GS Paper I – History & Geography

Steps into the past: 1,500-year-old reservoir unearthed on Elephanta Island near Mumbai

T.S. Subramanian

As we trudged through the scrub jungle on a hill on the Elephanta Island off the Mumbai coast on March 17, Abhijit Ambekar declared with a flourish, "We will show you the wonder-discovery of our excavation." Professor Abhijit Dandekar chipped in, "It is a show-stopper."

As we reached the trench, where several men and women were excavating the soil deep below, it was clear that it was a spectacular discovery. There it was: a series of steps leading to a reservoir below. In other words, it was a stepped reservoir or a reservoir built with a wide staircase of perfectly aligned stone blocks.

Dr. Ambekar, director of the current excavation and Superintending Archaeologist, Mumbai Circle of the Archaeological Survey of India (ASI), estimated the stepped reservoir to be about 1,500 years old.

The stepped reservoir excavated by the Mumbai Circle of the ASI on the Elephanta Island, off the Mumbai coast. ASI

"It is a massive structure – about 14.7 metres long, and 6.7 metres and 10.8 metres wide, forming a T-shape. The excavation has reached a depth of five metres so far. We have exposed 20 steps. The steps are built with stone-blocks which are not from the island. They were ferried from the mainland," he said.

While rock-cut cisterns have been found earlier on the Elephanta Island, the discovery of this stepped reservoir was important because it was a carefully designed architecture for storing water, Dr. Ambekar said. "Although the island receives a large amount of rainfall from the monsoon, very little seeps into the soil because of the island's rocky nature, and the water runs off into the sea," he said. Hence, this stepped reservoir, which was "a remarkable engineering work."

The ASI's Mumbai Circle began the excavation here in November 2025. It has excavated 19 trenches, each measuring 10 metres x 10 metres.

The excavation has so far yielded a beautifully built brick structure, which could be a dyeing vat for colouring textiles, a big storage pot, terracotta figurines, glass and stone bangles, beads made of carnelian and quartz and stone anchors. A total of about 3,000 amphorae sherds of Mediterranean origin and torpedo jar sherds from West Asia, including Mesopotamia, have been unearthed. Amphorae and torpedo jars were used for storing wine, oil and fish sauce. Their potsherds showed the island's long-distance maritime contacts.

Importantly, 60 copper, lead and silver coins have so far been found in the excavations. Several copper coins have been identified as belonging to ruler Krishnaraja of the Kalachuri dynasty of the sixth century CE, said Dr. Abhijit Dandekar, Department of Ancient Indian History, Culture and Archaeology of Deccan College, Pune.

The identification was made on the basis of the motif of a seated bull on the obverse and a temple symbol with the legend of Sri Krishnaraja on the reverse, he said.

GS Paper II – International Relations

Homebound now

Some 25 Indian-flagged vessels and foreign-flagged ships bound for India are stranded in the Persian Gulf region due to the West Asia conflict

INDIAN-FLAGGED VESSELS

Persian Gulf

Container ships: CMA CGM Diamond, SSL Kaveri and CMA CGM Manaus

Bulk carriers: Jag Arnav and APJ Priti 2

Oil tankers: Jag Pavitra, MT Desh Garima, MT Desh Suraksha, MT Desh Vaibhav, MT Desh Vibhor, Sanmar Herald, and Sanmar Suparna

Dredger: Volvox Olympia

LPG tanker: BW Loyalty

Gulf of Oman

Container: SSL Godavari

Gulf of Aden

Container: SM Mahi

Chemical tanker: Jal Garuda

India-bound foreign-flagged ships

LPG: Symi, DV Sarv Shakti (Marshall Islands), Gaschem Erica (Portugal)

Oil tankers: Plata Carrier (Liberia), Minerva Doxa (Greece), Nissos Keros (Marshall Islands), Monte Urbasa (Portugal)

LNG: Disha (Malta)

ALREADY BACK IN INDIA

LPG: Shivalik, Nanda Devi, Jag Vasant, Pine Gas, Green Asha, Green Sanvi, BW Elm & Tyr

Bulker: Vishva Nidhi

Container: CMA CGM Vittoria

GS Paper II – Polity

Transgender law: HC seeks Centre's reply on petitions

The Hindu Bureau
NEW DELHI

The Delhi High Court on Wednesday sought the Centre's stand on two petitions challenging provisions of the Transgender Persons (Protection of Rights) Amendment Act, 2026, claiming that the amendment replaces self-identified gender identity recognised by the Supreme Court, with State-determined identity through medical and administrative processes.

A Bench comprising Chief Justice D. K. Upadhyaya and Justice Tejas Karia issued notice on petitions by Chandresh Jain and Lakshay Jain and asked the Centre to file its reply within six weeks. The Transgender Persons (Protection of Rights) Amendment Bill, 2026, was passed by Parliament on March 25 and received assent from President Droupadi Murmu on March 30.

Petitioner Mr. Chandresh argued that while the original 2019 Act was enacted to implement the Supreme Court's recognition of transgender rights, the 2026 amendment fundamentally alters this framework by introducing medical and administrative verification of gender identity. The petition contends that, "this shift violates constitutional guarantees and amounts to a legislative rollback of a fundamental right recognised by the Supreme Court".

It also states that in 2014, the Supreme Court recognised transgender persons as a "third gender" and affirmed that gender identity is based on self-perception rather than biological or medical criteria. Mr. Chandresh said the amendment has serious practical consequences as legal recognition of gender identity directly affects access to identity documents, welfare entitlements, and protection under criminal law, thereby creating a real and immediate risk of exclusion and denial of justice.

