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The ongoing military confrontation between Iran and Israel has escalated dangerously, with direct missile exchanges, civilian casualties, and the destruction of critical infrastructure on both sides. This intensifying conflict threatens to engulf the wider West Asian region, destabilize energy markets, and derail diplomatic efforts around Iran's nuclear programme.

Iran vows severe response to Israel as regional crisis intensifies in West Asia

Reuters
JERUSALEM/DUBAI

Iranian President said that responses will grow 'severe' if Israel's hostile actions continue

Israel and Iran launched fresh attacks on each other overnight into Sunday, killing scores and raising fears of a wider conflict.

While the Israeli military has warned Iranians living near weapons facilities to evacuate, Iran's armed forces on Sunday told residents of Israel to leave the vicinity of "vital areas" for their safety.

Israel's military said several sites were hit by the latest Iranian missile barrage on Sunday night.

In Iran, images from Tehran showed the night sky lit up by a huge blaze at a fuel depot after Israel began strikes against Iran's oil and gas sector – raising the stakes for the global economy and the functioning of the Iranian state.

Iranian President Masoud Pezeshkian said on Sunday that the country's responses will grow "more decisive and severe" if Israel's hostile actions continue.

Israeli Prime Minister Benjamin Netanyahu said on Sunday that armed forces have destroyed Iran's principal uranium enrichment facility at Natanz.

U.S. President Donald Trump early on Sunday said the two sides will have peace "soon", adding that many unspecified meetings were taking place.

The U.S. President has repeatedly said Iran could end the war by agreeing to tough restrictions on its nuclear programme, which Iran says is for peaceful purposes but Western countries say could be used to make bombs.

The latest round of nuclear negotiations between Iran and the U.S., due to be held on Sunday, was scrapped after Tehran said it would not negotiate while under Israeli attack.

Iran has not given a full death toll but said 78 people were killed on Friday and scores more have died since, including in a single attack that killed 60 on Saturday, half of them children, in a 14-storey apartment block flattened in Tehran.

Israeli rescue teams on Sunday combed through the rubble of residential buildings destroyed by Iranian missiles, using sniffer dogs and heavy excavators, to look for survivors after at least 10 people, children among them, were killed, raising the two-day toll to 13

'Will pay a heavy price'

Israeli skies have been streaked with barrages of Iranian missiles and Israeli interceptor rockets.

"Iran will pay a heavy price for the murder of civilians, women, and children," Israeli Prime Minister Benjamin Netanyahu has said from a balcony overlooking blown-out apartments in the town of Bat Yam, where six people were killed.

(With AFP inputs)

INDIANS STUCK IN IRAN
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Key Developments:

- Israel has reportedly struck Iran's oil and gas sector and destroyed its principal uranium enrichment facility at Natanz, raising the specter of a full-scale war.
- Iran has vowed a "more decisive and severe" response, and warned Israeli civilians near critical infrastructure to evacuate.
- Civilian death tolls are rising on both sides, with Tehran suffering massive casualties, including the flattening of a residential tower and a fire at a fuel depot.
- The U.S. President's statements about imminent peace and ongoing backchannel diplomacy appear disconnected from the ground reality, especially after Tehran pulled out of nuclear negotiations, citing Israeli attacks.

Geopolitical Implications:

- **Regional Destabilization:**The confrontation risks triggering a regional war, potentially dragging in Hezbollah, Hamas, the U.S., and Gulf States. This would upend the fragile balance of power in the region and jeopardize maritime and energy security.
- **Impact on Global Oil Markets:**Attacks on Iran's oil infrastructure could shock global energy markets, pushing up oil prices and affecting energy-importing economies like India.
- **Breakdown of Nuclear Diplomacy:**The suspension of U.S.-Iran nuclear talks underlines the growing futility of diplomacy amid active hostilities. This increases the chances of Iran accelerating its nuclear ambitions, triggering a nuclear arms race in West Asia.
- **Violation of International Norms:**Civilian targeting and retaliatory strikes may be viewed as violations of international humanitarian law, eroding norms and emboldening state and non-state actors elsewhere.
- **India's Strategic Dilemma:** As a key energy importer, investor in Chabahar Port, and a partner to both Israel and Iran, India faces a diplomatic tightrope. Any escalation could disrupt India's West Asia policy, impact diaspora safety, and derail trade routes.
- **Ethical and Humanitarian Dimensions:**The large-scale civilian casualties, especially children, raise questions about the proportionality and legality of the use of force. Both nations risk being accused of indiscriminate targeting, and the humanitarian fallout could deepen anti-West or anti-Israel sentiment in the region.

Conclusion:

- The Iran-Israel conflict marks a dangerous phase in West Asian geopolitics, with long-term implications for regional stability, nuclear proliferation, and global security. The breakdown of diplomacy amid militaristic posturing sets a grim precedent. For India, the developments call for strategic vigilance, proactive diplomacy, and readiness to manage potential energy and security shocks.

UPSC Mains Practice Question

Ques : The deepening Israel-Iran conflict is a reflection of both failed diplomacy and strategic overreach. Analyze the implications of this confrontation for regional stability in West Asia and India's interests therein. **(250 words)**

Page 06: GS 2 : Internaional Relations

Prime Minister Narendra Modi's visit to Cyprus marks a strategic outreach in the Mediterranean, highlighting India's intent to diversify diplomatic partnerships, deepen trade relations, and reaffirm ties with nations that support its territorial integrity and anti-terror stand, such as Cyprus. The visit also assumes a geopolitical undertone, particularly in the context of strained India-Turkey relations and the ongoing Iran-Israel conflict.

India will continue efforts to strengthen ties with Cyprus: PM

Both nations to hold delegation-level talks today; Modi says visit will add significant momentum to bilateral trade and investment relations

Kallol Bhattacherjee
NEW DELHI

India will move ahead with its plans to strengthen ties with Cyprus, said Prime Minister Narendra Modi in Nicosia where he arrived Sunday evening.

