

The Hindu Important News Articles For UPSC CSE

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Page 04 : GS II : Indian Polity / Preliminary Examination

Recently, the Chhattisgarh government has constituted an 18-member task force for the expeditious implementation of the Forest Rights Act (FRA), 2006 and the PESA Act, 1996. The move is being strongly opposed by civil society and rights activists. Activists allege that the task force undermines the statutory and democratic institutions (such as the Gram Sabha) established under these laws and attempts are being made to institutionalise NGOs in the administration of tribal areas. This model is based on the November 2024 model of Madhya Pradesh and is planned to be implemented in Odisha as well.

FRA, PESA task force in Chhattisgarh weakens statutory bodies: activists

New working group set up to fast-track implementation of forest and panchayat laws; the move, modelled after a similar structure in Madhya Pradesh, is a way to institutionalise the role of Sangh Parivar-linked outfits, says civil society collective

The Hindu Bureau
 NEW DELHI

The constitution of a task force in Chhattisgarh to fast-track the implementation of laws such as the Forest Rights Act, 2006 and the Panchayats (Extension to the Scheduled Areas) Act, 1996, has led to fresh controversy.

Forest and tribal rights activists and the Opposition Congress allege that this undermines statutory bodies set up under these laws and institutionalises the role of Sangh Parivar-linked outfits in the implementation of these laws in tribal-dominated areas.

The Chhattisgarh government, on May 6, notified the task force, comprising an 18-member apex body headed by the Chief Minister and a 12-member implementation body headed by the Chief Secretary.



Tribal women on their way to collect forest produce in Dantewada district of Chattisgarh. FILE PHOTO

ary of the State. This task force is meant to map potential areas for community forest resource rights claims under the FRA, review pending claims, design strategies for PESA-related matters, and assist district authorities with implementation of the FRA.

The Campaign for Survival and Dignity (CSD), a

forest rights civil society collective, has noted in a statement that the Chhattisgarh government's notification of a task force appeared to be modelled on a similar structure established by the Madhya Pradesh government in November 2024.

The CSD also flagged that a similar task force

structure is likely to be constituted in Odisha as well.

The CSD has asserted that these task forces are a way to include representatives of Sangh Parivar-linked organisations such as the Janjati Suraksha Manch (JSM) and the Akhil Bharatiya Vanvasi Kalyan Parishad (ABVKA) in the process for implementing these laws.

'Gold standard'

Interestingly, on May 24, Union Home Minister Amit Shah had addressed a public meeting organised by the ABVKA and the JSM in New Delhi and hailed Madhya Pradesh's "model of PESA implementation" as the gold standard, adding that BJP-led State governments across the country are preparing to follow in its footsteps.

One of the key demands of the JSM and the ABVKA

leaderships at this event was to ensure that Gram Sabhas under the PESA include only tribal villagers "who had not converted" to any other religion.

Chhattisgarh-based forest rights activist Alok Shukla told *The Hindu* that such a task force structure was violative of the very laws they were meant to implement. "The idea of laws like the PESA and the FRA is to strengthen tribal governance at the village level. Instead of strengthening these bodies and ensuring they work as they are supposed to, this is the creation of a parallel structure outside of the statute."

On Tuesday, Congress leader Jairam Ramesh said these task forces "subvert the basic democratic structure of implementation of these two laws", adding that the ABVKA was the "driving force" behind this move.

Core Analysis Points

1. Structure and Objectives of the Task Force

- **Apex and Implementing Body:** This task force consists of an 18-member apex body headed by the Chief Minister and a 12-member implementing body headed by the Chief Secretary.

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- **Declared Functions:** Its main objective is to map the potential areas of Community Forest Resource Rights (CFRR) claims, review pending claims, and help the district administration in formulating strategies related to PESA.

2. The main concerns of activists and the opposition

- **Creation of Parallel Structure:** Activists argue that the basic purpose of the FRA and PESA is to delegate decision-making power directly to the 'Gram Sabha' (grassroots level). The formation of a central task force creates a parallel administrative structure outside the purview of the law.
- **Weakening of Statutory Bodies:** This move bypasses or weakens the already existing District and Sub-Division level Committees under these Laws which have the legal authority to settle claims.
- **Interference of non-statutory organisations:** Civil society organisations (such as the Campaign for Survival and Dignity) allege that through this task force, organisations associated with the Sangh Parivar (such as the Vanvasi Kalyan Ashram and the Janajati Suraksha Manch) are being given an opportunity to directly intervene in tribal policies.

3. 'Madhya Pradesh Model' and Religio-Social Disputes

- **Contentious demands:** This is being repeated in other states after the Union Home Minister described Madhya Pradesh's PESA implementation as the "gold standard". However, one of the major demands of the organizations active behind these new policy changes is that only those tribal villagers who have not converted should be included in the Gram Sabhas under PESA.
- **Constitutional crisis:** According to activists, this type of religious classification is against the secular structure of India and the traditional and constitutional rights of the tribals.

4. Key Laws Relevant to UPSC Exam

- **PESA Act, 1996:** This law extends the provisions of Part IX (Panchayats) of the Constitution to the Scheduled Areas (Fifth Schedule). It gives the Gram Sabha supreme power in the management of natural resources, land acquisition, and local disputes.
- **Forest Rights Act (FRA), 2006:** This law legalizes the traditional rights of forest-dwelling Scheduled Tribes (FDSTs) and other traditional forest dwellers (OTFDs) on forest land. Community Forest Resource Rights (CFRRs) are the most important of these.

Way Forward

- **Respect for decentralization:** Any new task force should act only as a 'facilitator' or 'facilitator' rather than usurping the powers of the Gram Sabha.
- **Transparency and Inclusion:** Policy formulation and implementation should involve all parties, especially local tribal representatives and nonpartisan civil society organizations, not just select ideological groups.

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- **Adherence to Constitutional Norms:** Tribal rights should be ensured to be implemented only under constitutional and legal provisions, keeping above any religious or political agenda.

Conclusion

The formation of the FRA and PESA task forces in Chhattisgarh can be seen as an administrative effort to intensify tribal empowerment, but centralization at the expense of democratic decentralization always leads to controversies. The soul of revolutions like PESA and **FRA lies in ensuring "the right of those who live on the land to the land"**. Therefore, the government has to ensure that in the name of speedy implementation, there is no compromise on the autonomy of the tribals and the supremacy of the Gram Sabha, only then the real and peaceful development of tribal areas is possible.

