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SPECIAL FOR UPSC & GPSC EXAMINATION

DATE : 24-07-25

The Hindu Important News Articles & Editorial For UPSC CSE

Thursday, 24 July, 2025

Edition: International Table of Contents

Page 06:GS 2& 3 : IR and Economy

Prime Minister Narendra Modi's recent visit to the United Kingdom marks a significant development in bilateral ties, with the India–UK Free Trade Agreement (FTA) expected to be signed during the visit. This deal is part of a broader strategic partnership — "UK–India Vision 2035", which replaces the earlier Roadmap 2030.

PM begins visit to U.K.; trade deal set to be inked today

U.K. says deal will boost trade by £25.5 billion each year; Modi will meet Keir Starmer and King Charles III, two sides will hold talks on technology, investment, climate, defence, trade, migration

Sriram Lakshman
LONDON

Prime Minister Narendra Modi arrived in the U.K. on Wednesday evening, kicking off the first leg of his two-nation tour, as India and the U.K. prepare to sign a "free trade" agreement (FTA) on Thursday.

During the visit, Mr. Modi and U.K. Prime Minister Keir Starmer are expected to review ties, with the sides discussing technology, investment, climate, defence, trade, and migration. Mr. Modi is also scheduled to meet Britain's monarch, King Charles III.

"The leaders will unveil their vision for a modern, reinvigorated partnership over the next decade - The UK-India Vision 2035," a U.K. government statement said. This newly packaged and extended framework appears to have replaced the '2030 Roadmap' announced by India and the U.K. in 2021, during former (Conservative) U.K. Prime Minister Boris Johnson's tenure.

The Prime Minister's visit is fleeting – less than 24 hours long – with Mr. Modi set to fly to the Maldives on Thursday evening to celebrate the country's 60th anniversary of Independence from Britain and the 60th anniversary of diplomatic ties between New Delhi and Male.

Gearing up: Prime Minister Narendra Modi greets as he emplanes for London, in New Delhi. PTI

"During my meeting with Prime Minister Rt Hon Sir Keir Starmer, we will have the opportunity to further enhance our economic partnership, aimed at fostering prosperity, growth and jobs creation in both countries. I also look forward to calling on His Majesty King Charles III during the visit," Mr. Modi said in a pre-departure statement. The so-called 'Comprehensive Strategic Partnership' with the U.K. had made "significant progress" in recent years, Mr. Modi said.

The meeting comes exactly a year since the two countries signed a technology cooperation framework – the Technology and Security Initiative. A new bilateral investment treaty is also currently under discussion and a defence industrial cooperation framework was announced earlier this year.

Commerce and Industry Minister Piyush Goyal, who is accompanying Mr. Modi, and his British counterpart, Business and Trade Secretary Jonathan Reynolds, will sign the trade agreement on behalf of the two governments.

The deal would boost trade between the two countries by £25.5 billion each year, a U.K. government statement said.

Indian consumers would have greater access to various British products "from soft drinks and cosmetics to cars and medical devices", the U.K. statement said, citing a drop in average tariff rates from 15% to 3%. The statement also said the U.K. clean energy sector would have "unprecedented" access to India's procurement market and U.K. financial services would be treated on a par with domestic firms in India, specifically in the insurance sector.

"Our landmark trade deal with India is a major win for Britain," Mr. Starmer said in a statement. "It will create thousands of British jobs across the U.K., unlock new opportunities for businesses and drive growth in every corner of the country, delivering on our Plan for Change," he added.

Key Highlights of the Visit:

- **FTA Signing:** Commerce Ministers of both nations to sign the FTA, expected to boost bilateral trade by £25.5 billion annually.
- **High-Level Engagements:** Modi to meet PM Keir Starmer and King Charles III; discussions on technology, investment, climate, defence, trade, and migration.
- **Strategic Frameworks:**
  - Technology and Security Initiative (signed in 2023)
  - Ongoing negotiations on Bilateral Investment Treaty (BIT)
  - Defence Industrial Cooperation Framework

Economic Significance:

- **Tariff Reduction:** Average Indian tariffs on U.K. goods to fall from 15% to 3%.
- **Market Access:** Indian consumers gain access to British goods (cars, cosmetics, medical devices), while U.K. firms gain access to:
  - India's clean energy procurement market
  - Equal treatment in Indian financial and insurance sectors
- **Job Creation & Growth:** U.K. PM Keir Starmer projects job creation and regional growth, aligning with Britain's "Plan for Change".

Strategic & Diplomatic Implications:

- **Post-Brexit Diplomacy:** The U.K., after Brexit, is actively forging bilateral FTAs — this deal helps position India as a key Indo-Pacific partner.
- **Vision 2035 Framework:** Aims to expand strategic partnership beyond trade — includes climate change, innovation, and global governance reform.
- **Soft Power Diplomacy:** Modi's short visit includes a symbolic meeting with King Charles III and underscores common historical ties and evolving diplomacy.

Challenges & Cautions:

- **Labour and Service Movement:** India seeks greater mobility for skilled professionals, which may face resistance from the U.K.
- **Regulatory Barriers**: Despite tariff concessions, non-tariff barriers (like standards, certifications) could persist.
- **Implementation Gap:** Real outcomes depend on how swiftly and effectively the agreement is operationalised.

Way Forward:

- Ensure mutual gains, especially for small and medium Indian exporters and service professionals.
- Address concerns related to data sharing, IPR, and e-commerce in follow-up rounds.
- Strengthen strategic convergences through technology, green energy, and defence industrial cooperation.
- Use the FTA as a model template for future bilateral agreements with other developed economies.

Conclusion:

The India–UK FTA, if executed with strategic foresight and institutional coordination, can serve as a landmark in India's new-age economic diplomacy. It reflects India's shift from reactive trade policy to proactive, interest-based global engagement.

UPSC Mains Practice Question

Ques: Discuss the significance of the 'UK–India Vision 2035' in redefining the post-colonial relationship between the two countries. How does it align with India's evolving global diplomatic strategy?

Page 07: GS 2 : Social Justice

A landmark Danish study published in The Lancet Psychiatry links neonatal vitamin D levels to long-term neurodevelopmental health, including risks for ADHD, schizophrenia, and autism. The findings are globally significant — and especially relevant for India, where vitamin D deficiency is alarmingly common despite abundant sunlight.