Mr. Lakshay's petition states the amendment alters the existing statutory framework by replacing self-perceived gender identity with a regime of medical and administrative verification, including scrutiny by a District Magistrate. The case will be next heard on July 22.

GS Paper II – International Relations

At long last

India must now revamp its nuclear regulatory regime

The Prototype Fast Breeder Reactor (PFBR) in Kalpakkam, Tamil Nadu, achieving first criticality is a genuine cause for satisfaction, albeit a measured one. A Parliamentary Standing Committee reported this year that the project's final cost is ₹8,181 crore, more than twice the sanctioned amount. Criticality itself is at least 16 years behind schedule; the fast reactor fuel cycle facility is expected to be commissioned by 2029, over a decade late. Poor planning and flawed procurement, abetted by political insulation, are the causes of the delay. The PFBR is the first commercial-scale component of the second stage of India's nuclear power programme. Its purpose is to use spent fuel, after reprocessing, from the first stage, and depleted uranium to produce more plutonium. In the final stage, reactors will use plutonium and thorium as fuel. The programme's design is based on India's abundant thorium deposits, but this sword cuts both ways. The nuclear establishment must also be scrupulous about the PFBR's performance as it is prepared for commercial operation, and admit mistakes or under-performance plainly. The goal is not to use thorium at any cost but to achieve energy security and self-sufficiency. If the economics of solar and wind power render the current nuclear power paradigm a poor allocation of scarce public capital, that finding should honestly determine policy.

Nuclear power contributes around 3% of India's electricity from 8.78 GW of installed capacity. The country has committed to becoming a net-zero economy by 2070 amid an energy demand growth that will be among the largest of any major economy over the next two decades. Nuclear power facilities are expected to consume 6% of the land area required for equivalent solar power generation per unit of electricity produced. Considering that India's biodiversity commitments depend on not converting green cover, nuclear power offers a non-trivial path forward. Breeder reactors are more fuel-efficient, and will also extend the fuel cycle and reduce dependence on uranium imports. The challenge is to realise these merits without squandering time and public money. This means fixing the problems that the PFBR throws up during commissioning, and proceeding with the planned FBR1 and FBR2 units at Kalpakkam based on lessons learned, without the opacity that has prevailed so far. The PFBR also comes online alongside the SHANTI Act, private nuclear power operations, the advent of small modular reactors, and a new liability regime. Now is an opportune time for India to revamp its regulatory regime. So far, the AERB and the DAE have reported to the Atomic Energy Commission, which is thus both the promoter and the regulator of nuclear energy. The government must resolve this administrative short-circuit before any new complexities arise.

GS Paper II – Polity

Cabinet clears draft amendment Bill over women's reservation

The Hindu Bureau
NEW DELHI

The Union Cabinet on Wednesday approved a draft amendment Bill to implement the Women's Reservation Act by the 2029 Lok Sabha elections.

The decision was taken at a Cabinet meeting chaired by Prime Minister Narendra Modi, sources said. The amendment seeks to revise the implementation framework of the Nari Shakti Vandan Adhiniyam, formally known as the Constitution (106th Amendment) Act, passed in 2023. Under the proposal, the strength of the Lok Sabha is set to rise from 543 to 816, following a fresh delimitation exercise.

Of the expanded House, 273 seats, around one-third will be reserved for women. The quota will be applied vertically, providing reservation for women within the Scheduled Caste and Scheduled Tribe categories as well.

In a significant departure from the existing law, the government plans to carry out delimitation based on the 2011 Census, rather than waiting for Census data from 2027.

The Bill will be taken up for debate at the Budget Session from April 16-18.

India to engage new govt. of Bangladesh constructively: MEA

Kallol Bhattacherjee
Suhasini Haidar
NEW DELHI

India will engage constructively with the 'new government' of Bangladesh and the two sides will 'deepen' bilateral ties, said the Ministry of External Affairs (MEA) on Wednesday after External Affairs Minister S. Jaishankar hosted Bangladesh Foreign Minister Khalilur Rahman and Prime Minister Tarique Rahman's Foreign Affairs Adviser Humayun Kobir in New Delhi.

Following the talks, the Ministry of Foreign Affairs of Bangladesh said Mr. Khalilur Rahman conveyed Dhaka's desire to conduct foreign policy in accordance with the principle of "Bangladesh First" and called for the extradition of former Prime Minister Sheikh Hasina. However, sourcessaid broader bilateral relations would not be "held hostage" by Ms. Hasina's presence here.

An MEA statement said the two sides agreed on "follow-on official meetings" that were expected to take place at an early date.

Modi urges MPs to back amendment to women's quota Bill

The Hindu Bureau
NEW DELHI

Prime Minister Narendra Modi on Wednesday appealed to MPs across party lines to support a Bill to amend the Women's Reservation Act, 2023. The Bill will be tabled when the Budget Session reconvenes on April 16. The Act seeks to provide 33% reservation for women in the Lok Sabha and State Assemblies.

Stating that the 2029 Lok Sabha election and Assembly polls in the future must be held with the provisions for women's reservation, Mr. Modi, in an oped article, said the Bill was an important step for women of India.