UPSC Prelims Exam Study Questions

Question: With reference to the Forest Rights Act (FRA), 2006, consider the following statements:

1. It recognizes the rights of forest dwelling Scheduled Tribes and other traditional forest dwellers.
2. Community Forest Resource Rights (CFRR) is an important provision of this Act.
3. The final decision to grant rights to forest land under this Act is taken by the State Government only.

Which of the above statements is/are correct?

- (a) Only 1 and 2
(b) 2 and 3 only
(c) Only 1 and 3
(d) 1, 2 and 3

Answer: (a)

UPSC Mains Practice Questions

Question: "The basic objective of the PESA Act, 1996 and the Forest Rights Act, 2006 is to provide self-governance and rights to resources to the tribal communities. In the light of this statement, critically examine the role of task forces set up by the states in recent years. (150 words)

Recently, the 'Mega Science Vision-2035' (MSV) report prepared by India's leading climate scientists has been made public. The report, prepared under the nodal role of the Indian Institute of Science (IISc), Bengaluru, and the Office of the Principal Scientific Adviser (PSA) to the Government of India, poses two serious challenges to Indian science and environmental policy: first, the decline of the domestic manufacturing capacity of scientific instruments that is threatening the credibility of Indian research; And second, a warning against the unintended climate impacts of the uncontrolled expansion of renewable energy (solar and wind energy).

India losing ability to build its own instruments: climate science report

Use of imported equipment that remains uncalibrated leads to incorrect data being reported, marring credibility of Indian science; researchers also aim to study long-term impact of uncontrolled tapping of natural resources for renewable energy

Jacob Koshy
 NEW DELHI

A group of India's leading climate scientists has warned that the country has almost lost the ability to build its own scientific instruments, leaving its climate observations dependent on imported equipment that is often run uncalibrated for years. This has led to "incorrect data being reported in national and international journals, often leading to questions on the credibility of Indian science", they said.

The researchers also called for long-term studies to evaluate the climate consequences of the "uncontrolled" growth of renewable energy installations, warning that the effects of large solar and wind plants on the climate remain "poorly understood".

The warning appeared in the Mega Science Vision-2035 (MSV) report on Climate Research, a road map prepared by the Indian climate research community with the Indian In-



Heat is on: The warning lands at a time when India is already facing the harmful effects of the warming climate. SHIV KUMAR PUSHPAKAR

stitute of Science, Bengaluru, as the nodal institution, and submitted to the Office of the Principal Scientific Adviser (PSA) to the Union government.

The report was made public earlier this week.

Atmanirbhar challenges

The warning on instruments sits awkwardly with the government's drive for "atmanirbhar" or self-reliance. To boost domestic manufacturing, the Government e-Marketplace (GeM) portal was made mandatory for public

scientific institutions, requiring procurement from the lowest-bidding India-registered vendor.

As *The Hindu* has reported, scientists found this a stumbling block when they needed customised equipment built to high-quality standards, with GeM vendors often unable to meet such specifications and the alternative – a global tender – entailing long bureaucratic delays.

In June 2025, the Finance Ministry rolled back some of the rules amid

complaints over sub-standard materials.

The warning also lands at a time when India is already facing the harmful effects of the warming climate, from intensifying heatwaves and erratic monsoons to accelerating Himalayan glacier melt – the very trends that reliable, well-calibrated observations are meant to track.

The MSV exercise, historically used to plan large, long-horizon projects in fields such as nuclear and high-energy physics, was for the first time extended to climate research, ecology and astronomy, and was facilitated by the PSA's office under Professor Ajay K. Sood.

On the energy transition, the report recommended devising "scientific methods to estimate the social cost of carbon [i.e., the cost of damages from an extra ton of CO₂] and a mechanism to implement the "polluter pays" principle to stop the atmosphere being used as "a dumping ground" for emissions, while seeking ways to "offset the effects of the carbon tax on the poor."

The scientists' justification for studying "uncontrolled" renewables is cautionary rather than sceptical. The report said that while "renewable energy seems to be the right solution to replace polluting energy sources, studies are needed to understand the long-term consequences of the uncontrolled tapping of natural resources."

India has pledged 500 GW of non-fossil capacity by 2030, and crossed the halfway mark on installed electricity capacity from non-fossil sources in 2025.

Mega projects

The report called for an indigenous Earth System Model built "from first principles", distinct from existing Indian models which have been "adapted from the U.S. or Europe."

It also proposed eight "mega projects" – spanning observatories, satellites, in-situ networks, field campaigns, indigenous sensors, carbon-neutrality research and adaptation science – phased across three roughly five-year blocks until 2035.

Core Analysis Points

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1. Crisis of 'self-reliance' in scientific instruments and threat to credibility

- **Excessive dependence on imports:** According to the report, India has almost lost the ability to manufacture scientific instruments on its own. The country has become completely dependent on foreign equipment for climate observations.
- **Lack of calibration:** Imported equipment has been running for years without calibration (accuracy check). Uncalibrated instruments are leading to **inaccurate data** being reported in national and international journals, raising questions about the global credibility of Indian science.
- **Policy Contradictions (GeMvs. Quality):** Under the government's 'Aatmanirbhar Bharat' campaign, procurement from domestic vendors with minimum bid (**L1**) from the **Government e-Marketplace (GeM)** was made mandatory for public institutions. But these vendors often failed to supply the high-quality and customized (made on special demand) equipment needed for scientific research, hampering research. However, in June 2025, the Ministry of Finance has relaxed these rules somewhat.

2. Uncontrolled development of renewable energy and unknown impact

- **Unintended impact on climate:** Scientists believe that the understanding of what long-term effects large-scale solar and wind power plants have on the local climate, environment, and natural resources is very limited right now.
- **Need for Study:** India has set a target of 500 GW of non-fossil energy capacity by 2030 (half of which was achieved in 2025 itself). The scientists want to clarify that they are not opposed to renewable energy, but rather they are advocating for in-depth studies to understand the long-term consequences of "uncontrolled exploitation of natural resources".

3. Key Recommendations of 'Mega Science Vision-2035'

- **Indigenous Earth System Model:** The models that India currently uses are adapted from the US or Europe. The report has stressed on the need to create a completely Indian model based on 'First Principles'.
- **Eight Mega Projects:** The report proposes 8 mega projects to be implemented in three phases (blocks of about 5-5 years) by 2035. These include advanced observatories, satellites, development of indigenous sensors, and carbon-neutrality research.
- **Social Cost of Carbon:** The report recommends financial calculation of the losses caused by carbon emissions and strict implementation of the 'Polluter Pays' principle. At the same time, it has also been said that measures should be found so that the burden of carbon tax does not fall on the poor.

