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THE HINDU NEWSPAPER

29 DECEMBER 2025

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1.	President undertakes dive sortie in submarine, calls it a very special experience राष्ट्रपति ने पनडुब्बी में डाइव सॉर्टी की, इसे बताया बहुत विशेष अनुभव
2.	Documentary flymaker S. Krishnaswamy passes away डॉक्यूमेंट्री फिल्म निर्माता एस. कृष्णस्वामी का निधन
3.	Brigitte Bardot, French cinema icon and screen siren of 1960s, dies at 91 ब्रिजिट बार्डो, फ्रांसीसी सिनेमा की आइकन और 1960 के दशक की स्क्रीन सिरन, का 91 वर्ष की आयु में निधन

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Page 1

President undertakes dive sortie in submarine, calls it a very special experience

PCS

The Hindu Bureau
NEW DELHI

President Droupadi Murmu on Sunday undertook a dive sortie aboard the Indian Navy's submarine *INS Vaghsheer* on the western seaboard.

Ms. Murmu was accompanied by the Chief of the Naval Staff, Admiral Dinesh K. Tripathi, during the sortie, according to the President's Secretariat.

She embarked on the indigenous Kalvari-class submarine at the Karwar Naval Harbour in Karnataka.

During the sortie, which lasted over two hours, Ms. Murmu interacted with officers and sailors of the submarine, and witnessed operational demonstrations, including complex manoeuvres and multiple successful firings.

"This maiden embarkation onboard an indigenous Kalvari-class submarine reflects the continued engagement of the Supreme Commander with the armed forces in opera-

President Droupadi Murmu aboard the submarine *INS Vaghsheer* at the Karwar Naval Harbour in Karnataka on Sunday. PTI

tional settings," the President's Secretariat said.

With this embarkation, Ms. Murmu became only the second President of India to undertake a sortie aboard a submarine after the late A.P.J. Abdul Kalam.

It was also her maiden embarkation on an indigenous Kalvari-class submarine, underlining India's growing self-reliance in defence manufacturing.

In a note penned in the visitors' book, the President described the experience as very special. "It was indeed a very special experience for me to sail,

dive and spend time with our sailors and officers onboard *INS Vaghsheer*. The multiple successful firings and challenging operations carried out by *INS Vaghsheer* demonstrate the crew's exceptional preparedness and dedication, in accordance with its motto 'Veerta Varchasva Vijaya' [courage, supremacy, victory]," Ms. Murmu said.

Witnessing the discipline and confidence and enthusiasm of the crew reassured her of the Indian Navy's readiness to counter any threat under all circumstances, she said.

President undertakes dive sortie in submarine, calls it a very special experience
राष्ट्रपति ने पनडुब्बी में डाइव सॉर्टी की, इसे बताया बहुत विशेष अनुभव

- President Droupadi Murmu on Sunday undertook a dive sortie aboard the Indian Navy's submarine **INS Vaghsheer** on the **western seaboard**.
  राष्ट्रपति **द्रौपदी मुर्मू** ने रविवार को भारतीय नौसेना की पनडुब्बी **INS Vaghsheer** पर **पश्चिमी तट** पर एक डाइव सॉर्टी की।

- Ms. Murmu was accompanied by the Chief of the Naval Staff, **Admiral Dinesh K. Tripathi**, during the sortie, according to the **President's Secretariat**.

  President's Secretariat के अनुसार, इस सॉर्टी के दौरान राष्ट्रपति के साथ नौसेना प्रमुख **Admiral Dinesh K. Tripathi** भी मौजूद थे।
- She embarked on the indigenous **Kalvari-class submarine** at the **Karwar Naval Harbour** in **Karnataka**.

  उन्होंने **Karnataka** के **Karwar Naval Harbour** में स्वदेशी **Kalvari-class submarine** पर सवार होकर यात्रा शुरू की।
- With this embarkation, Ms. Murmu became only the **second President of India** to undertake a sortie aboard a submarine after the late **A.P.J. Abdul Kalam**.

Documentary filmmaker S. Krishnaswamy passes away

The Hindu Bureau
CHENNAI

Internationally acclaimed documentary and television filmmaker S. Krishnaswamy, who produced over 900 non-fiction films, including the famed *Indus Valley to Indira Gandhi*, passed away on Sunday evening at a hospital in Chennai. He was 88.

He had been under treatment for a heart ailment and visited the hospital in the evening, said his daughter Gita Krishnaraj. He is survived by his wife Mohana Krishnaswamy and children Latha Krishna, Gita Krishnaraj, and Bharat Krishna.