Mr. Modi was greeted by Cyprus President Nikos Christodoulides at the airport. He met the resident Indian community in the island nation, which has been supportive of India's position on the Kashmir issue and has most recently expressed solidarity with India after the terror attack in Pahalgam in April.

"This visit will add significant momentum to India-Cyprus relations, especially in areas such as trade, investment and more," Mr. Modi said on arrival.

"I thank the Indian community for the love. India will continue its efforts to strengthen its ties with Cyprus in the future," said Mr. Modi after meeting the Indian community.

Closer ties: Prime Minister Narendra Modi being received by Cyprus President Nikos Christodoulides at the airport on Sunday. ANI

Following the welcome ceremony and the meeting with the resident Indians, Mr. Modi attended a Cyprus-India Roundtable Discussion organised by the Cyprus Chamber of Commerce and Industry.

The visit, which is significant for India as it sends a message to neighbouring Turkey, coincided with the Israel-Iran conflict.

As the airspaces over Iran, Lebanon and Israel were closed owing to the conflict, Mr. Modi's official aircraft aircraft flew over the Arabian Sea, Somalia, Ethiopia, Eritrea, and Egypt before arriving at Cyprus.

The ceremonial welcome for Mr. Modi is scheduled for Monday when the two leaderships will sit for restricted talks as well as for delegation-level talks that will be followed by press statements.

After conclusion of engagements at Cyprus, the Prime Minister will leave for Calgary, Canada to participate in the G-7 summit and then visit Croatia.

Significance of the Visit:

- **Strengthening Bilateral Ties:**The visit is expected to reinvigorate cooperation in trade, investment, technology, maritime cooperation, and tourism. Cyprus is part of the EU and holds significance for India's economic and geopolitical engagement with Europe.
- **Diaspora Diplomacy:**PM Modi's interaction with the Indian community in Cyprus strengthens people-to-people ties and acknowledges their role in enhancing India's global image.
- **Strategic Signalling to Turkey:**The visit comes against the backdrop of Turkey's assertive stance on Kashmir and its growing ties with Pakistan. By engaging Cyprus — a rival of Turkey — India is sending a subtle message, balancing the regional power matrix.
- **Geopolitical Context – West Asia Crisis:**The route taken by PM Modi's aircraft to bypass conflict zones in Iran, Lebanon, and Israel underscores the volatility in West Asia, and the significance of alternative diplomatic corridors such as Cyprus in maintaining uninterrupted engagements.
- **Economic and Business Outreach:**The Cyprus-India Roundtable Discussion opens avenues for private investment and commercial linkages, especially in sectors like shipping, financial services, and green technologies.
- **Global Diplomacy Linkage**:PM Modi's onward journey to the G-7 Summit in Calgary reflects India's intent to project itself as a responsible global player, leveraging partnerships both in the Global North and South.

India-Cyprus Relations – A Snapshot:

- **Political Support:** Cyprus has consistently supported India on Kashmir and condemned terrorism targeting India.
- **Economic Cooperation:** Despite modest trade volumes, Cyprus remains a favorable destination for FDI inflows, especially in finance and services.
- **Maritime Linkages:** Located at a maritime crossroads, Cyprus offers strategic value in Mediterranean connectivity.

Challenges Ahead:

- **Low Trade Volume:** Trade remains limited and needs diversification and scale-up.
- **Turkish Lobbying:** Cyprus's disputes with Turkey require India to balance relations diplomatically without overt alignment.
- **Global Uncertainties:** The Iran-Israel crisis could affect Mediterranean and West Asian stability — regions crucial for Indian energy and diaspora interests.

Conclusion:

- India's engagement with Cyprus demonstrates a mature, multipolar foreign policy that balances strategic interests with economic diplomacy. It reflects New Delhi's aim to strengthen old

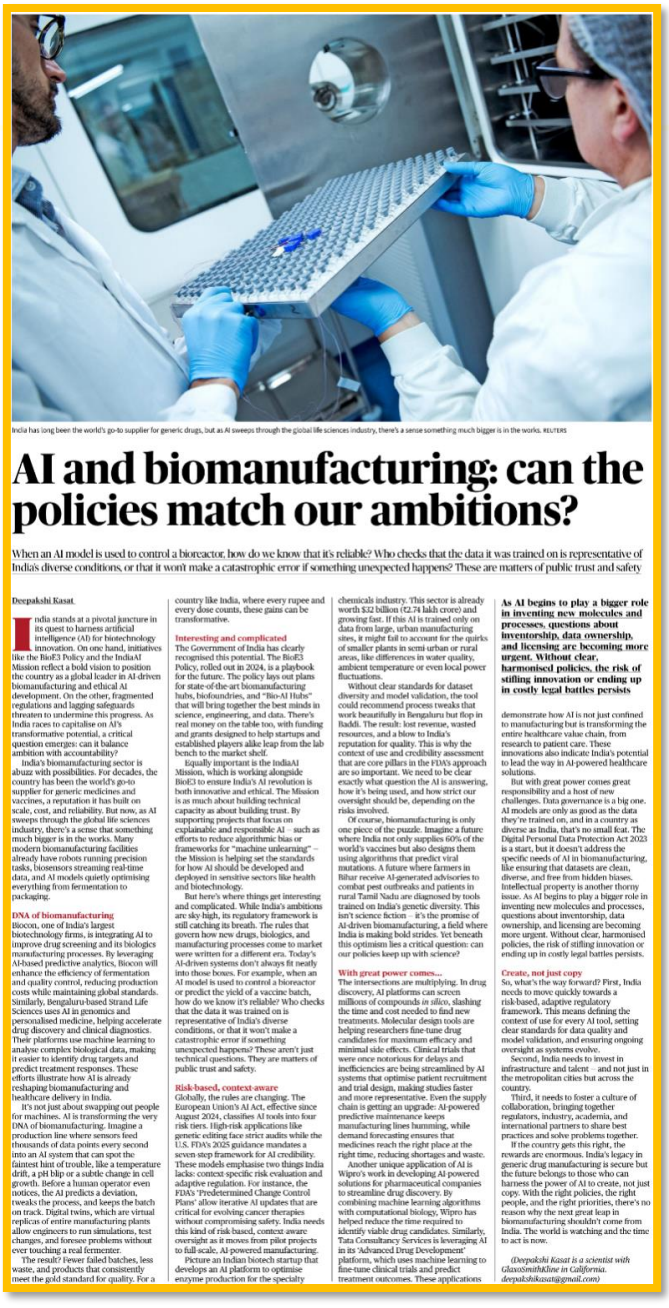
partnerships, counter adversarial narratives, and secure footholds in geopolitically significant regions. As India expands its diplomatic footprint, such visits reaffirm India's role as a global balancer in turbulent times.