Vitamin D deficiency linked to neurodevelopmental issues

Vitamin D deficiency represents more than individual concern; it constitutes biological inheritance transmitted across generations, affecting skeletal health and, as Danish research reveals, brains; findings correspond with medical practice in India, where physicians advocate early supplementation

Anirban Mukhopadhyay

From bones to immune cells, vitamin D is everywhere, guiding growth and shaping defence. But could it also have an effect on the mind?

A major new study suggests so. Published in *The Lancet Psychiatry*, the study drew from the extraordinary depth of Danish health data to establish whether neonatal vitamin D levels might contribute to psychological and neurodevelopmental conditions.

Researchers measured vitamin D levels in dried blood spot samples from 88,764 individuals born between 1981 and 2005, part of a universal neonatal screening programme that stores nearly all newborns' blood in the Danish Neonatal Screening Biobank. YURI LI/UNSPLASH

What the study found

Researchers at Aarhus University, in collaboration with the Statens Serum Institut in Copenhagen, used dried blood spot samples from 88,764 individuals born between 1981 and 2005 – part of a universal neonatal screening programme that stores nearly all newborns' blood in the Danish Neonatal Screening Biobank.

From these samples, the team measured levels of 25-hydroxyvitamin D, or 25(OH)D, which is the standard marker of vitamin D status, and vitamin D-binding protein, which carries vitamin D in the blood and prolongs its activity.

Using nationwide Danish health registries, the researchers tracked which individuals developed major depressive disorder, bipolar disorder, schizophrenia, attention deficit hyperactivity disorder (ADHD), autism spectrum disorder, or anorexia nervosa – and asked whether their vitamin D levels at birth were linked to these outcomes.

The results were striking. Babies with higher vitamin D levels were less likely to be diagnosed with schizophrenia, ADHD, or autism. Newborns with levels about 12.6 nmol/l higher than average had an 18% lower risk of schizophrenia, an 11% lower risk of ADHD, and a 7% lower risk of autism. Vitamin D-binding protein levels were also linked to schizophrenia risk.

To understand the broader public health impact, the researchers modelled a scenario in which every baby had vitamin D levels in the top 60% of the sample. In that case, they estimated that 15% of schizophrenia cases, 9% of ADHD cases, and 5% of autism cases might have been prevented. These effects appeared early, with children who had higher vitamin D levels showing lower risk from a young age.

The lack of association with depression or bipolar disorder, the authors suggested, may reflect both the later onset of these conditions in life and the possibility that neonatal vitamin D plays a more central role in early neurodevelopmental pathways than in mood disorders.

Testing plausible causality

Observational studies, especially in nutrition, often face two big problems. One is reverse causation, where what looks like a cause is actually an early effect. For example, early brain changes might influence how the body handles vitamin D, making it look like vitamin D is the cause when it's actually an effect. The second is confounding, where a third factor like a mother's diet or immune health influences both vitamin D levels and the child's risk of mental illness.

To check for these biases, the researchers turned to genetics. They started with the polygenic risk score (PRS), which looks at many small inherited differences that alter a person's vitamin D levels and generates a score. They found that individuals with higher PRS scores for vitamin D were less likely to be diagnosed with schizophrenia, ADHD or autism.

PRS also helped rule out reverse causation since a child's later psychiatric diagnosis can't influence the vitamin D genes they were born with.

However, PRS couldn't fully resolve confounding: some variants might still influence other traits beyond vitamin D. Perhaps a gene variant perturbing vitamin D levels also alters neurodevelopment?

As Upasana Bhattacharyya, a scientist at Northwell Health in New York, explained, "While PRS can suggest a biological link, they mainly capture variants that are associated with a trait – not necessarily ones that cause it." She added that PRS typically uses variations that are related to many other functions as well, thereby establishing associations without directionality.

To test for a more direct effect, the researchers turned to Mendelian randomisation, a method that uses genetic variants that have a stronger effect on vitamin D levels. If people who inherit variants that raise (only) vitamin D levels consistently have a lower risk of schizophrenia, ADHD or autism, it will be stronger evidence of a causal relationship between vitamin D levels and the risk of developing these conditions.

The researchers used two levels of Mendelian randomisation. First, they tested whether genetic predictors of vitamin D were associated with lower risk of psychiatric conditions. Then they examined two specific genetic variants in the *GC* gene, which regulates levels of vitamin D-binding protein in the blood. Together, they suggested that higher vitamin D levels may play a protective role, particularly in lowering the risk of ADHD, and possibly schizophrenia and autism.

What the findings don't mean

While the study used powerful genetic tools to test for causality, the authors have cautioned that some important uncertainties remain. Some gene variants might influence both vitamin D and brain development independently, a phenomenon known as pleiotropy. And because vitamin D was measured only at birth, the study couldn't pinpoint which periods in pregnancy were more critical.

Second, if deficiency begins in the womb, it makes sense for intervention to begin there, too. However, a 2024 randomised controlled trial in Denmark found that high-dose vitamin D supplementation (2800 IU/day) starting at pregnancy week 24 had no significant effect on the risk of autism or ADHD in children.

But such results also depend on timing, dosage, and whether mothers were actually deficient to begin with. In short, while vitamin D may not be the sole or dominant factor shaping neurodevelopment, it remains a plausible piece of a larger, complex puzzle.

Another key limitation was that nearly all participants were of European ancestry. In a smaller non-European group, the results were less consistent – possibly due to lower vitamin D levels, smaller sample size, and/or genetic diversity.

For these reasons, the researchers concluded that while their findings support a causal link, they can't yet prove it outright.

> This is not about alarm but about recognising that brain development is shaped by access to nutrients – and vitamin D is one such modifiable element we can and must intervene on
>
> ANURADHA KAPUR
> DIRECTOR OF OBSTETRICS AND GYNAECOLOGY AT MAX SMART SUPER SPECIALITY HOSPITAL

India's vitamin D problem

Sunlight is abundant in India, but vitamin-D deficiency is rampant, and the findings carry especial weight here. A study conducted at AIIMS Rishikesh between 2017 and 2018 found that 74% of infants and 85.5% of their mothers were deficient in vitamin D, with nearly half experiencing severe deficiency. Another study from Bengaluru observed that 92.1% of newborns were deficient.

