enhances or undermines its deterrence credibility**, especially in asymmetric conflict scenarios. This discussion has implications for India's nuclear posture, force structure, and diplomatic relations.

➤ **Nuclear Security and Safety Concerns:** Ensuring the security and safety of its growing nuclear infrastructure is a critical challenge for India.

○ The country has **23 operational nuclear reactors as of 2023**, with plans to increase nuclear power capacity to **22,480 MWe by 2031.**

○ While India has a good nuclear safety record, incidents like the **2010 Mayapuri radiation exposure** highlight potential vulnerabilities.

○ International concerns persist about the security of India's nuclear materials, despite its participation in global initiatives like the Nuclear Security Summit process.

○ The Nuclear Threat Initiative (NTI) Nuclear Security Index ranked **India 20th out of 22 countries** with weapons-usable nuclear materials, indicating areas for improvement in nuclear security practices.

➤ **Civil Nuclear Cooperation and NSG Membership:** India's quest for greater integration into the global nuclear order faces ongoing challenges.

○ Despite the landmark **India-US Civil Nuclear Agreement of 2008** and subsequent **Nuclear Suppliers Group (NSG) waiver,** India's full membership in the NSG remains elusive.

○ China's opposition, linked to **Pakistan's parallel NSG bid**, has been a significant obstacle.

○ This situation impacts India's access to advanced nuclear technologies and its ability to participate fully in global nuclear commerce.

○ Recent developments, such as **India's civil nuclear cooperation agreements with countries like Japan (operationalized in 2017)** demonstrate progress but also highlight the complexities of India's unique position in the global nuclear landscape.

➤ **Technological Advancements and Strategic Stability:** India's pursuit of advanced nuclear and missile technologies presents both opportunities and challenges.

○ **The successful test of the Agni-P missile in December 2021**, a canisterized missile with improved accuracy and quicker response time, enhances India's deterrence capabilities.

○ However, such advancements, along with the development of **Multiple Independently Targetable Reentry Vehicles (MIRVs)** and **Ballistic Missile Defense (BMD) systems,** could potentially trigger an arms race in the region.

➤ **Nuclear Energy Expansion and Environmental Concerns:** India's ambitious plans to expand its nuclear energy sector face significant challenges.

○ The target of increasing nuclear power capacity to 22,480 MWe by 2031 requires **substantial investment and overcoming public opposition**.

○ Protests against nuclear power plants, such as those at **Kudankulam and Jaitapur,** highlight concerns about safety and environmental impact.

○ The push for indigenous technology, exemplified by the design of the **700 MWe Pressurized Heavy Water Reactors (PHWRs),** aims to reduce dependence on foreign technology but faces technical and economic hurdles.

What Measures India Can Adopt to Balance Nuclear Deterrence with Disarmament?

➤ **Strengthen Credible Minimum Deterrence (CMD): India can reinforce its Credible Minimum Deterrence** posture by clearly defining what constitutes **"minimum" in the current geopolitical context.**

○ The successful test of the K-4 submarine-launched ballistic missile in 2020 demonstrates India's commitment to a credible sea-based deterrent.

○ By emphasizing **quality over quantity in its nuclear modernization efforts**, India can maintain deterrence while signaling its commitment to restraint and eventual disarmament.

➤ **Promote Regional Strategic Stability Dialogues:** India can initiate and participate in regional strategic stability dialogues**, involving both nuclear and non-nuclear states in South Asia.**

○ These dialogues could focus on **risk reduction measures, confidence-building, and crisis management mechanisms.**

○ For instance, India could propose regular meetings of nuclear risk reduction centers with Pakistan, similar to the **US-Russia model.**

○ By fostering open communication channels, India can work towards reducing nuclear tensions while demonstrating its commitment to regional stability and eventual disarmament.

➢ **Engage in Global Disarmament Initiatives:** While maintaining its deterrent, India can take a **more active role in global disarmament initiatives.**

○ This could include proposing **concrete steps towards a nuclear-weapon-free world at forums like the Conference on Disarmament.**

○ For example, India could champion the development of a **multilateral treaty on No First Use of nuclear weapons, building on its own policy**.

○ India's participation in the **Nuclear Security Summits** and its contributions to the **International Atomic Energy Agency** (IAEA) demonstrate its capacity for constructive engagement.

○ By leading such initiatives, India can strengthen its position as a responsible nuclear power committed to ultimate disarmament.

➢ **Invest in Verification Technologies:** India can invest in and contribute to the development of nuclear disarmament verification technologies.

○ This demonstrates a **commitment to creating the technical conditions necessary for future disarmament** while maintaining current deterrence capabilities.

○ India's expertise in space and satellite technology, demonstrated by missions like **Chandrayaan-3 in 2023,** could be leveraged for developing verification satellites.

● Such investments position India as a key player in shaping the future of disarmament processes.

➢ **Strengthen Domestic Controls and Export Regulations:** India can further strengthen its domestic nuclear controls and export regulations, demonstrating **responsible stewardship of nuclear technology while maintaining deterrence.**

○ This could involve enhancing physical security at nuclear facilities, improving nuclear material accounting systems, and tightening export controls on dual-use technologies.

○ For instance, **India's implementation of the Special Chemicals, Organisms, Materials, Equipment and Technologies (SCOMET) list,** which regulates the export of sensitive items, can be further refined and expanded.

○ These measures reinforce India's image as a responsible nuclear power committed to non-proliferation and eventual disarmament.

➢ **Promote Nuclear Energy for Sustainable Development:** India can emphasize the peaceful uses of nuclear technology, **particularly in addressing climate change** and sustainable development goals, while maintaining its deterrent.

○ This could involve expanding its nuclear energy program with a focus on advanced, safer reactor designs.

○ For example, **India's development of the Advanced Heavy Water Reactor (AHWR), which uses a thorium fuel cycle,** demonstrates its commitment to sustainable nuclear energy.

○ By highlighting the **civilian benefits of nuclear technology**, India can maintain public support for its nuclear program while advocating for global disarmament in the long term.

➢ **Engage in Track 1.5 and Track 2 Diplomacy:** India can actively participate in and support Track 1.5 and Track 2 diplomatic initiatives focused on nuclear risk reduction and disarmament.

○ These unofficial dialogues can explore innovative ideas and build relationships that facilitate official negotiations.

○ For instance, I**ndia could sponsor regional workshops on nuclear risk reduction,** similar to the "**Stability-Instability Paradox**" workshops held by the Stimson Center.

○ Such initiatives allow India to contribute to disarmament discourse while maintaining its deterrent posture.