UPSC Mains Practice Question

Ques: India's growing engagement with smaller European nations like Cyprus signals a shift in its foreign policy priorities. Discuss the significance of such engagements in the context of regional geopolitics and global diplomacy. **(250 words)**

Page : 07 :GS 3 : Science and Technology

India, known globally as the pharmacy of the world, stands at the threshold of a biotechnological revolution powered by Artificial Intelligence (AI). With the BioE3 Policy and the IndiaAI Mission, the country is laying down ambitious foundations to become a global leader in AI-enabled biomanufacturing. However, a critical gap persists — the lack of robust, adaptive, and risk-sensitive regulation that can ensure safety, accountability, and trust without stifling innovation.



India has long been the world's go-to supplier for generic drugs, but as AI sweeps through the global life sciences industry, there's a sense something much bigger is in the works. REUTERS

AI and biomanufacturing: can the policies match our ambitions?

When an AI model is used to control a bioreactor, how do we know that it's reliable? Who checks that the data it was trained on is representative of India's diverse conditions, or that it won't make a catastrophic error if something unexpected happens? These are matters of public trust and safety

Deepakshi Kasat

India stands at a pivotal juncture in its quest to harness artificial intelligence (AI) for biotechnology innovation. On one hand, initiatives like the BioE3 Policy and the IndiaAI Mission reflect a bold vision to position the country as a global leader in AI-driven biomanufacturing and ethical AI development. On the other, fragmented regulations and lagging safeguards threaten to undermine this progress. As India races to capitalise on AI's transformative potential, a critical question emerges: can it balance ambition with accountability?

India's biomanufacturing sector is abuzz with possibilities. For decades, the country has been the world's go-to supplier for generic medicines and vaccines, a reputation it has built on scale, cost, and reliability. But now, as AI sweeps through the global life sciences industry, there's a sense that something much bigger is in the works. Many modern biomanufacturing facilities already have robots running precision tasks, biosensors streaming real-time data, and AI models quietly optimising everything from fermentation to packaging.

DNA of biomanufacturing

Biocon, one of India's largest biotechnology firms, is integrating AI to improve drug screening and its biologics manufacturing processes. By leveraging AI-based predictive analytics, Biocon will enhance the efficiency of fermentation and quality control, reducing production costs while maintaining global standards. Similarly, Bengaluru-based Strand Life Sciences uses AI in genomics and personalised medicine, helping accelerate drug discovery and clinical diagnostics. Their platforms use machine learning to analyse complex biological data, making it easier to identify drug targets and predict treatment responses. These efforts illustrate how AI is already reshaping biomanufacturing and healthcare delivery in India.

It's not just about swapping out people for machines. AI is transforming the very DNA of biomanufacturing. Imagine a production line where sensors feed thousands of data points every second into an AI system that can spot the faintest hint of trouble, like a temperature drift, a pH blip or a subtle change in cell growth. Before a human operator even notices, the AI predicts a deviation, tweaks the process, and keeps the batch on track. Digital twins, which are virtual replicas of entire manufacturing plants allow engineers to run simulations, test changes, and foresee problems without ever touching a real fermenter.

The result? Fewer failed batches, less waste, and products that consistently meet the gold standard for quality. For a country like India, where every rupee and every dose counts, these gains can be transformative.

Interesting and complicated

The Government of India has clearly recognised this potential. The BioE3 Policy, rolled out in 2024, is a playbook for the future. The policy lays out plans for state-of-the-art biomanufacturing hubs, biofoundries, and "Bio-AI Hubs" that will bring together the best minds in science, engineering, and data. There's real money on the table too, with funding and grants designed to help startups and established players alike leap from the lab bench to the market shelf.

Equally important is the IndiaAI Mission, which is working alongside BioE3 to ensure India's AI revolution is supplier for generic medicines and vaccines, a reputation it has built on scale, cost, and reliability. But now, as AI sweeps through the global life sciences industry, there's a sense that something much bigger is in the works. Many modern biomanufacturing facilities already have robots running precision tasks, biosensors streaming real-time data, and AI models quietly optimising everything from fermentation to packaging.

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Equally important is the IndiaAI Mission, which is working alongside BioE3 to ensure India's AI revolution is as much about building technical capacity as about building trust. By supporting projects that focus on explainable and responsible AI – such as efforts to reduce algorithmic bias or frameworks for "machine unlearning" – the Mission is helping set the standards for how AI should be developed and deployed in sensitive sectors like health and biotechnology.

But here's where things get interesting and complicated. While India's ambitions are sky-high, its regulatory framework is still catching its breath. The rules that govern how new drugs, biologics, and manufacturing processes come to market were written for a different era. Today's AI-driven systems don't always fit neatly into those boxes. For example, when an AI model is used to control a bioreactor or predict the yield of a vaccine batch, how do we know it's reliable? Who checks that the data it was trained on is representative of India's diverse conditions, or that it won't make a catastrophic error if something unexpected happens? These aren't just technical questions. They are matters of public trust and safety.

