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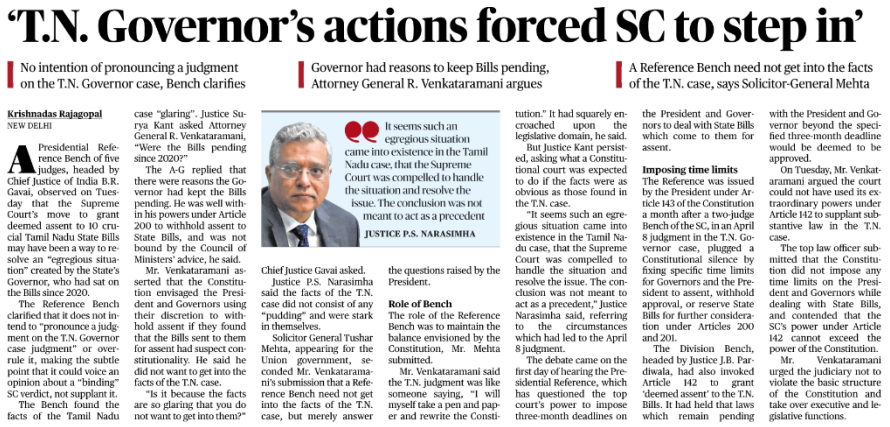
The recent Presidential Reference to a five-judge Supreme Court Bench has reignited the debate on the constitutional role of Governors and the judiciary's powers under Articles 200, 201, 142, and 143. The controversy stems from the Tamil Nadu Governor's prolonged inaction on State Bills since 2020, which compelled the Supreme Court to grant "deemed assent" in its April 8 judgment. The present hearings highlight the tension between constitutional silence, judicial activism, and the principle of separation of powers.

Key Issues



'T.N. Governor's actions forced SC to step in'

No intention of pronouncing a judgment on the T.N. Governor case, Bench clarifies

Governor had reasons to keep Bills pending, Attorney General R. Venkataramani argues

A Reference Bench need not get into the facts of the T.N. case, says Solicitor-General Mehta

Krishnadas Rajagopal
NEW DELHI

A Presidential Reference Bench of five judges, headed by Chief Justice of India B.R. Gavai, observed on Tuesday that the Supreme Court's move to grant deemed assent to 10 crucial Tamil Nadu State Bills may have been a way to resolve an "egregious situation" created by the State's Governor, who had sat on the Bills since 2020.

The Reference Bench clarified that it does not intend to "pronounce a judgment on the T.N. Governor case judgment" or overrule it, making the subtle point that it could voice an opinion about a "binding" SC verdict, not supplant it.

The Bench found the facts of the Tamil Nadu case "glaring". Justice Surya Kant asked Attorney General R. Venkataramani, "Were the Bills pending since 2020?"

The A-G replied that there were reasons the Governor had kept the Bills pending. He was well within his powers under Article 200 to withhold assent to State Bills, and was not bound by the Council of Ministers' advice, he said.

Mr. Venkataramani asserted that the Constitution envisaged the President and Governors using their discretion to withhold assent if they found that the Bills sent to them for assent had suspect constitutionality. He said he did not want to get into the facts of the T.N. case.

"Is it because the facts are so glaring that you do not want to get into them?" Chief Justice Gavai asked.

It seems such an egregious situation came into existence in the Tamil Nadu case, that the Supreme Court was compelled to handle the situation and resolve the issue. The conclusion was not meant to act as a precedent

JUSTICE P.S. NARASIMHA

Justice P.S. Narasimha said the facts of the T.N. case did not consist of any "pudding" and were stark in themselves.

Solicitor General Tushar Mehta, appearing for the Union government, seconded Mr. Venkataramani's submission that a Reference Bench need not get into the facts of the T.N. case, but merely answer the questions raised by the President.

Role of Bench

The role of the Reference Bench was to maintain the balance envisioned by the Constitution, Mr. Mehta submitted.

Mr. Venkataramani said the T.N. judgment was like someone saying, "I will myself take a pen and paper and rewrite the Constitution." It had squarely encroached upon the legislative domain, he said.

But Justice Kant persisted, asking what a Constitutional court was expected to do if the facts were as obvious as those found in the T.N. case.

"It seems such an egregious situation came into existence in the Tamil Nadu case, that the Supreme Court was compelled to handle the situation and resolve the issue. The conclusion was not meant to act as a precedent," Justice Narasimha said, referring to the circumstances which had led to the April 8 judgment.

The debate came on the first day of hearing the Presidential Reference, which has questioned the top court's power to impose three-month deadlines on the President and Governors to deal with State Bills which come to them for assent.

Imposing time limits

The Reference was issued by the President under Article 143 of the Constitution a month after a two-judge Bench of the SC, in an April 8 judgment in the T.N. Governor case, plugged a Constitutional silence by fixing specific time limits for Governors and the President to assent, withhold approval, or reserve State Bills for further consideration under Articles 200 and 201.

The Division Bench, headed by Justice J.B. Pardiwala, had also invoked Article 142 to grant 'deemed assent' to the T.N. Bills. It had held that laws which remain pending with the President and Governor beyond the specified three-month deadline would be deemed to be approved.

On Tuesday, Mr. Venkataramani argued the court could not have used its extraordinary powers under Article 142 to supplant substantive law in the T.N. case.

The top law officer submitted that the Constitution did not impose any time limits on the President and Governors while dealing with State Bills, and contended that the SC's power under Article 142 cannot exceed the power of the Constitution.

Mr. Venkataramani urged the judiciary not to violate the basic structure of the Constitution and take over executive and legislative functions.

1. **Governor's Role under Article 200:**
   - Governors can assent, withhold assent, or reserve Bills for the President's consideration.
   - The Constitution is silent on time limits, leading to political and administrative deadlocks.
2. **Judiciary's Intervention:**
   - The SC (April 8, 2024 judgment) imposed a three-month deadline and granted deemed assent if the Governor/President failed to act.
   - Invoked Article 142 to "do complete justice" in the extraordinary circumstances of Tamil Nadu.
3. **Presidential Reference under Article 143:**
   - The President has now sought clarity on whether the SC can impose such timelines and whether this undermines executive discretion.

Arguments in the Debate

- **Attorney General & Union Govt's View:**
  - Governor is not bound by Council of Ministers' advice in all cases.
  - The Constitution permits discretion where constitutionality of a Bill is in question.
  - SC cannot rewrite the Constitution by introducing deadlines.
  - Article 142 cannot override substantive constitutional provisions.
- **Supreme Court Bench's Observations:**
  - The T.N. case presented "egregious" facts of Bills pending for years without action.
  - Judicial intervention was necessary to protect legislative functioning and prevent constitutional paralysis.
  - The April 8 judgment may not serve as a precedent but was a case-specific corrective step.
- **Underlying Concern:**
  - Balance of power between legislature, executive (Governor/President), and judiciary.
  - Avoiding misuse of the Governor's office for political ends versus judicial overreach.