Conclusion:

India faces the complex task of balancing its national security interests with global disarmament goals. By modernizing its **deterrence capabilities while actively advocating for nuclear disarmament,** engaging in international diplomacy, and investing in peaceful nuclear technologies, India can strengthen its position as a responsible nuclear power committed to eventual disarmament.

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Exploring the Prospects of One Nation One Election

This editorial is based on "GOI, think through ONOE" which was published in The Times of India on 25/09/2024. The article highlights that the implementation of "One Nation, One Election"(ONOE) requires political compromise, including the central government shortening

its parliamentary term. This statesmanship could foster consensus among states, ensuring a fair transition while enhancing voter turnout and preserving the festive significance of elections in India.

Tag: GS Paper - 2, Federalism, Elections, Government Policies & Interventions.

With the approval of a proposal for **simultaneous elections** nationwide and the report submitted by a **high-level committee** chaired by former President Ram Nath Kovind, the idea of "**One Nation, One Election(ONOE)**" has once again gained significant traction in India's political landscape. Advocates argue that this approach could enhance governance by **reducing the frequent interruptions** caused by staggered elections, allowing governments to focus on long-term policy implementation rather than short-term electoral strategies. Additionally, it could **potentially lower the costs** associated with conducting multiple elections and **streamline the electoral process**, promoting a sense of stability and predictability in governance.

However, the proposal has also sparked considerable debate, raising critical concerns about its **implications for federalism** and political representation.Critics warn that simultaneous elections may **overshadow local issues** and **marginalize regional parties**, favoring national parties and reducing political diversity. Additionally, the **logistical challenges** and the need for fair **representation across diverse demographics** must be carefully considered as India explores this significant change.

What is One Nation, One Election?

➢ **Definition**: **ONOE** refers to the proposal of holding simultaneous elections for the **Lok Sabha** and all **State Legislative Assemblies** in India.

   ○ In some cases, it may also include local body elections, such as those for municipalities and panchayats.

➢ **Objective**: The fundamental aim of ONOE is to **align the electoral cycles** across different levels of government, conducting elections concurrently or within a set timeframe.

   ○ This would necessitate significant **constitutional amendments** and changes to various election related laws and processes..

➢ **Historical Context**: India experienced synchronized elections from **1951 to 1967**, during which elections for the Lok Sabha and most State Assemblies were **held simultaneously**.

   ○ However, this practice eroded due to political factors and **premature dissolutions of assemblies.**

   ○ The election cycles diverged further due to **political instability and defections** in the 1960s**.**

What are the Advantages of One Nation, One Election?

➢ **Cost Reduction**: Simultaneous elections could lead to significant savings in resources like **security personnel, polling staff, and election materials**.

   ○ The cost of Lok Sabha elections in India has increased significantly, rising from **Rs 10.5 crore** in the first election of 1951-52 to **Rs 50,000 crore** in 2019.

   ○ This significant escalation reflects the growing complexities and scale of the electoral process over the decades.

   ○ Also, the **Election Commission of India's** (ECI) **operational costs** could decrease due to streamlined processes.

➢ **Governance Continuity**: Fewer elections could mitigate the "policy paralysis" caused by short-term electoral strategies and the **Model Code of Conduct**, while also reducing resource strain, constant campaigning, and corruption among political parties.

➢ **Reduced Disruptions**: Less frequent elections would mean fewer disruptions to public life, benefiting **educational institutions** often used as polling stations.

   ○ Also, teachers, along with other government service holders, are indulged in election duties and training, **disrupting their actual duties**.

   ○ Thus, ONOE could **enhance administrative efficiency** by allowing officials to focus more on governance instead of election duties.

➢ **Increased Voter Participation**: Supporters argue that simultaneous elections may reduce "**election fatigue**," potentially leading to higher voter turnout and engagement.

➢ **Streamlined Campaigns**: Political parties could benefit from **concentrated campaign efforts**, allowing smaller parties a better chance to compete effectively.

➢ **Economic Benefits**: The **Kovind Committee** report indicated that India's national real **GDP growth** could

be **1.5%** points higher in the year following simultaneous elections compared to the previous year.

- ❍ The report also indicated a potential **1.28% increase in fiscal deficit** and a **17.67% rise in public spending** following simultaneous elections.
- ❍ Also, fewer elections might diminish the **influx of black money** and pressure on businesses for political donations. The ECI seized **Rs 10000 crore** during the **18th Lok Sabha elections**.

➢ **Improved Election Monitoring**:The concentrated nature of simultaneous elections might facilitate better election monitoring.

➢ **Enhance Administrative Efficiency:** Supporters argue that holding joint polls can enhance **administrative efficiency**.

- ❍ Simultaneous elections would **reduce governance downtime** and improve security by **freeing resources** usually tied up in the election process.

What are the Challenges of One Nation, One Election?

➢ **Threat to Federalism**: Synchronizing national and state elections could overshadow local issues, as the national narrative may dominate electoral discourse.

- ❍ This could result in **national parties overshadowing regional voices**, diminishing the representation of local concerns and needs, which are often best understood by state-level parties.
- ❍ Also, in a synchronized election framework, smaller regional parties may find it difficult to compete against parties having deeper pockets and larger influence, potentially **diminishing political diversity** and **overshadowing regional issues**.
- ❍ Simultaneous voting may **confuse less informed or first-time voters**, leading to uninformed choices and more invalid votes, which could undermine democracy.

➢ **Logistical Challenges**: Organizing simultaneous elections would place immense strain on the resources and capabilities of the **ECI** and security forces.

- ❍ Implementing simultaneous elections would require a significant purchase of **Electronic Voting Machines (EVMs)** and **Voter Verifiable Paper Audit Trail (VVPAT)** machines.
- ❍ The **Parliamentary Standing Committee on Personnel, Public Grievances, Law and Justice**

(2015) estimated that around **Rs 9,284.15 crore** would be needed for the procurement of these machines.

- ❍ Logistical challenges in diverse regions could compromise the integrity and smooth execution of elections.

➢ **Constitutional Concerns**: Implementing ONOE would necessitate significant amendments to the Constitution and Representation of People Act, 1951 (RPA) potentially altering its fundamental structure.

- ❍ Some amendments will require a **special majority** of one third members under art 368 and require **ratification by more than half of India's states**.
- ❍ Such changes might infringe on existing **powers of the President** and state governors, raising questions about the balance of power and the nature of India's parliamentary democracy.

➢ **Governance Vacuums**:The reduced flexibility in calling early elections in response to political crises could result in prolonged periods of **President's Rule** in states where governments fall mid-term.

- ❍ This could create **governance vacuums**, leaving citizens without adequate representation or decision-making during critical periods.