Risk-based, context-aware

Globally, the rules are changing. The European Union's AI Act, effective since August 2024, classifies AI tools into four risk tiers. High-risk applications like genetic editing face strict audits while the U.S. FDA's 2025 guidance mandates a seven-step framework for AI credibility. These models emphasise two things India lacks: context-specific risk evaluation and adaptive regulation. For instance, the FDA's 'Predetermined Change Control Plans' allow iterative AI updates that are critical for evolving cancer therapies without compromising safety. India needs this kind of risk-based, context-aware oversight as it moves from pilot projects to full-scale, AI-powered manufacturing.

Picture an Indian biotech startup that develops an AI platform to optimise enzyme production for the specialty chemicals industry. This sector is already worth $32 billion (₹2.74 lakh crore) and growing fast. If this AI is trained only on data from large, urban manufacturing sites, it might fail to account for the quirks of smaller plants in semi-urban or rural areas, like differences in water quality, ambient temperature or even local power fluctuations.

Without clear standards for dataset diversity and model validation, the tool could recommend process tweaks that work beautifully in Bengaluru but flop in Baddi. The result: lost revenue, wasted resources, and a blow to India's reputation for quality. This is why the context of use and credibility assessment that are core pillars in the FDA's approach are so important. We need to be clear exactly what question the AI is answering, how it's being used, and how strict our oversight should be, depending on the risks involved.

Of course, biomanufacturing is only one piece of the puzzle. Imagine a future where India not only supplies 60% of the world's vaccines but also designs them using algorithms that predict viral mutations. A future where farmers in Bihar receive AI-generated advisories to combat pest outbreaks and patients in rural Tamil Nadu are diagnosed by tools trained on India's genetic diversity. This isn't science fiction – it's the promise of AI-driven biomanufacturing, a field where India is making bold strides. Yet beneath this optimism lies a critical question: can our policies keep up with science?

With great power comes...

The intersections are multiplying. In drug discovery, AI platforms can screen millions of compounds *in silico*, slashing the time and cost needed to find new treatments. Molecular design tools are helping researchers fine-tune drug candidates for maximum efficacy and minimal side effects. Clinical trials that were once notorious for delays and inefficiencies are being streamlined by AI systems that optimise patient recruitment and trial design, making studies faster and more representative. Even the supply chain is getting an upgrade: AI-powered predictive maintenance keeps manufacturing lines humming, while demand forecasting ensures that medicines reach the right place at the right time, reducing shortages and waste.

Another unique application of AI is Wipro's work in developing AI powered solutions for pharmaceutical companies to streamline drug discovery. By combining machine learning algorithms with computational biology, Wipro has helped reduce the time required to identify viable drug candidates. Similarly, Tata Consultancy Services is leveraging AI in its 'Advanced Drug Development' platform, which uses machine learning to fine-tune clinical trials and predict treatment outcomes. These applications

As AI begins to play a bigger role in inventing new molecules and processes, questions about inventorship, data ownership, and licensing are becoming more urgent. Without clear, harmonised policies, the risk of stifling innovation or ending up in costly legal battles persists

demonstrate how AI is not just confined to manufacturing but is transforming the entire healthcare value chain, from research to patient care. These innovations also indicate India's potential to lead the way in AI-powered healthcare solutions.

But with great power comes great responsibility and a host of new challenges. Data governance is a big one. AI models are only as good as the data they're trained on, and in a country as diverse as India, that's no small feat. The Digital Personal Data Protection Act 2023 is a start, but it doesn't address the specific needs of AI in biomanufacturing, like ensuring that datasets are clean, diverse, and free from hidden biases. Intellectual property is another thorny issue. As AI begins to play a bigger role in inventing new molecules and processes, questions about inventorship, data ownership, and licensing are becoming more urgent. Without clear, harmonised policies, the risk of stifling innovation or ending up in costly legal battles persists.

Create, not just copy

So, what's the way forward? First, India needs to move quickly towards a risk-based, adaptive regulatory framework. This means defining the context of use for every AI tool, setting clear standards for data quality and model validation, and ensuring ongoing oversight as systems evolve.

Second, India needs to invest in infrastructure and talent – and not just in the metropolitan cities but across the country.

Third, it needs to foster a culture of collaboration, bringing together regulators, industry, academia, and international partners to share best practices and solve problems together.

If the country gets this right, the rewards are enormous. India's legacy in generic drug manufacturing is secure but the future belongs to those who can harness the power of AI to create, not just copy. With the right policies, the right people, and the right priorities, there's no reason why the next great leap in biomanufacturing shouldn't come from India. The world is watching and the time to act is now.

(Deepakshi Kasat is a scientist with GlaxoSmithKline in California. deepakshikasat@gmail.com)

— potentially revolutionising rural healthcare delivery.

Challenges: Policy-Technology Mismatch

- **Regulatory Lag:**India's current regulatory systems were designed for conventional drug processes and are ill-equipped to handle AI-controlled systems, real-time learning algorithms, or autonomous decision-making in manufacturing.
- **Data Governance & Bias:**AI models trained on urban-centric, homogeneous datasets may fail in semi-urban or rural contexts, creating risk of systemic failure. Existing laws like the Digital Personal Data Protection Act 2023 don't address sector-specific needs of biotech-AI convergence.
- **Accountability & Oversight:**Who is responsible if an AI model misjudges a production parameter leading to a contaminated batch? Lack of context-aware, risk-based evaluation models, like those in the EU and U.S., raises concerns around AI credibility and liability.
- **Intellectual Property (IP) Ambiguity:** As AI begins to invent new compounds and processes, India lacks clarity on AI inventorship, data ownership, and licensing frameworks — vital for encouraging innovation and preventing disputes.

Global Lessons India Can Adopt

- The EU's AI Act categorises AI use cases based on risk level, demanding stricter oversight for high-risk areas like genetic engineering.
- The U.S. FDA's 7-step AI framework ensures model reliability, performance monitoring, and iterative change protocols.
- Both models underline the need for adaptive regulation — an area India must urgently act upon.

