

EDITORIALS HIGHLIGHTS
18-08-2026

1. TAXING FRIVOLOUS INDUSTRIES WILL NOT FUND INDIA SCIENCE

(THE HINDU PAGE NO 6)

1. Syllabus

- a. GS Paper III: Science and Technology developments and their applications, Indigenization of technology, Government Budgeting, and Resource Mobilization.
- b. GS Paper II: Government policies and interventions for development in various sectors.

2. Syllabus Sub-topics

- a. R&D expenditure in India, science funding bottlenecks, bureaucratic governance versus academic autonomy, GeM procurement rules, CSR funding norms, and import substitution policies.

3. Key Themes

- a. **Resource Allocation Dilemma:** Flaws in using sin or frivolous taxation to fund public goods.
- b. **Structural Issues:** Rigid compartmentalization of scientific grants, year-end spending rushes, archaic UGC rules, and high import tariffs on laboratory equipment.

4. Relevant Questions and Focus Areas

- a. *Mains:* The challenges confronting Indian scientific research are less about fiscal allocation and more about institutional governance and rigid bureaucracy. Analyze.

Taxing ‘frivolous’ industries will not fund India’s science

Whenever concerns are raised about the lack of funding for Indian science, a solution often put forward is to tax “unintellectual” industries such as cinema, tourism, apparel, and perfumes. For example, only recently, an academic from one of India’s leading research institutes suggested taxing the Indian Premier League (IPL), which, he argued, would magically generate “₹15 billion” for scientific pursuits; the “stroke of genius” was duly fawned over.

This reflects a common instinct: it is naturally hard not to want a share of the cake for a ‘nobler’ cause, when a ‘frivolous’ business makes profit in plain view.

A flawed proposition

It is equally easy to overlook the economic cascade effects of such frivolities. Organised sport, for example, generates employment across a multitude of allied industries: merchandise, food and beverage, broadcasting, physiotherapy and rehabilitation (sports science is a science too). This investment has undeniable trickle-down benefits, across more sports than one and beyond major cities.

Though well-intentioned, the myopic and fallacious “tax-this-to-fund-that” proposition needs to be dispelled immediately.

If ‘profit’ in the sports or film industries necessarily came at the expense of science, then the exercise in financial imputation should be very simple: of the \$5 billion in profit earned by a match or a movie, \$1 billion was made because a laboratory fell short of centrifuges. If that were true, then all scientists should refrain from watching movies or sports on government-subsidised campus Wi-Fi, as this would imply scientific funding flowing back to the entertainment industry. Luckily for them, the empirical evidence does not hold up: countries boasting a high expenditure on sport do not necessarily have poor scientific output, and vice versa. Besides, science is not an isolated pursuit: significant scientific input goes into making films or manufacturing textiles.

The disastrous economic experiments in India and around the world in the 20th century demonstrated that wealth is not a fixed, zero-sum pie: progress in X does not necessarily come at the expense of Y. As academics, we must refrain from making sweeping moralistic remarks, as though we know the right level of wealth surplus and how it should be spent better than the market does. Millions of dispersed individual decisions made by ordinary people contain more information than centralised academic or bureaucratic intelligence.

Moreover, how do we know that the state can reliably direct the proceeds towards science?



Ritvik Chaturvedi

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Government spending is the prerogative of bureaucrats and politicians, who are inevitably insulated from the consequences of such expenditure.

Should the money be directed towards science, must it be distributed equally among all institutes and laboratories across the country, or apportioned according to productivity? If the latter, how will productivity be measured, and by whom? Some scientists appointed as advisers to the Department of Science and Technology? Would they not favour their colleagues and collaborators?

But, why only science? Just as scientists can make a fair claim for the setting up of state-of-the-art research laboratories, surgeons could demand better hospitals in Tier-3 towns, and policemen could call for better protective gear. Given the same pool of government money, how does one choose among these equally valid, competing claims? Politicians are notorious for basing such decisions on the electoral strength of each group, while academics form factions among themselves: microbiologists might grumble about theoretical physicists receiving disproportionately high funding, much to the delight of funding agencies.

If ‘only science’, then what kind of science? Should the money go towards buying more microscopes, gene sequencers, or chromatography equipment?

Most scientists would, credulously, want these decisions to be left to scientists themselves: a grand delusion, for no subsidy is ever unconditional. A government that provides a fertilizer subsidy will ensure that it is used only to purchase fertilizers, and will go to extreme lengths to define what a fertilizer is. The subsidy giver has historically viewed the subsidy recipient as a potential embezzler. State funding for science is no different.

What is ‘allowed’ instead of ‘needed’

Government funding for science is, by definition, categorised into watertight compartments, for example, electronics, chemical reagents, consumables, travel grants, and equipment. Laboratories that do not need that extra bottle of hydrogen chloride but desperately need a computer monitor are often unable to make the purchase because the money has been rigidly earmarked. Once, a laboratory was allowed to purchase a server under “electronics”, but not a graphics card because, for some inexplicable reason, it fell under “consumables” rather than “electronics”. If a scientist does not spend all the money allocated to her in a financial year, she may receive less funding in the next one. This absurd incentive produces colossal wastage, as what is “allowed” is bought instead of what is “needed”, often at the cheapest possible price.

Consequently, precious time is wasted learning tricks to circumvent these restrictions, much like companies did during the Licence Raj. Experiments are often put on hold while scientists navigate cumbersome procurement rules, particularly towards the end of each financial year.

Steps to take

Theoretically, the money is there, but it is squandered because its expenditure is predetermined by archaic rules that the bureaucracy has little incentive to change. Removing these restrictions would free up considerable resources for their intended use. Procurement aside, even the recruitment of scientists is governed by the archaic University Grants Commission Act (1956), contributing to India losing some of its best scientists to opportunities overseas.

Another indirect and “less bad” measure for expanding available funds would be to remove the Goods and Services Tax and steep import duties on scientific equipment. The rent on knowledge creation slows research and stagnates the circulation of money, which ultimately returns to the government.

Right now, India also places crippling restrictions on private investment in science. Strict compliance requirements under CSR rules incentivise short-term, low-risk research projects. Foreign Contribution (Regulation) Act procedures remain tedious, and many laboratories struggle to navigate the paperwork required to attract foreign funding. This is unfortunate, as private endowments have a greater stake in the success of research than any anonymous bureaucrat ever would.

In a bid to promote domestic manufacturing, the government has resorted to import substitution, a measure that serves only to insulate local industries from global competition while failing to deliver world-class products.

The mandatory adoption of the Government e-Marketplace (GeM) has been a death knell, further delaying procurement and forcing scientists to settle for cheaply made Indian equipment that looks identical on paper but falls short of international standards. Often, they spend time identifying “features” available only in foreign-made products so that they can be allowed to purchase them.

If a venture can be a great success in attracting international talent by virtue of being taxed less, so can other endeavours. For India to be at the forefront of science, the mechanism is to liberalise the bottlenecks through which money and capital somehow manage to trickle into academia and reduce dependence on the government, rather than taxing the few geese that lay the golden eggs.

2. LOSING FOREST FOR TREES

(THE HINDU PAGE NO 6)

5. Syllabus

- GS Paper III: Conservation, environmental pollution and degradation, environmental impact assessment.
- GS Paper II: Statutory, regulatory, and various quasi-judicial bodies like the CAG.