"On April 16, Parliament will be convened to discuss and pass an important Bill that advances women's reservation. To describe this merely as a legislative exercise would be an understatement. It is a reflection of the aspirations of crores of women across India. It is an affirmation of a principle that has long guided our civilisational ethos, that society progresses when women progress," he said. "This moment calls for collective action. It is not about any one government, party or individual. It is about the nation as a whole recognising the importance of this step and coming together to realise it," he said, calling for "the broadest possible consensus" for the passage of the Bill.

GS Paper II – Polity

Presiding officers bypassed Parliament in rejecting CEC removal notice: INDIA

The Hindu Bureau
NEW DELHI

Criticising the decision of Lok Sabha Speaker Om Birla and Rajya Sabha Chairman C.P. Radhakrishnan to reject the notice submitted by 193 Opposition MPs seeking the removal of Chief Election Commissioner Gyanesh Kumar, INDIA bloc leaders on Wednesday said "collective parliamentary wisdom" had been bypassed.

They alleged that the presiding officers held a "mini-trial" of their own without revealing whom they had consulted before arriving at the decision.

Congress MP Abhishek Manu Singhvi and other Opposition leaders addressing a press conference in New Delhi on Wednesday. ANI

Rajya Sabha MP and senior Congress leader Abhishek Manu Singhvi said the presiding officers were only required to form a "*prima facie*" view. "This means that they need to establish whether the notice is in order," he said.

Mr. Singhvi was joined by senior Trinamool Congress leaders Derek O'Brien and Sagarika Ghosh, senior RJD leader Manoj K. Jha, and AAP leader Sandeep Pathak, among others.

He explained that once such a notice is submitted, it has to be referred to an inquiry committee to probe the charges levelled. The committee then presents a report to Parliament, which takes the final call.

Mr. Singhvi said that if the Opposition's notice is not allowed to go beyond the presiding officer's table, there can never be an impeachment, and no one can be held accountable. "Instead of taking a *prima facie* view, the Chair has held a mini-trial. This is completely wrong," he added.

GS Paper II – International Relations

India withdraws bid to host climate summit in 2028

The government cites a review of its 2028 commitments, says report; the country had last hosted the summit in 2002, when it was a low-key affair

Jacob Koshy
NEW DELHI

The COP30 was held in Brazil and the COP31 is to be jointly hosted by Turkiye and Australia this year. AP

India has withdrawn its bid to host the 33rd edition of the Conference of Parties (COP 33) in 2028 – the annual United Nations climate talks, according to a report by Climate Home News (CHN) on Wednesday.

Prime Minister Narendra Modi had announced India's interest in hosting the COP33 at the COP28 in Dubai in 2023.

The Ministry for Environment, Forests and Climate Change did not comment on the report, but *The Hindu* has independently confirmed its veracity.

According to the CHN report, an April 2 letter by Rajat Agrawal, Joint Secretary in the Environment Ministry, to the United Nations Framework Convention on Climate Change (UNFCCC) stated that India was withdrawing its candidacy following a "review of its commitments for 2028".

In July 2025, the Environment Ministry set up a dedicated cell for the "professional and logistical requirements" for organising the COP33. This followed a joint declaration at the 17th BRICS summit on July 7, where the member countries "welcomed" India's candidacy.

The hosting of the COP rotates among the UN's five regional groups, with India belonging to the Asia Pacific group.

The COP30 was held in Brazil. The edition this year is to be jointly hosted by Turkiye and Australia and the 2027 summit (COP32) is scheduled to be held in Ethiopia. With India withdrawing, South Korea is the only country that has so far expressed interest in hosting the COP33. India has hosted the summit only once – in 2002 (COP8) – when it was a relatively low-key affair.

On March 25, India announced its updated Nationally Determined Contributions (NDCs), committing by 2035 to source 60% of its installed electricity capacity from non-fossil sources, reduce emissions intensity of GDP by 47%, and increase its carbon sink by 3.5-4 billion tonnes of CO_2 equivalent.

GS Paper III – Economics

The other side of sport — mastering manufacturing

Sanjeet Singh
Senior Adviser at NITI Aayog

Lakshita Mehrotra
Senior Team Lead at the Foundation for Economic Development (FED)

To say that sports is an emotion in India is an understatement. Although cricket takes up most of the mindshare, the sports ecosystem in India is evolving rapidly with athletes such as Neeraj Chopra and Lakshya Sen bringing attention to the diversity in sports in the right manner. But besides viewership and athletes, the sports ecosystem comprises several key players that keep the growth engine running. One such important, but rather overlooked, component is that of sports goods manufacturing.

Sports equipment manufacturing, a highly labour-intensive sector, plays a significant role in the economics of sport. NITI Aayog and the Foundation for Economic Development (FED) have recently released a report on 'Realising the export potential of the sports equipment manufacturing market in India' that details the state of affairs. Culturally, India interacts heavily with sports, but the country contributes only about 0.5% to the nearly $50 billion global trade in sports equipment. This under-representation is not due to the absence of legacy or capability. Rather, it points to structural issues in the industry that have significantly hampered its ability to reach its full potential.

Diverse manufacturing landscape

India's manufacturing footprint in sports equipment is geographically concentrated and operationally fragmented. Production still primarily hinges on old, well-established centres such as Jalandhar (Punjab) and Meerut (Uttar Pradesh), which together hold more than an 80% share of domestic output. The sports equipment industry in India is small in terms of production volume and is largely dominated by micro, small, and medium enterprises (MSMEs) engaged in labour-intensive segments such as stitched balls, cricket gear, protective accessories and entry-level fitness equipment. If, on the one hand, this artisanal skill level has sustained the industry for a long time, on the other hand, it has restricted scaling, the adoption of new technologies, and the emergence of internationally recognised brands.