Way Forward

- **Flexibility in Scientific Procurement Policies:** The process of exemption from GeM's stringent regulations for the procurement of complex scientific instruments should be further simplified so that researchers can access cutting-edge global technology without compromising on quality.

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- **Promotion of Indigenous Manufacturing (Investment in R&D):** India has to strengthen the domestic ecosystem for the design and manufacture (R&D) of high-end scientific instruments rather than just becoming a consumer of equipment.
- **Balanced Energy Transition: The Environmental Impact Assessment (EIA)** of solar/wind parks should also include their local micro-climate and ecological impacts as they move towards the target of 500 GW.

Conclusion

In this era of climate change—when India is facing intense heatwaves, erratic monsoons, and melting of Himalayan glaciers—accurate scientific data is the backbone of our policies. The 'Mega Science Vision-2035' report is a serious warning given in time. India is leading climate action on the global stage, but to keep this leadership sustainable and credible, we have to strengthen our 'scientific infrastructure' by going beyond self-reliance, precision and political priorities.

UPSC Prelims Exam Study Questions

Question: With reference to the 'Mega Science Vision-2035' (MSV-2035) report, consider the following statements:

1. It aims to prepare a long-term roadmap for India's climate science and earth system research.
2. It has been prepared in the nodal role of the Indian Institute of Science (IISc), Bengaluru.
3. The report focuses only on the expansion of renewable energy.

Select the correct answer using the code given below:

- (a) Only 1 and 2
- (b) 2 and 3 only
- (c) Only 1 and 3
- (d) 1, 2 and 3

Answer: (a)

UPSC Mains Practice Questions

Q: "Reliable scientific data is just as important for effective management of climate change as a robust policy framework." Discuss in the context of the Mega Science Vision-2035 report. (150 words)

Page 06 : GS II :Social Justice /Preliminary Examination

Recently, an unprecedented study conducted by the All India Institute of Medical Sciences (AIIMS), Delhi and funded by the Indian Council of Medical Research (ICMR) has clarified how urban air pollution (especially PM2.5 and PM10) harms the unborn child by penetrating the placental barrier that protects the foetus. The study, published in **the journal EMBO Molecular Medicine**, brings out for the first time the precise biological pathway and molecular details that lead to embryonic development and serious problems such as low birth weight in newborns.

AIIMS Delhi study shows how air pollutants breach placental barriers and affect foetuses

Ramya Kannan
 CHENNAI

That environmental pollutants can breach the placental barrier and affect foetuses is now well established in research. But how exactly does this happen? Researchers at AIIMS, Delhi have mapped the step-by-step biological pathway through which urban air pollution silences a key foetal growth protein, causing lasting harm to babies.

The ICMR-funded study, published in *EMBO Molecular Medicine*, has reportedly shown, for the first time, in comprehensive molecular detail, how the fine particulate matter from urban air pollution crosses the placenta, triggers a wave of inflammation and shuts down a protein that is essential for growth. This could have consequences right into late childhood.

Particulate matter



Exposure to particulate matter PM2.5 was a significant risk factor for low birth weight in Delhi, researchers find

PM2.5 and PM10 are capable of crossing the placental barrier, and cause oxidative stress and inflammation, impairing the development of the foetus. Placental dysfunction, and complications including pre-term birth, low birth weight and preeclampsia are all possible outcomes.

Key growth protein
 "Since we know that pollu-

tants do affect foetuses, our primary goal," said Subhradip Karmakar, professor of biochemistry, AIIMS, Delhi, and corresponding author for the paper, "was to examine the pathways that enable the pollutants to cause distress to the placenta and the foetus. While this has been studied before, it has been done in a piecemeal way. We showed the entire pathway."

"Our research reveals that exposure during pregnancy to Urban Particulate Matter activates inflammatory pathways that inhibit IGFBP3 expression, a key protein governing the equilibrium of the placenta and growth of the embryo. This reduction in IGFBP3 impairs critical placental processes, resulting in restricted foetal growth and altered developmental trajectories," he added.

The research focused on both rodents and on delivery records of 994 women

from two cities: high-pollution Delhi and low-pollution Deoghar, Jharkhand.

In women from Delhi, PM2.5 exposure was identified as a significant risk factor for low birth weight. The rate of preeclampsia, a dangerous spike in blood pressure during pregnancy, significantly increases as pollution levels rise.

In the case of rodents, particulate matter impaired the placenta's ability to invade the uterine wall, form its essential nutrient-exchange layer, and support blood vessel growth. Pollution also triggered severe cellular stress and rewrote the cells' epigenetic switches, permanently altering which genes are switched on or off, researchers on the study said. In pregnant rats, exposure to New Delhi's pollution levels caused litter sizes to shrink by up to 25%, placentas to be smaller, and newborns to weigh 34% less at term. Offspring

also showed clear neurological harm: impaired motor coordination, heightened anxiety, and stress responses; effects consistent with damage that begins before birth, the paper indicates.

Future research

Looking at the transgenerational effect, where researchers study the impact on development of motor development skills, IQ, cardio-vascular complications, cancer and metabolic disorders will entail further studies, Dr. Karmakar said.

He suggested that risk mitigation strategies such as wearing masks and eating antioxidant-rich foods could provide a buffer to people. "We must remember that risk mitigation in terms of controlling pollution will have to be multi-dimensional. The research findings call for pollution monitoring to be integrated into prenatal care."



Core Analysis Points

1. The Biological Pathway of Pollution and the Umbilical Cord

- **Inhibition of IGFBP3:** According to the study, when a pregnant woman comes in contact with urban particulate matter, it activates the pathways that cause inflammation in the body. This inflammation **inhibits the expression of** a key protein called IGFBP3. This protein is essential for balancing the umbilical cord and controlling fetal development.

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- **Cellular & Epigenetic Stress:** Air pollution particles weaken the ability of the umbilical cord to penetrate the uterine wall and form a nutrient-exchange layer. In addition, it alters the 'epigenetic switch' of cells, making it permanently fixed which genes will remain active and which will remain inactive.