Constitutional Dimensions

- Article 200 & 201→ Governor/President's powers on State Bills.
- Article 142→ Court's extraordinary powers to ensure complete justice.
- Article 143→ Presidential Reference for advisory opinion of the SC.
- Basic Structure Doctrine→ Separation of powers must not be violated, yet constitutional functionaries cannot act in a vacuum.

Conclusion

The Tamil Nadu case illustrates how constitutional silences can be exploited, leading to institutional friction. While judicial activism in the form of "deemed assent" addressed an immediate deadlock, it raises concerns of encroachment into the legislative-executive domain. Going forward, a structured constitutional amendment or parliamentary law defining time limits for Governors/President in dealing with State Bills may offer a balanced solution. The broader challenge lies in ensuring that constitutional offices are not politicized while upholding the principle of federal balance and democratic accountability.

UPSC Prelims Practice Question

Ques: Under which Articles of the Indian Constitution does the Governor deal with assent to State Bills?

(A) Articles 153 and 154

(B) Articles 200 and 201

(C) Articles 356 and 357

(D) Articles 72 and 74

Ans : B)

UPSC Mains Practice Question

Ques: "Judicial activism cannot be a substitute for constitutional reform." Critically evaluate this statement in light of the Supreme Court's order granting 'deemed assent' to State Bills. **(250 Words)**

Page 07: GS 3 : Science and Technology

One of the deepest unsolved problems in modern physics is reconciling quantum mechanics (which governs the microscopic world) with Einstein's general relativity (which governs gravity and spacetime). While both theories are individually successful, they do not form a unified framework. A recent study published in PRX Quantum (July 2025) has proposed an innovative experiment using entangled atomic clocks to probe this elusive interface — marking a possible step towards experimental tests of quantum gravity.

Key Issues and Context

1. **The Puzzle of Quantum Gravity**
   - General relativity treats gravity as spacetime curvature, while quantum theory describes forces as quantized particles.
   - No direct experimental framework has yet probed how quantum systems behave under curved spacetime.
2. **New Experimental Proposal**
   - Researchers propose a network of three entangled ytterbium atomic clocks placed at different elevations.
   - These would measure time dilation effects due to spacetime curvature, using quantum entanglement to amplify sensitivity.
   - Central feature: use of the W state (a robust form of quantum entanglement).
3. **Scientific Significance**
   - Could provide the first laboratory probe of spacetime curvature with quantum systems.
   - Would test if foundational principles — unitarity, linearity, Born rule — hold true under gravity.
   - Deviations may hint at new physics beyond the Standard Model.
4. **Challenges**
   - Fragility of entangled states makes the experiment difficult.
   - Requires cutting-edge precision in quantum networking and timekeeping.
   - Currently at the boundary of experimental feasibility.

Entangled clocks may reveal where quantum physics and gravity meet

The new experimental design allows scientists to probe the interface between quantum theory and general relativity, a frontier that has so far been largely theoretical, it also illustrates that not all fundamental questions about the universe need ever-larger machines to look for the answers

Yasudevan Mukunth

One of the deepest puzzles in modern science is how quantum mechanics and general relativity – the two great pillars of 20th century physics – fit together. Quantum mechanics governs the microscopic world of atoms and subatomic particles. General relativity describes gravity and the structure of spacetime. Both theories are stunningly successful in their domains, but they don't yet combine into a single unified framework. A central difficulty lies in testing where the two theories might meet. While quantum experiments often take place in controlled laboratories, the effects of spacetime curvature are usually faint and detectable only on astronomical scales.

A new study by Jacob Covey, Igor Pikovski, and Johannes Borregaard, all from universities in the U.S., has proposed a new way to probe this intersection. By using a distributed network of atomic clocks, they outline an experiment that could directly reveal how quantum systems behave in curved spacetime. Their approach uses advances in atomic physics, quantum networking, and precision timekeeping to make a once-outlandish idea a real experimental possibility.

"The interplay between quantum theory and gravity is one of the most challenging problems in physics today, but also fascinating," Igor Pikovski, one of the co-authors and assistant professor in the School of Engineering and Science at the Stevens Institute of Technology in the U.S., said in a statement.

The study was published in *PRX Quantum* in July. A complementary theoretical work co-authored by Borregaard and Pikovski appeared in *Physical Review Research* in May.

Sensing the curve

For more than a century, physicists have dreamed of bridging quantum mechanics and gravity. Efforts generally fall into two categories. One is the search for a full theory of quantum gravity, where gravity itself is quantised like the other forces of nature. For example, the electromagnetic force is quantised as photons, the particles of light. The goal in this category is to develop a theory that can explain the universe's gravitational features using hypothetical particles called gravitons.

The other category has a more modest goal: exploring how ordinary quantum systems behave in a spacetime already curved by gravity. This approach does not require speculative new theories but still asks foundational questions. For example, do basic quantum principles like unitarity, linearity, and the Born rule still hold?

Thus far, most laboratory experiments have only tested quantum mechanics with the assumption that gravity is a simple force that pulls objects towards a heavier mass. For example, neutron bouncing experiments and atom interferometers have shown phase shifts induced by the earth's gravitational potential, but they haven't probed deeper effects due to relativity.

One such effect is the curvature of spacetime. That is, according to the general theory of relativity, a massive object will curve spacetime around itself. When a lighter body passes through this region of spacetime, it will naturally be deflected along the curved path. The apparent force responsible for the deflection is said to be gravity. This is why, for example, the moon is said to be in orbit around the earth: it's simply moving along the spacetime curved by the earth's mass.

A tell-tale feature of curvature is that time doesn't just flow differently at two points: it changes nonlinearly across space. For example, the difference between the time measured by two clocks 1 km and 2 km away from the earth's surface is not exactly the same as the difference between the time measured by two clocks 3 km and 4 km away. This disparity is a direct sign that the spacetime that the clocks inhabit is curved.

Measuring this in an experiment will require the setup to compare data from at least three locations simultaneously.

The overarching goal is to (i) set up a purely quantum system, then (ii) look for the effects of curved spacetime in the properties of the system. If scientists spot any effects, they will demonstrate an intersection of (post-Newtonian) gravity and quantum physics.

In the new study, the authors have proposed building a network of three entangled atomic clocks, separated by kilometer scale elevation differences, that act together as one "distributed clock." By doing so, they say they can directly test how curved spacetime influences quantum interference patterns in the clock.

If this experimental setup is successful, it could be the first laboratory probe of spacetime curvature using quantum systems – a major leap forward.

The researchers designed a protocol based on cutting-edge quantum networking and atomic clock technologies. At its heart is a state of entanglement called the W state.

A resilient friendship

In quantum physics, particles like electrons or photons can be linked in such a way that what happens to one instantly affects the others. This strange connection is called entanglement. It's one of the most important resources for quantum technologies like quantum computers and quantum communication.