Born in Chennai (at the time, Madras) on July 15, 1937, to iconic film director K. Subrahmanyam and lyricist Meenakshi Subrahma-

nyam, he joined Columbia University in the U.S. in 1960 and studied mass communications with a special reference to documentary films. He founded his firm Krishnaswamy Associates in 1963.

His magnum opus, *Indus Valley to Indira Gandhi*, a four-hour film traversing 5,000 years of subcontinental history, was released in December 1976. It was shot in 100 locations across the country and the rights for its international distribution were bought by Warner Brothers.

Among his works were *Unknown Freedom Fighters* (1978); *Rajaji* (1979); *Kamaraj* (1981); *With Apologies to Tagore* (1987), a five-minute, hilarious portrayal of the state of the nation with animation; *Jaya*

S. KRISHNASWAMY (1937-2025)

Jaya Sankara (1991), a film on the Kanchi Math; and *Reality Behind Religion* (1992), which emphasised the need for brotherhood and understanding among the followers of various religions.

His films covering political leaders included those on R. Venkataraman and C.

Subramaniam, both released in 2002, and M.G. Ramachandran in 1984. In the 1980s, he made films on the complex problems of Punjab and Sri Lanka, highlighting the operations of the Indian defence forces. The subject of electoral reforms did not escape his imagination, which was re-

His magnum opus *Indus Valley to Indira Gandhi* was shot in 100 locations across the country

flected in *Who loses when India wins* (2006).

Awards received
In 2009, he received the Padma Shri and in 2020, the Dr. V. Shantaram Lifetime Achievement Award for his contribution to documentary films at the Mumbai International Film Festival.

He also won the Honor Summus Award of the Watumull Foundation, Hawaii, in 1987 and the Lifetime Achievement Award in 2005 at the U.S. International Film and Video Festival, Los Angeles.

He authored several books, including one brought out by *The Hindu* titled *Voyages Retraced: India's Influence in East Asia* in February 2025. The book gave an insight into ancient India's impact on Southeast Asian countries, and a phase in history when Indian sailors travelled to countries such as Vietnam, Laos, Cambodia, and Thailand, and became conduits for spreading Indian culture, architecture, and fine arts to these countries over centuries. It was a narrative of his travels between 2005 and 2010.

He co-authored the book *Indian Film* with Erik Barnouw.

During the writing of the book, the authors camped in Darjeeling where Satyajit Ray was filming his *Kanchenjunga*.

Documentary flymaker S. Krishnaswamy passes away
डॉक्यूमेंट्री फिल्म निर्माता एस. कृष्णस्वामी का निधन

- Internationally acclaimed documentary and television filmmaker **S. Krishnaswamy**, who produced over **900 non-fiction films**, including the famed **Indus Valley to Indira Gandhi**, passed away on Sunday evening at a hospital in **Chennai**. He was **88**.

  अंतरराष्ट्रीय स्तर पर प्रशंसित डॉक्यूमेंट्री और टेलीविजन फिल्म निर्माता **एस. कृष्णस्वामी**, जिन्होंने प्रसिद्ध **Indus Valley to Indira Gandhi** सहित **900 से अधिक गैर-फिक्शन फिल्में** बनाई थीं, का रविवार शाम **चेन्नई** के एक अस्पताल में निधन हो गया। वह **88 वर्ष** के थे।
- Born in **Chennai** (at the time, **Madras**) on **July 15, 1937**, to iconic film director **K. Subrahmanyam** and lyricist **Meenakshi Subrahmanyam**, he joined **Columbia University** in the **U.S.** in **1960** and studied mass communications with a special reference to documentary films.

  15 जुलाई 1937 को **चेन्नई** (तत्कालीन **मद्रास**) में प्रसिद्ध फिल्म निर्देशक **के. सुब्रह्मण्यम** और गीतकार **मीनाक्षी सुब्रह्मण्यम** के घर जन्मे, उन्होंने **1960** में **अमेरिका** की **कोलंबिया यूनिवर्सिटी** में प्रवेश लिया और डॉक्यूमेंट्री फिल्मों पर विशेष संदर्भ के साथ **जनसंचार** की पढ़ाई की।
- He founded his firm **Krishnaswamy Associates** in **1963**.

  उन्होंने **1963** में अपनी फर्म **Krishnaswamy Associates** की स्थापना की।
- His magnum opus, **Indus Valley to Indira Gandhi**, a four-hour film traversing **5,000 years** of subcontinental history, was released in **December 1976**.

उनकी महान कृति **Indus Valley to Indira Gandhi**, जो उपमहाद्वीप के **5,000 वर्षों** के इतिहास को दर्शाने वाली **चार घंटे** की फिल्म है, **दिसंबर 1976** में रिलीज़ हुई।

- It was shot in **100 locations** across the country and the rights for its international distribution were bought by **Warner Brothers**.