2. Results of Studies on Humans and Organisms (Key Findings & Impact)

The study was based on rodents and the delivery records of **994 women** from **two cities with different pollution levels (high-pollution Delhi and low-pollution Deoghar, Jharkhand)**:

- **Impact on Infants:** PM2.5 exposure was found to be a major cause of Low Birth Weight in women in Delhi.
- **Complications in pregnancy:** A significant increase in cases of preeclampsia (**dangerously high blood pressure during pregnancy**) was observed with an increase in pollution levels.
- **Shocking statistics of testing on mice:** The number of babies in pregnant mice exposed to Delhi's pollution levels decreased by 25%, the umbilical cord size became smaller and the newborn mice were found to weigh less by 34%.

3. Long-term & Transgenerational Risks

- **Neurological Damage (Mental Health):** Neurological damage was observed in the children of organisms exposed to pollution even before birth, which led to lack of motor coordination, excessive anxiety and stress problems.
- **Crisis on future generations:** According to scientists, this damage can persist until the last years of childhood. In the future, the long-term effects of this on children's IQ, motor skills development, heart disease, cancer and metabolic disorders are being studied.

4. Risk Mitigation Strategies

- **Personal Safety:** The use of masks by pregnant women and the consumption of food rich in antioxidants can reduce this risk to some extent.
- **Integration in Prenatal Care:** Researchers have suggested that pollution monitoring should now **be made a part of routine prenatal care** or health check-ups.

Way Forward

- **Policy Integration:** Air pollution should no longer be considered just an environmental problem, but a serious **public health emergency**. The goals of the National Clean Air Programme (NCAP) should be aligned with the Maternal and Child Health Schemes (such as the Pradhan Mantri Matru Vandana Yojana).
- **Targeted Protective Measures:** 'Health advisories' should be issued by health ministries, especially for pregnant women, in case of poor air quality index (AQI).

- **Upgradation of medical infrastructure:** Women should be made aware of the dangers of air pollution and measures to avoid them (such as improving indoor air quality) during antenatal check-ups in government hospitals.

Conclusion

This study by AIIMS Delhi is irrefutable scientific proof that air pollution is crippling and weakening our future generation even before birth. Just like PESA or forest rights, **the "right to breathe clean air"** is also part of the right to life (Article 21). To achieve Sustainable Development Goal-3 (SDG 3: Good Health and Well-being), India will have to intensify its pollution control efforts, as a healthy nation can never be built in a polluted environment.

UPSC Prelims Exam Study Questions

Question:What is 'Preeclampsia'?

- (a) Increase of glucose in the blood in pregnancy
- (b) Conditions related to high blood pressure and organ damage during pregnancy
- (c) Respiratory problems in the newborn after birth
- (d) Genetic disorders in the fetus

Answer: b)

UPSC Mains Practice Questions

Q: "Air pollution is no longer just an environmental **but** a serious public health crisis related to maternal and child health. Discuss. (150 words)

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Page 10 :GS III :Indian Economy & Science & Technology / Preliminary Examination

Recently, NITI Aayog's 'Frontier Tech Hub' has released an important report titled 'Future of India's Semiconductor Industry'. The report comes at a time when the Indian government has made chip manufacturing a national priority through the **India Semiconductor Mission (ISM)**. This report by NITI Aayog makes it clear that although India's local ecosystem is not currently fully prepared to meet domestic demand, it is still imperative to achieve self-sufficiency in the region in the face of geopolitical pressures and national security.

The future of India's chip industry

A new NITI Aayog report says India's semiconductor ecosystem is not yet equipped to fully meet domestic demand, while stressing the need to strengthen local manufacturing, as geopolitical pressures could potentially disrupt the electronics supply chain

EXPLAINER

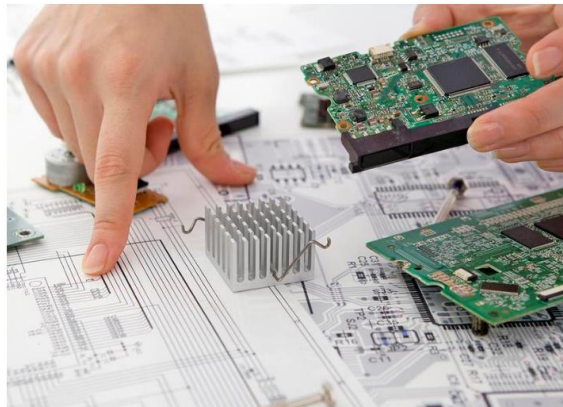
Aroon Deep

NITI Aayog's Frontier Tech Hub released a report last week that had two main messages: first, that India faces steep challenges in developing world-class semiconductor manufacturing capabilities, and second, that national interest necessitated pursuing this field doggedly regardless of those difficulties.

The Union government has made chipmaking a priority, since semiconductors are a part of nearly all electronics, from consumer gadgets to defence gear. Yet, India does not have a single fabrication unit, with the first expected to open in Dholera, Gujarat by 2028, with a total of ten in various stages of development. Multiple semiconductor packaging and testing facilities have been generously subsidised and supported by the Union government (as well as some State governments), through initiatives like the India Semiconductor Mission (ISM).

The ISM is a ₹76,000 crore corpus, and it is almost fully earmarked to projects across semiconductor fabs, incentives for component manufacturing, and bulk subscriptions to industry-grade semiconductor design applications for students and academia. While the most cutting edge and ambitious projects – fabs – have received capital subsidies of upwards of 50%, other projects have received production- or output-linked incentives.

The report, titled 'Future of India's Semiconductor Industry', reiterates that these are yet early days for the semiconductor industry, since even chips used in domestic electronics assembly operations are largely sourced from outside the country. "India's local ecosystem is not ready to fully meet domestic demand for semiconductors," the report said. But it insisted that there



GETTY IMAGES

was still a need to manufacture locally, as geopolitical pressures like a disaster in Taiwan could massively disrupt the electronics supply chain. "As many semiconductor parts used in defence systems are produced outside India, deploying them in our aerospace and defence programmes is increasing threats to national security," the report adds.

The sector "requires sustained, mission-mode commitment over a decade or more," the report said.

Fab gestation

The report points to several challenges in this indigenisation process, not least of which is the time involved. "Typically, fab units require four to five years before commencing production," the report points out. "During the gestation phase, these units need to invest in purchasing more than 50 specialised equipment from global players. Even after the production is over, processes like yield optimisation and reliability test take several quarters

before chips reach the market." Developing talent to work in these fabs is also, as a result, time consuming, the report says.

The report urges the government to work on "building sovereign design and research capabilities, R&D excellence and harnessing agentic AI for semiconductor engineering," since "building deep capabilities" in materials sciences and silicon designing will "move India from a services-led design base to a creator of differentiated IP, architectures and integration technologies that define next generation systems."