The W state is a particular example of entanglement involving three or more particles. Imagine you have three quantum bits (qubits). The W state looks something like the following: One qubit is in the state 1 (excited) and the others are in 0 (not excited). But you do not know which one is the 1. Instead, all three possibilities – first is 1 *or* second is 1 *or* third is 1 – are combined together in a balanced quantum superposition. In other words, exactly one of the three qubits is 1 but in a perfectly shared way across all three.

The W state has a very robust kind of entanglement. Even if you lose one of the particles, the others are still entangled with each other. This is different from another famous entangled state, the GHZ state, which completely loses its entanglement if you remove a particle.

Think of three friends sharing a secret. In a GHZ state, if one friend leaves, the secret is lost. In a W state, even if one friend leaves, the two remaining friends still share part of the secret. That's why physicists like the W state: it's more resilient.

A ytterbium lattice atomic clock. For representational purposes only. AFP

> The interplay between quantum theory and gravity is one of the most challenging problems in physics today, but also fascinating
>
> IGOR PIKOVSKI
> ASSISTANT PROFESSOR IN THE SCHOOL OF ENGINEERING AND SCIENCE AT THE STEVENS INSTITUTE OF TECHNOLOGY

The quantum symphony

The new protocol proposes to use ytterbium atoms as the qubits. Some property of the atoms changes back and forth in periodic fashion, like a clock ticking. Each atom will experience time differently because of its position in the earth's gravity. After evolving for some time, the three states are recombined and measured. If the atoms' W state has been affected by curved spacetime, scientists should expect to measure 'shifts' in the property's value corresponding to the time-dilation between the three pairs of atoms. That is, these shifts will carry the imprint of the curvature itself.

According to the researchers' analysis, this proposed setup could in principle resolve small shifts in the atoms' frequency. For example, when the atoms are separated by 1 km through earth's gravitational field and individual ytterbium atoms are able to hold their quantum state for around 50 seconds (called the coherence time), the frequency shifts could be of the order of 0.02 Hz. This shift would be easy to measure. And while the coherence time is very high, it's within reach of modern technologies – if only just.

"Implementing the scheme proposed by Covey and his colleagues is currently at the limit of what is experimentally possible," Djordje Minic, a professor of physics at Virginia Tech in the U.S. and who was not affiliated with the study, wrote in a commentary in *APS Physics*. "The main difficulty is the inevitable fragility of the required collective, entangled state."

That said, the implications of such an experiment are far-reaching. First, it would mark a major step in experimentally probing the interface between quantum theory and general relativity, a frontier that has so far been largely theoretical. Direct evidence that quantum coherence and interference persist in curved spacetime would strengthen confidence in the universality of quantum mechanics.

Second, the experiment can be modified to test unitarity, linearity, and the Born rule under the influence of curved spacetime, which would address some of the most fundamental open questions in physics. If quantum mechanics were a symphony, linearity means all possible notes can be played at once, unitarity ensures the music never loses its rhythm or energy, and the Born rule means that when you finally listen, you hear one clear melody rather than a cacophony.

If scientists observe any deviations, it could be a sign of new physics beyond standard quantum theory. Even a null result – that everything behaves as expected – would provide valuable confirmation that no hidden breakdowns occur at this scale.

These three facets "are central to the structure, evolution, and measurement of quantum states," Minic wrote. "The main novelty of the team's approach is that it combines several advances made in the past decade on neutral atoms and trapped ions to achieve a new, unique quantum probe of curved spacetime."

Room to be clever

"We assume that quantum theory holds everywhere – but we really don't know if this is true," Pikovski said. "It might be that gravity changes how quantum mechanics works. In fact, some theories suggest such modifications, and quantum technology will be able to test that."

Third, the methodology opens doors for further exploration. By refining entangled atomic networks, scientists could probe more extreme gravitational environments, perhaps even onboard satellites, where larger separations and nearly-zero-noise environs are possible. Such systems could one day serve as sensitive detectors for exotic entities like dark matter and gravitational waves.

For students and young researchers, the new study also illustrates that some of the most fundamental questions about the universe can be addressed not by building ever-larger machines but also by cleverly combining precision tools scientists already have. The dream of uniting quantum mechanics and relativity may still be distant but experiments like this one could bring it tangibly closer.

In this visual metaphor, the pillow is like spacetime and the heavy ball could be the earth or the sun. The mass bends spacetime around itself. When another body traverses this area, it follows a curved path. IMAGE CREATED WITH CHATGPT 5

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Broader Implications

- **For Physics:** Could bridge the gap between relativity and quantum theory, providing evidence for or against modifications in quantum mechanics under gravity.
- **For Technology:** Precision entangled clocks may evolve into tools for detecting dark matter, gravitational waves, or anomalies in spacetime.
- **For Science Policy:** Shows that fundamental breakthroughs don't always require massive infrastructure (like particle colliders); clever use of quantum technologies can also answer big questions.

Conclusion

The proposal to use entangled atomic clocks as quantum probes of curved spacetime represents a paradigm shift in experimental physics. If successful, it would bring humanity closer to unifying two foundational yet incompatible theories. Even null results would strengthen confidence in the universality of quantum mechanics.

UPSC Prelims Practice Question

Ques: Consider the following statements about "Entangled Atomic Clocks":

1. They can be used to probe spacetime curvature caused by gravity.

2. The "W state" entanglement used in such clocks is relatively more robust.

3. Such experiments are possible only at astronomical scales.

Which of the above is/are correct?

(A) 1 and 2 only

(B) 2 and 3 only

(C) 1 and 3 only

(D) 1, 2 and 3

Ans: A)

UPSC Mains Practice Question

Ques: Reconciling quantum mechanics with general relativity remains one of the greatest challenges in modern science. Discuss this challenge in the context of the recently proposed experiment using "Entangled Atomic Clocks." **(150 Words)**

Page : 08 :GS 3 : Agriculture

M.S. Swaminathan, often hailed as the *"Father of the Green Revolution in India"*, played a decisive role in achieving food self-sufficiency during the 1960s when India faced recurring droughts and dependence on PL-480 wheat imports from the U.S. His scientific vision, global collaboration, and ability to work with political leadership transformed India from a "ship-to-mouth" nation to a food surplus country. As India aspires for *Viksit Bharat@2047*, Swaminathan's life and work hold enduring lessons on the synergy of science, leadership, and institution-building.

A tribute to M.S. Swaminathan, 'the man who fed India'

The Viksit Bharat aspiration, which has gained considerable momentum, will require a significant development of scientific capability, and some of this, especially in the new digital economy, will have to be *aatmanirbhar*. There is much to learn in this context from the most successful experiment in *atmanirbharata* in the past, which was the achievement of food self-sufficiency in the 1960s. M.S. Swaminathan was the man who did it and he was a living hero to all of us. This is the centenary year of his birth and it has seen the publication of a new biography, *M.S. Swaminathan: the Man who Fed India*, by Priyambada Jayakumar.

Ms. Jayakumar had the benefit of detailed discussions with him on both the personal and professional side of his life and she has produced a book which is a great read. However, in this article, I will focus on some lessons from his experience which have relevance for the future.