➢ **Reduced Accountability**: Frequent elections keep representatives vigilant, but experts warn that less frequent elections might **reduce their accountability**, limiting voters' chances to express dissatisfaction.

- ❍ This could **lead to complacency** among elected officials, reducing their responsiveness to constituent needs and concerns.

➢ **Pressure on Election Machinery**: The **ECI** would face significant **pressure to conduct free and fair elections** simultaneously across the country.

- ❍ Any systemic failures or irregularities could have **far-reaching consequences**, potentially eroding public trust in the electoral process and institutions.

What have various Committees Recommended on ONOE?

➢ **High level Committee on Simultaneous Elections**: The Union Cabinet has recently approved the proposal for simultaneous elections in India, as recommended by the **high-level committee** led by former **President Ram Nath Kovind**.The **Key Recommendations** are-

- ❍ **Phased Implementation**: Simultaneous election in two phases-

- **First Phase**: Conduct **Lok Sabha and State Assembly** elections simultaneously.

- **Second Phase**: Hold local body elections (panchayats and municipalities) within 100 days of the first phase.

○ **Constitutional Amendments**: The **Kovind committee** proposed **15 amendments** to the Constitution, requiring two Constitution Amendment Bills.

- **First Bill**: Addresses the transition to a simultaneous election system and allows for fresh elections if a Lok Sabha or State Assembly is dissolved before its term ends. This bill does not require state ratification.

- **Second Bill**: Focuses on local body elections and the establishment of a **Single Electoral Roll**. This bill will require **ratification by more than half of India's states**.

○ **New Constitutional Articles**:

- **Article 82A**: Proposed to facilitate the transition to simultaneous elections.

- Notification by the President marking the "**Appointed date**."

- All legislative assemblies formed after this date will end with the Lok Sabha's full term.

- Expands Parliament's power to include conducting simultaneous elections by amending **Article 327.**

○ **Handling Early Dissolutions**:

- Amendments to **Articles 83 and 172** clarify the terminology of "full term" and "unexpired term" for **Lok Sabha and State Assemblies**.

- Assemblies that replace dissolved ones will serve only for the unexpired term before subsequent simultaneous elections.

○ **Local Body Elections and Electoral Roll**:

- The second Bill proposes a new **Article 324A**, empowering Parliament to ensure local elections occur simultaneously with general elections.

- A new **Article 325(2)** introduces a **Single Electoral Roll** for all elections, to be managed by the ECI, reducing the role of State Election Commissions to a consultative capacity.

- **Logistical Considerations**: The implementation of these recommendations will require extensive planning and coordination among various levels of government to ensure a seamless electoral process.

➢ **Earlier Recommendations**:

○ **The Law Commission Working Paper (2018)**:

- Amend the Constitution and the **Representation of the People Act, 1951**, to enable simultaneous elections.

- Modify the **Anti-Defection Law** to prevent stalemates in hung legislatures.

- Extend the six-month limit for issuing election notifications for added flexibility.

○ **Parliamentary Standing Committee on Personnel, Public Grievances, Law and Justice (2015)**:

- The 2015 report emphasized the advantages of synchronized elections for better political stability.

- The committee noted that implementing simultaneous elections would need extensive resources, including **EVMs and VVPATs**, estimated to cost around **Rs 9,284.15 crore**, while also highlighting significant logistical and constitutional challenges.

○ **National Commission to Review the Working of the Constitution**: Their 2002 report **advocates for simultaneous elections** to promote continuity in governance.

○ **NITI AAYOG**: The 2017 Working Paper **supports simultaneous elections** to streamline the electoral process and strengthen democracy.

What Should be the Way Forward?

➢ **National Dialogue**: Initiate comprehensive discussions involving p**olitical parties, civil society organizations, and experts** to assess support and address concerns regarding ONOE.

○ This dialogue should aim to ensure that diverse perspectives are taken into account, facilitating consensus-building around the initiative.

○ For instance, the high-level committee on ONOE has gathered more than 20,000 responses from citizens, with **81%** expressing their support for the concept of simultaneous elections.

➢ **Gradual Implementation**: Consider a **phased approach** by starting with pilot programs that align a few state elections with Lok Sabha elections.

○ This allows for real-world testing of the concept, enabling stakeholders to identify challenges and make necessary adjustments before a nationwide rollout.

➢ **Legal Preparations**: Draft essential constitutional amendments and legislative changes, with guidance

from legal experts, to establish a strong legal framework for ONOE.

○ For instance, as suggested by ECI, to prevent **premature dissolution**, a <u>**no-confidence motion**</u> must include **a confidence motion** for a named successor.

● If dissolution is unavoidable, the President may administer until the next election if the remaining term is short; otherwise, fresh elections should occur for the original term length. Similar provisions apply to Legislative Assemblies.

○ This process should involve extensive consultations to ensure that the proposed amendments uphold democratic principles and the integrity of the Constitution.

➢ **Safeguarding Federalism**: Design measures to ensure that state-specific issues remain central in electoral discussions, while also considering ways to protect and promote **regional political parties**.

○ This will help maintain the diversity and representation of various interests within India's federal structure.

➢ **Strengthening the Election Commission**: Enhance the **capabilities and independence** of the Election Commissions to effectively manage the increased responsibilities associated with ONOE.

○ This may involve **upgrading technological infrastructure** and increasing human resources to handle simultaneous elections.

○ Invest in more **EVMs and VVPAT systems**, and develop tech solutions for **voter registration**, voting, and result tabulation to manage simultaneous elections effectively.

➢ **Capacity Building**: Implement comprehensive **training programs for election officials, security personnel**, and other stakeholders to ensure efficient management of simultaneous elections.

○ These programs should focus on best practices in election administration and crisis management.

➢ **International Engagement**: Engage with other countries and international organizations to share experiences and best practices related to electoral reforms.

○ Learning from global examples can provide valuable insights and help avoid potential pitfalls in the implementation of ONOE.

○ For example, **South Africa** holds simultaneous elections for the National Assembly and provincial legislatures every five years, with the President elected by the Assembly.

● In contrast, **Sweden and Germany** elect their Prime Ministers and Chancellors every four years, while the UK has fixed-term elections every five years.

➢ **Economic Planning**: Prepare for changes in election-related expenditures by developing strategies to **mitigate potential economic disruptions** during the transition period.

○ This includes planning for resource allocation and budgeting to accommodate the new electoral framework.

➢ **Public Consultations**: Conduct **extensive public awareness** campaigns to educate citizens about the implications of ONOE.