During pregnancy, the mother's body undergoes a complex set of hormonal and metabolic changes to supply calcium for the developing foetal skeleton. These changes intensify in the third trimester as the skeleton grows rapidly. To meet this need, the mother's intestines absorb more calcium, her kidneys excrete more, and her levels of active vitamin D rise to roughly twice their pre-pregnancy levels.

Despite these adaptations, maternal vitamin D levels don't rise unless sunlight exposure or dietary intake improves. This is why even well-nourished pregnancies in India can result in deficiency. Sunlight alone isn't always enough.

Evidence from Indian hospitals has also shown that a mother's vitamin D status directly shapes her baby's. A 2024 study conducted in the Bundelkhand region of India found a strong positive correlation between mothers' and their infants' vitamin D levels and interpreted it to mean babies born to vitamin D-deficient mothers were very likely to be deficient themselves.

This reinforces the idea that vitamin D insufficiency is not just an individual issue: it is a biological legacy passed from one generation to the next, shaping not just bones but, as the Danish study suggests, brains too.

These findings align with clinical experience in India. According to Anuradha Kapur, principal director of obstetrics and gynaecology at a Max Smart Super Speciality Hospital in New Delhi, timely supplementation in deficient mothers can remarkably improve both maternal and neonatal levels.

In her practice, she said high-dose therapy – typically of 60,000 IU per week in the third trimester – has been effective and safe, with clear benefits in infant growth and immunity. A small Indian trial last year echoed these findings: babies born to supplemented mothers had significantly better vitamin D levels at birth. By six months, none had developed severe deficiency, compared to more than half in the control group.

Caution rather than alarm

The Danish study adds to growing evidence that early-life exposure, including nutrition, can shape long-term mental health. Vitamin D is no magic bullet, but through the right window, it might tilt the odds.

Dr. Kapur noted that routine vitamin D screening during pregnancy remains uncommon across much of the country. While some obstetricians in urban areas do test high-risk pregnancies, cost and lack of awareness continue to limit uptake in rural and semi-urban settings. As a result, many deficiencies go undiagnosed, especially when symptoms are subtle or overlooked during pregnancy.

She argued that India needs to shift from reactive treatment to preventive care. The growing evidence of vitamin D's role in neurodevelopment, she said, strengthens the case for routine antenatal supplementation, ideally beginning as early as the first or second trimester.

"This is not about alarm," Dr. Kapur said, "but about recognising that early brain development is shaped by access to nutrients – and vitamin D is one such modifiable element we can and must intervene on."

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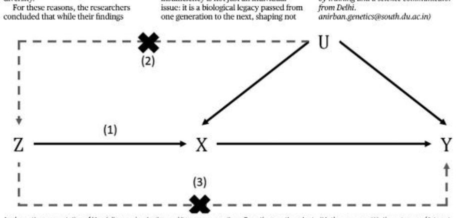


A schematic representation of Mendelian randomisation and its core assumptions. Z are the genetic variants, X is the exposure, Y is the outcome of interest, and U are possible confounding factors. KAITLIN HAZEL WADE (CC BY-SA)

Key Findings of the Danish Study:

- Sample: 88,764 newborns (1981–2005) from the Danish Neonatal Screening Biobank.

- Method: Measured 25-hydroxyvitamin D and vitamin D-binding proteins at birth; tracked mental health outcomes using national health records.
- **Results:**
  - 12.6 nmol/L higher vitamin D linked to:
    - 18% lower risk of schizophrenia
    - 11% lower risk of ADHD
    - 7% lower risk of autism
  - No significant link to bipolar disorder or depression.
- Predictive Models: If all babies had top 60% vitamin D levels:
  - 15% of schizophrenia
  - 9% of ADHD
  - 5% of autism cases could be prevented.
- Causality Tests:
  - Polygenic Risk Scores (PRS) and Mendelian Randomisation suggest a biological link between low vitamin D and higher psychiatric risk.

Significance for India:

1. Widespread Deficiency Despite Sunlight:

- **AIIMS Rishikesh study:**74% infants and 85.5% mothers vitamin D deficient.
- **Bengaluru study:**Over 92% of newborns deficient.

2. Biological Inheritance:

- Vitamin D deficiency is intergenerational — mothers pass their deficiency to unborn children.
- It affects bone, immune, and now possibly brain health of future generations.

3. Clinical Practices in India:

- High-dose maternal supplementation (e.g. 60,000 IU/week in third trimester) shown effective in Indian hospitals.
- However, routine screening during pregnancy is rare, especially in rural and semi-urban areas.

Public Health Implications:

Opportunities:

- Early-life nutritional intervention can shape long-term brain development.
- Reinforces the role of preventive health care over reactive treatment.

- May reduce disease burden related to neurodevelopmental disorders, lowering future costs for families and health systems.

Challenges:

- Limited awareness among general public and frontline health workers.
- Lack of universal guidelines or mandatory screening for vitamin D levels during pregnancy.
- Cost and logistical barriers in rural health care systems.
- Need to clarify optimal dosage, timing, and maternal risk assessment protocols.

Ethical and Governance Dimensions:

- **Right to Health:** Ensuring early interventions like supplementation is part of maternal health care aligns with Article 21.
- **Equity in Healthcare:** Rural mothers and children are more vulnerable — underscores need for targeted interventions.
- **Scientific Responsibility:** Translating genetic and epidemiological findings into ethical, culturally appropriate public health policy.

Way Forward:

Area	Recommendation
Policy	Introduce mandatory vitamin D screening for high-risk pregnancies under NHM
Programs	Integrate with existing schemes like Janani Suraksha Yojana, Anemia Mukt Bharat
Health System	Train ASHAs and ANMs in early detection and supplementation protocols
Research	Fund Indian longitudinal studies on vitamin D and neurodevelopment
Awareness	Launch IEC campaigns promoting safe sun exposure, diet, and antenatal supplements

Conclusion:

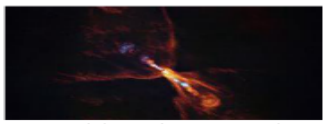
This study reinforces the evolving understanding that early-life nutrition shapes lifelong mental and physical health. For India, where vitamin D deficiency is endemic, it presents a clear, actionable insight: ensure adequate maternal and neonatal vitamin D through preventive health measures. Though not a panacea, it is a modifiable factor — and an opportunity to break intergenerational cycles of poor health.