6. Syllabus Sub-topics

- National Action Plan on Climate Change, Green India Mission, CAMPA funds, India State of Forest Report metrics, Aravalli degradation, and ecological restoration versus tree plantation drives.

7. Key Themes

- Restoration versus Landscaping:** The difference between true forest ecosystems with native biodiversity and fragmented tree cover or mere plantations.
- Audit Accountability:** CAG performance audits identifying implementation failures and a lack of inter-scheme convergence between GIM, MGNREGS, and CAMPA.

8. Relevant Questions and Focus Areas

- Prelims:* GIM targets under NAPCC, CAMPA guidelines, ISFR definitions of forest cover versus tree cover.
- Mains:* Merely increasing tree cover cannot substitute for the ecological integrity of forest ecosystems. Critically examine in the light of recent CAG findings on the Green India Mission.

Losing forest for trees

India is counting trees when it should be restoring forests

A performance audit by the Comptroller and Auditor General (CAG) of the Green India Mission (GIM) has found that a scheme conceived to heal India's forests had, across a decade, achieved almost nothing it set out to do. Instead of improving forest quality over 1.4 million hectares, the mission only managed 0.11 million – not even a tenth of the target. On expanding forest cover, the mission barely scraped together four per cent. The Compensatory Afforestation Fund Management and Planning Authority (CAMPA) channels money collected from industry for diverting forest land into afforestation, while the Mahatma Gandhi National Rural Employment Guarantee Scheme, now re-branded as VB-G RAM G funds rural wage labour that can be used for plantation and land-restoration works, but GIM's intended convergence with these schemes never materialised. The mission was one of the eight pillars of the National Action Plan on Climate Change, unveiled in 2008, and the instrument through which India promised the Paris Agreement an additional carbon sink of 2.5 billion to 3 billion tonnes by 2030. Its animating idea was ecological – biodiversity, water, sequestration, and the revival of habitat. GIM however seems to be on the back burner and, for all practical purposes, replaced by a tree plantation drive called 'Ek Ped Maa Ke Naam (A Tree in the Name of Mother)'. Launched in 2024, the government reports planting 140 crore saplings so far, but the latest forest data expose the gulf between a tree and a forest. The India State of Forest Report 2023 records a gain of 1,445 square kilometres in green cover but only 156 sq km of it is true forest. The rest, 1,289 sq km, is 'tree cover outside recorded forests.' Within the recorded forests, dense canopy is thinning into scrub. Ergo, India is planting more and foresting less.

Few examples encapsulate this as much as the controversy over the Aravallis. Arguably the country's most degraded range – its hillocks quarried away, its native growth overrun by the invasive 'vilayati kikar' (*Prosopis juliflora*) – it is now to be rescued by a 'Green Wall' of fresh planting. But these arboreal conscripts cannot undo the damage from years of mining, halt encroachment, or summon back an ecosystem that took millennia to form. Restoration is not landscaping. The CAG's instrument is accountancy: it can count hectares and rupees, not the worth of a living forest; and its assessment cannot always capture the practical challenges of implementing missions. However, its verdict still lands. A mission to restore India's forests has been allowed to wither while the state busies itself counting trees.

3.DECODING INDIA GROWTH IN MERCHANDISE EXPORTS

(THE HINDU PAGE NO 7)

9. Syllabus

- a. GS Paper III: Indian Economy and issues relating to planning, mobilization of resources, growth, development, and employment. Effects of liberalization on the economy.

10. Syllabus Sub-topics

- a. Foreign Trade Policy, export basket diversification, petroleum and engineering goods export trends, trade deficits, and bilateral trade partners.

11. Key Themes

- a. **Export Volatility:** Export growth driven predominantly by refining and petroleum product price fluctuations rather than broad-based manufacturing competitiveness.
- b. **Market Concentration:** Trade dynamics with key partners like the US, China, UAE, Southeast Asia, and emerging African markets.

12. Relevant Questions and Focus Areas

- a. **Mains:** Assess the strengths and vulnerabilities in India's merchandise export basket. What strategic structural reforms are needed to diversify beyond refined petroleum and engineering goods?

Decoding India's growth in merchandise exports

While the country has made marginal progress in diversification, the nearly 20% growth in merchandise exports was largely driven by petroleum products

DATA POINT

Areena Arora
Gandla Sneha

Data released by the Ministry of Commerce and Industry on August 13, 2026, showed India's exports gaining momentum, despite the ongoing war in West Asia, driven in particular by the growth in export of merchandise (goods).

In July 2026, India exported \$44.2 billion worth of goods, up nearly 20% compared to July 2025. Though the growth in the goods exports was encouraging, India's merchandise trade deficit widened from nearly \$28 billion in July 2025 to \$32 billion in July 2026 due to higher growth in imports. Analysis showed that the growth in exports was largely driven by an increase in the export of petroleum products, whose prices have gone up since the U.S. launched its attack on Iran in the last week of February.

India exported \$7.26 billion more merchandise in July 2026 than it did in July 2025. Petroleum products accounted for nearly \$2.8 billion of that increase (39%). Electronics added another \$2.16 billion (30%), while engineering goods contributed \$1.84 billion (25%). The growth in petroleum products in April-July 2026 compared with the same period in 2025 was 42.6%. India exported \$30 billion worth of petroleum products in April-July this year as against \$21 billion in the same period last year.

Export of engineering goods grew by 18.2% from \$39.2 billion to \$46.4 billion, while electronic goods' exports grew by 30.7% from \$16.2 billion to \$21.2 billion. Chart 1 shows the top five commodity groups in terms of value of goods exported.

A few other sectors also reported strong growth. Marine product exports rose nearly 18%. Meat, dairy and poultry products increased

41%, while handicrafts grew 16%.

The share of the top six commodity groups in India's total merchandise export shows that the majority of fluctuations came from petroleum products, hugely influencing the value of goods exported by the country (Chart 2). The share of engineering goods and drugs and pharmaceuticals have largely remained the same while the share of electronic goods nearly doubled in April-July 2026.

Despite the impact due to tariffs imposed by U.S. President Donald Trump, the country remained India's largest market for merchandise export. The U.S. accounted for about a fifth of India's exports between April and July 2026-27, almost unchanged from its share in the previous two financial years (Chart 3). Singapore's share has risen more noticeably from 2.7% in 2024-25 to 4.7% in the first four months of 2026-27.

China's share, which saw an increase from 3.3% to 4.4% between 2024-25 and 2025-26, has remained around the same level as of the April-July period in 2026-27. The UAE's share in India's exports came down from 8.5% to 6.5% in the same period due to the West Asia crisis. The share of other countries shown in Chart 3 increased marginally.

A country-wise breakdown showed that the highest growth came from countries such as South Africa, Tanzania, Sri Lanka, Malaysia and Kenya (Chart 4). Tanzania nearly doubled its share in India's total goods exports from 1.1% to 2%. However, an analysis of commodity groups showed that the majority of the increase in export to these countries came from refined petroleum products.

India also showed promising increase in exports to countries such as Vietnam (\$2.6 billion) and Taiwan (\$0.8 billion) in April-July 2026, which were not driven primarily by petroleum goods. An easing of the West Asia crisis will reveal the true extent to which India is diversifying its exports.