One key characteristic of the sector is the high level of diversity in sports equipment manufacturing compared to other sectors. Raw materials, machinery and the techniques of making footballs, for example, are entirely different from the ones required for making hockey sticks or golf shafts. This vast range of differences makes effective policy design exceedingly difficult and often leads to generic interventions that overlook category-specific realities.

To understand the right ways to compete at a global level, we first need to find out what makes local manufacturers inherently less cost-effective.

Critical structural problems are preventing India's sports equipment industry from reaching its full potential

As per the report, industry data show that Indian firms encounter on average a 15% cost disadvantage when compared to their peers in China and Pakistan. For example, a football produced in India might cost ₹100, while competing countries might be able to produce it for only ₹85-₹87. This gap, which is a result of factors such as higher input prices, inefficient logistical planning, and limited economies of scale, greatly reduces export competitiveness and impacts the pricing power that companies have.

The core issues

Making high-performance sports equipment requires feature-specific items such as specialised polymers, performance fabrics, carbon composites and precision tooling. The issue is that not all of these are produced domestically, and those that are made locally are manufactured on an extremely limited scale. Moreover, import duties on such components, as well as on advanced manufacturing machinery, drive up production costs. For MSMEs which function with extremely low margins, these additional levies essentially hinder the possibility of investing not only in technology upgrades but also in product diversification.

Issues related to ease of doing business aggravate the problem. Manufacturing is mainly concentrated in the northern parts of India, which leads to extremely high logistics costs when exporting goods through distant ports. On top of that, rising land prices, fragmented industrial infrastructure, and industrial delays on account of compliance are some of the other factors that keep on eroding operational efficiency. As these challenges are structural rather than cyclical, smaller firms with weak financial strength are most affected.

Another problem is certification and standards compliance. Globally traded sports equipment must meet the very stringent performance standards laid down by international federations. India lacks certified production facilities that meet international standards for most sports categories; therefore, manufacturers must have their products validated by European labs.

Testing expenses can range from ₹5 lakh to ₹50 lakh per stock keeping unit (SKU) which is an enormous amount for an MSME. Apart from the direct monetary costs, a prolonged certification process also delays market launches, which in turn discourages experimentation and, consequently, impedes innovation.

There are many reasons why the sports sector in India is not expanding rapidly, one of which is demand side problems. India has, by and large, failed to create sports brands with worldwide appeal, similar to those for cricket equipment, that could command premium pricing. The main reasons for the lack of organic global demand for Indian sports equipment are low marketing investments, few international brand partnerships, and the absence of long-term, athlete-brand relationship-driven demand. Hence, most domestic firms today focus on contract manufacturing at the lowest-value end of the spectrum, whereas they should be aiming for original brand ownership.

Reform, support, upgrade

Addressing these issues is complex and requires a balanced approach. The report outlines a clear pathway with key recommendations. First, rationalise import duties on specialised raw materials and advanced machinery to regain price competitiveness. Second, provide targeted fiscal support, such as export-linked incentives, offsetting certification costs, and aiding participation in international trade platforms. Third, India should leverage its advantage in industries such as technical textiles, footwear production, plastics processing, and light engineering alongside sports goods clusters to enable rapid technological upgrades, increase production scale, and shift toward higher-value, performance-oriented equipment.

In the medium term, India must also establish internationally recognised testing and certification centres, which reduce compliance costs, facilitate quicker time-to-market for new innovations, and showcase India's intent to be a standards-setting player rather than just a supplier.

Finally, by investing in local raw materials, especially advanced composites and performance fabrics, India can gradually reduce imports and improve supply availability. On the demand side, relying solely on contract manufacturing is insufficient; building strong domestic brands is essential. A unified national campaign involving top athletes, sports federations, industry bodies, and government departments can help showcase Indian sports equipment globally.

Utilising strategic procurement methods linked with India's forthcoming international sporting events can generate a short-term demand uplift while also promoting domestic production to global buyers.

For long, India has supplied sports goods mainly through indirect global value chains. The next decade offers a chance to change this. With growing domestic sports activity, a reshaping of global supply chains, and opportunities from hosting major international events, the ingredients for change exist. What is lacking is a strategic, well-executed plan to shift from scattered traditional production to large-scale, advanced manufacturing. If India seizes this opportunity, it could become a key player in the global sports economy and set new trends in how sports are played worldwide.

GS Paper III – Economics

The thermal cost of India's textile surge

Sreoshi Banerjee

Postdoctoral researcher at the Potsdam Institute for Climate Impact Research (PIK)

Raktimava Bose

Consultant at the National Council of Applied Economic Research (NCAER)

India is currently winning the global trade shuffle. As political instability rocks traditional hubs such as Bangladesh, international buyers are pivoting toward Indian textile clusters. But as factories in Tiruppur and Bengaluru take on these surge orders, they are walking into a thermodynamic crisis they haven't budgeted for.

The crisis is personal before it is industrial. A textile worker in Tamil Nadu loses 50% of her work capacity on a 40°C afternoon; and as she does not have any sick leaves or cooling breaks, she also loses 50% of her day's wages. She absorbs the cost of a warming planet so that global supply chains remain 'efficient.' However, the biology of labour is hitting a wall, and India's textile industry is quietly cracking under the weight.