Conclusion

The proposal for "**One Nation, One Election**" presents a transformative vision for India's electoral landscape, promising to enhance **governance efficiency and reduce costs** associated with frequent elections. While proponents emphasize the potential for streamlined administration and improved policy focus, significant concerns remain regarding the impact on federalism, local representation, and the practical challenges of implementation.

As India navigates this complex issue, it is crucial to **engage in thorough discussions**, consider **diverse perspectives**, and ensure that any reforms uphold the **principles of democracy** and equity in representation.

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India's Rise as a Global Investment Hub

This editorial is based on "<u>The world wants to Make in India</u>" which was published in Hindustan Times on 26/09/2024. The article highlights India's transformation into a global investment hub, driven by the Make in India initiative and supported by complementary policies like Startup India and PLI schemes. It underscores India's appeal through its "four Ds" and success in sectors like toy manufacturing, leading to increased exports, job creation, and foreign investment.

Tag: GS Paper - 3, Mobilization of Resources, Capital Market, GS Paper-2, Government Policies and Interventions

India's transformation from an economically constrained nation to a global investment hotspot can be significantly attributed to the **Make in India initiative**. This flagship program has reinvigorated **job creation, stimulated economic growth, and empowered businesses,** particularly MSMEs, to produce high-quality goods. It has helped transform several sectors from importers of substandard products to exporters of premium goods, with the toy manufacturing industry serving as a prime example, witnessing a **239% increase in exports while halving imports.**

The success of Make in India is complemented by other effective policies and initiatives such as **Startup India, Production Linked Incentive** (PLI) schemes, and significant infrastructure investments. These efforts have attracted substantial foreign investments, created millions of jobs, and positioned India as a key partner in high-tech and emerging technologies. The country's appeal to global investors is further enhanced by its **"four Ds": decisive leadership, demand from a large population, demographic dividend, and vibrant democracy**. As a result, India has become a sought-after destination for manufacturing and innovation, with a promising future ahead.

How India is Becoming an Increasingly Attractive Investment Destination?

➢ **Robust Economic Growth:** India has emerged as one of the world's fastest-growing economies, with total FDI inflows reaching **USD 990.97 billion from April 2000 to March 2024.**

 ○ IMF expects **India's GDP to grow by 6.7% in FY24,** making it one of the fastest-growing large economies.

 ○ The **Atmanirbhar Bharat Abhiyan**, introduced a **USD 270 billion** economic stimulus package, equivalent to **10% of the nation's GDP.**

➢ **Demographic Dividend:** India is home to the world's largest youth population, with a projected increase from 121.1 crore in 2011 to 152.2 crore by 2036, making it a powerhouse of demographic advantage. With a vibrant workforce and a vast pool of young talent, **India will remain one of the youngest countries globally until 2030.**

 ○ This young population is **increasingly tech-savvy**, with **internet users in India projected to reach 900 million by 2025,** creating opportunities in e-commerce, digital services, and tech-enabled sectors.

➢ **Infrastructure Development:** India's infrastructure development is advancing rapidly, with the **National Infrastructure Pipeline** (NIP) being a **key driver for growth.**

 ○ This initiative aims to create world-class infrastructure and boost India's economy to a **USD 5 trillion target by FY 2025.**

 ○ Over 9,700 projects worth USD 3,093.51 billion have been identified, spanning critical sectors like **Energy (24%), Roads (18%), Urban (17%), and Railways (12%).**

 ● Additionally, a significant equity infusion of INR 6,000 crore into the **National Investment and Infrastructure Fund (NIIF)** further strengthens India's capacity to attract global investments.

➢ **Improving Ease of Doing Business:** The Indian government has implemented numerous reforms to enhance the business environment.

 ○ India's rank in the **World Bank's Ease of Doing Business Index** improved from 142 in 2014 to **63 in 2019**.

 ○ Recent initiatives include the elimination of **over 25,000 compliance requirements, digitization of processes**, and the introduction of the **Goods and Services Tax (GST).**

 ○ The **India Industrial Land Bank (IILB),** a GIS-based portal, provides extensive information on industrial parks, enhancing ease of doing business.

➢ **Competitive Labor Costs:** India's large and growing workforce offers a significant cost advantage to investors.

 ○ India has one of the world's largest labor forces, ensuring a steady supply of workers across various skill levels. Indian labor costs remain competitive compared to many other countries, particularly in manufacturing and services sectors.

 ● The average manufacturing labor cost in India is **significantly lower than in China and many Southeast Asian countries.**

 ● Recent **labor reforms have aimed to provide more flexibility to businesses while protecting workers' rights,** potentially making India more attractive for labor-intensive industries.

➢ **Large and Growing Consumer Base:** India's massive and expanding consumer market is a major draw for investors:

 ○ India's population is equivalent to **17.78% of the total world population,** offering an enormous potential customer base.

❍ The strength of the **middle class** is expected to rise from 432 million people in 2020-21 to 715 million **(47%) in 2030-31,** driving increased consumer spending across various sectors.

➢ **Strategic Geopolitical Position**: India's rising geopolitical importance and its **position as a counterbalance to China** in the Indo-Pacific region have increased its attractiveness to global investors.

❍ India's participation in strategic groupings like the **Quad (with the US, Japan, and Australia)** and its leadership in initiatives like the **International Solar Alliance** showcase its growing global influence.

❍ Recent developments, such as the **Supply Chain Resilience Initiative,** have further enhanced its appeal to international investors looking for alternatives to China.

➢ **Booming Start-up Ecosystem**: India's start-up ecosystem has seen explosive growth, making it the third-largest globally.

❍ As of **3rd October 2023**, India is home to **111 unicorns** with a total valuation of $ 349.67 billion.

❍ The government's **Startup India initiative,** launched in 2016, has played a crucial role in this growth by providing funding, tax benefits, and regulatory support.

● This thriving ecosystem has attracted significant foreign investment, with **Indian start-ups raising USD 24 billion in equity funding in 2022** despite global economic headwinds.

➢ **Renewable Energy Push**: India's commitment to renewable energy has created substantial investment opportunities.

❍ The country aims to achieve **500 GW of renewable energy capacity by 2030**, up from about 170 GW in early 2023.

❍ This ambitious target has **spurred investments in solar, wind, and green hydrogen** projects.

● Such initiatives not only attract foreign investment but also position India as a leader in the global transition to clean energy.

➢ **Digital Infrastructure and Fintech Revolution:** India's **digital infrastructure**, particularly the **India Stack** has revolutionized financial inclusion and created new investment opportunities.

❍ **Unified Payments Interface (UPI)** processed a staggering **3729.1 transactions per second** with 117.6 billion transactions being processed on the platform in 2023.