UPSC Mains Practice Question

Ques: Vitamin D deficiency is not merely a nutritional issue but a public health concern with intergenerational consequences. Discuss in the context of recent global research and India's healthcare landscape. **(150 Words)**

Page : 07:GS 3 : Science & Technology

A landmark study published in Nature has reported the first direct observation of the earliest stage of planet formation — the condensation of rock vapour into solid crystals — around a young star named HOPS-315 in the Orion constellation. This is considered a major breakthrough in our understanding of how planets like Earth begin to form.



HOPS-315, a baby star where astronomers have observed evidence for the earliest stages of planet formation, as imaged by ALMA.
ALMA(ESO/NAOJ/NRAO)/M. MCCLURE ET AL.

Telescopes spot start of planet formation in Orion

The Hindu Bureau

When rocky worlds like the earth began to form, dust in the young Solar System was first heated until it vaporised and then cooled so that the very first, refractory (i.e., heat-loving) minerals could crystallise. Catching that moment in another star system would show astronomers exactly how planet formation begins — but no one had seen it before. A new study in *Nature* this month has reported just such an event.

By examining the star HOPS-315 in Orion, whose protoplanetary disc is tilted just enough for someone on or near the earth to peer deeper within, researchers from France, the Netherlands, Sweden, Taiwan, and the U.S. observed raw rock vapour cool and crystallise.

The protoplanetary disc is a flat, rotating pancake-shaped mass of gas and dust that surrounds a newborn star. Inside it, dust grains bump together, stick, and gradually grow into rocks, planets, moons, and other bodies while the gas creates atmospheres and influences the planets' long-term orbits.

The observations themselves were conducted by the NASA James Webb Space Telescope and the Atacama Large Millimeter/sub-millimeter Array (ALMA) observatory in Chile. In 2023, the team used the NIRSpec and MIRI integral-field spectrographs onboard the telescope to collect sharp energy readings across a range of frequencies. Eight months later, ALMA observed the same system for signs of carbon monoxide, silicon monoxide and sulphur monoxide.

Together, the telescope traced warm gas and dust only a few stellar radii from

The relative quantities of crystals were reminiscent of inclusions that have been found in primitive meteorites on the earth, meaning that a similar condensation is under way around the star

the star while ALMA mapped cooler gas farther out.

The telescope's data contained evidence of a strong band of silicon monoxide gas at around 470 K as well as crystalline silicates. Both lay within 2.2 AU of the star — well inside Mercury's orbit if this were in the solar system. (1 AU equals the earth-sun distance.)

The team also ran computer simulations, which predicted that around 1 AU from the star, temperatures hovered around 1,300K, which is the temperature at which dust just begins to evaporate. The study's energy readings matched the prediction: that interstellar grains must have vaporised there, releasing silicon monoxide gas that then cooled and re-condensed into fresh shards of crystals.

According to the study, the relative quantities of crystals of forsterite, enstatite, and tentative silica were reminiscent of inclusions — i.e. minerals trapped inside minerals — that have been found in primitive meteorites on the earth, meaning that a similar condensation chemistry is under way around the star.

The ALMA data also revealed no slow silicon monoxide at the star's position whereas the Webb telescope's data was blueshifted by around 10 km/s. Together, they indicate that the minerals lay inside the rising disc atmosphere, the thin upper layer of gas and dust above the mid-plane of the protoplanetary disc, rather than in the material pouring out of the star.

Thus the study has reported the first evidence of solid matter condensing out of rock vapour around a star, a.k.a. the first step of planet formation.

Key Findings:

- **Star Studied:**HOPS-315, a baby star with a visible protoplanetary disc — the rotating mass of dust and gas around newborn stars where planets form.
- **Instruments Used:**
  - James Webb Space Telescope (JWST) – NASA's infrared space observatory
  - Atacama Large Millimeter/sub-millimeter Array (ALMA) – ground-based observatory in Chile
- **What Was Observed:**
  - High temperatures (~1300K) near the star caused interstellar dust grains to vaporise, forming silicon monoxide gas.
  - Cooling of this gas resulted in crystallisation into minerals like:
    - Forsterite
    - Enstatite
    - Silica
  - These minerals resemble inclusions found in primitive meteorites on Earth, showing similar condensation chemistry.
- **Location of Formation:**
  - Within 2.2 Astronomical Units (AU) of the star – well inside Mercury's orbit in our solar system.
  - Occurring in the upper atmosphere of the disc, not in outflows from the star.

Scientific Significance:

- First Evidence of the solidification of rock vapour into crystals — considered the first physical step in the formation of rocky planets.
- Confirms the theoretical model of dust evaporation and re-condensation, previously only hypothesised from studying meteorites.

- Observations help trace the timeline and chemistry of planet formation in real-time.

Implications for Planetary Science:

- Offers a live snapshot of the earliest building blocks of planet formation — crucial for understanding:
  - How Earth-like planets form
  - The distribution of minerals and atmospheres
  - Origins of water and organics
- May provide clues about exoplanet formation and habitability potential in other solar systems.

UPSC Prelims Practice Question

Ques: Which of the following telescopes were used to observe the earliest stage of planet formation around the star HOPS-315?

A. Hubble Space Telescope and Chandra X-ray Observatory

B. James Webb Space Telescope and Atacama Large Millimeter/sub-millimeter Array (ALMA)

C. Spitzer Space Telescope and Giant Metrewave Radio Telescope (GMRT)

D. Very Large Telescope (VLT) and Keck Observatory

Ans: b)

Page 09 : GS 2 : Social Justice

The 9th edition of Swachh Survekshan, conducted under the Swachh Bharat Mission-Urban, has gone beyond rankings to emerge as a diagnostic tool for evaluating the urban sanitation landscape. With participation from over 4,500 cities, the survey now offers deep insights into urban solid waste management (SWM), community engagement, policy implementation, and decentralised governance.