  इसे देशभर के **100 स्थानों** पर फिल्माया गया और इसके अंतरराष्ट्रीय वितरण के अधिकार **Warner Brothers** ने खरीदे।

- Among his works were **Unknown Freedom Fighters (1978); Rajaji (1979); Kamaraj (1981); With Apologies to Tagore (1987)**, a five-minute, hilarious portrayal of the state of the nation with animation; **Jaya Jaya Sankara (1991)**, a film on the **Kanchi Math**; and **Reality Behind Religion (1992)**, which emphasised the need for brotherhood and understanding among the followers of various religions.

  उनकी प्रमुख कृतियों में **Unknown Freedom Fighters (1978); Rajaji (1979); Kamaraj (1981); With Apologies to Tagore (1987)** शामिल हैं, जो एनीमेशन के माध्यम से राष्ट्र की स्थिति का पाँच मिनट का हास्यपूर्ण चित्रण था; **Jaya Jaya Sankara (1991)**, **Kanchi Math** पर आधारित फिल्म; और **Reality Behind Religion (1992)**, जिसने विभिन्न धर्मों के अनुयायियों के बीच भाईचारे और समझ की आवश्यकता पर बल दिया।

- His films covering political leaders included those on **R. Venkataraman** and **C. Subramaniam**, both released in **2002**, and **M.G. Ramachandran** in **1984**.

  राजनीतिक नेताओं पर बनी उनकी फिल्मों में **R. Venkataraman** और **C. Subramaniam** पर बनी फिल्में (दोनों **2002** में जारी) और **M.G. Ramachandran** पर **1984** में बनी फिल्म शामिल हैं।

- In the **1980s**, he made films on the complex problems of **Punjab** and **Sri Lanka**, highlighting the operations of the **Indian defence forces**.

  1980 के दशक में उन्होंने **पंजाब** और **श्रीलंका** की जटिल समस्याओं पर फिल्में बनाईं, जिनमें **भारतीय रक्षा बलों** के अभियानों को उजागर किया गया।

- The subject of **electoral reforms** did not escape his imagination, which was reflected in **Who loses when India wins (2006)**.

  चुनावी सुधारों का विषय भी उनकी कल्पना से अछूता नहीं रहा, जिसका प्रतिबिंब **Who loses when India wins (2006)** में दिखाई देता है।

- He authored several books, including one brought out by **The Hindu** titled **Voyages Retraced: India's Influence in East Asia** in **February 2025**.

  उन्होंने कई पुस्तकें लिखीं, जिनमें **The Hindu** द्वारा प्रकाशित **Voyages Retraced: India's Influence in East Asia** (**फरवरी 2025**) भी शामिल है।

- The book gave an insight into ancient India's impact on **Southeast Asian countries**, and a phase in history when Indian sailors travelled to countries such as **Vietnam, Laos, Cambodia, and Thailand**, and became conduits for spreading Indian culture, architecture, and fine arts to these countries over centuries.

  इस पुस्तक ने **दक्षिण-पूर्व एशियाई देशों** पर प्राचीन भारत के प्रभाव और उस ऐतिहासिक कालखंड पर प्रकाश डाला जब भारतीय नाविक **वियतनाम, लाओस, कंबोडिया और थाईलैंड** जैसे देशों की यात्रा कर भारतीय संस्कृति, वास्तुकला और **ललित कलाओं** के प्रसार के माध्यम बने।

- It was a narrative of his travels between **2005 and 2010**.

  यह **2005 से 2010** के बीच की उनकी यात्राओं का वर्णन था।

- He co-authored the book **Indian Film** with **Erik Barnouw**.

  उन्होंने **Erik Barnouw** के साथ मिलकर **Indian Film** पुस्तक का सह-लेखन किया।

- During the writing of the book, the authors camped in **Darjeeling** where **Satyajit Ray** was filming his **Kanchenjunga**.

  पुस्तक लेखन के दौरान लेखक **दार्जिलिंग** में रुके, जहाँ **सत्यजीत रे** अपनी फिल्म **Kanchenjunga** की शूटिंग कर रहे थे।

Awards received
प्राप्त पुरस्कार

- In **2009**, he received the **Padma Shri** and in **2020**, the **Dr. V. Shantaram Lifetime Achievement Award** for his contribution to documentary films at the **Mumbai International Film Festival**.