❍ This digital backbone has fueled the growth of fintech, with India's fintech market expected to reach **USD 150 billion by 2025.**

❍ **Global tech giants and venture capitalists** are increasingly investing in Indian fintech startups, recognizing the potential of India's large, underserved market and innovative digital solutions.

What Challenges Hinder India's Attractiveness as an Investment Destination?

➢ **Infrastructure Gaps**: Despite significant improvements, India's infrastructure still lags behind global standards, impacting efficiency and increasing costs for businesses.

❍ In 2023, India ranked **38 out of the 139 nations in the World Bank's Logistics Performance Index (LPI),** highlighting room for improvement.

❍ The infrastructure deficit is particularly acute in areas like **power distribution, water supply, and last-mile connectivity,** affecting manufacturing competitiveness.

➢ **Regulatory Complexity and Policy Uncertainty:** India's regulatory environment, while improving, remains complex and sometimes unpredictable, deterring potential investors.

❍ Recent examples include **retrospective tax disputes with companies like Vodafone and Cairn Energy,** which were only resolved in 2021 after years of litigation.

❍ The frequent changes in **e-commerce rules** and **data localization requirements** have also created uncertainty for tech companies.

➢ **Labor Market Rigidities:** India's new **4 labor codes** which were introduced in **2019 & 2020** are yet to be implemented. The workers in the unorganized sector constitute more than **90% of the total employment** in the country.

❍ The skills mismatch in the labor market is another concern. A employability survey of 2019 reveals that **80% of Indian engineers are not fit for any job in the knowledge economy** and only **2.5% of them possess tech skills in Artificial Intelligence (AI)** that industry requires.

➢ **Banking Sector Challenges:** The Indian banking sector, particularly public sector banks, continues to grapple with **high non-performing assets (NPAs) and capital adequacy issues,** constraining credit flow to businesses.

○ According to RBI's Financial Stability Report of June 2024, non-performing assets (NPAs) of **scheduled commercial banks** (though declining) are still at **2.8% (Gross NPA).**

○ The recent **near collapse of Yes Bank in 2020** raised questions about the stability of the financial system.

➢ **Land Acquisition Challenges:** Land acquisition remains a significant hurdle for large-scale industrial and infrastructure projects in India.

○ The **Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act of 2013**, while protecting landowners' rights, has made the process more time-consuming and expensive.

○ For example, the **Mumbai-Ahmedabad High Speed Rail project has faced significant delays** due to land acquisition issues.

○ The **lack of digitized land records** in many states further complicates the process, leading to disputes and project delays.

➢ **Intellectual Property Rights (IPR) Concerns:** While India has made progress in strengthening its **IPR regime**, concerns persist among international investors, particularly in sectors like pharmaceuticals and technology.

○ India ranked **42nd out of 55 countries** in the **U.S. Chamber of Commerce's 2023 International IP Index.**

○ The country's patent laws, especially **Section 3(d) of the Patents Act,** which sets a high bar for pharmaceutical patents, have been a point of contention.

○ The prevalence of **counterfeit goods,** with a 2022 FICCI report estimating the size of the counterfeit market in India at **₹2.6 trillion** (in 5 Key Indian industries), further underscores the challenges in IPR protection.

➢ **Digital Infrastructure and Cybersecurity**: Despite rapid digitalization, India still faces challenges in digital infrastructure and cybersecurity, which are critical for attracting investments in the tech sector.

○ **Indian Computer Emergency Response Team (Cert-In)** handled **1,391,457 cyber security incidents in 2022**, raising concerns about data protection.

What Steps Can India Take to Enhance Its Appeal as an Investment Destination?

➢ **Accelerate Infrastructure Development:** India should prioritize closing its infrastructure gap by accelerating project implementation and increasing investment.

○ Emphasis should be on **improving logistics efficiency**; **India's logistics costs (14% of GDP) are significantly higher than in developed countries (8-10%).** Initiatives like the PM Gati Shakti National Master Plan should be fast-tracked.

○ Successful implementation could potentially **save billions of dollars** annually in logistics costs and boost export competitiveness.

➢ **Streamline Regulatory Processes:** India needs to further simplify its regulatory environment to reduce compliance burdens and improve ease of doing business.

○ The government should build on its success in eliminating over 25,000 compliance requirements and **decriminalizing minor offenses.**

○ Implementing a **single-window clearance system** for all central and state-level approvals could significantly reduce project delays.

○ For instance, the success of **Gujarat's single-window system** could be replicated nationally.

○ **Digitizing and integrating** various regulatory processes could potentially save businesses billions in compliance costs annually.

➢ **Labor Law Reforms and Skill Development:** Implementing the four new labor codes swiftly and effectively is crucial to increase labor market flexibility.

○ Simultaneously, India should **ramp up its skill development initiatives** to address the employability gap.

○ The government should aim to increase the number of people skilled under the **Pradhan Mantri Kaushal Vikas Yojana**.

○ Collaborations with industry, like the **recent partnership between Google and NASSCOM to train 100,000 developers in cloud technologies**, should be scaled up.

➢ **Strengthen the Banking Sector:** India should continue its efforts to clean up bank balance sheets and recapitalize public sector banks.

○ Implementing the recommendations of the **RBI's Internal Working Group on ownership guidelines** for Indian private sector banks could attract more investment in the banking sector.

➤ **Land Reforms and Digitization:** Implementing comprehensive land reforms, including digitization of land records and streamlining the land acquisition process, is crucial.

  ○ The government should aim to **complete the digitization of land records** under the <u>Digital India Land Records Modernization Programme</u> **in all states.**

  ○ Successful implementation could potentially reduce land-related disputes by 50% and cut project implementation times significantly.

➤ **Strengthen Intellectual Property Rights Protection:** India should focus on strengthening its IPR regime to boost investor confidence, **particularly in high-tech and R&D-intensive sectors.**

  ○ In order to reduce the time taken in the application process of patents, prescribed time limits for the first step may be reduced to **14-15 months (from 18 months currently),** bringing it in line with the US and China

  ○ Increasing the number of **patent examiners and modernizing the IP offices could help achieve this goal.**

➤ **Boost Digital Infrastructure and Cybersecurity:** India should accelerate its digital infrastructure development, aiming to provide high-speed internet access to all villages **under the <u>BharatNet project</u>**.

  ○ The government should focus on increasing the average fixed broadband speed.

  ○ Implementing the **National Cyber Security Strategy** and establishing a robust system could potentially reduce cybersecurity incidents by **50%** and position India as a secure destination for data-driven investments.

➤ **Promote Sustainable Development:** India should accelerate its transition to renewable energy and sustainable practices to **attract ESG-focused investments.**

  ○ Also, promoting **circular economy practices and water conservation** could address resource scarcity issues.