Capital investment

While the details on the second phase of the India Semiconductor Mission are yet to be revealed, the report pegs the necessary capital expenditure from the state at \$45-60 billion over a period of ten years. This amount should, however, be spent on projects where the risk is less and "bankability" can assure returns to

investors, the report warns. This translates to a shift away from directing public funds towards frontier chips, whose transistors are the smallest – 3 to 7 nanometres – and towards "mature, advanced – aligned with strategic relevance – as well as compound nodes," the report says.

The report is key in understanding the potential scope of ISM 2.0, since its ambition is defined and largely stays out of big-ticket frontier fab projects. It advocates, for instance, "selective depth, capital efficiency and system-level differentiation, rather than attempting to replicate the full global manufacturing spectrum."

For instance, packaging, which is among the last steps of a chipmaking process, and less expensive and complex than fabrication, is identified as a "core production pillar, not a downstream activity" in the report. The report calls for "[r]apid import substitution in high volume domestic segments".

Trusted partners

The report implies that China is an adversary in chipmaking in spite of the recent thaw in relations. In a list of "priority partners," the report highlights the U.S., Japan, the European Union, and South Korea as partners with whom to work to get "access to critical tools, equipment servicing and lifecycle support," and to take advantage of "India's market scale, talent base and packaging capacity."

"With sustained commitment and strategic clarity, India can build a competitive semiconductor ecosystem that strengthens economic resilience and positions the nation as a key player in the future of advanced technology," the report concludes. IT Secretary S. Krishnan welcomed the report as a "structured, actionable framework," and said in a foreword that, "India is well positioned to convert its semiconductor ambition into enduring industrial and strategic reality".

THE GIST

▼ The Union government has made semiconductor manufacturing a priority, but India does not yet have a fabrication unit. A recent report by NITI Aayog's Frontier Tech Hub underscores the need to bolster local manufacturing.

▼ The report urges the government to work on 'building sovereign design and research capabilities, R&D excellence and harnessing agentic AI for semiconductor engineering'.



Core Analysis Points

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1. Strategic and Security Importance of Semiconductors for India

- **Risks to National Security:** Most of the semiconductor parts used in India's defence and aerospace programmes are currently manufactured overseas. According to the report, this situation is a major threat to national security.
- **Global Supply Chain Disruptions:** Any geopolitical tensions or natural disasters in countries like Taiwan (which is the world's largest chip maker) can lead to a complete shutdown in the global electronics supply chain. Therefore, local manufacturing is essential for India's economic resilience.
- **Current Status:** India does not have a single Commercial Fabrication Unit (FAB) functioning right now. However, the country's first 'fab' at Dholera in Gujarat is expected to be commissioned by 2028, and a total of 10 projects are in various stages of development.

2. Major Challenges in the Path of Chip Manufacturing

- **High Gestation Period:** A 'Fab' unit usually takes 4 to 5 years to start production. During this period, more than 50 extremely specialized and expensive equipment has to be purchased from global companies. Even after production, it takes several quarters of yield optimisation and reliability tests before the chips are brought to market.
- **Skill and Talent Growth:** Creating a skilled workforce (talent pool) is a major challenge for this highly complex and time-consuming manufacturing process.
- **Policy Constraints and Financial Burden:** The ISM corpus of ₹76,000 crore has been almost fully allocated under the first phase. NITI Aayog estimates that over the next 10 years, India will need **huge public capital expenditure of \$45 to \$60 billion** (about Rs 3.7 to 5 lakh crore) in the sector.

3. NITI Aayog's Strategic Recommendations (Roadmap for ISM 2.0)

- **Frontier vs. Mature Nodes:** The report advises the government to focus all its money on "mature and advanced nodes" and compound nodes rather than on highly advanced and risky **frontier chips** (such as chips with 3 to 7 nanometers). Where the risk is low and the returns to the investors are guaranteed (Bankability).
- **Focus on packaging:** Semiconductor packaging and testing (which is the last and less expensive and less complex stage of chip making) **should be considered a "core production pillar"** rather than a "downstream activity". This will enable faster import substitution in high-volume segments in the domestic market.
- **Sovereign Design and Agentic AI:** **India should develop its own Differentiated IP and architecture** instead of just becoming a 'Services-Led Design Base' (working for others). For this, it has been recommended to leverage 'Agentic AI' in materials sciences and chip engineering.

4. Geopolitics and Trusted Partners

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Daily News Analysis

- The report sees China as a competitor in the field of chipmaking and suggests India to work strategically **with "priority partners" such as the US, Japan, the European Union (EU) and South Korea**. This will provide India access to critical tools, equipment maintenance and lifecycle support, while these countries will be able to take advantage of India's large market and technical talent.

Way Forward

- **Long-Term Mission-Mode Commitment:** Success in the semiconductor industry requires governments to go beyond political shifts and provide sustained financial and policy support for at least a decade or more.
- **Selective Depth: India should focus on** 'capital efficiency' and system-level specificity rather than trying to mimic the entire spectrum of global manufacturing.
- **Academia and Industry Linkages:** Students and researchers will have to enhance research capabilities (R&D Excellence) at the grassroots level by ensuring the wholesale availability of industry-grade semiconductor design applications.

Conclusion

This NITI Aayog report provides a practical and actionable framework for India's semiconductor ambitions. Although it is a daunting challenge to compete with the global giants and address infrastructure gaps, the journey is indispensable for 'digital sovereignty' and national security. As also acknowledged by the Ministry of Electronics and IT, if India moves forward with strategic clarity and financial discipline, it will not only be able to secure its domestic demands, but also emerge as an indispensable and reliable player on the global map of advanced technologies of the future.

UPSC Prelims Exam Study Questions

Question: With reference to semiconductors, consider the following statements:

1. It is a material whose electrical conductivity **lies between the conductor** and the **insulator**.
2. Silicon is the most commonly used material in semiconductor manufacturing.
3. Semiconductor chips are only used in computers.

Select the correct answer using the code given below:

- (a) Only 1 and 2
- (b) 2 and 3 only
- (c) Only 1 and 3
- (d) 1, 2 and 3

Answer: a)

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UPSC Mains Practice Questions

Q: Semiconductor self-sufficiency for India is not only an economic necessity but also a strategic necessity. Explain. (150 words)

Page :10 : GS III :Environment / Preliminary Examination

This recently published article outlines the growing market for electric vehicles (EVs) in India and the new geopolitical and economic challenges that have emerged in parallel with it. A record 2.5 million electric vehicles were sold in India in the financial year 2026 (FY26), reflecting the success of the favorable policies of the central and state governments (such as FAME, PLI, and tax exemptions). However, the article warns that India is inadvertently becoming overly dependent on imports of lithium-ion batteries (especially on China) in an attempt to reduce the import **dependence of fossil** fuels. Now, the success of India's EV transition should not be measured by sales figures alone, but by supply chain resilience and strategic autonomy.