The Way Forward for India

- **Build Context-Specific Regulation:** Develop dynamic standards for AI model validation based on use-case risk and sectoral impact (e.g., vaccines vs. enzyme production).
- **Mandate Data Diversity Standards:** Ensure AI tools are trained on inclusive datasets that reflect India's environmental, demographic, and infrastructural diversity.
- **Expand Talent & Infrastructure Nationwide:** Move beyond urban hubs by investing in AI-bio innovation ecosystems across tier-2 and tier-3 cities.
- **Foster Multi-Stakeholder Collaboration:** Encourage joint working groups of regulators, industry, academia, and global partners to develop best practices and ethical guidelines.
- **Update IP and Data Protection Norms:** Frame sector-specific amendments for AI-driven inventions, data sharing protocols, and innovation licensing.

Conclusion

- India's vision to lead the global AI-biotech revolution is bold and timely. But without an equally agile regulatory system, the ambition could falter. The country must act swiftly to translate policy intent into enforceable, forward-looking frameworks. Doing so will not only safeguard public trust but also allow India to move from being a supplier to a creator in the global life sciences ecosystem.

UPSCMainsPractice Question

Ques:Discuss the transformative potential of Artificial Intelligence in India's biomanufacturing sector. What regulatory and ethical challenges does this integration pose? (150 Words)

Page 08 : GS 2 : Social Jusice

India's decline in the Global Gender Gap Index 2025, dropping to 131st out of 148 countries, highlights a troubling stagnation in efforts toward gender parity, particularly in political empowerment. While incremental gains in economic participation, education, and health are visible, the political underrepresentation of women continues to weigh down India's overall progress.

Key Observations from the Report:

- **Overall Score:** India's gender parity score stands at 64.1%, among the lowest in South Asia.
- Economic Participation: Improvement in estimated earned income parity (from 28.6% to 29.9%) and labour force participation stability (45.9%) offer cautious optimism.
- **Education and Health**: Scores have marginally improved due to wider access to basic education and healthcare.
- **Political Empowerment:**
  - Representation of women in Parliament fell to 13.8% in 2025 from 14.7% the previous year.
  - Women in ministerial positions dropped to 5.6%, marking a sustained decline since 2023.

Analysis: Why Political Representation Matters

- **Policy Prioritization:** More women in legislatures ensures that issues such as maternal health, gender-based violence, and unpaid care work receive appropriate policy attention.
- **Democratic Inclusivity:** Political representation is not merely symbolic; it reflects the inclusiveness and maturity of a democracy.
- **Role Modelling:** Women in politics serve as aspirational figures, encouraging civic engagement among younger women and girls.

Women's Reservation Bill: Promise Deferred

- The passage of the Women's Reservation Bill in 2023, after 27 years, was historic, but its implementation is deferred until 2029, contingent on the completion of the Census and delimitation —

Mind the gap

India needs to ensure women's participation in policymaking

India has dropped two points from its position last year in the World Economic Forum's Global Gender Gap Index report, holding at 131 out of 148 countries. The parity score is just 64.1%, making it among one of the lowest-ranked countries in South Asia, according to the report released last week. The Index measures gender parity in a country across four aspects – economic participation and opportunity; educational attainment; health and survival, and political empowerment. While the performance of India in three of the four dimensions is either stable or has marginally improved, the significant lack of achievement in the fourth weighs down the overall result. The report says, in the economic participation and opportunity category, India has improved by +0.9 percentage points. The parity in estimated earned income rises from 28.6% to 29.9%, positively impacting the subindex score, the report said. Scores in labour force participation rate remained the same (45.9%) as last year – India's highest achieved to date. In the educational attainment and health and survival categories, the scores have been driven up by positive shifts. It is in the political empowerment category that India records a drop in parity, since the last evaluation. Female representation in Parliament fell from 14.7% to 13.8% in 2025, lowering the indicator score for the second year in a row below 2023 levels. Also evaluated was the share of women in ministerial roles, which fell from 6.5% to 5.6 %, continuing the sinking trend since 2023.

The path ahead is obvious – consolidate and improve on the gains and make efforts to set right the lacunae with policies and political will. India has had a long, shameful tussle on this issue as it toyed with the idea of increasing representation for women in polity. The controversial Women's Reservation Bill was passed in 2023, 27 years after it was first introduced in 1996. The Bill has been visited upon by many charades, was blocked at every turn, and the path to actualisation of the goal was lined with monumental impediments. The present Act reserves one third of the seats for women in Parliament and the State legislatures, but will only be implemented from 2029, after the completion of the Census, and the delimitation exercise. But India climbing up the ranks of a global index should be only secondary to achieving a rounded, applause-worthy, gender parity structure within the country. There is, also, nothing keeping political parties from increasing women's participation in the electoral process, even before the law necessitates it.

processes already delayed. This postponement dilutes the urgency and impact of a long-awaited reform.

- Despite the passage of legislation, political will remains weak. The reluctance of major parties to field more women candidates, even without legislative compulsion, highlights the entrenched patriarchal mindset within India's political institutions.

Way Forward: Bridging the Gap

- **Fast-track Implementation of the Women's Reservation Act:** Expedite Census and delimitation exercises to bring early enforcement of the constitutional amendment.
- **Voluntary Party Reforms:** Political parties must proactively increase ticket allocation to women candidates, even in absence of legal obligation.
- **Capacity Building:** Invest in leadership training, financial support, and mentorship programs for women, especially at the grassroots level.
- **Institutional Reforms :** Encourage gender budgeting in political funding and campaign finance, and strengthen anti-discrimination laws in political appointments.
- **Public Awareness Campaigns**:Combat gender stereotypes and challenge societal norms that discourage women from participating in politics.

Conclusion

- India's marginal gains in gender parity are undercut by the systemic exclusion of women from political decision-making. A true democracy must reflect the voice of half its population in governance. Achieving gender equality in politics is not a matter of global rankings alone — it is central to justice, equity, and effective policymaking. India must move beyond symbolic measures to create an inclusive and representative polity, driven by both legislative mandates and political ethics.