  ○ These measures could potentially attract over **USD 100 billion** in green investments by 2030 and position India as a leader in sustainable manufacturing.

➤ **Enhance Education and Skill Development::** India should focus on aligning its education system with industry needs, particularly in **emerging technologies.**

  ○ Implementing the <u>National Education Policy 2020</u> effectively, with a focus on digital skills and practical training, is crucial.

  ○ Scaling up successful models like the **Indian Institutes of Skills**, which aim to provide industry-relevant training, could help bridge the skill gap.

Conclusion:

India's journey toward becoming a global investment hub is on a **promising path**, driven by strategic reforms, infrastructure development, and a young, tech-savvy workforce. To fully realize its potential, India must address key challenges in **infrastructure, regulatory complexity, and skill development,** while continuing to strengthen its digital and sustainable growth initiatives. With targeted measures, India can cement its position as a **top destination for global investments.**

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Strengthening India's Air Quality Management

This editorial is based on "<u>Delhi's Winter Action Plan for pollution appears unconvincing</u>" which was published in The Hindu on 07/05/2024. The article brings into picture the recurring air pollution crisis in Delhi, emphasizing the need for a comprehensive, year-round strategy rather than short-term fixes. It also highlights systemic flaws in India's broader air quality management, calling for more proactive and science-based interventions.

> **Tag:** GS Paper - 3, Environmental Pollution & Degradation, GS Paper - 2, Government Policies & Interventions

As winter approaches, Delhi once again grapples with its **annual <u>air pollution crisis,</u>** implementing a **Winter Action Plan** with some promising additions like drone monitoring and inter-departmental task forces. However, the city's efforts remain plagued by delayed implementation and a short-term perspective. While the plan addresses immediate concerns such as stubble burning in neighboring states, it fails to integrate into a **comprehensive year-round strategy** necessary for a metropolis with consistently high baseline pollution levels.

The challenge extends beyond Delhi, highlighting **systemic issues in India's approach to air quality management.** The Central government's <u>**Commission**</u>

for Air Quality Management (CAQM) has been criticized for lack of effective mediation between states. Moreover, despite expert recommendations for targeted, **geography-based interventions** using the airshed method, Delhi's plan lacks substantial implementation of this approach. As India faces another season of hazardous air quality, there is an urgent need for authorities to adopt more flexible, proactive, and scientifically informed strategies to combat this persistent public health emergency.

Why Air Pollution Remains a Major Concern in India?

➢ **Ineffective Implementation of Pollution Control Measures:** Despite numerous policies and regulations, India struggles with the implementation of pollution control measures.

   ○ For instance, the **National Clean Air Programme (NCAP)** launched in 2019 aimed to reduce particulate matter concentrations by 20-30% by 2024 in 122 cities.

      ● However, as of 2023, **only 95 cities** have shown a decrease in PM10 levels, with many still far from reaching the target.

➢ **Persistent Agricultural Practices Contributing to Seasonal Spikes:** The practice of **stubble burning in northern India** continues to be a significant contributor to air pollution, especially during the winter months.

   ○ In 2022, Punjab alone reported over **30,000 stubble burning incidents,** despite efforts to provide farmers with alternative solutions.

   ○ The stubble burning contributes about **25% to 30% of the air quality issues** (in Delhi) during peak burning days.

   ○ While there has been a slight decrease in burning incidents compared to previous years, the **practice remains widespread due to economic constraints faced by farmers** and the lack of viable alternatives, highlighting the need for more comprehensive and supportive policies.

➢ **Rapid Urbanization and Infrastructure Development:** India's rapid urbanization and **infrastructure development** continue to exacerbate air pollution levels.

   ○ According to the **2019 London Atmospheric Emissions Inventory (LAEI),** construction activities account for approximately **30% of particulate matter (PM10) emissions in the city**, along with **8% of fine particulate matter (PM2. 5).**

   ○ This **unchecked growth**, coupled with inadequate dust management practices, significantly contributes to the deterioration of air quality in urban areas.

➢ **Increasing Vehicle Emissions in Urban Centers:** The burgeoning number of vehicles in Indian cities continues to be a major source of air pollution.

   ○ India is the **largest tractor producer, second-largest bus manufacturer, and third-largest heavy truck manufacturer** in the world.

      ● India's annual production of automobiles in FY23 was **25.9 million vehicles.**

   ○ Despite efforts to promote **electric vehicles (EVs)**, they still represent only a small fraction of total vehicles.

      ● The **slow transition to cleaner fuels and electric mobility**, coupled with **inadequate public transportation infrastructure,** keeps vehicle emissions a persistent problem in urban air quality management.

➢ **Industrial Emissions and Lack of Stringent Enforcement:** Industrial emissions remain a significant contributor to air pollution in India.

   ○ Only **5% of India's coal-fired power plants** have installed air pollution control devices for sulfur dioxide emissions.

   ○ Furthermore, the **Central Pollution Control Board** identified **43** industrial clusters in 17 States as **Critically Polluted Areas (CPAs).**

      ● Further, **32** industrial clusters are categorized as **Severely Polluted Areas (SPAs).**

   ○ The lack of stringent enforcement and frequent relaxation of norms for industries highlight the ongoing challenge in balancing economic growth with environmental protection.

➢ **Indoor Air Pollution and Its Health Impacts**: Indoor air pollution remains an often-overlooked but critical issue in India.

   ○ According to the World Health Organization's 2023 report, about **6.7 million premature deaths** annually are attributed to indoor air pollution globally, with India being one of the most affected countries.

   ○ Despite government initiatives like the **Pradhan Mantri Ujjwala Yojana,** the sustained use of clean fuels remains a challenge due to economic factors and cultural preferences.

      ● Around 5**3% of Indian households** still depend on solid fuels for part or all of their cooking needs.

- The practice of using solid fuels alongside LPG, known as **fuel stacking,** leads to ongoing exposure to **harmful household air pollution (HAP),** even for those with access to LPG connections.

➢ **Climate Change Exacerbating Air Quality Issues:** Climate change is increasingly **recognized as a factor exacerbating air pollution in India.**

  ○ The **2023 report by the Intergovernmental Panel on Climate Change (IPCC)** highlighted that rising temperatures and changing weather patterns in South Asia are likely to increase the frequency and intensity of air pollution episodes.

  ○ For instance, the **unusual rainfall patterns in October 2023 in North India** led to prolonged periods of **stagnant air, trapping pollutants and worsening air quality**.

  ○ The interplay between **climate change and air pollution creates a vicious cycle,** where each exacerbates the other, making it crucial to address both issues simultaneously for effective long-term solutions.