The need for strengthening India's EV supply chains

As EV adoption gathers pace, there is a greater need to focus on reducing vulnerability to external shocks

Jaideep Saraswat
Akanksha Golchha

India's electrification of road transport has entered a decisive growth phase. Around 2.5 million vehicles were sold in FY26, a significant increase from FY25. This momentum reflects the effectiveness of policy support from both the Centre and the States, including upfront purchase incentives, road tax exemptions and other demand-side interventions. These measures helped create the initial market, reduce consumer hesitation, and establish electric vehicles (EVs) as a credible and tested technology.

Import dependence

The next phase of EV adoption demands a different policy and industrial logic. As the sector scales, India is moving away from imported fossil fuels, only to find itself becoming increasingly dependent

on imported lithium-ion batteries. The challenge is no longer how quickly India can electrify transport, but how it can do so without creating a new strategic vulnerability. EV growth must now be judged by three additional metrics: supply chain resilience, strategic autonomy, and long-term sustainability.

India's domestic cell manufacturing is still far below the scale needed to alter import dependence meaningfully. Under the ACC Battery Production Linked Incentive scheme, 40 GWh of capacity has been awarded, but only about 1 GWh has been installed so far. Meanwhile, passenger EVs sold in India are sourcing batteries from 14 global manufacturers, with 7,987 MWh imported in 2025. Of this, a significant share came from Chinese manufacturers, highlighting that increasing EV sales are tightly correlated with increasing imports from China.

This concentration creates a structural risk for Indian EV OEMs (original

equipment manufacturers). Battery supply is increasingly exposed to a single-country ecosystem that is shaped by policy, geopolitics, and industrial strategy outside India's control. Several developments in China are influencing pricing and availability, like tighter technology restrictions, prioritisation of domestic demand, withdrawal of VAT exemptions on battery exports, and more. Additionally, the West Asia conflict has compounded the pressure through higher raw material costs, elevated manufacturing expenses in China, and rising transport and risk premiums.

The consequences extend beyond OEM balance sheets. Battery inflation delays price parity with internal combustion engine (ICE) vehicles and slows the shift from early adopters to mass-market buyers. In a market as price-sensitive as India's, rising cell costs can confine EVs to premium segments and place national adoption targets at risk if the situation

persists and OEMs are forced to pass on higher costs to consumers.

This requires a holistic situational assessment and identifying key interventions in the short to medium term. The near-term response must be pragmatic. Many OEMs already talk of a "China + 1" sourcing strategy, but actual supplier diversity varies widely by segment. Higher-end EVs are increasingly paired with non-Chinese NMC batteries, while cost-sensitive mass-market models continue to rely on cheaper Chinese LFP cells. True diversification, across suppliers, chemistries, and geographies, may raise costs initially; but it significantly lowers the risk of strategic disruption over time.

Product modifications

The cost shock should also drive product-level discipline. OEMs need to design EVs around efficiency, lighter architectures, more effective drivetrains, smarter software calibration, and battery right-sizing aligned with actual usage rather than aspirational range. India's market may ultimately reward lean, purpose-built electrification over oversized vehicles designed around imported battery economics. Software-defined battery platforms that support multiple chemistries without hardware redesign would further improve flexibility as the cell market evolves. Moreover, Indian manufacturers should

begin type-testing vehicles across emerging chemistries, including sodium-ion batteries. Sodium-ion is not yet a full substitute for lithium-ion across all use cases, but it could serve as a meaningful hedge as production scales domestically, broadening the technology base and reducing dependence on any single chemistry or supplier.

Further, India's path forward lies in building a structured 'EV supply chain alliance' with trusted partners, one that spans minerals, manufacturing, technology, and standards. Such an alliance would distribute risk across geographies, deepen domestic capability over time, and ensure that no single external disruption can stall India's electrification agenda.

The EV transition is no longer straightforward and the recent disruptions underscore the need for a more resilient approach. India has already demonstrated that it can create demand for clean mobility. The next test is whether it can build the industrial depth to sustain that demand without becoming dependent on a single external bottleneck.

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Core Analysis Points

1. Import Dependence and Excessive Concentration on China (The Dependency Risk)

- **Slow pace of domestic manufacturing:** A capacity of 40 GWh (gigawatt-hours) has been allocated under the Production Linked Incentive (PLI) scheme for Advanced Chemistry Cell (ACC) batteries, but only about 1 GWh capacity has been installed on the ground at present.
- **Dependence on China:** 7,987 MWh of batteries were imported from 14 global manufacturers for passenger EVs sold in India in 2025, with a significant portion coming from Chinese companies.
- **Structural Risk:** Changes in Chinese policies (such as withdrawal of VAT exemption on exports, prioritizing domestic demand) and geopolitical conflicts in the Middle East are driving up raw material costs, transportation expenses, and risk premiums. This is a major risk for Indian Original Equipment Manufacturers (OEMs).

2. Barriers to Price Sensitization and Mass Adoption.

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- **Delay in Price Parity:** Due to the inflation in battery prices, the gap between the prices of EVs and conventional internal combustion engine (ICE) vehicles is not narrowing.
- **Market Contraction:** In a highly price-sensitive market like India, if batteries are expensive, manufacturers will pass on the cost to consumers. This will limit EVs only to the premium segment (high-end vehicles) and may jeopardize the larger goals of national EV adoption.

3. 'China + 1' Strategy and Diversification

- **Segmented Sourcing:** Currently, Indian manufacturers talk about 'China+1', but it is uneven. High-end (premium) EVs are using non-Chinese NMC (Nickel Manganese Cobalt) batteries, while low-cost mass-market models still rely on cheaper Chinese LFP (LFP - Lithium Iron Phosphate) cells.
- **Solution:** True strategic autonomy requires full diversification across suppliers, battery chemistry and geographies, even if the cost is a little higher initially.