A refining-led boom in exports

Data for the charts were sourced from Ministry of Commerce and Industry. Gandla Sneha is interning with The Hindu's Data team



CHART 1: The five commodity groups that accounted for the highest value of merchandise exports from April to July this year

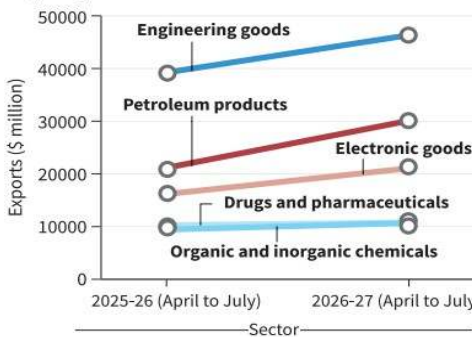


CHART 3: The share (%) of major countries in India's total merchandise exports. Countries that account for at least 2.5% of total exports are shown

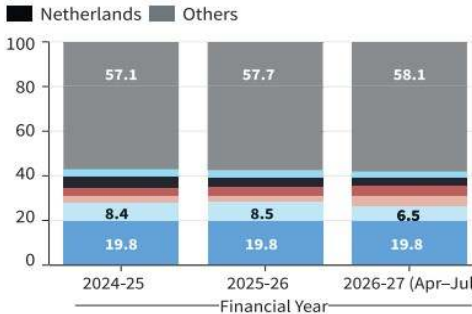


CHART 2: The share (%) of the six biggest commodity groups in India's total merchandise exports. The data for 2026-27 is only for the April-July period

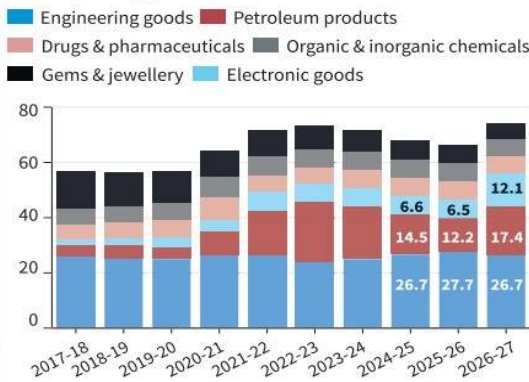
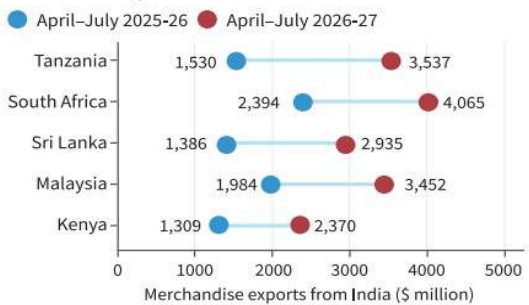


CHART 4: The top five countries in the 'Others' category in Chart 3 that saw the highest growth in value of merchandise exports



THE ROAD TO E20 IS NOT WITHOUT BUMPS

(THE HINDU PAGE NO 8)

13. Syllabus

- a. GS Paper III: Infrastructure Energy, Science and Technology, Environmental Conservation.
- b. GS Paper II: Government policies and interventions, Consumer protection.

14. Syllabus Sub-topics

- a. National Policy on Biofuels, Ethanol Blended Petrol Programme, fuel economy, mechanical corrosion issues, phase separation, and consumer rights under transition regimes.

15. Key Themes

- a. **Macro versus Micro Balance:** Macroeconomic goals like crude import reduction and decarbonization versus micro-level vehicle damage and mileage losses in legacy vehicles.
- b. **Supply Chain Vulnerabilities:** Underground storage tank water contamination, phase separation, and ethanol quality variance.

16. Relevant Questions and Focus Areas

- a. *Prelims:* Ethanol blending targets, properties of anhydrous ethanol, octane ratings.
- b. *Mains:* A hasty green transition can risk undermining consumer trust. Discuss the technical, financial, and logistical bottlenecks in India's transition to E20 fuel.

The road to E20 is not without bumps

India's rapid transition to E20 fuel has raised concerns over mileage loss, mechanical wear, contamination risks and the lack of an unblended petrol option for millions of legacy vehicles; the debate underlines the need for clearer fuel labelling, quality controls and independent real-world studies

FULL CONTEXT

O.R.S. Rao

India's rapid transition to a nationwide E20 fuel regime (petrol blended with 20% anhydrous ethanol) has triggered a complex multidimensional debate at the intersection of macroeconomic energy policy, automotive engineering, supply-chain quality control, and consumer protection. While championed by the Government of India to reduce crude oil import dependency, save foreign exchange, and reduce carbon emissions, the rollout has ignited widespread friction regarding real-world mileage drops, mechanical vulnerabilities in legacy vehicles, chemical contamination risks, and the elimination of unblended petrol (E0) as a user choice at retail pumps.

The regulatory baseline

The Government of India notified on February 17, 2026, that, effective April 1, 2026, all States and Union Territories must sell petrol blended with up to 20% ethanol and a minimum Research Octane Number (RON) of 95. It replaces the earlier 2021 notification that permitted blending of up to 10% ethanol.

Earlier, the government mandated that all automobile manufacturers comply with the Bharat Stage 6 Phase 2 Real Driving Emissions (BS 6 Phase 2 RDE) norms starting in April 2023.

Vehicles manufactured to comply with Real Driving Emissions (RDE) norms were factory-engineered with ethanol-resistant fluorinated rubber (FKM/Viton), upgraded fuel pump seals, and recalibrated Powertrain Control Modules (PCMs).

The legacy fleet, built before April 2023, was factory-calibrated for E5 or E10 configurations, featuring traditional Nitrile Butadiene Rubber (NBR) and metallic fuel system components lacking chemical shielding against higher alcohol concentrations.

Consumer surveys highlight widespread friction: over 66% of pre-2023 vehicle owners report mileage loss exceeding 10%, and 55% cite higher maintenance frequency and component wear-out.

In a written reply in Rajya Sabha, the Minister of State for Petroleum and Natural Gas, Suresh Gopi, informed the House that the Ministry of Heavy Industries had not conducted any formal assessment to determine the share of India's vehicle fleet that is genuinely E20-compatible. India's active petrol-powered vehicle pool is estimated at roughly 310 million units and may be classified broadly as shown in Table 1, based on surveys and social media.

While about 70 million post-April 2023 vehicles possess certified factory-level E20 compatibility, the remaining 240 million legacy vehicles, most of which are two-wheelers, rely on fuel delivery sub-assemblies built for E5 or E10 parameters.

Engineering realities

Ethanol functions as a powerful polar solvent and natural detergent. In older legacy vehicles, steel fuel tanks inevitably develop microscopic oxidised scale, rust layers, and varnish residues from years of standard petrol usage. When E20 is introduced, the alcohol scours and dislodges these dormant rust particles, suspending them in the fuel stream. This suspended particulate sludge quickly clogs inline fuel filters, chokes fuel pump strainers, and abrades high-pressure fuel

A fleet in transition

Around 70 million newer vehicles are E-20-compatible, while 240 million legacy vehicles were built for lower ethanol blends

Vehicle category	BS 6 Phase 2 compliant (post-April 2023)	Non-compliant / legacy (pre-April 2023)	Total estimated fleet (approx)
Two-Wheelers (Motorcycles & scooters)	55 million to 60 million	200 million to 210 million	260 million
Four-Wheelers (Passenger cars & SUVs)	12 million to 15 million	35 million to 38 million	50 million
Combined fleet (approx.)	70 million	240 million	310 million
Combined fleet % share	23%	77%	100%



GETTY IMAGES

injector nozzles, causing erratic spray patterns and engine misfires.