UPSC Mains Practice Question

Ques: Gender parity in political representation is essential for inclusive governance. Discuss in the context of India's performance in the Global Gender Gap Index 2025. (**250 words)**

Page : 10: GS 3 : Environment

India's attempt to curb sulphur dioxide (SO_2) emissions from coal-fired thermal power plants (TPPs) through Flue Gas Desulphurisation (FGD) units is under review, with a high-level expert committee recommending a rollback of the decade-old mandate. This development has ignited a debate over economic feasibility vs environmental responsibility, raising critical questions about India's commitment to clean energy, public health, and emission norms.

What are flue gas desulphurisation units?

What are the different types of FGD systems commonly used in coal-fired thermal power plants? Why are emissions of sulphur dioxide a threat to the planet? Why is the government advocating for a rollback of FGDs in coal-fired power plants? What are the alternatives?

EXPLAINER

Priyali Prakash

The story so far:

On June 4, *The Hindu* reported that a committee of experts, chaired by Principal Scientific Advisor (PSA) Ajay Sood, has recommended that India do away with a decade-long policy of mandating Flue Gas Desulphurisation (FGD) units in all coal-fired thermal power plants (TPPs).

What is a FGD unit?

Flue gas is emitted as a byproduct of combustion of fossil fuels. It mainly contains pollutants such as carbon dioxide (CO2), sulphur dioxide (SO2), nitrogen oxides, particulate matter, etc. FGD units specifically target the SO2 emissions in flue gas. SO2 is an acidic gas, and is usually treated with a basic compound in the FGD unit to neutralise the pollutant. There are three common types of FGD systems around the world – dry sorbent injection, wet limestone treatment, and using sea water to remove SO2. The dry sorbent injection method involves adding a powdered sorbent like limestone to the flue gas, where it reacts with SO2. The resultant compound can be removed by using an electrostatic precipitator, or a fabric filter. The wet limestone treatment method also uses limestone to remove SO2, but instead of using it in a powdered form, it uses a limestone slurry. Passing SO2 through this slurry results in the formation of gypsum, which is a stable compound and has wide applications in industries like construction. This is the commonly used technology, and has very high efficiency.

Sea water treatment is used in plants located near coastal areas. Sea water first absorbs SO2 from flue gas, and then the water is treated to make it suitable to be discharged back into the sea.

Why are SO2 emissions bad?

SO2 is one of the major greenhouse gases that cause global warming, and can cause respiratory problems in humans. Sulphur dioxide can also lead to the formation of other oxides of sulphur in the atmosphere, which can in turn react with other compounds to form particulate matter. "It has been established in several modelling studies that 15% of India's ambient PM2.5 is attributable to coal. A significant share of this (80%) is in turn attributable to secondary particulate matter formed from the SO2 that is released when coal is burned. FGDs are absolutely necessary to mitigate this route to PM2.5 formation," Karthik Ganesan, Fellow and Director - Strategic Partnerships, Council on Energy, Environment and Water told *The Hindu*.

Costly cleanup: Smoke comes out from the Tuticorin Thermal Power station in Thoothukudi. FILE PHOTO

What's status of FGD units in India?

In 2015, the Union Environment Ministry issued a policy that mandated all 537 coal-fired TPPs in India to install FGD units to reduce SO2 emissions. The first deadline for this was 2018, but merely a handful of the plants met the deadline. As of April 2025, compliance had been pushed to 2027, 2028, and 2029, respectively, depending on the category of the thermal power plant. It takes around two years to install an FGD unit.

According to a government press release dated August 1, 2024, FGD units have been installed in only 39 out of 537 coal-fired TPPs in India. On December 30, 2024, the Ministry of Environment, Forest and Climate Change (MoEFCC) issued a notification, pushing back the deadline for complying with SO2 emission norms by three years without specifying any reasons. In April 2025, a study commissioned by the PSA's office concluded that the Environment Ministry should roll back its 2015 policy mandating all of India's TPPs to install FGD units.

Why are FGD units contentious?

Installing FGD units is a costly affair. According to the Central Electricity Authority, FGD costs approximately ₹1.2 crore per MW to install. As of April 2025, India's installed coal capacity stood at 2,19,338 MW, which is more than 46% of the country's total electricity installed capacity. This is expected to rise in the coming years. In his statement at a June 10 press conference, Union Power Minister Manohar Lal Khattar said, "About 97,000 MW of power will be added, and implementing FGD means an additional expense of ₹97,000 crore. We have to consider this carefully. Neither should health be harmed, nor people face increased tariffs, nor warming increase."

However, some researchers like Shruti Sharma, Lead, Affordable Energy, at the International Institute for Sustainable Development, Bengaluru, believe that even though "skipping FGD units may appear to offer short-term savings, it risks undermining India's clean air targets and public health commitments". "FGDs can add up to ₹0.72 per kWh to electricity tariffs – a cost that reflects the price of cleaner air. Importantly, over 80% of this increase in tariffs is due to the FGD technology's fixed costs, and variable cost increase is in all cases less than ₹0.1 per kWh. This limits the risk of volatile or unexpected costs and makes it easier for utilities and regulators to plan and manage the impact," she said. It's also tricky to gauge how FGDs make an impact on air quality, since it depends on the proximity of towns to power plants. "The contribution to PM2.5 in Delhi, for example, is not that significant from coal-based power plants but given the levels that Delhi experiences, many sources have to be addressed, and stationary sources are easier to target," Dr. Ganesan said.

Is there an alternative to FGD?

According to experts, no. "There is no alternative to FGDs itself to remove SO2 that is released from the burning of coal....There is an urgent need to get these [TPPs] compliant without delaying any further," Dr. Ganesan said.

THE GIST

- Flue gas is emitted as a byproduct of combustion of fossil fuels. It mainly contains pollutants such as carbon dioxide (CO2), sulphur dioxide (SO2), nitrogen oxides, particulate matter, etc.
- SO2 is one of the major greenhouse gases that cause global warming, and can cause respiratory problems in humans.
- Installing FGD units is a costly affair. According to the Central Electricity Authority, FGD costs approximately ₹1.2 crore per MW to install.