4. Product Level Improvements and Alternative Technologies (Sodium-ion Option)

- **Lean and Purpose-Built Design:** Indian manufacturers should make vehicles lighter, more efficient drivetrains and smart software-calibration based instead of relying solely on imported battery capacity. For India, 'battery right-sizing' (battery of exact size as per use) is more useful.
- **Choice of Sodium-ion Batteries:** India should focus on type-testing emerging technologies such as sodium-ion. Although sodium-ion is not yet a complete alternative to lithium, it can prove to be a strong hedge in the future due to the abundant availability of sodium in India.

Way Forward

- **Global EV Supply Chain Alliance: India** must forge a strong alliance with mineral-rich and reliable partner countries (such as Australia, Chile, the US, Japan). This alliance should focus on mining, processing, manufacturing and sharing standards of critical minerals.
- **Software-defined Platforms:** Vehicle platforms should be developed that can support multiple types of battery chemistry (NMC, LFP, Sodium-ion) without any hardware changes, to avoid market fluctuations.
- **Acceleration in Domestic Cell Manufacturing (ACC PLI):** The government has to remove the bottlenecks of battery cell manufacturing infrastructure at the domestic level so that commercial production of the allocated 40 GWh capacity can start at the earliest.

Conclusion

India has successfully proven that it can create a huge demand for clean mobility or EVs within the country. But the next phase of electrification of the transport sector will test whether India can develop its industrial depth to keep up with this demand. If India does not secure and diversify its supply chain, it will change from a mere oil-importing country to a battery importing country. To truly achieve Sustainable Development Goal-7 (affordable and clean energy) and Goal-13 (climate action), India will have to fully secure its 'EV self-reliance' from geopolitical shocks.

The 'harvest' China wants is one India cannot afford

When Luo Zhaohui, then China's Ambassador to India, revived the idea of an "early harvest" in India-China boundary negotiations in 2017, India responded with scepticism. The proposal – to settle the Sikkim boundary in isolation from the three other sectors – was an asymmetric concession dressed up in the language of progress. India has resisted it. There is now a gnawing doubt as to whether it can hold that position. The trigger for this piece is a former border negotiator's concern that India might "stumble" into a damaging course of action under Chinese pressure and driven by the temptation to project contrived progress. Diplomacy that trades long-term strategic interests for short-term optics is self-defeating.

New Delhi must be cautious

The readout issued by the Ministry of External Affairs (MEA) on the 24th round of the Special Representatives' Dialogue on the Boundary Question between India and China (on August 19, 2025) between National Security Adviser Ajit Doval and Chinese Foreign Minister Wang Yi recorded India's agreement to "set up an Expert Group ... to explore an early harvest in boundary delimitation in the India-China border areas". China's own readout was more pointed: it used the term "demarcation" rather than "delimitation" and spoke of "launching boundary demarcation negotiations in sectors where conditions are ripe."

The MEA press release on the 35th Meeting of the Working Mechanism for Consultation and Coordination on India-China Border Affairs, held in Beijing on May 27, 2026, mentions that the two sides "discussed issues pertaining to delimitation, border management, mechanism building and cross-border cooperation" and "agreed to work together to make substantive preparation" for the next SRs' meeting. The reference to 'delimitation' is significant as it suggests follow-up discussions on the understanding "to explore Early Harvest in boundary delimitation".

The cornerstone of Special Representative negotiations is the Agreement on Political Parameters and Guiding Principles, signed on April 11, 2005. Article III explicitly envisages "a package settlement" covering all sectors of the India-China boundary. It establishes a three-step process: first political parameters, then a framework for a final settlement, then delineation and demarcation. Demarcation – placing physical markers on the ground – comes last, not first. China's proposal to begin demarcation in a single "ripe" sector inverts this sequence and, in effect, asks India to abandon the package architecture in exchange for the appearance of progress. India should decline.

Why does the package settlement matter so much? Because the four sectors of the



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Diplomatic optics must not dictate India's boundary negotiations with China

India-China boundary are strategically interlinked, requiring give and take across sectors. It also guards against China extracting concessions sector by sector. An early harvest in Sikkim, where India holds comparative geographical advantage, would let Beijing bank a settlement on its preferred terms while leaving the other three sectors unresolved.

The Sikkim stakes

The Sikkim Sector boundary is not, as sometimes claimed, a simple matter. Clashes at Nathu La and Cho La in 1967, with heavy casualties, showed how sharp these differences are. Article I of the 1890 Great Britain-China Convention identifies "Mount Gipmochi on the Bhutan frontier" as the starting point of the Sikkim-Tibet boundary, but it is preceded by an assertion that the boundary "shall be the crest of the mountain range separating the waters flowing into the Sikkim Teesta and its affluents from the waters flowing into the Tibetan Mochu". China reads the article as placing the trijunction at Gipmochi. India and Bhutan hold that the trijunction lies at Batang La, some 6.5 kilometres to the north, on the watershed – which is the operative geographical principle in Article I.

Zompehri (or Jampheri) Ridge adjoining Geymochen commands a direct view of the Siliguri Corridor, the narrow strip connecting mainland India to its northeastern States. Any settlement implicitly endorsing the Gipmochi trijunction would hand China a legal instrument to press its claim to the very edge of the Himalayas, exposing the Corridor. The Chinese objective is to deepen and widen its Chumbi Valley and increase pressure on India's most acute territorial vulnerability.

The Doklam dimension reinforces this concern. Since 2017, China has systematically consolidated its position in western Bhutan – building roads and military facilities, constructing villages including Pangda on the Amo Chu river, and developing routes to the Jampheri Ridge that bypass the 2017 Doklam standoff site. A Sikkim settlement would immediately be leveraged by Beijing to step up pressure on a vulnerable Bhutan to settle its boundary with China. India and China have agreed that trijunction points must be finalised in trilateral consultation with all countries concerned. Even if the trijunction point is left out, China could force Bhutan to settle the rest of the disputed boundary on its own terms and present India with a *fait accompli* in Doklam.

Since the Eastern Ladakh transgressions of 2020, China has pursued multiple pressure tracks simultaneously: military consolidation along the Line of Actual Control (LAC), steady resurrection of the "Zangnan" (South Tibet) narrative to describe Arunachal Pradesh, renaming of places in Arunachal Pradesh, and expansion of "border defence villages" close to India-China LAC.

The resumption of Special Representative talks is welcome, but dialogue must be conducted with strategic clarity, not under diplomatic pressure or for the optics of progress. Three principles should guide India's approach.

First, hold the 2005 Agreement's framework firm. The Expert Group agreed upon in August 2025 must not become a vehicle for an early harvest in Sikkim. Agreeing to "explore" is not a commitment to accept. India should reject a standalone Sikkim delimitation or demarcation exercise.