The planting of a seed of an idea

Scientific advancement was at the core of the Green Revolution and the book brings out that such advances are not achieved by dedicated scientists working in isolation in a lab. They involve collaboration with other scientists and a cross-fertilisation of ideas. It was known that wheat productivity could be increased through application of fertilizers and other inputs, but the problem was that the higher weight of grains caused the plant to bend and lodge if the stalk was not strong enough. Swaminathan was trying to use radiation to develop a genetic mutation that would have a stronger stalk, but this approach was not getting anywhere.

In 1958, a Japanese scientist visiting Delhi told Swaminathan that a dwarf wheat variety developed in Japan, and which had a shorter, stronger stalk, could hold the higher weight of grain without bending. Swaminathan found that the new variety had been taken to the United States where a seed breeder was working on it. The breeder told Swaminathan that they were developing a winter variety, which would not be suitable for India, but Norman Borlaug in Mexico was developing a different variety that might work. As it happened, Swaminathan had met Borlaug earlier at a seminar in the U.S. He was able to persuade him to send a small quantity of his Mexican seeds to India. These seeds did well and Swaminathan wanted to invite Borlaug to come to India to discuss ways of adapting these varieties to Indian conditions.

The proposal to invite Borlaug was promptly approved by the Director of the Indian Agricultural Research Institute (IARI) in 1960 but it took more than two years to get the bureaucratic approvals needed to send the invitation and Borlaug arrived only by March 1963.

Swaminathan often quoted Pandit Nehru's phrase, "everything can wait but not agriculture", but the bureaucracy was clearly unaware of it. It is interesting to speculate on what would have been the benefits if the Green Revolution had come two years earlier. The important lesson is that for science to flourish, our scientists must be much better connected to relevant scientists abroad and become familiar with cutting-edge work in their field. This means they should travel more freely to attend conferences abroad and build personal contacts, all of which means bureaucratic control must be drastically reduced.

The next step was to subject the seeds to trials on the fields of actual farmers. Swaminathan could not get the Ministry to fund the effort. Fortunately, Lal Bahadur Shastri, who became Prime Minister in 1964, wanted to give higher priority to agriculture and for this purpose appointed C. Subramaniam as Minister of Agriculture. This made a critical difference. Subramaniam called about 20 agricultural scientists for a meeting to hear their views on how to increase food production. When Swaminathan was asked to speak, he frankly told the Minister that he had identified the new seeds that would solve the problem, but the Ministry was unable to fund the necessary trials. Subramaniam promptly called for the file and ensured that the funds were provided. It is a pity that we have no record of what the other scientists said in the meeting, and in particular whether the more senior scientists (Swaminathan was then only 39) had a different view.

The politician needs to listen to the scientist

This yields the second important lesson. In dealing with complex technical issues, the political leadership must hear the scientists/technical people involved directly instead of relying on the generalist bureaucracy to convey their views. Swaminathan greatly admired Pandit Nehru's commitment to science, but the book brings out that he soon realised that this "had few takers even in his own government, ministries and the bureaucracy". On page 48 the author puts it bluntly: "Most ministers barely supported, understood, or believed in research and development.... this was also true of the Agriculture Minister in 1958.. (who) would order scientists like Swaminathan to go into the field and 'sort out the problems' without really understanding the ground realities."

One of the reasons China has done so well on the economic and technical front is that Ministers are usually technically qualified people, often engineers with a track record of successful management. Subramaniam exemplified that type of political leader: he was a physics graduate and had a good knowledge of science. If we want to achieve Viksit Bharat, and explore new and increasingly complex areas of science, we will need many more such Ministers in the years ahead, not only at the Centre but also in the States.

The field trials were a great success and the next step was to roll out the Green Revolution across the country. This required importing 18,000 tonnes of seed – the largest seed shipment in history – costing ₹5 crore in foreign exchange. There were objections from many fronts. The Finance Ministry was not happy releasing that much foreign exchange. The Planning Commission opposed the proposal on the grounds that it did not believe that the new seeds would do better than what we already had. The Left also opposed the move because the seeds were developed under a grant from a U.S. institution (the Rockefeller Foundation).

Shastri was understandably concerned about these conflicting views. Fortunately, Swaminathan persuaded him to visit the IARI to see for himself how the new wheat was doing. Shastri was convinced and the import of new seeds was duly approved. Tragically, Shastri passed away in January 1966 but Indira Gandhi, who took over as the next Prime Minister, also gave Swaminathan full backing.

The lesson is that when dealing with new and untried ideas, there will always be conflicting opinions even among so-called experts. It is important that all the different points of view are appropriately aired and considered. However, this process may not always result in a consensus. In such a situation, a decision has to be taken at the highest level. Once taken, the thing to do is to back the effort fully. But it must also be subjected to truly independent monitoring, with course corrections.

In the case of the Green Revolution, the results were amply evident within a few years. We reaped a bounteous wheat harvest in 1968 and we were able to start phasing out PL 480 imports. Over time, new problems arose. The excessive dependence on water and also fertilizer use led to environmental problems. Swaminathan himself, having left the government by then, warned about the corrections needed to make the Green Revolution environmentally sustainable. It is a pity that we are yet to implement these corrections.

The issues India needs to look at

Looking ahead, we know that climate change will have a severely negative effect on agricultural productivity. Once again, science will be critical and much will depend upon the performance of our research institutions. India was ahead of China in agricultural research in the late 1960s, but today, China has eight agricultural research institutions in the world's top 10 and India does not have any in the top 200. One reason is inadequate funding: we spend only 0.43% of our agricultural GDP on research and development, whereas the percentage in China is twice our level. But there is also the issue of the quality. Do our agricultural research institutions have the institutional autonomy and governance structure that they need to recruit and promote meritorious scientists? And can we ensure that our top agricultural scientists have the kind of access to political decision makers that Swaminathan had?

Filling these gaps is the best way of really honouring M.S. Swaminathan. And the lessons are relevant for other areas of scientific development also.

Montek Singh Ahluwalia
is Distinguished Fellow, Centre for Social and Economic Progress

There is much to learn from one of India's most successful experiments — the achievement of food self-sufficiency in the 1960s and the scientist who made it possible

Key Lessons from Swaminathan's Experience

1. **Collaboration & Global Networking in Science**
   - Breakthroughs in agriculture emerged not from isolated lab work but from cross-border collaboration (e.g., accessing Borlaug's Mexican wheat varieties).
   - Lesson: Indian scientists must be globally networked and bureaucratic hurdles limiting international exchange must be reduced.
2. **Political Support to Scientific Advice**
   - Leaders like Lal Bahadur Shastri and Agriculture Minister C. Subramaniam directly engaged with Swaminathan, bypassing bureaucratic indifference.
   - Lesson: Complex technical challenges require decision-makers to consult scientists directly, not rely solely on generalist bureaucrats.
3. **Decisive Leadership Amid Conflicting Opinions**
   - Despite resistance from the Finance Ministry, Planning Commission, and ideological critics, Shastri and Indira Gandhi backed large-scale seed imports.
   - Lesson: Political will and risk-taking are essential for transformative reforms; once a decision is made, it must be supported but also independently monitored.
4. **Balancing Productivity with Sustainability**
   - While the Green Revolution solved food shortages, it created ecological challenges—water overuse, fertilizer dependence, and soil degradation.
   - Lesson: Scientific progress must anticipate long-term sustainability; Swaminathan himself advocated an "Evergreen Revolution."
5. **Strengthening Agricultural Research**
   - India once led Asia in agricultural research, but today lags behind China. Funding (0.43% of agri-GDP), institutional autonomy, and quality governance remain weak.
   - Lesson: Investment in R&D, merit-based recruitment, and scientist-policy engagement are vital to face new challenges like climate change.