The crisis of productivity

Between 2001 and 2020, India lost an estimated 259 billion labour hours annually due to heat stress, a productivity haemorrhage exceeding $600 billion each year. In 2024 alone, that loss spiked to as high as 247 billion hours.

The productivity crisis is no longer a theoretical risk; it is a mechanical and biological reality crippling India's industrial heartlands. In the manufacturing hubs of Palghar, Maharashtra, factory owners report production capacity dropping by up to 50% as extreme heat triggers hazardous conditions that jeopardise both man and machine. Intense temperatures often restrict operations to just four hours daily, as heat becomes unbearable for the workforce. It also increases the likelihood of workplace injuries and serious health conditions, including heatstroke and dehydration. Industrial equipment, designed for more temperate baselines, frequently overheat, leading to sudden operational shutdowns and technical failures that derail tight production schedules. This physical collapse of the shop floor is mirrored in Karnataka's textile factories, where, indoor temperatures routinely exceed 35-40°C, far above the permitted threshold of 30°C. At these extremes, the "human engine" throttles down as a matter of survival. International studies confirm that at 33-34°C, a worker's capacity is effectively halved.

The productivity crisis is no longer a theoretical risk; it is a mechanical and biological reality crippling India's industrial heartlands

As per research published in the *Journal of Political Economy* in 2021, annual output falls by 2% per degree Celsius. On individual hot days, the decline reaches 4%. For India's textile industry, which employs 45 million people and controls 39% of global cotton cultivation, this crisis has led to operational collapse.

The supply chain trap

Global brands impose strict delivery deadlines and heavy financial penalties for delays. Yet, workers cannot be pushed beyond physiological limits. Thus, factory managers face an impossible choice: ignore worker collapse to meet a shipment, or face financial ruin. As orders shift to India due to regional and political instability, hubs such as Tiruppur are being crushed by a "thermodynamic bottleneck" where surge orders collide with record-breaking heat. This creates a regressive tax on the poor, disguised as a weather problem. While global brands insulate themselves by diversifying sourcing – shifting orders to Vietnam or Mexico – local factory owners lack the bargaining power to renegotiate terms and the burden is pushed downward. Ultimately, the cost is absorbed by the millions of informal workers who have no safety net; when a factory floor becomes a furnace, they don't just lose productivity, they lose their daily wages. History has shown that when disruption strikes, workers pay the price; for example, during COVID-19, brands cancelled $2.8 billion worth of orders from Bangladesh in March 2020 alone, affecting approximately 1.2 million workers.

By 2030, India is projected to lose 5.8% of its daily working hours to extreme heat, the equivalent of 34 million full-time jobs. The supply chain will not break gradually; it will break when orders simply cannot be met because the human element has reached its thermal limit.

The way forward

India has a choice. It can either continue to externalise the cost of a warming planet onto workers, or the country can systematically transit to a climate-smart supply chain. This requires action on five fronts: first, policymakers must recognise heat stress as a supply chain risk and integrate climate-heat projections into industrial policy and trade agreements. Second, industrial clusters must adopt mandatory heat-action plans with enforceable temperature thresholds, cooling breaks, and worker health assessments. Third, financing mechanisms must be reformed. Banks must incorporate climate risk into loan assessments, and governments must offer concessional credit lines supporting investments in cooling systems, water management, and heat-resilient technologies. Fourth, labour protection codes must be strengthened to address heat stress explicitly. Workers must have guaranteed access to clean drinking water, and shaded rest areas. Fifth, innovation must be driven through targeted R&D grants for wearable cooling technologies, heat-tolerant cotton varieties, and energy-efficient manufacturing processes. And finally, international buyers must bear part of the adaptation cost, through fairer pricing and longer lead times. For decades, the global fashion industry has operated on a convenient lie: that the 'cost of production' is a static number on a spreadsheet. This number was artificially deflated by a climate we took for granted. The physics of thermoregulation will not bend to profit margins. If heat stress remains invisible in boardrooms, India's workers will pay in lost wages and shortened lives.

Views expressed are personal.

GS Paper III – Science & Technology

Why India wants fast breeder reactors

How does a fast breeder reactor work? How is an FBR different from a PHWR? What is India's three-stage nuclear programme? Why are FBRs difficult to build and operate? How has India pursued fast breeder reactors? What happens after a reactor achieves criticality? What next for the PFBR?

EXPLAINER

Vasudevan Mukunth

The story so far:

In an important milestone, the prototype fast breeder reactor (PFBR) at Kalpakkam achieved criticality on April 6. The term 'criticality' is familiar to India: over the decades, it has been associated with the slow and tedious successes of India's nuclear power programme. At the same time, in keeping with many terms in the nuclear vocabulary, 'criticality' is also often mistaken as an end goal. In reality, it is actually the first step.

What is criticality?

A nuclear reactor becomes critical when its chain reaction is able to sustain itself. That is, when an atom's nucleus undergoes nuclear fission, it releases neutrons that trigger at least one more fission reaction in the surrounding nuclei. Reactor engineers ensure this happens by controlling the composition of the fuel (the material whose nuclei undergo fission), how well the neutrons are able to 'access' more nuclei, and the temperature of the reactor. Once a reactor is critical, it also means it is in a kind of stable state. However, it does not mean that it is operating in a commercially viable way. That comes much later. After criticality, the operators keep the reactor running as it produces a low amount of power, for months if necessary, while they check if its operating parameters are within design limits. If an operator is sure that the parameters are, they can go to the next stage.

How do FBRs work?