Takeaways from the Swachh Survekshan

Akshay Rout

Former Director General, Swachh Bharat Mission. Views are personal

Rankings and celebrations apart, the ninth edition of Swachh Survekshan, branded as the world's largest cleanliness survey, provides policy makers and city managers a reality check on urban sanitation and waste management, and a reliable database. The annual survey steered by Swachh Bharat Mission (SBM)-Urban had not only over 4,500 cities competing, compared to less than 100 in 2016, but was also backed by elaborate assessments and third party verification and further bolstered by feedback from 140 million city dwellers. From segregation, collection, transportation, and management of waste to the welfare of sanitation workers and grievance redressal, the 10 parameters of the survey are comprehensive. The survey has emerged as an effective driver of competition and movement in city sanitation. It also provides a measure of the gaps in India's journey towards clean cities.

Different population sizes

The advent of Super Swachh League this year was an overdue twist to break the stalemate at the top of the rankings. Indore, Surat, and Navi Mumbai – all mascots of cleanliness for a while – entered this new space along with 20 other cities of different population sizes. Members of the League could create new benchmarks and compete among themselves while yielding space to new aspirants to enter clean city ranks. That is how Ahmedabad, Bhopal, and Lucknow could break into the top as India's cleanest cities this time in the million-plus category, with another 12 receiving ranks in their own population segments.

Swachh Survekshan 2024-25 appeared focused on faster democratisation of city cleanliness. The expansion of population categories from two to five, starting from cities with a population of less than 20,000 to those with a million-plus population, provided a fairer platform for cities to perform.

The business of waste management in cities may look chaotic, but it remains possible

Those hitherto lagging are now catching up. Odisha is an example. Bhubaneswar moved up from the 34th to the 9th rank; small towns such as Aska and Chikiti worked their way to the top three clean cities in their categories; and mid-size cities including Rourkela, Cuttack, and Berhampur moved considerably upwards. These trends create hope that cleanliness is not a preserve of only certain States. Cities from the south are yet to make any big mark in the clean city show with Bengaluru being the least inspirational. Hyderabad, Tirupati, Vijayawada, Guntur, and Mysuru were the best in the region. The National Capital Region presents an interesting medley: while the New Delhi Municipal Council areas and Noida ranked best for meticulous sanitation implementation, Delhi, Gurugram, and Ghaziabad improved their ranks irrespective of the negative reports they received in the public domain.

The clean city basket has grown larger since one promising clean city was picked up from each State based on its progress and potential. Once cities are positively stamped, they tend to stay in the aspirational course. Understood this way, the 78 Swachh awards given were not too many.

Setting up the cleanest cities as mentors to the most underperforming ones could help in the proliferation of multiple good practices among urban local bodies (ULBs). While Indore is a veteran in segregating the last gram of waste into six buckets at source – dry, wet, domestic hazardous, plastic, sanitary and e-waste; Surat has been making good revenue by selling sewage-treated water. Pune's waste management is anchored on cooperatives formed by ragpickers. Visakhapatnam made an eco-park from remediated legacy waste site. Lucknow produced an iconic waste wonder park. The Kuberpur area in Agra, once a toxic dumpsite, transformed to 47 acres of green, by engaging bioremediation and biomining technologies.

Tourist destinations and places of high footfall received special emphasis in the survey. Prayagraj was awarded in the category of Ganga towns, and special recognition was extended to the recent Maha Kumbh for its sanitation management. India accounts for less than 1.5% of international tourist arrivals. Cities need to do much more than an occasional cleanliness drive to enhance tourist experience.

The theme this year

The theme of 'reduce, reuse, and recycle (RRR)', advocated by the 2025 survey, carries the prospect of jobs, enterprise, and invigoration of self-help groups. The theme of the last survey was 'waste to wealth'. We are yet to raise the billions of rupees out of waste that is possible. For this, policy needs to better incentivise investors. Waste-to-energy plants are gaining traction but the private sector may be concerned about commercial viability.

Citizens are yet to take meaningful action even though the RRR approach is entrenched in India's ancient traditions. While a universal resentment against open defecation has been achieved by SBM, a behaviour change movement fostering intolerance against waste and fighting against consumerism has been tough to initiate.

As more cities get identified as hubs of growth, we must prioritise the management of 1.5 lakh tonnes of solid waste generated every day. A lot will depend on delivery at decentralised levels, especially by ULBs in enforcing segregation, collection, transport, and processing, including of the more challenging plastic and e-waste.

The business of waste management in cities may look chaotic, but it remains possible. The rise of Surat from being a place of garbage three decades ago to the top place in the sanitation chart last year shows that this is a possibility in all cities in India.

Key Takeaways:

Evolution of Survey and its Scale:

- From <100 cities in 2016 to 4,500+ cities in 2024-25.
- Backed by third-party assessments, citizen feedback (140 million responses), and 10 key parameters including sanitation worker welfare, grievance redressal, and waste management.

Structural Improvements:

- Introduction of Super Swachh League created space for newer cities to rise.
- Democratisation of rankings through five population categories (from <20,000 to 1 million+).
- Odisha's success story shows equitable urban sanitation progress — e.g., Bhubaneswar (rank 9), Aska, and Chikiti among top cities in their segments.

Innovation and Best Practices:

- Indore: Six-category waste segregation.
- Surat: Selling sewage-treated water.
- Pune: Cooperative model involving ragpickers.
- Visakhapatnam: Eco-park from legacy waste.
- Agra's Kuberpur: Dumpsite turned into 47-acre green zone using bioremediation.
- Lucknow: Waste Wonder Park — awareness and aesthetics.

Thematic Focus – RRR (Reduce, Reuse, Recycle):

- Theme of Swachh Survekshan 2025.
- Encourages circular economy, job creation via self-help groups and waste-based enterprises.
- Challenge: Low investor confidence in waste-to-energy due to commercial viability concerns.

Challenges Identified:

- South Indian cities lagging despite infrastructural strengths.
- Citizen participation in RRR and behavioural change against littering and consumerism is still weak.
- Tourism-linked sanitation remains seasonal and event-driven; needs institutionalisation.
- Decentralised execution (by ULBs) remains patchy, especially in plastic and e-waste.

Broader Implications for Governance:

- Shows the power of data-backed competition in pushing systemic reform in cities.
- Mentorship model between high and low performers can drive knowledge-sharing.
- Reflects the potential for India to turn waste into wealth through technology and public-private participation (PPP).