Relevance for India's Future

- **Climate change** will adversely affect crop yields — demanding breakthroughs in climate-resilient agriculture.
- **Food and nutritional security** remain core to human development and social stability.
- As India moves toward **self-reliance in critical technologies (aatmanirbharata)**, Swaminathan's model shows how scientific excellence, policy support, and global partnerships can create lasting impact.

Conclusion

M.S. Swaminathan's legacy goes beyond the Green Revolution; it lies in demonstrating how science, when backed by vision and political courage, can change the destiny of a nation. Honouring him today means not only celebrating past achievements but also committing to a new scientific revolution — one that ensures food security, sustainability, and climate resilience. As India charts its path to *Viksit Bharat*, Swaminathan's life remains a guiding beacon on how to combine **science, leadership, and institutional reform** for national transformation.

UPSC Prelims Practice Question

Ques: Consider the following statements regarding the Green Revolution in India:

1. M.S. Swaminathan is often referred to as the Father of the Green Revolution in India.

2. The Green Revolution in India initially focused on wheat and rice.

3. It led to complete elimination of food imports under PL-480 immediately in 1963.

Which of the statements given above is/are correct?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

Ans : a)

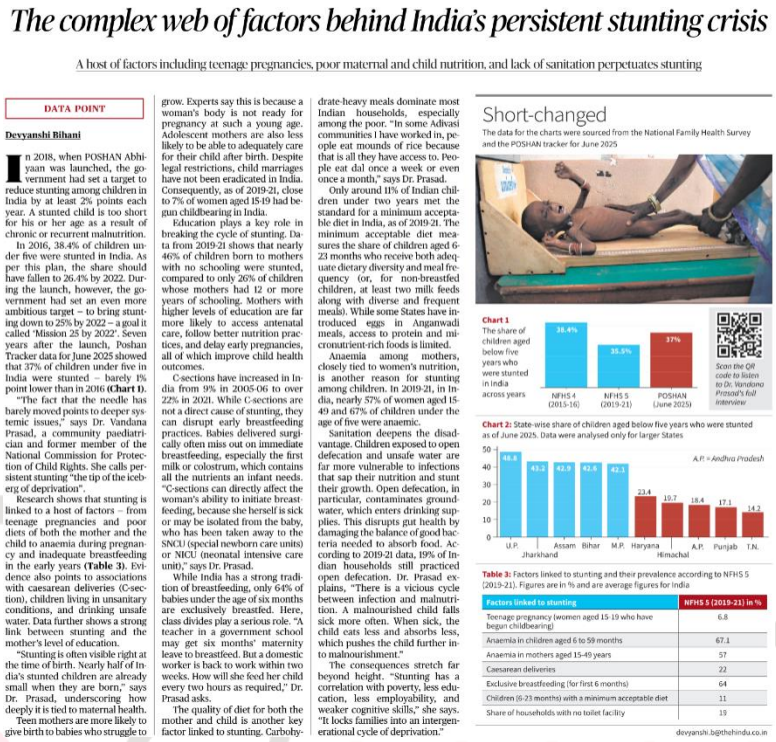
UPSC Mains Practice Question

Ques : The Green Revolution ensured food self-sufficiency but also created long-term environmental challenges. Critically examine the lessons it holds for India's future agricultural policies in the context of climate change. **(150 Words)**

Page 09 : GS 2 : Social Justice

Despite ambitious targets under **POSHAN Abhiyaan (2018)** and "Mission 25 by 2022," India continues to grapple with alarmingly high rates of stunting. As per *Poshan Tracker (June 2025)*, **37% of children under five** remain stunted — barely a 1% decline since 2016. This stagnation reflects not just a failure of programmes but deep-rooted structural determinants of maternal and child health.

Factors Contributing to Persistent Stunting



The complex web of factors behind India's persistent stunting crisis

A host of factors including teenage pregnancies, poor maternal and child nutrition, and lack of sanitation perpetuates stunting

DATA POINT

Devyanshi Bihani

In 2018, when POSHAN Abhiyaan was launched, the government had set a target to reduce stunting among children in India by at least 2% points each year. A stunted child is too short for his or her age as a result of chronic or recurrent malnutrition.

In 2016, 38.4% of children under five were stunted in India. As per this plan, the share should have fallen to 26.4% by 2022. During the launch, however, the government had set an even more ambitious target – to bring stunting down to 25% by 2022 – a goal it called 'Mission 25 by 2022'. Seven years after the launch, Poshan Tracker data for June 2025 showed that 37% of children under five in India were stunted – barely 1% point lower than in 2016 **(Chart 1)**.

"The fact that the needle has barely moved points to deeper systemic issues," says Dr. Vandana Prasad, a community paediatrician and former member of the National Commission for Protection of Child Rights. She calls persistent stunting "the tip of the iceberg of deprivation".

Research shows that stunting is linked to a host of factors – from teenage pregnancies and poor diets of both the mother and the child to anaemia during pregnancy and inadequate breastfeeding in the early years **(Table 3)**. Evidence also points to associations with caesarean deliveries (C-section), children living in unsanitary conditions, and drinking unsafe water. Data further shows a strong link between stunting and the mother's level of education.

"Stunting is often visible right at the time of birth. Nearly half of India's stunted children are already small when they are born," says Dr. Prasad, underscoring how deeply it is tied to maternal health.

Teen mothers are more likely to give birth to babies who struggle to grow. Experts say this is because a woman's body is not ready for pregnancy at such a young age. Adolescent mothers are also less likely to be able to adequately care for their child after birth. Despite legal restrictions, child marriages have not been eradicated in India. Consequently, as of 2019-21, close to 7% of women aged 15-19 had begun childbearing in India.

Education plays a key role in breaking the cycle of stunting. Data from 2019-21 shows that nearly 46% of children born to mothers with no schooling were stunted, compared to only 26% of children whose mothers had 12 or more years of schooling. Mothers with higher levels of education are far more likely to access antenatal care, follow better nutrition practices, and delay early pregnancies, all of which improve child health outcomes.