Most of India's currently operating nuclear reactors are pressurised heavy water reactors (PHWRs). They are designed to support the fission of natural uranium. Natural uranium consists of 99.3% of uranium-238 and 0.7% of uranium-235. '235' and '238' denote the total number of protons and neutrons in the nucleus. In a PHWR, neutrons are introduced into the reactor, where a device called a moderator slows them down. This is necessary for the neutrons to cause uranium-235 to undergo fission. When it does, it releases heat, which the PHWR converts to electricity; a small amount of plutonium; and a few neutrons.

PHWRs are inefficient because only a small fraction of the fuel, around 1%, undergoes fission before it becomes unusable.

A fast-breeder reactor (FBR) is more efficient, achieving a fuel use rate of around 10% or more. Mainly, the fuel consists of plutonium, not uranium. The reactor core is surrounded by a 'blanket' of depleted uranium, like the unusable fuel produced by PHWRs. When a fast neutron bombards the blanket, the uranium nuclei are transmutated to plutonium nuclei, which are reprocessed as nuclear fuel. The plutonium-based fuel also uses the fast neutrons to undergo fission, releasing more fast neutrons.

What is India's three-stage programme?

The nuclear physicist Homi Bhabha is widely credited with conceiving India's nuclear programme in the first years of its independence. The programme has three stages. In the first stage, PHWRs will use natural uranium to produce plutonium and depleted uranium and electricity. In the second stage, FBRs will use the plutonium and depleted uranium from the first stage to produce even more plutonium and electricity. Finally, future nuclear reactors will use plutonium and thorium to produce electricity.

Bhabha came up with this programme because India has abundant quantities of thorium but only modest reserves of uranium.

And in this scheme, FBRs have been envisaged as a bridge between the initial step, to use what we have, and the final step, to complete the cycle and thus make India self-sufficient in nuclear power.

Why are FBRs challenging?

That an FBR is easier said than done would be a gross underestimate. The Indian government approved the PFBR more than two decades ago. It was designed by the Indira Gandhi Centre for Atomic Research and built by the Bharatiya Nabhikiya Vidyut Nigam, Ltd. The latter proved to be more challenging than first expected.

Among other features, the PFBR uses liquid sodium as coolant. Sodium becomes liquid at a higher temperature, and at higher temperature heat transfer is more efficient. Liquid sodium also does not need to be pressurised. However, it reacts violently with air and water, so the pumps, pipes, and tanks exposed to liquid sodium need to be perfectly sealed, with stringent leak detection protocols. Water-cooled reactors do not have such operational complexities, nor the additional cost.

India is also not alone in confronting these challenges. Japan's Monju Nuclear Power Plant suffered a sodium leak and fire in 1995, leading to long shutdowns; the plant eventually had to be decommissioned. The Superphénix in France was once the world's largest breeder reactor but it was shut down as well, due to technical issues and high operating costs, which also fanned political opposition. Russia, however, has continued to maintain a small fleet of fast-breeder reactors.

In other words, operators have shown FBRs to be technically feasible but they are not yet economically feasible; they have also not won broader public acceptance. Aside from the costs of making them, they also demand rigorous oversight – which depends on both engineering excellence and the safety culture.

How has India pursued FBRs?

India is pursuing FBRs because, as discussed earlier, the three-stage nuclear programme prioritises long-term fuel security. Importantly, it is able to do so because India's nuclear sector remains largely driven by the state. Its decision-making structure is relatively insulated from the ruling establishment: the Department of Atomic Energy (DAE) reports directly to the Prime Minister's Office. As a result, as long as there has been political stability, India has been able to sustain nuclear projects across electoral cycles.

On the flip side, this insulation has reduced scrutiny of the nuclear power programme and protected it from the same pressure to deliver that assails other public sector enterprises like the Indian Railways and the National Highways Authority of India. Engineers have taken on projects with limited transparency on timelines and budgets. When one or both have slipped, the accountability has been spread across agencies. The PFBR's original cost was ₹3,500 crore. It came to ₹6,800 crore in 2019. The DAE also sought multiple deadline extensions. In 2020, it said the PFBR would be commercialised in October 2022. That milestone is still pending.

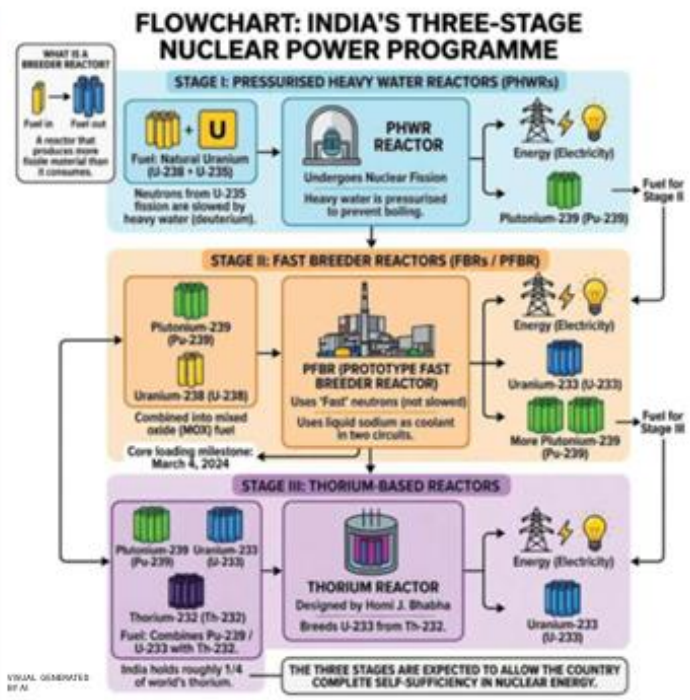
The economics of FBRs also remain uncertain. In addition to the aforementioned issues, the broader fuel cycle – especially the reprocessing of spent fuel and the fabrication of new fuel assemblies – will require its own infrastructure. And for this the nuclear establishment will have to set up new regulatory processes.