What Are FGDs and Why Are They Important?

- FGD units are pollution control devices installed in thermal power plants to remove SO_2 from flue gas, a harmful byproduct of coal combustion. SO_2 is a toxic, acidic gas contributing to:
  - Respiratory ailments in humans
  - Acid rain
  - Formation of secondary particulate matter (PM2.5) — a key cause of air pollution
- **There are three main FGD technologies:**
  - Dry Sorbent Injection (DSI): Uses powdered lime or limestone
  - Wet Limestone Scrubbing: Highly efficient; produces gypsum
  - Seawater FGD: Used in coastal plants

The Status Quo: Low Compliance, High Costs

- Out of 537 coal-fired TPPs, only 39 have installed FGD units as of April 2025.
- Originally mandated in 2015, the deadline has been repeatedly pushed back, now extended to 2029.
- Installation costs around ₹1.2 crore/MW, which, when scaled to current and upcoming capacity, implies tens of thousands of crores in investment.

The Government's Concerns

- The Union Power Minister cited economic stress: an additional 97,000 MW capacity would cost ₹97,000 crore in FGD setup.
- Tariff impact: ₹0.72 per unit rise in electricity tariffs may burden consumers.
- Emphasis is placed on balancing clean air with affordability and energy security.

The Counterarguments: Health and Sustainability

- SO_2 contributes to up to 15% of India's PM2.5 burden, a key pollutant linked to premature deaths.
- Public health costs of poor air quality far exceed FGD installation costs in the long run.
- Experts argue that FGDs are essential and irreplaceable for SO_2 mitigation — there is no proven alternative.

Policy Paradox: Rolling Back Without Replacement

- The rollback proposal is particularly controversial because:
- It could weaken India's National Clean Air Programme (NCAP) goals.
- It signals regulatory uncertainty to environmental advocates and international observers.
- It contradicts India's stated climate commitments, including those under the Paris Agreement.

What Lies Ahead?

- **India must weigh:**
  - Short-term economic relief vs long-term public health and environmental damage
  - Whether tariff increases can be cushioned by targeted subsidies or phased implementation
  - Whether retrofitting timelines can be revised without scrapping the mandate altogether

Conclusion

- The call to roll back mandatory FGD installations may offer temporary economic convenience, but risks permanently damaging India's clean air agenda. It's a reminder that environmental policymaking must be scientifically informed, economically viable, and socially responsible. India needs coherent policies that align industrial growth with public health imperatives — not trade one off for the other.

UPSC MainsPractice Question

Ques: What are Flue Gas Desulphurisation (FGD) units? Discuss their significance in the context of India's air pollution control strategy and critically examine the implications of the proposed rollback of mandatory FGD installation in thermal power plants. **(250 Words)**

Page : 08 Editorial Analysis

More 'mind space' for India in America's imagination

Why is there no 'Schwarzman Scholars' programme for India? Why does a country of 1.4 billion people – an ancient civilisation, a dynamic economy, a nuclear power, and a key player in the Indo-Pacific – still appear marginal in the priorities of elite American institutions? The answer lies not merely in policy lag but in perception, psychology, and deeply embedded narratives that continue to shape the West's engagement with Asia.

The Schwarzman Scholars programme

The 'Schwarzman Scholars' programme, launched in 2016 and based at Beijing's Tsinghua University, was explicitly modelled after the Rhodes Scholarship (founded in 1902). Its mission is ambitious: to cultivate a future generation of global leaders, deeply familiar with China's systems, strategic worldview, and societal aspirations. That no such equivalent programme exists for India is not an accident. It is the culmination of decades of lopsided intellectual investment – one that privileges China as essential, and views India, at best, as peripheral.

This imbalance was presciently explored by Harold R. Isaacs in his seminal work, *Scratches on Our Minds: American Images of China and India* (1958). Isaacs uncovered the psychological residue – "scratches", as he termed them – left on American consciousness by media, education, missionary engagement, and diplomatic narratives. China loomed large in this imagination: revolutionary, mystical, dangerous, promising. India, by contrast, was filtered through colonial British lenses: remote, spiritual, chaotic, and, ultimately, less urgent.

Even today, those scratches endure. India is often misunderstood, misrepresented, or, more often, simply missing in the frameworks that shape western elite understanding. The Cold War's bipolar logic left India unmoored in American strategic thinking. China was a site of ideological competition, and later, a partner in global capitalism. India, non-aligned and self-reliant, never fit the template. Its democracy attracted rhetorical admiration, but its strategic ambivalence dampened deeper interest.

This selective seduction continued into the 21st century. China masterfully framed its rise as an opportunity – and the West was psychologically prepared to believe it. Scholars such as Australian sinologist Stephen FitzGerald described in the 1980s how the West "wanted China to succeed" – economically, politically, even ideologically. China offered a compelling, seductive narrative of transformation: poverty to prosperity, isolation to globalisation, authoritarian control with capitalist efficiency. Western business leaders, academics and policymakers were drawn in. Programmes such as Schwarzman were not just reflections of China's pull –they were symptoms of the West's emotional and intellectual readiness to be seduced.

Nirupama Rao

is a former Foreign Secretary and Ambassador to the United States

India needs to ensure that it captures intellectual space in the American imagination, and is understood on its own terms

India never orchestrated such seduction. It emerged from colonialism with a focus on sovereignty and self-reliance. It rebuffed bloc politics, avoided entanglements, and developed slowly and unevenly. Its strengths – pluralistic democracy, entrepreneurial diaspora, and cultural richness – did not easily translate into strategic urgency or narrative coherence for the West. While the Chinese state invested heavily in soft power – through Confucius Institutes, think tanks, cultural exchanges, and university partnerships – India's outreach was modest, sporadic, and often bureaucratically constrained.