Way Forward:

1. Strengthen ULB capacity for decentralised waste management.
2. Mainstream citizen participation in daily sanitation efforts.
3. Incentivise private sector investment in waste-to-energy and recycling startups.
4. Institutionalise cleanliness in tourism circuits and pilgrimage sites.
5. Use top-performing cities as mentors to replicate success models.

Conclusion:

Swachh Survekshan has evolved into more than a competition — it's a national instrument of behavioural transformation and urban policy monitoring. The learnings from cities like Surat, Indore, and Bhubaneswar show that cleanliness is achievable with political will, community engagement, and innovation. The focus must now shift from symbolic clean drives to systemic urban reforms.

UPSC Mains Practice Question

Ques: Swachh Survekshan has evolved into a powerful instrument of behavioural change, competition, and policy correction in urban sanitation. Critically evaluate the impact of Swachh Survekshan on urban governance and waste management in India. **(250 Words)**

Page 10 :GS 2: Indian Constitution

President Droupadi Murmu has invoked Article 143 of the Constitution to seek the Supreme Court's opinion on whether the President or Governors can be judicially compelled to act within a time limit on Bills passed by State legislatures. This follows the Supreme Court's April 8 judgment in the Tamil Nadu vs. Governor case.

Can Presidential Reference change a judgment?

What is the issue on which President Droupadi Murmu has invoked the Supreme Court's advisory jurisdiction? Are such advisory opinions binding? What did the April 8 ruling state? Can a Presidential Reference prompt the Supreme Court to revisit an earlier ruling?

EXPLAINER

Aaratrika Bhaumik

The story so far:

On July 22, the Supreme Court issued notices to the Union Government and all States on a Presidential Reference seeking its opinion on whether the President and Governors can be judicially compelled to act within prescribed timelines on Bills passed by State legislatures. A Constitution Bench led by Chief Justice B.R. Gavai and comprising Justices Surya Kant, Vikram Nath, P.S. Narasimha, and A.S. Chandurkar indicated that detailed hearings would begin around mid-August.

What was the Presidential Reference?

The Reference stems from President Droupadi Murmu's submission of 14 questions following the Supreme Court's April 8 ruling. That decision arose from a petition filed by the Tamil Nadu government challenging Governor R.N. Ravi's delay in granting assent to 10 Bills that had been re-passed by the State legislature, and his subsequent decision to reserve them for Presidential consideration. The judges held that the Governor's prolonged inaction was illegal and, for the first time, imposed judicially enforceable timelines on Governors and the President to act on State Bills. The Presidential Reference broadly seeks clarity on whether courts can prescribe the manner and timeframe within which constitutional authorities must act.

Can the court advise?

Article 143(1) of the Constitution confers advisory jurisdiction on the Supreme Court, empowering it to render opinions on questions of law or fact that are not connected to any ongoing litigation. The only prerequisites are that the President must be satisfied that such a question has arisen or is likely to arise, and that it is of such a nature and of such public importance that it warrants the court's opinion.

However, the court is bound to limit itself strictly to the questions referred by the President and cannot exceed the scope of the Reference.

Judicial opinion: President Droupadi Murmu administers the oath of office to Justice Bhushan Ramkrishna Gavai as Chief Justice of India, in New Delhi on May 14. ANI

Can it decline a Reference?

Although the Supreme Court has chosen to entertain the present Reference, it is not bound to do so in every case. In *In Re: The Special Courts Bill* (1978), the court held that the word "may" in Article 143(1) grants it discretion to decline a Reference. However, it must record reasons for such refusal.

In 1993, the court declined to answer a Reference on the Ayodhya-Babri Masjid dispute, citing the pendency of a civil suit and deeming the Reference "unconstitutional" for violating secularism. The judges also cautioned against the misuse of the court's advisory opinion for political ends.

Are advisory opinions binding?

The binding force of advisory opinions remains contested. Article 141 of the Constitution states that the "law declared" by the Supreme Court is binding on all courts in India. In *St. Xavier's College versus State of Gujarat* (1974), the court clarified that advisory opinions do not amount to binding precedents, though they command significant persuasive authority. Nevertheless, there have been instances where the court has appeared to treat such opinions as authoritative. A notable example is the *R.K. Garg versus Union of India* (1981) case, where Justice P.N. Bhagwati treated the legal reasoning in the *Special Courts Bill* Reference as a binding precedent. This was despite Justice Y.V. Chandrachud's explicit caveat in that Reference that the court's opinion were not binding on other courts. As it stands, any advisory opinion issued in the present presidential Reference would not have binding force. The Supreme Court's April 8 judgment, delivered in the exercise of its adjudicatory jurisdiction under Article 141, would continue to prevail irrespective of the opinion.

Can the court overturn its April 8 ruling through the Reference?

In its opinion on the *Cauvery Water Disputes Tribunal* Reference, the Supreme Court underscored that Article 143 cannot be used as a means for the executive to seek a review or reversal of its settled judicial decisions. "When this court in its adjudicatory jurisdiction pronounces its authoritative opinion on a question of law, it cannot be said that there is any doubt about the question of law or the same is *res integra* so as to require the President to know what the true position of law on the question is," the opinion said. Accordingly, the only valid recourse to challenge the April 8 ruling is through review or curative petitions.

However, in *re Natural Resources Allocation* (2012), the court held that there is no constitutional bar on its ability to clarify, restate, or even formulate a fresh opinion on a question of law under Article 143(1), so long as the *ratio decidendi* of an earlier judgment remains intact and the rights of parties in the original case are unaffected. The Reference followed the court's decision quashing the 2G spectrum allocation and mandating auctions as the sole method for spectrum distribution.

However, in 1998, a Presidential Reference was used to modify certain aspects of a previous ruling on judicial appointments. While reaffirming the validity of the collegium system laid down in *Supreme Court Advocates-on-Record Association versus Union of India* (1993), the court revised the composition and functioning of the collegium, thereby refining the appointment process without overturning the earlier judgment.

While the April 8 judgment is final, its findings on the law may still be refined or elaborated upon by the Constitution Bench hearing the present Reference.