What next for the PFBR?

The PFBR will be operated at a low power level to check its behaviour in different operating conditions. Engineers will collect the data from these tests to inform decisions about raising the reactor's power output and refining safety protocols. Eventually, they will seek approval from the Atomic Energy Regulatory Board to operate the reactor in commercial mode.

This entails running the PFBR at or near its rated capacity to generate electricity for the grid on a sustained basis, with standard operating procedures and clear regulatory oversight. At this point in time, the reactor will also have transitioned from being experimental to a commercial power plant.

In parallel, the DAE will also develop fuel reprocessing facilities and plan for future FBRs. Once these aims are closer to being realised, the government and India will develop a clearer sense of whether the broader vision of a closed fuel cycle can be realised.



THE GIST

- PFBR at Kalpakkam achieved criticality, the first step in a sustained chain reaction, but commercial operation remains pending.
- Fast breeder reactors use plutonium and depleted uranium to produce more fuel, forming a bridge in India's three-stage nuclear programme aimed at long-term fuel security.
- Despite being technically feasible, FBRs face high costs, operational complexity, and delays, making their economic viability and wider acceptance uncertain.

GS Paper III – Economics

MPC factors in ceasefire to keep repo rate unchanged

Intensity and duration of West Asia conflict, damage to energy and other infra add risk to inflation and growth outlooks, says panel, cuts growth forecast to 6.9%, hikes inflation projection to 4.5%

Lalatendu Mishra
MUMBAI

Hours after Donald Trump announced on social media about the conditional temporary ceasefire in West Asia, the Monetary Policy Committee (MPC) unanimously voted to hold the repo rate at 5.25%. It also decided to continue with the neutral stance.

Later, addressing a press conference, Reserve Bank of India (RBI) Governor Sanjay Malhotra said that the ceasefire, to some extent, has been taken into account in the monetary policy decision.

Low interest rates

Mr. Malhotra said despite the impact of the war in West Asia, there was a possibility of having low interest rates in the short to medium term in India.

Stating that the West Asia conflict would impede growth, the MPC opined that the intensity and the duration of the conflict and the resultant damage to the energy and other infrastructure added risk to the inflation and growth outlooks.

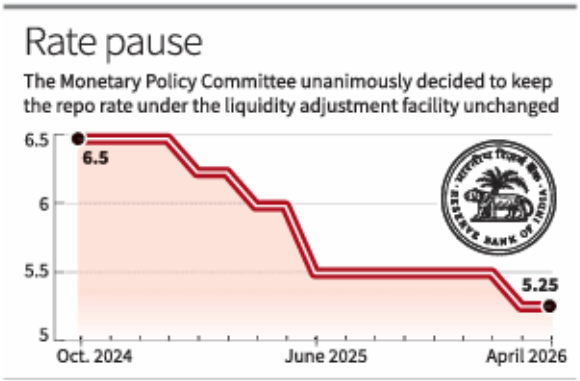
The economy is confronted with a supply shock, it emphasised. Going forward, elevated energy and other commodity prices, as also shocks to availability of inputs due to disruptions in the Strait of Hormuz, were likely to impact growth in 2026-27, it added.

Taking various factors into consideration, the real GDP growth forecast for 2026-27 has been reduced by 70 bps to 6.9%.

And the CPI inflation for 2026-27 had been projected a tad higher at 4.5% from 4.4% earlier.

The RBI has factored in crude price at $85 a barrel in the inflation forecast for this year and $75 for next year. Stating that the global economic conditions and sentiment had soured after the outbreak of the West Asia conflict, the MPC said these had adversely impacted the growth-inflation outlook.

The MPC noted that geopolitical uncertainties had heightened significantly and the upside risks to the inflation outlook, driven by increased energy price pressures and probable weather disturbances affecting food prices, had increased.



GS Paper III – Economics

Elevated crude prices to increase imported inflation, widen CAD: Malhotra

Lalatendu Mishra
MUMBAI


Sanjay Malhotra

Despite the unprecedented geopolitical disturbances in West Asia and supply chain disruptions as well as its resultant impact on the global economy, Reserve Bank of India Governor Sanjay Malhotra on Wednesday said the fundamentals of the Indian economy remained on a stronger footing at the current juncture than in previous crisis episodes, providing it with 'greater resilience to withstand shocks'.

However, Mr. Malhotra noted that elevated crude oil prices could increase imported inflation and widen the current account deficit. He said the disruptions in energy markets, fertilisers and other commodities may adversely impact industry, agriculture and services, reducing domestic output.

"The heightened uncertainty, increased risk aversion and safe haven demand could impact domestic liquidity conditions, economic activity, consumption and investment and weaker global growth prospects may dampen external demand and reduce remittance flows and adverse spillovers from global financial markets could tighten domestic financial conditions and raise the cost of borrowing," he said.

Overall, the initial supply shock can potentially transform into a demand shock over the medium term if the restoration of supply chains is delayed, he emphasised.