2009 में उन्हें **पद्म श्री** और **2020** में **Mumbai International Film Festival** में डॉक्यूमेंट्री फिल्मों में योगदान के लिए **Dr. V. Shantaram Lifetime Achievement Award** से सम्मानित किया गया।

- He also won the **Honor Summus Award** of the **Watumull Foundation, Hawaii**, in **1987** and the **Lifetime Achievement Award** in **2005** at the **U.S. International Film and Video Festival, Los Angeles**.
   उन्होंने **1987** में **Watumull Foundation, Hawaii** का **Honor Summus Award** और **2005** में **U.S. International Film and Video Festival, Los Angeles** में **Lifetime Achievement Award** भी प्राप्त किया।

- He authored several books, including one brought out by The Hindu titled Voyages Retraced: India's Influence in East Asia in **February 2025**.
   उन्होंने कई पुस्तकें लिखीं, जिनमें **The Hindu** द्वारा प्रकाशित **Voyages Retraced: India's Influence in East Asia** (**फरवरी 2025**) भी शामिल है।

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Brigitte Bardot, French cinema icon and screen siren of 1960s, dies at 91

PCS

Agence France-Presse
PARIS

French film icon Brigitte Bardot, a symbol of sexual liberation of the 1950s and sixties who turned her back on cinema to devote herself to protecting animals, has died aged 91, her foundation said on Sunday.

"The Brigitte Bardot Foundation announces with immense sadness the death of its founder and president, Madame Brigitte Bardot, a world-renowned actress and singer, who chose to abandon her prestigious career to dedicate her life and energy to animal welfare and her foundation," it said in a statement sent to *AFP*.

Tributes were immediately paid to the star who was became known as "BB" in her home country.

Born on September 28, 1934 in Paris, Bardot was raised in a well-off traditional Catholic household. Married four times, she had one child, Nicolas with her second husband, actor Jacques Charrier.

Bardot became a global star after appearing in "And God created Woman" in 1956, and went on to appear in about 50 more movies before giving up acting in 1973. She turned her back on celebrity to look after abandoned animals, saying she was "sick of being beautiful every day".

Bardot went on to found the Brigitte Bardot Foundation in 1986, which now has 70,000 donors and around 300 employees, according to its website.

'Mourning a legend'

French President Emmanuel Macron called Bardot a "legend" of the 20th century.

"With her films, her voice, her dazzling glory, her initials (BB), her sorrows, her generous passion for animals, and her face that became Marianne, Brigitte Bardot embodied a life of freedom," he wrote on X, referring to the female symbol of the French republic.

"We mourn a legend of the century," he said.

Brigitte Bardot

Brigitte Bardot, French cinema icon and screen siren of 1960s, dies at 91
ब्रिजिट बार्डो, फ्रांसीसी सिनेमा की आइकन और 1960 के दशक की स्क्रीन सिरन, का 91 वर्ष की आयु में निधन

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CONTACT: 9971932488

- Brigitte Bardot, French cinema icon and screen siren of 1960s, dies at 91
  ब्रिजिट बार्डो, फ्रांसीसी सिनेमा की आइकन और 1960 के दशक की स्क्रीन सिरन, का 91 वर्ष की आयु में निधन
- French film icon **Brigitte Bardot**, a symbol of sexual liberation of the **1950s and sixties** who turned her back on cinema to devote herself to protecting animals, has died aged **91**, her foundation said on **Sunday**.
  फ्रांसीसी फिल्म आइकन **ब्रिजिट बार्डो**, जो **1950 और 1960 के दशक** में यौन स्वतंत्रता की प्रतीक थीं और जिन्होंने सिनेमा छोड़कर पशु संरक्षण को अपना जीवन समर्पित किया, का **91** वर्ष की आयु में निधन हो गया, उनकी फाउंडेशन ने **रविवार** को कहा।
- "The **Brigitte Bardot Foundation** announces with immense sadness the death of its founder and president, **Madame Brigitte Bardot**, a world-renowned actress and singer, who chose to abandon her prestigious career to dedicate her life and energy to animal welfare and her foundation," it said in a statement sent to **AFP**.
  "**ब्रिजिट बार्डो फाउंडेशन** अत्यंत दुःख के साथ अपनी संस्थापक और अध्यक्ष, **मैडम ब्रिजिट बार्डो**, विश्वप्रसिद्ध अभिनेत्री और गायिका, के निधन की घोषणा करता है, जिन्होंने अपने प्रतिष्ठित करियर को छोड़कर अपना जीवन और ऊर्जा पशु कल्याण और अपनी फाउंडेशन को समर्पित कर दी," **AFP** को भेजे गए बयान में कहा गया।
- Bardot became a global star after appearing in "**And God created Woman**" in **1956**, and went on to appear in about **50** more movies before giving up acting in **1973**.
  1956 में "**And God created Woman**" में अभिनय के बाद बार्डो वैश्विक स्टार बनीं और **1973** में अभिनय छोड़ने से पहले लगभग **50** और फिल्मों में दिखाई दीं।
- She turned her back on celebrity to look after abandoned animals, saying she was "**sick of being beautiful every day**".
  उन्होंने प्रसिद्धि से मुंह मोड़कर परित्यक्त जानवरों की देखभाल की और कहा कि वह "**हर दिन सुंदर बने रहने से थक चुकी थीं**"।
- Bardot went on to found the **Brigitte Bardot Foundation** in **1986**, which now has **70,000 donors** and around **300 employees**, according to its website.
  बार्डो ने **1986** में **ब्रिजिट बार्डो फाउंडेशन** की स्थापना की, जिसके पास अब वेबसाइट के अनुसार **70,000 दाता** और लगभग **300 कर्मचारी** हैं।