Being strongly hygroscopic, Ethanol draws ambient moisture directly from the air. In humid environments or during prolonged parking, the absorbed water reaches its saturation point, causing the ethanol-water mixture to separate from the gasoline (phase separation) and settle at the bottom of the fuel tank. This stagnant, acidic water-alcohol layer directly attacks the bare metal base of legacy steel tanks, accelerating severe internal pitting and bottom-tank perforation.

In pre-2023 fuel circuits, conventional NBR rubber hoses, O-rings, and pump diaphragms absorb ethanol, leading to swelling, premature hardening, embrittlement, and fuel leaks.

Because ethanol contains roughly 30-35% less energy per unit volume than petrol, unadjusted ignition timing in older engines results in reduced thermal efficiency, mileage penalties, and localised carbon/soot accumulation on spark plugs and valves.

Major vulnerabilities

The physical risks of ethanol blending are not limited to vehicle fuel tanks; they represent a major operational challenge at the retail dealer storage level.

Most retail petrol pumps in India utilise Underground Steel Tanks (UST). During heavy monsoons, waterlogging, or due to aged manhole gaskets, surface run-off can seep into UST vent pipes and inspection pits. While pure petrol floats on top of water with minimal mixing (allowing water to be pumped out from the bottom), E20 absorbs water instantaneously. When moisture ingress in a dealer's UST exceeds the critical saturation threshold (typically around 0.5% water content), catastrophic phase separation occurs within thousands of litres of fuel. The separated, low-octane, highly corrosive water-ethanol layer is drawn by the submerged suction pumps directly into the dispensing nozzles, leading to catastrophic engine stalling and immediate fuel system failure in customer vehicles.

Beyond retail seepage, fuel quality is vulnerable to chemical contaminants introduced during distillation,

dehydration, and transit.

Originating from agrochemical residues in sugarcane/grain feedstocks or chemical reagents used during distillery processing, trace chlorides form hydrochloric acid during combustion, causing severe corrosion in high-pressure fuel injectors and cylinder walls.

If dehydration units (molecular sieves) falter at distilleries, or transport tankers fail to maintain hermetic seals, excessive water content enters the supply chain prior to retail delivery.

Scientific divergence

The controversy deepened following a report from the Engine Research Laboratory at IIT Kanpur, asserting that E20 fuel causes no notable engine damage and that efficiency drops are restricted to under 5%. The institute attributed minor mileage fluctuations primarily to driving behaviours, localized traffic congestion, and variable ambient conditions rather than fuel chemistry alone.

However, these institutional findings have met with profound scepticism from independent automotive experts and consumer communities. Forums like r/CarsIndia have actively documented structural discrepancies, noting that labelling legacy, E10-calibrated engines entirely safe for E20 overlooks material science limitations. Reports highlight that auxiliary peripheral systems experience catastrophic wear even if engine blocks remain intact. Real-world logs from independent mechanics highlight premature fuel pump and injector failures, which they attribute to ethanol's low lubricity and aggressive solvent properties.

Adding significant weight to the technical debate are the leaked internal industry communications reviewed by Reuters and subsequent industry clarifications. The data reviewed by Reuters revealed that top automakers harboured deep private anxieties regarding chemical contaminants in E20 fuel, referencing tests of over 250 fuel samples across 21 States.

While official standards specify a maximum ceiling of 3 ppm, industry samples logged readings from 6 to 570 ppm in Rajasthan, 1.4 to 420 ppm in

Delhi, and 10 to 357 ppm in Maharashtra. Automakers noted modern high-pressure injectors have a tolerance threshold near 1 ppm. Water content was found to reach up to 12,500 ppm in Uttar Pradesh and 13,000 ppm in Andhra Pradesh (against standard operating thresholds). Internal emails warned that organic chlorides could ruin engine components "within 200 km".

Following the leak, the Society of Indian Automobile Manufacturers (SIAM) issued detailed media clarifications on August 4 and August 13. SIAM clarified that the withdrawn document contained preliminary data collected by very few OEMs intended solely for internal discussion, which had not been authenticated or reviewed by the broader membership. SIAM announced plans to conduct a comprehensive, validated scientific study, in collaboration with members and technical experts to guide future policy submissions.

The Ministry of Petroleum and Natural Gas confirmed that State-run fuel networks adhere to stringent testing, treating contamination reports as localised anomalies.

Need for balancing

To bridge the gap between national macro-economic ambitions and ground-level realities, a pragmatic, multi-pronged corrective framework is required.

Fuel retail outlets must be mandated to maintain dual-dispensing infrastructure, reintroducing lower-blend or unblended fuel (E0/E10) as a "protection-grade" option. This restores informed consumer choice under the Consumer Protection Act for owners of legacy two-wheelers and older passenger cars.

Clear, standardised visual labelling must be enforced at every retail fuel dispenser indicating ethanol content. Furthermore, oil marketing companies (OMCs) should publish regular batch-level quality metrics regarding moisture and chloride limits to prevent infrastructure-led contamination.

Regulatory bodies should incentivise the development and certification of affordable, aftermarket retrofit kits (such as ethanol-resistant fuel lines and reinforced seals) for legacy vehicles. Simultaneously, structured service guidelines should be issued to help vehicle owners mitigate the risks of phase separation and corrosion.

Moving beyond controlled laboratory trials, an independent, transparent, and multi-year empirical study tracking real-world pre-2023 fleet performance across diverse geographic and climatic conditions must be commissioned to permanently settle the scientific debate.

Brazil, one of the global leaders in biofuels, also faced similar bumps, but they steered clear of them successfully using shock absorbers. India can learn from their biofuel journey.

The way forward

The E20 mandate requires a consumer-centric pivot. To protect the interests of consumers who own over 240 million legacy vehicles, the government may introduce dual-fuel dispensing, ensuring unblended petrol accessibility as a user choice at petrol outlets. Beyond laboratory trials, independent field audits, clear pump labelling, and subsidised retrofit support, particularly for two-wheelers, are essential. Balancing macroeconomic energy goals with consumer protection measures is critical to regaining public trust.

(Prof. O R S Rao is the Chancellor of the ICFAI University, Sikkim. Views are personal)

THE GIST

India's petrol fleet is divided between newer E20-compatible vehicles and a much larger legacy fleet built for E5 or E10.

Ethanol's solvent and water-absorbing properties can affect older fuel systems, including tanks, hoses, pumps and injectors.

While IIT Kanpur reports limited efficiency losses and no notable engine damage, industry data and consumer reports point to concerns over fuel contamination and component failures.

ROTATING DETONATION ENGINES: THE SCIENCE AND THE PROMISES

(THE HINDU PAGE NO 9)

17. Syllabus

- GS Paper III: Science and Technology developments and applications in everyday life. Achievements of Indians in science and technology, Indigenization of technology.