THE GIST

- Article 143(1) of the Constitution confers advisory jurisdiction on the Supreme Court, empowering it to render opinions on questions of law or fact that are not connected to any ongoing litigation.
- In its opinion on the *Cauvery Water Disputes Tribunal* Reference, the Supreme Court underscored that Article 143 cannot be used as a means for the executive to seek a review or reversal of its settled judicial decisions.
- The binding force of advisory opinions rendered by the Supreme Court remains contested.

What is a Presidential Reference?

Under Article 143(1) of the Constitution:

- The President may refer to the Supreme Court questions of law or fact of public importance for its advisory opinion.
- This is part of the advisory jurisdiction of the court, distinct from adjudicatory powers.

Can a Presidential Reference Overturn a Supreme Court Judgment?

No, a Presidential Reference cannot reverse or nullify a settled judgment.

- The April 8 judgment, being a binding judicial pronouncement under Article 141, remains the law of the land.
- Article 143 does not allow the President or executive to seek a review, reversal, or bypass of authoritative legal rulings.

Case law:

- Cauvery Water Disputes Tribunal Reference: Court held that Article 143 cannot be misused to seek review of settled law.
- In re Natural Resources Allocation (2012): Court clarified that it can explain or elaborate on law under Article 143, without affecting the rights of parties or overruling existing law.

Is the Supreme Court Bound to Answer a Reference?

No.

- Article 143 uses the word "may," giving the court discretion to refuse.
- E.g., Ayodhya Reference (1993) was declined, citing its political and communal sensitivity and pending litigation.

Are Advisory Opinions Binding?

Not technically binding, but have persuasive value.

- Under Article 141, only judgments given in adjudicatory jurisdiction are binding.
- Yet, advisory opinions have influenced judicial reasoning in later cases:
  - R.K. Garg v. Union of India cited an advisory opinion as precedent.
  - But courts have generally held that advisory opinions ≠ binding precedent.

Scope of the Current Reference:

- The President seeks clarity on:
  - Whether judicially enforceable timelines can be imposed on constitutional authorities (President/Governor).

- Whether courts can dictate procedure and timeframes to such functionaries.

Important Note: The Supreme Court will only answer the specific legal questions referred to it. It cannot revisit the entire case or alter the verdict affecting parties in the original litigation.

Can the April 8 Judgment Be Refined via Reference?

Yes, but only limited to legal clarifications.

- The court may explain or nuance its interpretation of constitutional duties (like assent to Bills).
- It cannot dilute or overturn the April 8 verdict except through:
  - Review Petition under Article 137
  - Curative Petition (in rarest cases)

Conclusion:

While a Presidential Reference cannot change a Supreme Court judgment, it can prompt legal clarification or elaboration on a matter of public importance. The current Reference thus opens a vital constitutional debate on executive accountability, judicial oversight, and the role of Governors and the President in the legislative process.

UPSC Mains Practice Question

Ques: Discuss the scope and limitations of Article 143 in the Indian Constitution. Can it be used to circumvent the finality of judicial decisions? **(150 Words)**

Page : 08 Editorial Analysis

The reality of the changing dimensions of warfare

Machiavelli believed that in politics, one is guided solely by the harsh realities of political life, *viz.*, a struggle for power and survival. Today, we are at a point in history when old rules that once governed international politics appear to be in terminal decline. Alongside this, the means to achieve dominance are undergoing fundamental changes. To today's power brokers, the Peace of Westphalia in 1648 (that sanctified the construct of a nation state), and the Congress of Vienna in 1814-15 have little or no meaning. For most, new weapons are the be-all and end-all of modern politics.

The year 2025 is also one that celebrates eight decades of seemingly relative peace following the end of the Second World War, though the years in between did see, and had seen, several conflicts, though not on the scale of the Second World War. For many, even more than the defeat and decline of Nazi Germany, it appeared that it was the apparent invincibility of the United States (wielding the mighty atom bomb – two of which were dropped in Hiroshima and Nagasaki in Japan in 1945) – that seemed to usher in a new era of peace. Concepts such as a 'rules-based international order' also gained traction at this time.

This was, however, at best an illusion of peace, and more of a 'riddle wrapped in an enigma' than the reality. A succession of wars of a lesser magnitude that continued to occur across the world – beginning with Korea, Vietnam and North Africa, not excluding parts of Europe itself – confirmed this. It reinforced a truth embedded in a seminal piece of advice often given to diplomats based in the United Kingdom, *viz.*, 'do not believe anything anyone tells you unless you have checked it yourself'.

Already by the 1990s, many of the fundamentals that prevailed had begun to be questioned. The end of the Cold War looked more like the beginning of a new era of conflict. Quite a few new conflicts had begun to emerge which had the potential to shatter any illusion that peace was at hand. Alongside this, it was increasingly becoming evident that a new era in global warfare was emerging. Few, however, admitted that the world was about to enter a new era of conflict.

The impact of 9/11

One of the more widely read articles recently harps on the End of Modernity and talks of the current state of the world in some detail. It lists the year 1989, when the Berlin Wall came down, as the beginning of a new era in global politics. For many others, however, it was September 11, 2001, when the Twin Towers in New York were attacked by terrorists, that seemed to usher in a new beginning. Admittedly, the events of 9/11 did begin a new chapter in global affairs, but it was hardly the curtain-raiser, or even indicative, of the fundamental changes about to take place in the future. What 9/11, perhaps, did was to give the U.S. and certain other nations an opportunity to invade other states based on their perception of what was right and wrong. It was not yet obvious, however, whether the basic fundamentals of conflict would undergo any radical change, and the implications it could have for future generations. The evidence for this is only now beginning to unfold. Even so, the catastrophic consequences of the change are yet to be fully understood or comprehended.

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It entails much more than the use of highly sophisticated weaponry; it extends to tactics as well, which India must note

For this, perhaps, one needs to go to the early 1990s, and more specifically to 1991, to the impact which the U.S.-led Operation Desert Storm caused at the time, and also its impact on future wars. It was in effect the first modern-era war which would mark a "dramatic acceleration of warfare and the transformative synthesis of its operative, tactical and strategic elements", and possibly transforming the nature of war and battlefield doctrines itself. It was also, perhaps, the first instance of three-dimensional strikes on a 'preferred' enemy. Even then, it is only very recently that strategists and military planners have become aware of how transformative it was and the impact it would have in the years to come.