What are the Key Steps Taken by the Government for Air Quality Improvement?

➢ **National Clean Air Programme (NCAP):** Launched in January 2019, the NCAP aims to improve air quality in 131 non-attainment and million-plus cities by reducing **PM10 levels by 40% by 2025-26.**

  ○ Public grievance systems, emergency response mechanisms, and other measures have been implemented, showing improvements in 88 out of 131 cities as of FY 2022-23.

➢ **Control of Vehicular Emissions:** The government has implemented **BS-VI fuel standards** nationwide and introduced BS VI-compliant vehicles since April 2020.

  ○ Schemes like **FAME-II** promote electric vehicles, while **SATAT** supports biogas production.

  ○ New expressways and highways divert non-destined traffic from major cities to reduce vehicular emissions.

➢ **Control of Industrial Emissions:** New standards for SO2 and NOx emissions in thermal power plants have been enforced.

  ○ **Pet coke and furnace oil are banned in NCR states,** and industrial units are shifting to cleaner fuels like PNG or biomass.

  ○ Emission standards for 56 industrial sectors have been notified, and **online continuous emission monitoring systems (OCEMS)** are mandated for high-polluting industries.

➢ **Measures to Control Stubble Burning:** Subsidies are provided for crop residue management machinery to prevent stubble burning in **Punjab, Haryana, and Uttar Pradesh.**

  ○ Financial assistance has been offered to set **up pelletization and torrefaction** plants to utilize paddy straw.

  ○ Monitoring by CPCB and enforcement by the **Commission for Air Quality Management (CAQM)** help prevent stubble burning incidents during harvest seasons.

➢ **Air Quality Monitoring and Network:** The **National Air Quality Index (AQI)** was launched in 2015, with over 1,400 air quality monitoring stations set up across the country.

  ○ Data is disseminated through bulletins, and air quality forecasts are made available, especially for Delhi-NCR. The Central Control Room provides real-time tracking of air quality data and hotspots.

➢ **Control of MSW and Construction Waste:** Guidelines for **managing construction and demolition (C&D) waste have been issued**, and directions were provided for deploying anti-smog guns at large construction sites.

  ○ Efforts to manage **municipal solid waste (MSW) include bioremediation** of legacy waste and preventing fires at landfill sites, contributing to overall air quality improvement.

➢ **Regulatory Actions and Graded Response Action Plan (GRAP):** CPCB has implemented the **Graded Response Action Plan (GRAP)** to address air pollution based on AQI categories.

  ○ Revised versions of GRAP, effective from 2022, include measures like **restricting DG set usage, shifting industries to cleaner fuels**, and imposing dust control measures.

  ○ These policies help in curbing air pollution in the NCR region.

What are the Various Technology-driven Projects Aimed at Reducing Air Pollution?

➢ **Pariyayantra Filtration Units on Buses:** In a pilot study, 30 buses were retrofitted with Pariyayantra Filtration units on their rooftops.

  ○ These passive filter**s capture dust particles from the environment,** reducing the pollution caused by vehicular movement.

  ○ Each unit provides filtration equivalent to six room air filters without requiring any power.

➢ **WAYU Air Purification Units at Traffic Intersections:** They were installed at major traffic intersections in Delhi to reduce the impact of vehicular emissions.

  ❍ These localized **air purifiers target pollution at the source,** offering a solution for high-traffic areas.

➢ **Ionisation Technology for Air Pollution Reduction:** This technology neutralizes pollutants through ionization, improving air quality in targeted areas. It explores the **potential of ionization as a method to curb ambient pollution.**

➢ <u>**Smog Towers**</u>**:** Large-scale smog towers have been installed to act as air purifiers, specifically designed to reduce particulate matter and other pollutants over a wider area.

➢ **Retrofitting Emission Control Devices in Older Vehicles:** A pilot project focused on retrofitting older vehicles **(like BS III compliant ones)** with emission control devices.

  ❍ This aims to lower emissions from in-use vehicles, helping reduce their environmental impact.

What Measures can be Adopted to Enhance Air Quality Management in India?

➢ **Implement Stringent Industrial Emission Controls:** India can adopt more stringent industrial emission norms, similar to **China's coal-fired pollution control measures.**

  ❍ For instance, mandating the installation of **Flue Gas Desulfurization (FGD)** units in all coal-based power plants, as per the latest Central Electricity Authority directive, could significantly reduce SO2 emissions.

  ❍ Implementing a **nation-wide emissions trading scheme**, like the one piloted in Gujarat, could incentivize industries to adopt cleaner technologies.

    ● This approach, combined with **real-time emission monitoring systems linked directly to pollution control boards,** can ensure better compliance and reduce industrial pollution effectively.

➢ **Accelerate Transition to Clean Energy:** Rapidly scaling up renewable energy adoption is crucial for improving air quality.

  ❍ India's target of **500 GW of non-fossil fuel capacity by 2030** is a step in the right direction. The recent success of the **Solar Parks scheme demonstrates** the feasibility of large-scale clean energy projects.

  ❍ Encouraging **rooftop solar installations through simplified regulations** and incentives, as seen in **Gujarat's Suryashakti Kisan Yojana** can further accelerate this transition.

  ❍ Additionally, promoting **energy storage solutions and green hydrogen production** can address intermittency issues and enable deeper penetration of renewables.

➢ **Enhance Urban Green Cover and Vertical Forests**: Taking inspiration from China's **vertical forest in Nanjing,** Indian cities can adopt similar green infrastructure projects.

  ❍ For example, **Mumbai's recent initiative to create urban forests in Aarey Colony** is a step in this direction.

  ❍ Implementing mandatory **green building codes that incorporate vertical gardens** and rooftop plantations, as seen in **Singapore's Skyrise Greenery Incentive Scheme**, could significantly increase urban green cover.

  ❍ Cities like **Bengaluru**, can focus on creating mini-forests using the **Miyawaki technique,** which has shown success in creating dense urban forests in small areas, enhancing air purification capacity in cities.

➢ **Revolutionize Urban Transportation:** India needs to prioritize sustainable urban mobility to combat vehicular emissions.

  ❍ The successful implementation of **Delhi's electric vehicle policy** can be replicated in other cities.

  ❍ Expanding and improving public transport infrastructure, like **Kochi's water metro system launched in 2023**, can provide efficient alternatives to private vehicles.

  ❍ Implementing **congestion pricing in major cities**, similar to **London's Ultra Low Emission Zone,** can discourage private vehicle use in high-pollution areas.

    ● Additionally, creating extensive networks of **dedicated bicycle lanes and pedestrian zones**, as seen in **Copenhagen**, can promote non-motorized transport options.