GS Paper 1: History,	
TOPICS COVERED	29 December 2025
1. QUIZ	Mao Zedong

Questions and Answers to the previous day's daily quiz: 1. In which village and province was Mao Zedong born? **Ans: Shaoshan, Hunan.**
2. Which influential early essay by Mao examined physical education and national strength? **Ans: A Study of Physical Culture (1917)**
3. What was the name of the arduous 1934-35 retreat that became symbolic of Chinese communist endurance? **Ans: The Long March**
4. Which poetic work was written by Mao in 1936, soon after the Long March? **Ans: Snow: To the Tune of Chin Yuan Chun**
5. How old was Mao at the time of his death in 1976? **Ans: 82 years old**
Visual: This 1971 painting by Tang Xiao calls back to Mao's famous 1966 swim across China's longest river. Identify this river. **Ans: Yangtze River**
Early Birds: Tamal Biswas | Parimal Das | Vidyasagar Reddy Kethiri | Surojit Pal | Piyali Tuli

Mao Zedong

- Mao Zedong was the **founding leader of the People's Republic of China**
- He was a central figure in the **Chinese Communist Revolution** and Chinese politics in the 20th century
- He served as the **Chairman of the Chinese Communist Party** and shaped China's political, social, and economic trajectory

Birth Details

- **Date of birth: 26 December 1893**
- **Village: Shaoshan**
- **Province: Hunan**
- **Country:** China

Hunan Province

- Hunan lies in **south-central China**, south of the Yangtze River
- The name "Hunan" literally means **"south of the lake"**, referring to **Dongting Lake**

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Influential Early Essay by Mao Zedong on Physical Education and National Strength

• The influential early essay by **Mao Zedong** that examined physical education and national strength is **"A Study of Physical Culture" (1917)**.

• **Title: A Study of Physical Culture**
• **Year of publication: 1917**
• **Author: Mao Zedong**
• **Written during:** Mao's student years at **Hunan First Normal School**

Nature of the Essay

• One of Mao's **earliest published writings**
• Focuses on the **relationship between physical education, moral strength, and national vitality**
• Written before Mao became a Marxist, reflecting his **early nationalist and reformist thinking**

The Long March (1934–1935): Symbol of Chinese Communist Endurance

• The arduous **1934–35 retreat** that became symbolic of Chinese Communist endurance was called **The Long March**.

• **The Long March** was a **strategic military retreat** undertaken by the **Chinese Communist Party (CCP)** and the **Chinese Red Army**
• It took place between **October 1934 and October 1935**
• The retreat was carried out to **escape encirclement and destruction** by Nationalist forces

Leadership Context

• The Long March is closely associated with **Mao Zedong**, whose leadership position was consolidated during this period

• The CCP faced intense military pressure from the **Nationalist government under Chiang Kai-shek**
• A series of **Encirclement Campaigns** were launched against Communist base areas
• The **fifth encirclement campaign** forced the Communists to abandon their **Jiangxi Soviet** base

• Of around **80,000–90,000** participants at the beginning, only **8,000–10,000** reached the final destination
• Despite heavy losses, the march strengthened **discipline, unity, and revolutionary commitment**

Zunyi Conference (1935)

Turning Point

• Held in **January 1935** during the Long March
• Marked the rise of **Mao Zedong** as the dominant leader of the CCP
• Led to a shift toward **independent military and political strategy**

• Came to represent **extraordinary resilience, sacrifice, and perseverance**
• Became a core **foundational narrative** of the Chinese Communist movement

• The poetic work written by **Mao Zedong** in **1936**, soon after the Long March, is **"Snow: To the Tune of Chin Yuan Chun."**