C-sections have increased in India from 9% in 2005-06 to over 22% in 2021. While C-sections are not a direct cause of stunting, they can disrupt early breastfeeding practices. Babies delivered surgically often miss out on immediate breastfeeding, especially the first milk or colostrum, which contains all the nutrients an infant needs. "C-sections can directly affect the woman's ability to initiate breastfeeding, because she herself is sick or may be isolated from the baby, who has been taken away to the SNCU (special newborn care units) or NICU (neonatal intensive care unit)," says Dr. Prasad.

While India has a strong tradition of breastfeeding, only 64% of babies under the age of six months are exclusively breastfed. Here, class divides play a serious role. "A teacher in a government school may get six months' maternity leave to breastfeed. But a domestic worker is back to work within two weeks. How will she feed her child every two hours as required," Dr. Prasad asks.

The quality of diet for both the mother and child is another key factor linked to stunting. Carbohydrate-heavy meals dominate most Indian households, especially among the poor. "In some Adivasi communities I have worked in, people eat mounds of rice because that is all they have access to. People eat dal once a week or even once a month," says Dr. Prasad.

Only around 11% of Indian children under two years met the standard for a minimum acceptable diet in India, as of 2019-21. The minimum acceptable diet measures the share of children aged 6-23 months who receive both adequate dietary diversity and meal frequency (or, for non-breastfed children, at least two milk feeds along with diverse and frequent meals). While some States have introduced eggs in Anganwadi meals, access to protein and micronutrient-rich foods is limited.

Anaemia among mothers, closely tied to women's nutrition, is another reason for stunting among children. In 2019-21, in India, nearly 57% of women aged 15-49 and 67% of children under the age of five were anaemic.

Sanitation deepens the disadvantage. Children exposed to open defecation and unsafe water are far more vulnerable to infections that sap their nutrition and stunt their growth. Open defecation, in particular, contaminates groundwater, which enters drinking supplies. This disrupts gut health by damaging the balance of good bacteria needed to absorb food. According to 2019-21 data, 19% of Indian households still practiced open defecation. Dr. Prasad explains, "There is a vicious cycle between infection and malnutrition. A malnourished child falls sick more often. When sick, the child eats less and absorbs less, which pushes the child further into malnourishment."

The consequences stretch far beyond height. "Stunting has a correlation with poverty, less education, less employability, and weaker cognitive skills," she says. "It locks families into an intergenerational cycle of deprivation."

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Short-changed

The data for the charts were sourced from the National Family Health Survey and the POSHAN tracker for June 2025

Chart 1
The share of children aged below five years who were stunted in India across years

38.4%
35.5%
37%
NFHS 4 (2015-16)
NFHS 5 (2019-21)
POSHAN (June 2025)

Scan the QR code to listen to Dr. Vandana Prasad's full interview

Chart 2: State-wise share of children aged below five years who were stunted as of June 2025. Data were analysed only for larger States

A.P. = Andhra Pradesh

48.8 43.2 42.9 42.6 42.1 23.4 19.7 18.4 17.1 14.2
Jharkhand Assam Bihar M.P. Haryana Himachal A.P. Punjab T.N.

Table 3: Factors linked to stunting and their prevalence according to NFHS 5 (2019-21). Figures are in % and are average figures for India

Factors linked to stunting	NFHS 5 (2019-21) in %
Teenage pregnancy (women aged 15-19 who have begun childbearing)	6.8
Anaemia in children aged 6 to 59 months	67.1
Anaemia in mothers aged 15-49 years	57
Caesarean deliveries	22
Exclusive breastfeeding (for first 6 months)	64
Children (6-23 months) with a minimum acceptable diet	11
Share of households with no toilet facility	19

1. **Maternal Health and Teenage Pregnancies**
   - Nearly half of stunted children are already small at birth.
   - Adolescent pregnancies (7% among women aged 15–19) worsen risks due to immaturity and inadequate childcare capacity.
2. **Education of Mothers**
   - Strong correlation: **46% of uneducated mothers vs. 26% with 12+ years of schooling**.
   - Education delays early pregnancies, improves antenatal care and nutrition practices.
3. **Poor Infant & Young Child Feeding (IYCF) Practices**
   - Rise in C-sections (9% in 2005 → 22% in 2021) disrupts early breastfeeding.
   - Only **64% of infants under six months exclusively breastfed**.
   - Structural inequalities: working-class mothers lack maternity leave, reducing feeding frequency.
4. **Dietary Quality & Micronutrient Deficiency**
   - Carbohydrate-heavy diets dominate, with limited access to protein-rich foods.
   - Only **11% of children under 2 years** meet the Minimum Acceptable Diet standard.
   - **Anaemia prevalence:** 57% women (15–49 yrs) and 67% children under 5.
5. **Sanitation and Environment**
   - **19% households still practice open defecation**, contaminating water and food chains.
   - Recurrent infections weaken nutrient absorption → vicious cycle of malnutrition and illness.

Consequences

- **Cognitive Deficits**→ lower learning outcomes, reduced productivity.
- **Economic Costs**→ reduced employability, perpetuating intergenerational poverty.
- **Public Health Burden**→ higher morbidity and healthcare expenditure.

Way Forward

1. **Strengthening POSHAN 2.0** with a focus on dietary diversity (eggs, pulses, micronutrients).
2. **Delaying Early Pregnancies** via enforcement of child marriage laws, adolescent health programmes.
3. **Women's Education & Empowerment** as a structural long-term solution.
4. **Maternal Health & Anaemia Reduction** – strengthen iron-folic acid supplementation, antenatal care outreach.
5. **Infant and Young Child Feeding Support** – extend maternity benefits, regulate unnecessary C-sections, and provide breastfeeding support.
6. **WASH (Water, Sanitation, Hygiene) Interventions** – sustained focus on safe water and elimination of open defecation.

Conclusion

India's stunting crisis is not merely a nutritional shortfall but a **multi-dimensional deprivation rooted in maternal health, social inequities, and sanitation gaps**. Tackling it requires a **life-cycle approach** — investing in girls' education, delaying marriage, ensuring maternal nutrition, and improving sanitation. Without addressing these systemic determinants, India risks perpetuating a cycle of poor health, low productivity, and intergenerational poverty despite well-meaning programmes.

UPSC Mains Practice Question

Ques: Despite several nutrition programmes like POSHAN Abhiyaan, India has witnessed only marginal progress in reducing child stunting. Examine the major factors behind this persistence and suggest a way forward. **(150 Words)**

Page 09 : GS 2 : International Relation

As India and China mark **75 years of diplomatic relations (2025)**, recent developments — resumption of the Kailash Manasarovar Yatra, ministerial visits, and high-level meetings — signal a tentative thaw. Yet, bilateral engagement continues to be defined by **strategic ambiguity, border tensions, and cautious diplomacy**. The article invokes the **Nalanda tradition** of intellectual and cultural exchanges to argue for a deeper, more confident framework of cooperation.

Civilisational Connect

- **Historical Exchanges:** Ancient links through monks like **Xuanzang, Faxian, Yijing**, who studied at Nalanda, highlight centuries of knowledge-sharing.
- **Nalanda as Symbol:** Represents intellectual diplomacy, peaceful dialogue, and "*Aa kratavo yantu viśvata*" — openness to *no bhadra* ideas.
- **Philosophical Roots:** Shared traditions of **Vasudhaiva Kutumbakam** (India) and **harmonious coexistence** (China) historically bound the two societies.