➢ **Adopt Advanced Air Quality Monitoring and Management Systems:** Implementing a comprehensive, real-time air quality monitoring network across India is crucial.

  ❍ The recent expansion of the **Central Pollution Control Board's network to 804 monitoring stations in 344 cities** is a positive step, but more granular data is needed.

○ Integrating **low-cost sensor networks,** satellite data, and AI-powered forecasting models can provide more accurate and localized air quality information.

○ Implementing a national-level air quality data platform, similar to **China's Blue Map app**, can increase public awareness and participation in air quality management.

○ **Pi Green Innovations,** a Pune-based green tech company, provides retrofit systems for vehicles and diesel generators to reduce carbon emissions and is a solution partner for UNDP's 'Clear Air Initiative' in India.

○ **BreathEasy,** a Delhi-based company, offers air quality testing, portable and centralized air purification solutions, and green consulting services to optimize indoor environments.

➢ **Tackle Agricultural Emissions Through Sustainable Practices:** Addressing stubble burning requires a multi-faceted approach.

○ **Promotion of Agricultural Mechanization for In-Situ Management of Crop Residue**, needs to be intensified.

○ Exploring innovative solutions like **bio-decomposers (PUSA Decomposer) and Palletisation,** can offer a cost-effective alternative to burning.

○ Additionally, promoting **crop diversification away from paddy in Punjab and Haryana,** can reduce stubble generation.

○ Implementing a reward system for farmers who adopt sustainable practices, similar to the **Payments for Environmental Services Program in Costa Rica**, could provide economic incentives for change.

➢ **Implement Sector-Specific Emission Reduction Strategies:** Developing and implementing targeted emission reduction strategies for key polluting sectors is essential.

○ For the construction sector, which contributes significantly to particulate matter pollution, enforcing strict dust control measures as mandated by the **Construction and Demolition Waste Management Rules, 2016**, is crucial.

○ The recent initiative by the **National Capital Region Planning Board to use artificial rain for dust suppression in Delhi-NCR** can be explored for wider application.

○ In the brick kiln industry, promoting the shift to cleaner technologies like **zig-zag kilns** can be implemented

○ For the transport sector, accelerating the adoption of **BS-VI fuel standards and incentivizing the scrapping of old vehicles** through programs like the **Vehicle Scrappage Policy launched in 2021** can significantly reduce vehicular emissions.

Conclusion:

To effectively tackle India's persistent air pollution crisis, **a holistic approach is essential—one that integrates long-term, science-based solutions, stringent enforcement of emission norms,** and promotion of sustainable practices across industries, transportation, and agriculture. Enhanced coordination between states and a shift towards clean energy and urban green infrastructure will play a critical role. Only through **proactive and comprehensive efforts** can India safeguard public health and improve air quality for future generations.

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Drishti Mains Questions

1. Discuss the evolution and impact of the collegium system of judicial appointments in India. Evaluate its effectiveness in ensuring judicial independence and transparency.

2. Discuss the economic dynamics between India and ASEAN. What steps should India take to address the trade imbalance and enhance economic cooperation with ASEAN countries?

3. Agricultural productivity is critical for ensuring food security and supporting economic growth in developing countries. Discuss the major challenges faced by India in enhancing agricultural productivity.

4. Assess the impact of India's ethanol production policy on its agricultural sector, domestic economy, and global trade. Analyze the challenges and benefits associated with this policy shift, and propose strategies to enhance the sustainability and efficiency of ethanol production

5. Discuss the key challenges in achieving sustainable urban development in India. How can transit-oriented development address these challenges?

6. Discuss the strategic significance of Africa for India in terms of its critical minerals requirements. How can India leverage its historical ties and soft power to deepen engagement with African nations?

7. The telecom sector plays a pivotal role in India's digital growth. Analyze the key challenges faced by the telecom industry in ensuring sustainable growth and affordable services.

8. The UAE has emerged as a key strategic partner for India, with deepening ties in trade, investment, defense, energy, and technology over the past decade. Discuss the significance of the UAE for India in terms of economic, strategic, and geopolitical interests.

9. Deep tech is emerging as a transformative force in addressing global challenges and redefining technological frontiers. Discuss the role of deep tech in shaping India's future growth, highlighting its potential benefits and challenges.

10. Given the burgeoning startup ecosystem in India, what are the key challenges and opportunities it presents for the Indian economy? How can the government and policymakers leverage this ecosystem to achieve sustainable and inclusive growth?

11. Discuss the extent of the sickle cell disease burden in India and propose effective strategies to tackle it.

12. With the increasing integration of Artificial Intelligence (AI) in India's healthcare sector, discuss the potential benefits and challenges associated with AI adoption in areas such as diagnosis, treatment, and public health management.

13. Urban flooding has become a recurring problem in Indian cities due to rapid urbanization and climate change. Discuss the key factors contributing to urban flooding and suggest measures for effective flood management.

14. Critically examine the role of multilateral institutions in global governance and discuss the challenges they face in addressing contemporary issues

15. Discuss the significance of developing a robust semiconductor manufacturing ecosystem in India, and analyze the key challenges and policy measures required to achieve self-reliance in this critical sector.

16. Examine the role of Indian Railways in fostering sustainable development and economic growth in India. Discuss the challenges faced by the sector and suggest measures to overcome them.

17. Assess the challenges India faces in balancing its global ambitions with domestic developmental priorities.

18. Discuss the role of solar energy in India's journey towards energy independence. How can India

effectively optimize its solar energy potential?

19. Analyze how India can leverage its participation in the QUAD to enhance its global standing while safeguarding its independent foreign policy

20. India has been actively pursuing its goal of becoming a major defense exporter in recent years. Analyze the factors that have contributed to this shift, the challenges faced in scaling up defense exports

21. Examine the potential of Agriculture 4.0 in addressing the challenges of food security and sustainable farming in India. How can emerging technologies be integrated with traditional agricultural practices to achieve these goals?

22. Discuss the current state of global nuclear disarmament efforts, with special reference to the challenges posed by geopolitical tensions and emerging technologies. How should India balance its national security interests with global disarmament goals?

23. Discuss the concept of 'One Nation, One Election' in India. Evaluate its potential benefits and challenges, particularly in relation to federalism, governance, and electoral integrity.

24. What are the key challenges hindering India's attractiveness as an investment destination, and what strategic measures can be adopted to enhance its potential for foreign and domestic investments? Discuss.

25. Despite various government initiatives, the problem of air pollution persists in India. Discuss the key challenges in managing air pollution in India and suggest long-term strategies for sustainable air quality improvement