Ukraine, West Asia and Operation Sindoor

At the time, the world was only riveted on the unrivalled power, economic, political and military, of the U.S. It has taken the war (since 2022) between Russia and a Ukraine backed by the North Atlantic Treaty Organization, to fundamentally revise the thinking of war planners and get them to realise how the nature of war itself had changed beyond anything seen in the past. The war in Ukraine and in West Asia have propounded many new doctrines that are very different from those seen previously in the annals of warfare. The very nature of war, it would seem, as also the conduct of warfare had changed, or is changing. Today's wars bear little resemblance to what was seen in the past. Automation has become an essential feature of modern conflicts. The extensive use of drones (with several variations such as drones to gather intelligence and conduct precision strikes; drones able to operate semi-autonomously employing image recognition algorithms to identify high-priority targets, together with 'loitering munitions') have altered the nature of warfare beyond recognition.

The India-Pakistan conflict in May 2025 helped provide some glimpses of the fundamental changes seen in modern warfare. Unlike the earlier India-Pakistan conflicts, the conflict this time featured fixed wing and several other kinds of drones, together with 'loitering munitions'. Fighter aircraft were a critical element to ensure air superiority and carry out precision strikes. Also, seen were advanced 'air-to-air missiles', supplemented and complemented with highly accurate GPS-guided and laser-guided bombs. The BrahMos missile was in place and reportedly also used on at least one occasion. Pakistan, for its part, made use of China-supplied PL-15 missiles and also Turkish-supplied Songar drones.

Modern warfare, however, entails much more than the mere use of highly sophisticated weaponry. It extends to tactics as well. Militaries are moving beyond traditional hierarchies, to advanced network-centric warfare. The advent of cyber and Artificial Intelligence (AI) has seen battlefields morph into complex multi-domain conflict zones, involving advanced technologies, AI and cyber warfare methodologies. The use of hypersonic weapons capable of travelling at speeds greater than Mach-5 also adds a further critical dimension to the current arms race and to the new forms of warfare. All told, digital strategies and autonomous systems are tending to make traditional concepts of how battles are won, *viz.*, through use of overwhelming physical force, outdated. Future warfare is increasingly set to become digitally autonomous and interconnected.

India needs to adapt

Hence, the message is loud and clear – and should be to one and all. We are entering a new era of technological warfare. India must adapt rapidly to keep pace with the changes taking place. Incidentally, it also raises questions about India's existing and established military modernisation plans. These may need to be completely revised and revamped. Perhaps the relevance of many existing tenders for certain categories of weapons may require to be reconsidered.

Overall, there is considerable room for a rethink about India's future defence procurement plans. China has already produced, and has in place, huge volumes of indigenously manufactured platforms (fighter jets, the J-10 and the J-20 as well as the fifth generation fighter). China is now poised to produce its sixth generation fighter.

Available information suggests that India is putting its faith in existing indigenous manufacture and continuing to procure more Rafale fighter jets from France. Clearly, the indigenous development and manufacture of missiles and aircraft are way behind schedule.

What is pertinent is that with the emergence of high-altitude, long-endurance, unmanned aerial vehicles that are essential for modern warfare, there is an overwhelming need for India to rethink its defence modernisation plans. Diversification of India's military hardware has become critically important. This does have a direct impact on India's capability to fight future wars, including against Pakistan or China, or worse, a two-front war.

Paper 03 Internal Security &Science and Technology

UPSC Mains Practice Question: Discuss the impact of emerging technologies such as Artificial Intelligence, drones, and hypersonic missiles on modern warfare. How should India respond to these changes to ensure national security? (250 words)

Context :

The article reflects on how the nature of warfare has fundamentally changed, especially in the 21st century. It argues that conventional models of warfare are outdated and highlights technological shifts, including drones, AI, cyber warfare, and hypersonic weapons, which are redefining global military doctrines. The article also reflects on India's preparedness amid these shifts.

Key Takeaways:

1. Decline of Traditional Power Frameworks

- Historical peace treaties like Westphalia (1648) or Congress of Vienna (1815) hold little value in today's conflict paradigm.
- The idea of a rules-based international order is increasingly being replaced by raw displays of power and technological dominance.

2. The Illusion of Post-War Peace

- While WWII ended in 1945, conflicts never ceased: Korea, Vietnam, Africa, West Asia, etc.
- US dominance (via nuclear capability) created an illusion of peace, not actual global harmony.

3. Transformation in Warfare – Key Events

- **Operation Desert Storm (1991):** First modern multi-domain war using smart bombs, satellite communication.
- **9/11 (2001):** Gave the U.S. justification to invade nations based on "perceived threats", shifting war doctrines.
- **Russia-Ukraine War (2022–):** Opened the eyes of planners to how automated and high-tech warfare has become.
- **India-Pakistan Clash (2025):** Marked by use of loitering munitions, AI-driven drones, BrahMos, GPS/laser-guided weapons.

4. Features of Modern Warfare

- **Drones:** Surveillance, autonomous targeting, loitering strike capability.
- **AI & Cyber Warfare:** Multi-domain conflicts; beyond physical battlefield to data and networks.
- **Network-Centric Warfare:** Real-time integration of intelligence, surveillance, and strike capability.
- **Hypersonic Weapons:** Ultra-fast, unpredictable, nearly impossible to intercept.
- **Autonomous Systems:** Minimising human involvement; decisions made by machines using deep learning algorithms.

5. India's Strategic Challenges

- **Outdated military procurement:** Reliance on Rafale jets, while countries like China are working on 6th generation fighters.
- **Slow indigenous development:** Missiles and fighter platforms lagging.
- Lack of modern drones and AI-integrated combat systems.
- **Diversification needed:** Heavy reliance on a few countries (e.g. France, Russia) limits flexibility.
- Threat of two-front war (Pakistan + China) makes preparedness urgent.

Implications for Exam:

Topics Covered:

- Role of technology in internal security
- Modernisation of armed forces
- Cyber and AI-based threats
- Emerging warfare doctrines
- India's defence preparedness

Conclusion:

The article delivers a stark warning: the future of warfare is here, and it is digital, autonomous, multi-domain, and relentless. India must move beyond traditional doctrines and procurement strategies to secure its place as a 21st-century military power.