Breaking down the Chinese wall

As India and China commemorate 75 years of diplomatic engagement this year, strong signs of a diplomatic thaw have emerged. The meeting between Defence Minister Rajnath Singh and his Chinese counterpart, Admiral Dong Jun, on the sidelines of the Shanghai Cooperation Organisation Defence Ministers' meeting in January; resumption of the Kailash Manasarovar Yatra in June; and Chinese Foreign Minister Wang Yi's two-day visit to India this week all offer glimpses of warmth.

A meeting point for two worlds

Long before modern diplomacy took shape, and borders were established and redrawn, the relationship between India and China was nurtured by something more enduring: the shared pursuit of knowledge. As early as the first millennium CE, Chinese monks such as Faxian, Xuanzang, and Yijing journeyed across treacherous landscapes to reach Indian centres of learning. At the heart of this exchange stood Nalanda, where ideas flowed more freely than goods, and religious belief and secular inquiry coexisted in harmony. Nalanda was a meeting point of the two worlds, where cultural and intellectual connections flourished far beyond the concerns of modern statehood. In the quest to revive Nalanda today, there is more than nostalgia; there is hope to rebuild the kind of meaningful, respectful engagement that once defined our ties.

Nalanda, both as an institution and as a philosophy, has long embodied a commitment to peace, dialogue, and intellectual diplomacy. It's enduring spirit lives on in its motto – "*Aa no bhadra kratavo yantu viśvata* (let noble thoughts come to us from all directions)." This same spirit lives on in the idea of *Vasudhaiva Kutumbakam* (the world as one family). This way of thinking has, for centuries, held together the threads of exchange between India and China.

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Anushka Padmanabh Antrolikar

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Just as Nalanda once created space for dialogue and learning between civilisations, perhaps today too, India can draw from that spirit to shape how it engages with China

Since the time of Xuanzang, scholars, teachers, and students from both nations have engaged in meaningful interaction, unimpeded by the boundaries that define the modern state. Today, the space for such academic and cultural exchange seems to be narrowed. Should contemporary political complexities necessarily limit the flow of ideas between two ancient civilisations? Stalling of trade, recurring military confrontations, and hundreds of academic or people-to-people connections awaiting bureaucratic clearance have created a kind of stillness, one that feels far removed from the natural flow of exchange that once defined our ties. Why must scholars on either side require permission to engage in dialogue, or students hesitate before considering an academic exchange with institutions of global standing across the border?

There is immense potential for mutual learning. India can look to China's initiatives in areas such as food security, local infrastructure development, or grassroots entrepreneurship. And China's academic and policy community may find value in studying India's democratic decentralisation, open civil society engagement, or digital public goods framework. These are not points of comparison, but possible pathways of collaborative learning.

In this light, one wonders: why does India's engagement with China remain so carefully limited? Why does strategic ambiguity continue to define a relationship rooted in shared intellectual history? How can we move from reactive diplomacy towards a more confident, future-facing framework that honours the depth of our civilisational ties, while meeting the complexities of the present? How do we deal with the emergence of 'the gatekeeper states,' limiting the range of possibilities?

The Nalanda way

Just as Nalanda once created space for dialogue and learning between civilisations, perhaps today too, we can draw from that spirit to shape how we engage with China. There will always be areas where our paths differ: on the border, in trade, or in the way we see the region around us. But Nalanda reminds us that disagreement does not have to mean disengagement. It is possible to hold firm where we must, and still stay open to conversations where they matter.

This approach also calls for some reflection on how we prepare ourselves. We don't need to change our principles, but we may need to adapt how we practice them. Investing in stronger academic and policy research on China, allowing smoother academic exchanges in areas such as environment, health, and culture, and building long-term people-to-people connections are quiet but important steps. Nalanda drew its strength from more than just being a beacon of knowledge.

At the heart of Nalanda's tradition were values that still feel close to us: curiosity, compassion, and the transformative power of knowledge. Scholars such as Śīlabhadra, who taught the Chinese monk Xuanzang, showed that learning could also be a form of diplomacy. Nalanda wasn't just India's; it was also a place of deep importance to generations of Chinese scholars who carried its teachings home and helped shape the intellectual and spiritual fabric of East Asia. Today, perhaps these principles matter even more. If India and China can draw from this shared legacy with genuine intention, they may find a way to engage with each other more thoughtfully. Curiosity without fear, dialogue without suspicion, and clarity without aggression could be the beginning of a steadier path built on understanding and mutual respect. We need to break down our Chinese wall to move beyond the paranoia that sustains our China policy.

Contemporary Challenges

1. **Border Issues:** Recurring create confrontations (e.g., Galwan 2020) mistrust.
2. **Trade & Economy:** Despite $136 billion trade (2024), imbalances persist, with limited diversification of cooperation.
3. **Restricted Exchanges:** Academic and policy collaborations, people-to-people ties, dialogues face bureaucratic hurdles.
4. **Geopolitics:** India's Indo-Pacific China's engagement, Quad membership, and assertiveness in South Asia constrain trust.
5. **Perception Gap:** India sees China through a **security lens**, while China often dismisses Indian concerns as regional balancing.

Opportunities for Engagement

- **Mutual Learning:**
  - India → China: lessons in food security, local infrastructure, grassroots entrepreneurship.
  - China → India: democratic decentralisation, civil society engagement, digital public goods.
- **Thematic Cooperation:** Climate change, public health, AI & technology governance, and cultural heritage preservation.

- **Academic Diplomacy:** Strengthening **China studies in India**, easing student & scholar exchanges, and fostering think-tank collaborations.

The Nalanda Approach

- **Disagreement ≠ Disengagement:** Even with border and trade disputes, channels of dialogue must remain open.
- **Soft Power & Intellectual Diplomacy:** Investment in culture, research, and education as quiet but impactful forms of engagement.
- **Values for Engagement:** Curiosity (learning without fear), Dialogue (without suspicion), and Clarity (without aggression).

Conclusion

India–China relations are shaped by both **strategic competition** and **civilisational connectedness**. The Nalanda legacy reminds us that **ideas and dialogue can bridge divides where politics fails**. For India, breaking down the "Chinese wall" requires moving beyond paranoia to pursue **principled yet pragmatic engagement** — firm on sovereignty but open in knowledge and culture. This balanced approach could stabilise ties and create space for cooperation even amidst rivalry.

UPSC Mains Practice Question

Ques: India–China relations appear trapped between conflict and cooperation. In this context, discuss how cultural and intellectual diplomacy can provide a framework for sustained engagement. **(150 Words)**

Page : 08 Editorial Analysis

Making India's climate taxonomy framework work

In May this year, the Ministry of Finance released India's draft Climate Finance Taxonomy for public consultation. As a foundational tool, the taxonomy aims to mobilise climate-aligned investments, prevent greenwashing, and clarify for investors which sectors, technologies and practices contribute to mitigation, adaptation, or transition. Importantly, the document calls itself a "living" framework, adaptable to India's evolving priorities and international obligations. However, its success as a credible governance tool will depend on how it operationalises this principle.