18. Syllabus Sub-topics

- Space exploration propulsion, hypersonic missile technology, defense R&D, thermodynamics of combustion, deflagration versus continuous detonation.

19. Key Themes

- Propulsion Physics:** Continuous pressure-gain combustion occurring at constant volume, offering much higher thermodynamic efficiency than conventional combustors.
- Strategic Applications:** Thrust enhancement for rockets, deep space thrusters, and hypersonic missiles.

20. Relevant Questions and Focus Areas

- Prelims:* Basic mechanism and advantages of Rotating Detonation Engines over conventional rocket combustors.
- Mains:* Highlight recent technological innovations in aerospace propulsion systems and their implications for India's space and defense sectors.

Rotating detonation engines: the science and the promises

RDEs are currently confined to research and development; there are no models known to be ready for commercial or military use; but going by their physics alone, they offer around 10% to 25% more thermodynamic efficiency than conventional combustors

Vasudevan Mukunth

Recently, India-based defence start-up D-Propulse announced that it had successfully demonstrated a rotating detonation engine at a Defence Research & Development Organisation facility in Hyderabad.

A rotating detonation engine, or RDE, is an engine design that promises to use fuel more efficiently than conventional rocket engines. Launching satellites to space on rockets and carrying explosives to distant targets on missiles are both expensive. If an engine can use fuel more efficiently, it will need correspondingly less fuel to achieve the same task. This saving can be passed to the payload, whether a satellite or a warhead, increasing the profitability of the mission. At least on paper.

In January, GE Aerospace and Lockheed Martin demonstrated an RDE for hypersonic missiles (using air from the atmosphere). In February, U.S.-based SpaceWorks reported hot-fire tests of its RDE for rockets. Its compatriots Astrobotic test-fired its Chakram RDE continuously for 300 seconds and L3Harris announced that it had tested two RDEs, in April and May respectively.

The Swiss start-up Stellar Alpina completed a commercial RDE hot-fire test and raised CHF 3.5 million while Juno Propulsion raised \$1.4 million to develop an RDE for spacecraft thrusters. In July, Venus Aerospace (then partnered with Lockheed Martin) raised \$91 million to scale its tested RDE.

Wait for advances

RDEs are currently confined to research and development. There are no models

known to be ready for commercial or military use.

The actual data from many tests by commercial entities are also not available in the public domain. But going by their physics alone, RDEs offer around 10% to 25% more thermodynamic efficiency than conventional combustors. The exact value depends on real-world conditions and the engine's design.

This is considered to be significant for rocket launches. Thermodynamic efficiency measures how much chemical energy becomes useful work. If an RDE improves thermodynamic efficiency by 20%, for instance, it could theoretically require around 17% less fuel for the same output, assuming other losses are unchanged.

Scientists figured out how an RDE could work by the 1960s. Building one was a different matter. Sustaining a continuous detonation in a compact chamber requires engineers to precisely control the injection of the fuel and the internal pressure.

The chamber also needs to have a specific geometry to ensure the engine works as desired.

Unlike in regular engines, even small instabilities in the fuel-air mixture in an RDE can destabilise the engine.

The engine materials must also withstand more than 2,000° C, 10-100 atmospheres of pressure (and in brief moments much higher), detonation speeds of more than 1,500 m/s, pressures oscillating at several thousand cycles per second, and potentially tens to hundreds of g, depending on the design.

So to invent working RDEs, scientists and engineers had to wait for advances in high-speed computing, diagnostics, fuel injection, materials, and manufacturing.

Supersonic flame

In a regular engine, the combustion chamber holds the fuel-air mixture. When a flame is introduced in the chamber – like from a spark plug – it travels through the mixture at less than the speed of sound. This is called a deflagration.

When the flame travels through the mixture at more than the speed of sound, it imposes a shock wave on the mixture and heats it up, triggering rapid combustion behind it. This is called a detonation. It is also what happens in the combustion chamber of a detonation engine.

As the flame passes through the mixture in a regular engine, the combustion happens at constant pressure. This means the mixture is free to expand as it heats up instead of being confined under pressure.

But when the flame passes through the mixture as a detonation, the combustion happens at constant volume. This is because the detonation compresses the unburned mixture with a shock wave immediately before combustion, and the mixture doesn't have enough time to expand under these 'forces'.

This is also why a detonation engine produces combustion products at a higher pressure, and more of the fuel's chemical energy is converted into pressure rather than being shed as heat. This is essentially the physics of how a detonation engine can have more fuel efficiency than a 'regular' engine with the same fuel.

Pulsed and rotating detonation

A simple type of the detonation engine is called the pulsed detonation engine, or PDE. A PDE has a long tube as the combustion chamber, to allow the

detonation to pass through the whole mixture.

First, the detonation races down the tube, rapidly compressing and burning the fuel-air mixture. This leaves behind very hot, high-pressure combustion products. Those gases expand towards the open end of the tube, where they exit at a high speed.

By Newton's third law, their momentum in one direction produces an equal and opposite momentum on the engine, pushing it forward. Alternatively, if the engine is connected to a piston, the same expanding gases would push on it, generating mechanical energy. The tube is then purged before the next cycle begins.

An RDE makes the detonation a continuous process. Instead of the detonation passing through a long tube, it is made to flow in a circle. In the general RDE design, the combustion chamber has an annular shape, i.e. two concentric cylinders with a narrow ring-shaped gap between them. The fuel and the oxidiser are injected continuously into this gap, called the annulus, even as one or more detonation waves race through.

As the detonation goes round and round, it continuously imposes high pressures and temperatures on the mixture.

And to keep the detonation going, fuel is continuously injected into the annulus just ahead of the detonation wave. The wave consumes the fresh fuel-air mixture and expels the products through the nozzle, along its axis. So as long as the fuel keeps coming at the right time and in the right conditions, the detonation can keep going – even at thousands of times per second.

This is how an RDE can continuously generate thrust (or mechanical energy).

August 15 after Jantar Mantar: The many spaces of freedom and unfreedom

(INDIAN EXPRESS PAGE NO 10)

21. Syllabus

- GS Paper II: Indian Constitution features, significant provisions, basic structure, Fundamental Rights, Functioning of the Judiciary and Executive.
- GS Paper IV: Democratic values, civil liberties, and dissent.

22. Syllabus Sub-topics

- Freedom of speech and expression, right to peaceful assembly, civil society and youth movements, application of anti-terror laws like UAPA, and judicial checks on executive overreach.

23. Key Themes

- Constitutional Morality:** The vital role of dissent, student movements, and institutional freedom in sustaining a vibrant democracy.
- Civil Liberties versus Security:** Balancing public order laws with fundamental civil protections.

24. Relevant Questions and Focus Areas

- Mains:** The space for constitutional dissent and assembly is an essential prerequisite for participatory democracy. Discuss in the light of contemporary civic and judicial trends.

August 15 after Jantar Mantar: The many spaces of freedom — and unfreedom

THIS INDEPENDENCE Day came close on the heels of a students' movement that forced a powerful government to bend and became a liberating moment in its own right. The day after brings an occasion to stand on tip toe, look at what has moved, and what did not change.