Second, make peace and tranquillity on the LAC the non-negotiable condition of progress. China has periodically attempted to delink border management from the broader relationship; India has resisted this, and should continue to do so. Unilateral alterations to the LAC cannot be normalised. Indeed, the so-called "buffer zones" in Eastern Ladakh must not be allowed to persist.

Third, press for genuine political engagement on a comprehensive settlement. Decades of talks have shown that the respective narratives cannot be reconciled through legal arguments. The 2005 Agreement recognised this: it called for a political settlement that would "safeguard the vital interests of both countries" and set out principles such as the two sides "safeguard(ing) due interests of their settled populations in the border areas". Any breakthrough requires political will on both sides. India should press for meaningful boundary negotiations, not paper over the lack of progress with working groups. The test of China's seriousness will be whether it is prepared to engage on the framework for a comprehensive settlement – and whether it is prepared to hold the LAC stable while that engagement proceeds. Absent those conditions, the Special Representative process risks becoming what it has sometimes been before: a forum for managing appearances while China improves its position on the ground.

Stay the course

In boundary talks, China has a track-record of cherry-picking and resiling from formal commitments, as it did in the case of an explicit agreement to arrive at a common understanding of the LAC after exchanging maps showing the entire alignment. India must prevent the Agreement On the Political Parameters and Guiding Principles for the Settlement of the India-China Boundary Question from meeting a similar fate. If peace and tranquillity on the LAC is the foundation for rebuilding India-China relations, the 2005 Agreement is the road map for resolving the boundary question. India has nothing to gain from an early harvest limited to Sikkim and must maintain its negotiating space through a comprehensive negotiation. India cannot afford a shortcut to a destination that suits China.

GS Paper II & III: International Relations and Indian Economy

UPSC Mains Exam Practice Questions: Explain the importance of the concept of "Package Settlement" in the resolution of the India-China border dispute. **(250 words)**

Reference:

Recently, the 35th meeting of the Working Mechanism for Consultation and Coordination on India-China Border Affairs (WMCC) was held in Beijing (May 27, 2026), where 'Delimitation' was discussed. The meeting was a follow-up to the Special Representatives (SRs) talks between National Security Advisor (NSA) Ajit Doval and Chinese Foreign Minister Wang Yi in August 2025, in which the two countries agreed to form an expert group to explore "Early Harvest" in the border areas. However, former diplomats and strategic analysts have warned that accepting China's 'early harvest' proposal could prove to be a strategic trap against India's long-term interests.

Core Analysis Points

1. What is China's 'Early Harvest' proposal?

- **Separation of Sikkim Region:** China proposes that instead of resolving the entire India-China border dispute simultaneously, the boundary line should be demarcated immediately by separating only the Sikkim sector (where the conditions are 'mature').
- **Terminology Difference:** India's official statement speaks of 'delimitation' (delimitation or drawing a line on a map), while China is using the term 'demarcation' (demarcation or erection of physical pillars on the ground), indicating that China wants to finalize the process.

2. Violation of the 2005 Historic Agreement

According to the author, China's proposal is contrary to the basic spirit of the 'Agreement on Political Parameters and Guiding Principles' signed on April 11, 2005:

- **Package Settlement:** Article III of this agreement makes it clear that the settlement of the boundary dispute will be in the form of a 'package' involving all the regions (western, central and eastern) and not in pieces.
- **Reversal of the process:** The 2005 agreement stipulated three stages—first the political criteria, then the framework of the final solution, and finally the demarcation on the ground. China wants to jump straight to the final stage (demarcation) to prevent India from negotiating in other areas in exchange for "ostentatious progress".

3. Strategic Stakes in the Sikkim Sector

The Sikkim border is not a simple issue. There is a profound difference of opinion between the two countries over the interpretation of the Great Britain-China Convention of 1890:

- **Dispute of Trijunction:** China believes that the trijunction point of India-China-Bhutan **is on 'Gipmochi Mountain'**. On the contrary, India and Bhutan believe that it **is on 'Batang La'** (6.5 km north of Gipmochi), which is based on the correct geographical principle of a watershed.
- **Threat to Siliguri Corridor (Chicken's Neck):** If India accepts the Chinese interpretation (Gipmochi), China will get legal rights over **the Jompelari (Jamferi) Ridge**. From here, China can directly monitor India's 'Siliguri Corridor', which connects the northeastern states with mainland India. This is India's greatest regional sensitivity.

4. The Bhutan Dimension

- **Changed ground reality:** Since the 2017 Doklam standoff, China has built massive roads, military facilities and villages (such as Pangra village on the Amo Chu River) in western Bhutan.
- **Pressure on Bhutan:** If India negotiates Sikkim separately, China will increase the pressure on Bhutan to resolve the border dispute on its own terms, creating a 'Fait Accompli' (unavoidable situation) for India in the Doklam area.

5. China's 'Multi-Track' Pressure Strategy

Under the guise of 'Early Harvest', China is pursuing aggressive policies against India on several fronts:

- Military reinforcement and creation of temporary 'buffer zone' along the Line of Actual Control (LAC) in eastern Ladakh (2020).
- To keep alive the narrative of describing Arunachal Pradesh as "Jangnan" (South Tibet) and to change the names of places there frequently.
- Rapid expansion of strategic "Border Defence Villages" close to the LAC.

Way Forward — Three Guiding Principles for India

- **Sticking to the 2005 Framework:** The 'Expert Group' constituted in August 2025 should not be used only for the demarcation of Sikkim. India should categorically reject any "unilateral or isolated" solution.
- **Peace on the LAC First Precondition:** Chinese attempts to isolate border management from overall bilateral relations must continue to be resisted. The 'buffer zone' created in eastern Ladakh should not be allowed to be permanent and restoration of status quo should be mandatory.

- **Comprehensive Political Engagement:** Border disputes will be resolved more with political will than legal arguments. India should put pressure on China for a comprehensive and complete settlement, not just 'pretend to progress' through meetings.

Conclusion

China's track record in border negotiations has been to renege on formal commitments (such as withdrawing from exchanging maps of the LAC). In such a situation, the 'Early Harvest' limited only to Sikkim will not bring any strategic advantage to India, but it will lose its geographical edge. India cannot choose any 'shortcut' for geopolitical pressure or diplomatic pretensions that suit China's interests. The foundation of India-China relations is complete peace and tranquility along the LAC, and the resolution of the border dispute is possible only through complete and comprehensive negotiations.



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