Basic Information about the Poem

Title and Literary Form

• **Title: Snow: To the Tune of Chin Yuan Chun**
• **Chinese title:** *Qinyuanchun · Xue*
• **Year of composition: 1936**
• **Form: Ci poetry**, a classical Chinese lyric form composed to a fixed tune pattern

• Written shortly after the completion of the **Long March (1934–1935)**
• Composed during a phase of **regrouping and consolidation** for the Chinese Communist leadership
• Reflects confidence following survival against overwhelming odds

• The poem opens with imagery of a **vast, snow-covered northern landscape**
• Nature is used as a symbol of **grandeur, endurance, and timelessness**

• The poem concludes by asserting that **true greatness lies in the present era**
• Implies that the Communist revolution represents a **new historical pinnacle**

Age of Mao Zedong at the Time of His Death (1976)

• **Mao Zedong was 82 years old** at the time of his death in **1976**.

• Mao died at the end of the **Cultural Revolution (1966–1976)**
• China was facing political uncertainty and transition
• His death marked the **end of the Maoist era** in Chinese politics

Position at the Time of Death

• Mao remained **Chairman of the Chinese Communist Party** until his death
• He had been the dominant political leader of China since **1949**

• Mao suffered from **chronic heart, lung, and neurological ailments** in his later years
• His health deteriorated significantly after the early 1970s

Impact of His Death

• His death led to **nationwide mourning**
• It paved the way for **leadership restructuring and later economic reforms**

• Mao's lifespan covered the **late Qing Dynasty, Republican era, civil war, Japanese invasion, and Communist rule**

GS Paper 1: Society	
TOPICS COVERED	29 December 2025
1. Tamil Nadu needs to think beyond the metro तमिलनाडु को मेट्रो से आगे सोचने की ज़रूरत है	

Tamil Nadu needs to think beyond the metro

Last month, Tamil Nadu Chief Minister M.K. Stalin criticised the Union government for denying metro rail projects to Coimbatore and Madurai. This created some political controversy and also sparked a wave of urban aspiration. For many people, glitzy metros have become a sign of development and modernity. The absence of metros feels like a slight; their approval, a stamp of urban arrival.

But we need to step back and ask a crucial question: do cities like Madurai and Coimbatore actually need metro rail systems? Or has the metro become an elite-driven aspiration that is fundamentally misaligned with how Indian cities move and live?

Tikender Singh Panwar

Former Deputy Mayor of Shimla and currently a member of the Kerala Urban Commission

Metro: not a mobility solution

India's obsession with metros is relatively new but powerful. Over the past 15 years, metros have consumed nearly 40% of all urban development funds, becoming the single largest item in the urban budget. And yet, their contribution to mobility remains surprisingly limited. In most metro cities, only 5-12% of daily trips are made on the metro. The overwhelming majority of people still walk, cycle, or take buses and small para-transit modes.

This gap arises from the mismatch between metro systems and the pattern of everyday mobility in India. Nearly 90% of India's urban workforce is informal, and the average daily commute for most workers is just 4-5 kilometres. These are short, dense journeys. They do not require high-speed, capital-intensive corridors designed for long-distance travel. Metros therefore do not serve the functional needs of the majority; they serve the elite imagination of a "world-class" city.

Tamil Nadu is one of India's most urbanised States. The middle class is rapidly rising and so is an aspiring elite. With this comes a new visual language of development: gleaming airports,

Modern mobility is not defined by infrastructure scale, but by access, affordability, and last-mile quality

skywalks, elevated corridors and, invariably, metro lines. But elite desire is not a substitute for public need. Globally, cities comparable to Madurai or Coimbatore – medium-density, mixed-use, and compact – do not rely on metro systems. The successful examples are buses, surface-level rapid transit, cycling highways, pedestrian-first planning, and integrated feeder systems.

Singapore and Dubai, the frequently cited models, are not comparable in scale, governance, land control, or economic structure. Their metros work because their entire urban systems are shaped around them. Indian cities cannot simply copy-paste such models.

Metros are also extremely expensive. A metro costs ₹300 crore-900 crore per kilometre, depending on whether it is elevated or underground. Operating costs are equally steep. Almost no Indian metro recovers its costs through fares. Massive public subsidies keep them afloat. For cities like Coimbatore and Madurai, metro systems would mean decades of financial strain – diverting scarce funds away from schools, water supply, local roads, housing, public health, and basic neighbourhood infrastructure. To interpret the lack of metro allocation as a lack of development is to miss the real opportunity: freedom from a financially draining model.