Let's begin with freedom's heady freezeframe. Till the Jantar Mantar moment, a narrative was becoming a stranglehold. It went like this — Congress and the regional parties are in unchecked decline and the BJP, armed with a will-to-power not diminished by power, enormous resources and control over central agencies, is seizing and filling spaces vacated by opposition parties. After the resignation of a Union minister in response to the protesters' demand at Jantar Mantar, that story is becoming unfrozen. A third force has flashed on the public mind, putting both the main players on notice. Suddenly, the government, too, looks vulnerable, not just the Opposition. Democracy's wet dog shake at Jantar Mantar is loosening democratic spaces.

Even though he did not mention the students' movement by name, Prime Minister Narendra Modi's I-Day speech acknowledged it and sought to domesticate it. He profusely invoked "yuva shakti", but asked that it be yoked to the national project. He described the young, the protagonists of Jantar Mantar, as the "labharthi" or passive beneficiaries. This is in line with the earlier recasting by his government of the rights-bearing citizen as the recipient of state largesse and as the performer of duties.

The PM identified the challenge before the nation — the threat posed by the "dimagi Naxal (one with a Naxal mindset)" well after the "hathiyari Naxal (armed in-

surgent)" had been defeated. In the PM's repertoire of slurs and labels for opponents, dissenters and critics — "ecosystem", "aandolan jeevi", "urban Naxal", among others — "dimagi Naxal" is perhaps the most unvarnished. It takes no detours, looks for no pretexts, allows no nuances. It reaches inside the mind to criminalise the thought and idea directly.

A few days before the PM's Red Fort speech, a sessions court in Mumbai delivered an uncannily similar-sounding lesson in unfreedom as it refused anticipatory bail to two TISS students accused of raising slogans during a memorial event held in October 2025 (the Bombay High Court has subsequently given one of the two students interim protection from arrest).

The students had gathered to pay tribute to the late Delhi University professor G N Saibaba, who died shortly after his acquittal ended a prolonged incarceration in a UAPA case. "... the act of accused persons appeared to be not limited to paying him (Saibaba) homage. They even allegedly raised slogans..." the court said. The slogans in question sought the release of Umar Khalid and Sharjeel Imam, former student activists facing trial under UAPA, jailed now for about six years, the trial still not in sight. The court also took note of reading material recovered from the students' electronic devices, which, the prosecution said, reflected Maoist ideology. "... though the accused have not committed a criminal offence, their act coupled with the material found... raises doubt about their conduct" — the court seemed to defer, in anticipation, to the PM's coinage of "dimagi Naxal".

In JNU, authorities withdrew permission for an event in which



VANDITA MISHRA

Umar Khalid's book was to be discussed, a PhD dissertation certified by the same university. It cited "non disclosure of full facts" — opaque bureaucracy-speak by a distinguished university once celebrated for the spaces it opened, not shut down, for questioning. And in the Capital's prestigious Sardar Patel Vidyalaya, an I-day address on "Why pluralism matters" by JNU professor emerita Zoya Hasan was cancelled at the last minute, because of "security concerns", a thin camouflage for a cave-in to right-wing threat-making.

The Bar Council of India chairman issued a diktat punishing the entire 2026 batch of the NALSAR University of Law, for criticism by some of them of the Chief Justice of India, and their opposition to him attending their convocation as chief guest. He retracted his repressive directive and apologised to students subsequently. But the lingering image is that of yet another institution cracking down on the freedoms of the young and the outspoken, in this case, also tomorrow's Bar and Bench, in order to cosy up to the current political/judicial regime.

The last snapshot is of Leader of the Opposition Rahul Gandhi participating in a sexist joke on stage recently, undermining his own serious critique of Modi's personalisation of foreign policy. In a time when freedom needs to be negotiated step by difficult step, and spaces for Opposition and civil society prised open carefully, the LoP's backsliding has larger costs and consequences.

The PM's new label for critics, the sessions court's constricted view, the clampdown by the premier university and school, the Bar's arrested slide and the Congress leader's crude joke — all

these came only days after the students' protests at Jantar Mantar scored a euphoric strike for freedom. They underline something that must be kept sight of in the post Jantar Mantar moment.

For all its spectacular arc, the students' success story is up against the mixed and congealed realities of a layered polity. Gen Z's success, therefore, lies more in what it can help illuminate, not just in what it has achieved. Going ahead, it will be measured by whether or not it can become a continuing catalyst.

The fact also is that though it came together at Jantar Mantar, and even as coherence is being artificially thrust upon it, Gen Z is a shifting construct. Even in electoral terms, it is not clear that Gen Z is a bounded category. Do the young vote in critical numbers, are they a vote bank with a defined set of issues and separate concerns, do they vote more for change than voters in other age groups — there are no firm answers.

What is clear is something much more amorphous, and at once powerful and fragile — the students' movement has dented power. It pointed to the suffocation of the electorate because of the limited menu of political choices. It changed the subject to the ruling behemoth's vulnerability.

Gen Z is not an actor or formula or a cliché to be co-opted or given a fixed ending. The day after the 80th Independence Day, let's see it for what it can be. A brush with democracy's many possibilities, an open-ended signifier that can contain many movements and beginnings, a sense of freedom that needs to be enhanced — patiently and painstakingly.

The writer is national opinion editor, The Indian Express

The students' success story is up against the congealed realities of a layered polity. Gen Z's success, therefore, lies more in what it can help illuminate, not just in what it has achieved

THE RUPEE BORROWED BREATHING SPACE

(INDIAN EXPRESS PAGE NO 11)

25. Syllabus

- GS Paper III: Indian Economy, Monetary Policy, External Sector, Currency Valuation, Foreign Exchange Management.

26. Syllabus Sub-topics

- Rupee depreciation, balance of payments, FCNR deposits, RBI swaps and forex intervention, asset-liability mismatch, and current account deficit.

27. Key Themes

- Borrowed Stability versus Earned Reserves:** Using debt-creating inflows with RBI absorbing hedging costs to defend the currency creates rollover risks and fiscal liabilities rather than sustainable external strength.
- Structural Solutions:** Promoting export surpluses, FDI attraction, and reducing energy import dependence instead of relying on carry trades.

28. Relevant Questions and Focus Areas

- Prelims:** FCNR accounts, foreign exchange swap facilities, current account versus capital account.
- Mains:** Critically evaluate the Reserve Bank of India's short-term foreign exchange management strategies against long-term external sector stability.



SAUMITRA BHADURI
AND SHUBHAM ANAND

The rupee's borrowed breathing space

A COUNTRY can defend its currency in two ways. It can earn more dollars or it can borrow them. The two look alike when the money arrives, but they are not the same. India's latest external-sector stabilisation largely falls into the second kind.

Between June 8 and August 13, banks mobilised \$52.3 billion in foreign-currency inflows under the RBI's special swap facility, with FCNR(B) deposits accounting for the bulk of the funds raised. The RBI has closed the FCNR(B) swap window a month earlier than originally scheduled. At a time when the rupee was under pressure, this has been read as a vote of confidence. However, the question is why the money needed such inducement or recorded such a sharp fall as soon as it was withdrawn.

Because confidence had left. The rupee was Asia's worst-performing currency in 2025-26. Foreign portfolio investors had pulled out billions. They turned net buyers in July, bringing in about \$2.1 billion. However, that is still a modest reversal relative to the scale of the preceding exodus. It is too early to read this as investors rediscovering India.