The review architecture

Herein is a proposed review mechanism that is structured for the taxonomy, drawing from the recent regulatory innovations under the Paris Agreement's Article 6.4 Mechanism. The Article 6.4 Supervisory Body has adopted a legal and editorial review system for climate market instruments. These principles offer a useful reference for India's taxonomy to ensure investor confidence, legal clarity, and domestic-international alignment.

The review system for the climate finance taxonomy should function on two complementary levels. First, there must be a periodic review mechanism that allows for timely course correction.

These reviews should be annual and triggered by implementation gaps, evolving international obligations, stakeholder feedback, or policy changes. To be effective, they must follow a structured and predictable process, with fixed timelines, clear documentation protocols, and mandatory public consultation.

Alongside this, a recurring review should be institutionalised every five years. This deeper, more comprehensive, process would reassess the taxonomy in light of emerging trends in carbon markets, shifts in global climate finance definitions, and lessons learned from sectoral transitions. A five-year cycle corresponds with India's updated Nationally Determined Contributions timeline and the global stocktake process under the United Nations Framework Convention on Climate Change. Together, these two levels of review would ensure that the taxonomy remains both responsive in the short term and resilient in the long term.

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This is important as the taxonomy's rollout coincides with critical developments in India's climate finance ecosystem

The substantive aspect of the review

Two key aspects must form the basis of any meaningful review: legal coherence and substantive content clarity. The legal assessment should examine the taxonomy's alignment with India's laws: Energy Conservation Act, SEBI norms, Carbon Credit Trading Scheme, and international obligations. The review should ensure enforceability, remove redundancies, clarify overlaps and harmonise terms. In addition, the review must identify interdependencies between climate finance mandates and other economic or fiscal measures such as green bonds, blended finance schemes, or environmental risk disclosures, so that revisional inconsistencies are avoided.

The substantive editorial review must ensure that the taxonomy remains readable, coherent and technically precise. Definitions must reflect evolving market standards and be usable by both experts and non-experts.

Where quantitative thresholds exist, for instance, greenhouse gas emissions reduction targets or energy efficiency benchmarks, these must be updated with empirical data and stakeholder input.

These reviews should ensure the taxonomy remains accessible for micro, small and medium enterprises, the informal sector, and vulnerable communities, crucial for net-zero goals, but which face barriers. It should provide simplified entry points, staggered compliance timelines, and proportionate expectations, especially in agriculture and small manufacturing.

Institutionalising accountability

To support such a review structure, the Ministry of Finance should establish a standing unit within the Department of Economic Affairs or an expert committee composed of stakeholders from financial regulators, climate science institutions, legal experts and civil society. Public dashboards can be developed to receive inputs, document implementation experiences and publish review reports. These measures will ensure the taxonomy evolves predictably and transparently

Annual review summaries and five-year revision proposals must be made available to the public, ideally in a consolidated format, to improve investor confidence and ease of access. This will also enable better coordination with parallel instruments such as India's carbon market mechanisms, disclosure obligations and green bond frameworks.

The taxonomy's rollout coincides with critical developments in India's climate finance ecosystem. The Carbon Credit Trading Scheme is expected to be fully operationalised, green bonds are entering mainstream portfolios, including on the stock market, and the pressure to align public investment flows with long-term climate goals is rising. A weak or opaque taxonomy will undercut these efforts. A 'living document' is only as effective as the process that keeps it alive through active review, transparent revision, and structured engagement. It is hoped that such consideration will form a part of the final climate taxonomy framework.

GS. Paper 03 Indian Economy

UPSC Mains Practice Question: India's draft Climate Finance Taxonomy has been described as a "living framework" to guide climate-aligned investments and curb greenwashing. Critically examine the need, review mechanism, and challenges of institutionalising accountability in this framework. Suggest measures to enhance its effectiveness. **(150 words)**

Context :

In **May 2025**, the **Ministry of Finance** released the draft **Climate Finance Taxonomy** — a tool to guide climate-aligned investments, curb greenwashing, and provide clarity on which sectors, technologies, and practices support **mitigation, adaptation, or transition**. By calling itself a *"living framework"*, it underscores adaptability. Its credibility, however, will depend on how effectively it institutionalises **review, coherence, and accountability**.

Why a Climate Taxonomy is Needed

- **Global alignment:** Helps India harmonise with international climate finance standards.
- **Investor clarity:** Identifies which investments truly qualify as green.
- **Curbing greenwashing:** Prevents companies from mislabeling projects as climate-friendly.
- **Policy integration:** Links with **carbon credit markets, SEBI norms, and green bonds**.
- **Net-zero pathway:** Ensures MSMEs, agriculture, and vulnerable sectors are not left behind.

Review Architecture

- **Annual Review:**
  - To address **implementation gaps** and adapt to new policies.
  - Must include **public consultation**, clear documentation, and fixed timelines.
- **Five-Year Review:**
  - Deeper, structural reassessment aligned with:
    - **India's updated NDCs** (Nationally Determined Contributions).
    - **Global stocktake under UNFCCC**.
  - Focus on carbon market shifts and lessons from sectoral transitions.

Key Substantive Aspects

1. **Legal Coherence:**
   - Alignment with **Energy Conservation Act, SEBI regulations, Carbon Credit Trading Scheme**.
   - Removal of overlaps and redundancies.
   - Integration with fiscal measures (green bonds, blended finance, ESG disclosures).
2. **Content Clarity:**
   - Accessible definitions and simplified compliance for **MSMEs and informal sector**.
   - Updating **emission thresholds and energy efficiency benchmarks** with empirical data.
   - Ensuring readability for both **experts and non-experts**.

Institutionalising Accountability

- **Expert Committee:** Within the **Department of Economic Affairs** with regulators, climate scientists, legal experts, civil society.
- **Public Dashboards:** To collect inputs, share implementation experiences, and publish reports.
- **Transparency:** Annual summaries and five-year revisions must be public.
- **Investor Confidence:** Coordination with **carbon market, disclosure norms, and green bonds**.

Significance

- Coincides with:
  - Rollout of **Carbon Credit Trading Scheme**.
  - Rising use of **green bonds** in stock markets.
  - Global pressure to align **public investment with long-term climate goals**.
- A weak or opaque taxonomy risks undermining investor trust and India's climate credibility.

Conclusion

India's Climate Taxonomy is a **pioneering governance tool** that can position India as a leader in sustainable finance. However, its promise as a *"living framework"* will only be realised if **reviews are timely, participation is broad, and accountability is institutionalised**. By ensuring legal clarity, accessibility, and transparency, the taxonomy can mobilise climate finance at scale while safeguarding against greenwashing — a crucial step in India's **net-zero journey**.