The problem with India-focused research

Even within American academia, the difference is stark. China Studies enjoys robust institutional support across top universities. With a few exceptions, India-focused research, by contrast, is fragmented, often subsumed under South Asian or Postcolonial Studies, with an emphasis on religion, anthropology, or classical languages. These are critical fields, but do not capture the lure of a civilisational state and a modern India that is shaping global technology, space innovation, climate policy, and strategic affairs. India appears in headlines, but rarely in syllabi.

The consequences are serious. Future American leaders, whether in diplomacy, business, or policy, are not being trained to understand India in its full complexity. The persistence of reductive frameworks, such as the old hyphenation of "India-Pakistan", continues to distort strategic thinking. U.S. President Donald Trump's repetitive remarks about mediating between India and Pakistan are not just personal gaffes. They reflect institutional inertia, a failure to update mental maps to match geopolitical reality.

And here lies a paradox: just as India's importance is rising, its visibility in American intellectual and philanthropic circuits remains limited. The absence of a flagship fellowship akin to Schwarzman is both a symbol and a cause of this gap. Such a programme would not just serve India's interests; it would meet a growing demand among global youth for deeper engagement with the world's largest democracy – its challenges, innovations, contradictions, and aspirations.

But for such a fellowship to succeed, India must first invest in the institutional foundation. Tsinghua University, where Schwarzman is housed, is not just a campus. It is a a brand, a node of state-backed ambition with global recognition. India has institutions of excellence – the Indian Institutes of Technology, Indian Institutes of Management, and emerging liberal arts universities such as Ashoka and Krea – but none as yet combine academic prestige, international pull, policy connectivity, and philanthropic momentum at the scale required.

This must change. India needs a globally oriented, strategically empowered academic platform that can host and nurture the next generation of world leaders – Indian and foreign – who understand India not just as a subject of study but as a site of leadership. Creating such an institution will require government will, private capital, academic autonomy, and long-term vision.

Narrative matters

India also needs to project its narrative with much more feeling and conviction. The Chinese have always felt they are a 'chosen' people. The world, from Napoleon, has felt the same. India is the Cinderella in this story. Strategic restraint and ambiguity has served Indian diplomacy in many arenas, but silence can be mistaken for absence and risk-aversion for reticence and a lack of confidence. Narrative matters. Global leadership today is as much about shaping perceptions as it is about GDP or military muscle. That means calling out outdated framing, investing in storytelling, and claiming intellectual space with confidence. The refrain of a rising GDP lifting all boats, of International Yoga Days, will not just do. Every few blocks in an American city you will find a yoga studio and an Indian restaurant. But does that change the power scene for India?

Ultimately, the battle for influence is not only fought in the corridors of power or in street corners, but is also shaped in classrooms, fellowships, research centres, and campus conversations. If India wants to be understood on its own terms, and not just as a counterweight to China or a bystander in someone else's story, it must be present in the places where ideas are formed and futures imagined.

The scratches on our minds can be healed, but not with silence. They require vision, voice, and a story compelling enough to inspire the next generation of global leaders. A Schwarzman-style fellowship in India would not just be a corrective. It would be a declaration that India is no longer content to be studied at a distance. It wants to be known, on its own terms.

Paper 03: Science and Technology

UPSC Mains Practice Question: Despite India's growing geopolitical and economic influence, it remains underrepresented in global intellectual and academic circuits. Critically examine the causes and suggest a way forward.(250 words)

Context :

- Nirupama Rao, former Foreign Secretary, critiques the persistent underrepresentation of India in elite American academic, intellectual, and strategic circles. Despite its status as the world's largest democracy, a growing economy, and a nuclear power, India lacks narrative and institutional visibility in the Western mindspace — a vacuum that countries like China have strategically filled through state-backed programmes such as the Schwarzman Scholars.

Key Issues Highlighted:

- **Perception Deficit in U.S. Strategic Circles**
  - India remains marginal in U.S. elite discourse despite its rising geopolitical weight.
  - Outdated frames such as "India-Pakistan hyphenation" persist in U.S. policy and academia.
  - India is still seen more through a colonial, spiritual, or anthropological lens, not as a modern, strategic state.
- **Contrast with China's Strategy**
  - China has strategically shaped global perceptions through Confucius Institutes, think tanks, fellowships, and storytelling.
  - The Schwarzman Scholars programme has institutionalised elite-level understanding of China's worldview.
- **India's Institutional Gaps**
  - While India has world-class institutions like IITs, IIMs, Ashoka, Krea, it lacks a globally recognised policy-academic brand to match Tsinghua or Peking University.
  - There is no flagship India-centric fellowship for global students that cultivates informed leaders.
- **The Need for Narrative and Soft Power Investment**
  - India must move beyond yoga and cuisine as cultural ambassadors.
  - A compelling narrative of innovation, pluralism, strategic relevance, and democratic leadership must be amplified globally.
  - Intellectual presence — in syllabi, research, and fellowships — is critical to global influence.

Strategic Recommendations for India:

- **Launch a Flagship Global Fellowship Programme**
  - A Schwarzman-style initiative housed in an Indian university that attracts international students and focuses on India's strategic, economic, and cultural journey.
- **Build World-Class Academic-Policy Hubs**
  - Integrate academic excellence with policymaking, entrepreneurship, and international affairs — backed by state support and private philanthropy.
- **Enhance Global Academic Presence**
  - Invest in India Studies centres abroad, fund India chairs at foreign universities, and bring India into global curricula.

- **Create an Intellectual Diplomacy Strategy**
  - Build think tank networks, support student exchanges, digital diplomacy, and strategic communication on international platforms.
- **Reclaim the India Story**
  - Tell stories of innovation (e.g., ISRO, digital public infrastructure), diversity, and resilience that are relevant and attractive to a global audience.

Conclusion:

- India's growing global importance is at odds with its limited intellectual footprint in the West. If India is to be understood on its own terms, it must actively invest in narrative shaping, institution building, and intellectual diplomacy. Establishing a global fellowship programme, rooted in India's values and future aspirations, is not just symbolic — it is strategic. It will bridge the perception gap and ensure that India is not a footnote in global affairs, but a central voice in shaping tomorrow's leaders and ideas.