The question is why this works when reassurance does not. Because currency markets move not only on fundamentals but on expectations. Once investors believe depreciation is one-way, good data stops persuading them. The way to break that loop is to make the bet

When the RBI absorbs hedging costs, the exposure moves onto the public balance sheet. When banks raise three-to-five-year money and lend against it, the risk resurfaces as an asset-liability mismatch

against the rupee expensive. That is what the FCNR(B) window does.

FCNR(B) deposits let non-resident Indians hold foreign currency with Indian banks, free of rupee risk, with tax-free interest and full repatriation. Banks raise fresh three-to-five-year deposits, swap the dollars with the RBI, and the central bank absorbs the hedging cost. Once that cost is lifted, banks can offer dollar rates near 6-7.5 per cent, and some add leverage of 9-19 times. For a wealthy depositor borrowing abroad and placing the proceeds here at a protected high yield, this is a carry trade with the currency risk removed by someone else.

Who is that "someone else"? That is the question the enthusiasm skips. The pace of mobilisation measures the incentive more than belief in Indian assets. Flows surged only after the subsidy appeared. Confidence that materialises only after the price is raised is not confidence. It is a purchase.

So, what has India bought? Time, and a quiet transfer of risk.

To be fair, the fundamentals are not in crisis. Reserves are large, services exports and remittances cushion the account, and part of the rupee's weakness reflects the strong dollar. But being out of crisis is not the same as being secure. India slipped into a current-account deficit in May. Against that backdrop, the surge in FCNR(B) deposits is best viewed as a balance-of-payments stabiliser rather than a durable

source of dollars. They are ultimately a form of external borrowing and create future repayment and rollover obligations.

Here is the part that deserves more attention. The scheme does not make the rupee's risk disappear. It relocates it. When the RBI absorbs hedging costs, the exposure moves onto the public balance sheet. When banks raise three-to-five-year money and lend against it, the risk resurfaces as an asset-liability mismatch. A visible currency problem today can become a less visible banking problem tomorrow.

There is a further reason not to relax: These deposits will mature. Every dollar arriving now must be repaid in three to five years.

What should India do with a window it has paid to open? Treat it as a purchased pause, and spend it well.

The RBI deserves credit for acting decisively. But, if India earns too few dollars, no better way of borrowing will solve it. The answer lies in building export-surplus sectors, attracting FDI, cutting energy import dependence, and treating tourism as a foreign-exchange industry.

The FCNR(B) surge proves India can summon diaspora dollars quickly when needed. However, it also shows that rupee stability increasingly rests on liabilities the country has paid to attract and must one day repay.

Bhaduri is professor, Madras School of Economics, and Anand is PhD scholar, MSE

NASA MOON BASE: WHAT INDIA WILL GAIN BY JOINING

(INDIAN EXPRESS PAGE NO 12)

29. Syllabus

- GS Paper III: Awareness in the field of Space, Indigenization of technology.
- GS Paper II: Bilateral, regional, and global groupings and agreements involving India.

30. Syllabus Sub-topics

- Artemis Accords, lunar exploration, ISRO Gaganyaan and Bharatiya Antariksh Station, space diplomacy, and governance.

31. Key Themes

- Strategic Pragmatism:** Navigating US-China space rivalries while securing access to critical technologies, shared infrastructure, and cost rationalization.
- ISRO Capacity Building:** Fast-tracking deep space experience without compromising indigenous long-term programs.

32. Relevant Questions and Focus Areas

- Prelims:* Artemis Accords provisions, Outer Space Treaty principles.
- Mains:* Space exploration is transitioning from a realm of geopolitical competition to multilateral technological cooperation. In this context, analyze the strategic and scientific advantages for India in joining the NASA Moon Base initiative.

• SPACE

NASA's Moon Base: What India will gain by joining

India's relationship with the US of late has been volatile, but this initiative aims to bring them closer. ISRO also needs to ensure that its targets are met



AMITABH SINHA

THE RECENT invitation to join NASA's Moon Base programme can be an important turning point in the history of the Indian Space Research Organisation (ISRO), one that can potentially put it on an entirely different trajectory.

The invitation itself was not surprising, considering that India has already signed the Artemis Accords, and entered into a strategic partnership with the US on human spaceflight missions. Yet, given the extremely volatile relationship between the two countries in the last couple of years, this initiative to forge a closer partnership on space is a refreshing move.

In scale and ambition, the Moon Base programme can be compared only to the Apollo missions. In terms of its impact on humanity and the future of the planet, it could turn out to be far more consequential.

Settling on the Moon

The programme is about creating a permanent research station on the Moon, one that can be inhabited by astronauts, and robots, for prolonged periods of time. The base, to be built in stages over several years, is meant to facilitate research, and allow exploration and exploitation of lunar resources. It will possibly be the most challenging engineering exercise ever undertaken, requiring several trips to the Moon by crewed and robotic missions. It could also be the costliest scientific project ever.

NASA is in no position, and does not want, to execute this entirely on its own. Its budget has been slashed significantly under the Donald Trump administration, while most of its hardware production is now happening in the private sector. So, it is seeking partners — both in the international community as well as in the private industry, to collaborate with.

The 70 countries that have signed on to the Artemis Accords have, in a way, already shown a willingness to join such a collaboration. This includes some major space-faring countries like Japan, India, South Korea, and Israel, besides several European countries.

In just six years, the Artemis Accords



MOON BASE: A THREE-PHASE PROGRAMME

The Moon Base is humanity's first lunar outpost, a place where astronauts will live, work, and explore near the Moon's South Pole.

PHASE ONE (NOW-2029): Focus will be on gaining reliable access to the lunar surface and building a deeper understanding of the environment. Robotic missions will explore the lunar South Pole, demonstrate new technologies, and gather the knowledge needed to guide future development.

PHASE TWO (2029-2032): NASA will begin deploying the first infrastructure needed to support long-term operations on the Moon. Early power systems, cargo transportation, logistics, and communications capabilities will expand humanity's footprint and enable increasingly complex missions.

PHASE THREE (2032 AND BEYOND): NASA will begin assembling a permanent lunar outpost where astronauts can live and work for extended periods. Habitats, power systems, communications, transportation, and other critical capabilities will support an enduring human presence. SOURCE: NASA

has come up as a unique grouping of countries interested in exploration of outer space. Although the Accords are a set of principles and good practices that countries agree to follow in their space activities, they are increasingly being seen as a US-led camp seeking to write its own rules for space exploration and use of extraterrestrial resources, subtly bypassing international multilateral arrangements.

That two major space powers, Russia and China, are not part of the group, gives credence to this argument.

India has traditionally been extremely reluctant to join any such group. But it was one of the early signatories to the Accords, joining as the 27th nation in 2023. There is no official confirmation as of now, but it is very likely that ISRO would join the Moon Base programme.

Not adversarial

It makes eminent sense for it to do so.

Artemis Accords

The Accords, introduced by NASA and the US Department of State in 2020, are a set of principles that countries agree to follow in space activities.

The 70 signatories include Japan, India, Israel, and South Korea.