Madurai's radial street system and Coimbatore's industrial neighbourhood clusters are inherently walkable and compact. The majority of workers move within short neighbourhood loops. Imposing metro systems onto such cities disrupts their organic form. What they need instead is a high-frequency electric buses, dedicated bus lanes on major corridors, shaded pedestrian networks, protected cycle tracks, better-integrated autos and share mobility, and neighbourhood-level last-mile systems. These are quick to build, cheaper, and beneficial.

Cities that redefined urban mobility in the last 30 years– Curitiba, Bogotá, Copenhagen, Freiburg, Medellín – did not rely on metros alone. Many, in fact, did not build metros at all. They invested in Bus Rapid Transit that moves more people per rupee than any metro; cycling superhighways; walkable neighbourhoods; hill connectivity via ropeways; multimodal integration rather than a single grand system. Modern mobility should not be defined by the scale of infrastructure, but by access, affordability, and last-mile connectivity and quality. India's own mobility patterns mirror these best practices far more than the metro-dominated model.

Tamil Nadu's opportunity

Mr. Stalin's disappointment at being denied metro projects for Madurai and Coimbatore is understandable from a political point of view. But it also inadvertently gives Tamil Nadu a an opportunity to reimagine Coimbatore with a grid of fast, frequent electric buses, connected to industrial clusters; Madurai with pedestrian-first temple circuits, cycle highways, and seamlessly integrated shared autos; and cities where neighbourhoods are built as 15-minute communities, where work, school, healthcare, and markets lie within short walking or cycling distance. These constitute modern, climate-sensitive, affordable, and socially inclusive infrastructure. They match how people actually move. And most important, they won't bankrupt cities.

Tamil Nadu must resist the pressure of equating development and modernity with metros. Instead, it should craft mobility systems that reflect the realities of its workers, the densities of its neighbourhoods, and the constraints of its municipal finances. If Tamil Nadu dares to think beyond the metro, it could set a new template for the rest of the country.

Tamil Nadu needs to think beyond the metro
तमिलनाडु को मेट्रो से आगे सोचने की ज़रूरत है

- Last month, **M. K. Stalin** criticised the **Union government** for **denying metro rail projects** to **Coimbatore** and **Madurai**

The **overwhelming majority** of people still **walk cycle or take buses** and **small para-transit modes**
अधिकांश लोग आज भी पैदल चलते हैं साइकिल चलाते हैं या बसों और छोटे पैरा-ट्रांजिट साधनों का उपयोग करते हैं

- This gap arises from the **mismatch** between **metro systems** and the **pattern of everyday mobility in India**
यह अंतर मेट्रो प्रणालियों और भारत की दैनिक गतिशीलता के स्वरूप के बीच असंगति से उत्पन्न होता है

- Nearly **90% of India's urban workforce** is **informal** and the **average daily commute** for most workers is just **4–5 kilometres**
भारत की लगभग 90% शहरी कार्यबल अनौपचारिक है और अधिकांश श्रमिकों की औसत दैनिक यात्रा केवल 4–5 किलोमीटर है

- These are **short dense journeys**
ये छोटी और सघन यात्राएँ हैं

- They do not require **high-speed capital-intensive corridors** designed for **long-distance travel**
इन्हें लंबी दूरी के लिए डिज़ाइन किए गए तेज़ और पूंजी-गहन गलियारों की आवश्यकता नहीं होती

- Metros therefore **do not serve the functional needs of the majority**
इसलिए मेट्रो बहुसंख्यक आबादी की कार्यात्मक आवश्यकताओं को पूरा नहीं करती

- They serve the **elite imagination** of a **"world-class" city**
वे "विश्व-स्तरीय" शहर की अभिजात कल्पना को पूरा करती हैं

- **Gleaming airports skywalks elevated corridors and metro lines** become symbols
चमकदार हवाई अड्डे स्कायवॉक एलिवेटेड कॉरिडोर और मेट्रो लाइनें प्रतीक बन जाती हैं

- But **elite desire** is not a **substitute for public need**
लेकिन अभिजात इच्छा सार्वजनिक आवश्यकता का विकल्प नहीं है

- Globally cities comparable to **Madurai or Coimbatore** medium-density mixed-use and compact **do not rely on metro systems**
वैश्विक स्तर पर मदुरै या कोयंबटूर जैसे मध्यम घनत्व मिश्रित उपयोग और सघन शहर मेट्रो प्रणालियों पर निर्भर नहीं होते

- The successful examples are **buses surface-level rapid transit cycling highways pedestrian-first planning and integrated feeder systems**
सफल उदाहरण हैं बसें सतही रैपिड ट्रांजिट साइक्लिंग हाईवे पैदल-प्रथम नियोजन और एकीकृत फीडर प्रणालियाँ