To a question on the impact on remittances, RBI Deputy Governor Poonam Gupta said, "Our remittances come from diverse jurisdictions in which the share of the Gulf countries have declined over time. If you look at the last 10 to 15 years data they [remittances from all geographies] have moved in the upward direction. So we are not anticipating any dip to the remittances because it [the war going by the social media post] is going to be resolved soon."

"We anticipate that the demand for migrant workers will infact increase from this [Gulf] region which will help the remittances," she added.

She said besides geographical diversity, remittances are coming from a diverse skill pool which includes low-skilled, mid-skilled and high-skilled migrant workers across countries.

GS Paper III – Economics

Jan Vishwas 2.0 is all about trust-based compliance

Chandrajit Banerjee
Director General, The Confederation of Indian Industry (CII)

Driven by clarity and proportionality, Jan Vishwas 2.0 will help shift Indian businesses toward a trust-based compliance culture

The passage of the Jan Vishwas (Amendment of Provisions) Bill, 2026 by Parliament reflects a conscious and forward-looking policy choice by the Government of India to recalibrate the balance between enforcement and facilitation, and to embed trust as a central pillar of the regulatory framework. The reform signals a clear departure from over-reliance on criminal sanctions toward a more proportionate, predictable, and facilitative approach to compliance.

In recent years, the decriminalisation of minor business-related offences has emerged as a core element of India's reform agenda. The underlying objective has been consistent: to rationalise compliance requirements, enhance ease of doing business and foster a regulatory culture that promotes voluntary compliance rather than fear-driven adherence. Excessive criminalisation of technical and procedural lapses had created compliance anxiety, discouraged entrepreneurship, and diverted administrative and judicial resources from more serious violations.

A journey of reform

This reform journey began with the Jan Vishwas (Amendment of Provisions) Act, 2023, which decriminalised minor offences by amending 183 provisions across 42 Central Acts administered by 19 Ministries and Departments. By replacing criminal penalties for technical and procedural non-compliances with civil penalties or administrative measures, it significantly reduced the compliance burden on businesses and citizens, improving both ease of doing business and ease of living.

Building on this foundation, the 2026 Bill, commonly referred to as the Jan Vishwas 2.0, represents a decisive scale-up of this reform effort. The Bill proposes amendments to 784 provisions across 79 Central Acts administered by 23 Ministries and Departments, including the decriminalisation of 717 provisions. It also rationalises the statute book by removing obsolete and redundant offences, thereby strengthening the coherence and credibility of India's overall regulatory architecture.

Extensive engagement between government, industry bodies, experts and other stakeholders has helped identify provisions where criminal liability was disproportionate to the nature of the offence. Such sustained dialogue has been critical in ensuring that regulatory objectives are preserved even as enforcement mechanisms are made more facilitative. Going forward, continued consultation will remain essential to keep regulation aligned with evolving economic realities.

A process of engagement

The Confederation of Indian Industry (CII) has shaped this reform agenda through sustained, evidence-based policymaker engagement. Industry representations consistently highlighted a large number of statutory offences related to minor and procedural lapses – delays in filings, documentation gaps or clerical errors – that did not warrant criminal prosecution. The CII has emphasised that decriminalisation of such offences strengthens compliance rather than diluting enforcement.

The CII's advocacy has gone beyond decriminalisation alone. A persistent industry recommendation has been to move away from court-imposed 'fines' toward a system of regulatory 'penalties' administered by executive authorities, with clear rules, proportionality, and time-bound resolution. The CII has also stressed the need for the retrospective application of decriminalisation reforms, covering cases currently pending in criminal courts. The Jan Vishwas 2.0 seems to address these long-standing concerns very well.

At a broader level, the Jan Vishwas 2.0 reflects a fundamental shift in regulatory philosophy, from criminalisation to trust, proportionality and economic efficiency. It recognises that most technical or procedural violations occur without *mala fide* intent and are better resolved through civil or administrative mechanisms. The reform explicitly retains stringent enforcement for serious offences where public interest, safety, environmental protection or national priorities are involved. The amendments span key sectors such as exports, textiles, the environment, and transport, and introduce graded enforcement mechanisms, including warnings and lower penalties for first-time or minor violations. Such measures should reduce regulatory uncertainty and boost confidence, especially for micro, small and medium enterprises (MSME) facing high compliance burdens.

Reduces 'court congestion'

These reforms could significantly help India's overburdened judiciary. With nearly 50 million cases pending in courts – many for minor procedural or technical violations – shifting such matters out of criminal courts can reduce congestion and improve efficiency. Government indications, post the passing of the Bill in Parliament, suggest many pending minor cases may be reviewed for closure under the revised framework.

The Bill also advances trust-based regulation by introducing tools such as improvement notices and proportionate penalties for first-time contraventions. This approach recognises the reality that most businesses and citizens act in good faith and comply more effectively in a regulatory environment that is clear, predictable and fair.

The success of the Jan Vishwas 2.0 will depend on effective implementation. Strengthening institutional capacity for administrative adjudication, ensuring uniform enforcement practices, and issuing clear guidance to regulated entities will be critical to realising the full benefits of the reform for industry and citizens.

By decisively moving towards a trust-based, proportionate and growth-oriented framework, The Jan Vishwas 2.0 has the potential to create a more predictable, transparent and investor-friendly environment. Ultimately, the reform reinforces a simple yet powerful principle: compliance works best when driven by clarity, proportionality, and – above all – trust.