ISRO has its own plans for human spaceflight missions, setting up a space station, and even landing humans on the Moon. Joining Moon Base offers the opportunity for it to gain valuable experience in planning and executing complex missions like these, and leapfrog in technology development. ISRO has demonstrated its capabilities in executing such missions on its own as well, but that would require time and huge amounts of money.

Space exploration is reaching a stage where a 10-year gap in technology development can leave a nation fairly well behind. Besides, it would not make economic sense to reinvent the wheel. ISRO's current plans — an independent human spaceflight programme, a Moon landing programme, and a full-fledged space station — are extremely ambitious. It is, no doubt, extremely important to have these capabilities. But it is difficult to imagine that India would have the scientific and econ-

omic rationale for running these sustainably on its own.

The Bharat Antariksh Station is a case in point. While ISRO must have the technology and capability to build such space infrastructure, it is extremely unlikely that India would have, in about a decade's time, a scientific ecosystem hungry enough to need an entire space station for its own use all year round. It will have to be a shared infrastructure like the International Space Station.

Similarly, maintaining a separate full-fledged programme for lunar exploration might not be economically feasible. The costs are prohibitively high even for the leading economy and richest country of the world. For India, which is chasing multiple parallel goals on the path to prosperity, it might be difficult to allocate resources on the scale required.

The concerns about India joining what appears like a US-led bloc might be overstated. The Artemis Accords are not like a geopolitical or military camp. Space, for now, is not adversarial. If the US lands on the Moon ahead of others, it does not get to control the area or the resources. It does not harm the interests of China or Russia, which are attempting to do the same thing through their own partnership.

The Moon is large enough, and its resources abundant enough, to support the efforts of all the parties, at least in the foreseeable future. So, the current trend of globalisation, or go-it-alone approach, in matters of critical technologies like semiconductors, clean energy, and artificial intelligence does not apply in the case of space. There is no domination of supply chains or control over resources.

For India, signing the Artemis Accords, or joining the Moon Base effort, does not prevent it from continuing its long-standing space cooperation with Russia, for example. ISRO, however, needs to ensure that while collaborating with the US, it doesn't lose sight of its own targets and objectives or doesn't get locked into the US technology ecosystem to the extent of overdependence. The Accords do emphasise on development of interoperable systems, but it is not a major restriction for ISRO, which is just beginning to develop these systems.

So, the space cooperation with the US is a major opportunity for ISRO to fast-track its project timelines, and get to the frontiers of technology development. It could result in a lot of spin-off benefits that can bring cascading dividends across sectors.

THE CENTRE-STATES TUSSLE OVER THE MINES AND MINERALS BILL

(INDIAN EXPRESS PAGE NO 12)

33. Syllabus

- a. GS Paper II: Issues and challenges pertaining to the federal structure, devolution of powers and finances, Seventh Schedule Union versus State List competencies, Judiciary.
- b. GS Paper III: Mineral resources distribution and management, Fiscal policy.

34. Syllabus Sub-topics

- a. Mines and Minerals Amendment Bill 2026, Supreme Court 2024 ruling, state taxation rights on mineral-bearing land, District Mineral Foundation, and fiscal federalism.

35. Key Themes

- a. **Fiscal Federalism Friction:** States' reliance on non-tax mining revenues versus the Union's objective of containing input costs, mineral inflation, and ease of doing business.
- b. **Judicial Overruling:** The 2024 Supreme Court verdict upholding states' power to tax mineral rights and the subsequent central legislative push to cap or extinguish state levies.

36. Relevant Questions and Focus Areas

- a. **Mains:** The taxation of mineral resources has emerged as a major flashpoint in Indian fiscal federalism. Analyze the constitutional and economic dimensions of the ongoing Centre-State conflict over the MMDR amendments.

• POLICY

The Centre-states tussle over the Mines and Minerals Bill

Pratyush Deep
New Delhi, August 17

THE PASSAGE of the Mines and Minerals (Development and Regulation) Amendment Bill, 2026, in Parliament last week has reignited a long-running tussle between the Centre and states over taxation of mineral resources and the revenues they generate.

The amendments seek to restrict states from imposing specified levies on mineral rights and mineral-bearing land, which they had been exploring following the Supreme Court's landmark 2024 ruling upholding their power to tax mineral rights.

The Bill has drawn sharp opposition from states. Jharkhand Chief Minister Hemant Soren has threatened protests against the amendments, saying they could significantly dent the state's prospective revenue, while Kerala Chief Minister V D Satheesan has raised concerns over their implications for India's federal structure.

The Bill will also extinguish unpaid or unrecovered dues arising from such levies imposed before it comes into force, with some estimates putting the value of such

outstanding dues across the mining sector at around Rs 2 lakh crore. The Centre's stand is that unchecked state-level levies could raise the cost of key minerals, feeding into inflation and infrastructure costs.

Fiscal certainty for industry

According to Mines Ministry officials, the amendments seek to address what the Centre considers excessive cess and other levies imposed by some states following the Supreme Court's 2024 judgment.

The July 25, 2024 ruling overruled the 1989 ruling in *India Cement Ltd v. State of Tamil Nadu*, which had held that royalty was a tax and that states lacked the legislative competence to tax mineral rights, as the subject fell under the Union List.

B K Bhatia, mining industry expert and former Director General of the Federation of Indian Mineral Industries, told *The Indian Express* that the amendments would help prevent states from imposing multiple and excessive levies on mining companies.

"Apart from royalty, District Mineral Foundation and National Mineral Exploration and Development Trust contribu-

Implications for federalism

- The Bill has drawn sharp opposition from states, who have raised concerns over loss of prospective revenue.
- The Centre's stand is that unchecked state-level levies could raise the cost of key minerals, feeding into inflation.

tions, mining companies currently pay various other cesses, including environmental and pollution cesses. But the mineral-bearing land tax was the biggest additional burden on the industry," Bhatia said.

According to him, while the amendments will help the industry by providing greater certainty over the fiscal burden, they are unlikely to result in any material revenue loss for states, as most of these levies have been legally contested for decades, resulting in large amounts of pending dues.

A senior official at the Mines Ministry said there are around 14 levies in the mineral sector, which will stay. "All we are saying is all these levies together should not go beyond a certain percentage," the official said, adding that this percentage would be decided after consultation with all the states.

States' revenue loss

Last week, Jharkhand CM Soren, in a letter to Prime Minister Narendra Modi, said mining revenue accounted for approximately 84.9% of the state's own non-tax revenue in 2024-25. Soren claimed the Mineral Bearing Land Cess, which the state

has been imposing on mining companies, was expected to generate approximately Rs 11,000 crore annually.

"These figures demonstrate that mineral-related revenues are not marginal receipts but a critical component of the state's fiscal capacity," the letter read.

Prabhat Ranjan, Senior Director at Nexdigm, a global consulting and advisory firm, said the amendments would, in effect, serve as a cost-containment and investment-certainty measure for mining companies, but concerns over potential revenue loss for states cannot be brushed aside. "The Centre should use the new framework to establish reasonable and transparent guardrails, while ensuring adequate consultation with mineral-producing states," he said.

The dispute

The Centre's stand is that unchecked state-level levies could raise the cost of key minerals, feeding into inflation and infrastructure costs.

States have raised concerns over loss of revenue as well as over the Bill's implications for India's federal structure.