- **Singapore** and **Dubai** the frequently cited models are **not comparable** in **scale governance land control or economic structure**
अक्सर उद्धृत Singapore और Dubai पैमाने शासन भूमि नियंत्रण या आर्थिक संरचना में तुलनीय नहीं हैं

- Their metros work because their **entire urban systems** are **shaped around them**

- A metro costs **₹300 crore–900 crore per kilometre** depending on whether it is **elevated or underground**
एक मेट्रो की लागत ₹300 करोड़ से ₹900 करोड़ प्रति किलोमीटर होती है यह इस पर निर्भर करता है कि वह एलिवेटेड है या भूमिगत

- **Operating costs** are **equally steep**
संचालन लागत भी उतनी ही अधिक होती है

- Almost **no Indian metro** recovers its **costs through fares**
लगभग कोई भी भारतीय मेट्रो किराए से अपनी लागत नहीं निकाल पाती

- **Massive public subsidies** keep them **afloat**
भारी सार्वजनिक सब्सिडी उन्हें चलाए रखती है

- For cities like **Coimbatore and Madurai**, metro systems would mean **decades of financial strain**
कोयंबटूर और मदुरै जैसे शहरों के लिए मेट्रो प्रणाली का अर्थ दशकों तक वित्तीय दबाव होगा

- Diverting **scarce funds** away from **schools water supply local roads housing public health and basic neighbourhood infrastructure**

- **Madurai's radial street system** and **Coimbatore's industrial neighbourhood clusters** are **inherently walkable and compact**

- What they need instead is **high-frequency electric buses**, **dedicated bus lanes** on **major corridors**, **shaded pedestrian networks**, **protected cycle tracks**, **better-integrated autos and shared mobility**, and **neighbourhood-level last-mile systems**
- Cities that **redefined urban mobility** in the last **30 years** — **Curitiba**, **Bogotá**, **Copenhagen**, **Freiburg**, **Medellín** — did **not rely on metros alone**
- They invested in **Bus Rapid Transit** that **moves more people per rupee than any metro**, **cycling superhighways**, **walkable neighbourhoods**, **hill connectivity via ropeways**, **multimodal integration** rather than a **single grand system**

  उन्होंने **बस रैपिड ट्रांजिट** में निवेश किया जो **प्रति रुपये मेट्रो से अधिक लोगों** को ले जाती है, साथ ही **साइक्लिंग सुपरहाइवे, पैदल चलने योग्य पड़ोस, रोपवे द्वारा पहाड़ी संपर्क,** और **एकल भव्य प्रणाली** के बजाय **बहु-मोडीय एकीकरण** पर जोर दिया
- Modern mobility should **not be defined by the scale of infrastructure**, but by **access, affordability**, and **last-mile connectivity and quality**
- **Madurai** with **pedestrian-first temple circuits**, **cycle highways**, and **seamlessly integrated shared autos**

  मदुरै को **पैदल-प्रथम मंदिर परिपथ, साइकिल हाईवे,** और **निर्बाध रूप से एकीकृत साझा ऑटो** के साथ
- And cities where **neighbourhoods are built as 15-minute communities**, where **work school healthcare and markets** lie within **short walking or cycling distance**

  और ऐसे शहर जहाँ **पड़ोस 15-मिनट समुदाय** के रूप में बने हों, जहाँ **काम स्कूल स्वास्थ्य सेवा और बाज़ार कम पैदल या साइकिल दूरी** में हों

GS Paper 1: Geography	
TOPICS COVERED	**29 December 2025**
1.	**Kosovo holds snap elections in bid to end year-long political deadlock** राजनीतिक गतिरोध समाप्त करने के प्रयास में कोसोवो में अचानक चुनाव
2.	**U.K. says has secured migrant return deal with Angola, Namibia** ब्रिटेन ने कहा कि उसने अंगोला, नामीबिया के साथ प्रवासियों की वापसी का समझौता किया

PRISTINA

Kosovo holds snap elections in bid to end year-long political deadlock

GS I: Geography: Mapping   REUTERS

Voters in Kosovo cast ballots on Sunday in snap parliamentary elections, hoping to end 10 months of political deadlock. Vetevendosje (VV), the party of incumbent Prime Minister Albin Kurti, won the most votes in parliamentary elections held in February, but its 42% was not enough to secure a majority. AFP

Kosovo holds snap elections in bid to end year-long political deadlock
 राजनीतिक गतिरोध समाप्त करने के प्रयास में कोसोवो में अचानक चुनाव

- Kosovo holds snap elections in bid to end year-long political deadlock
 राजनीतिक गतिरोध समाप्त करने के प्रयास में कोसोवो में अचानक चुनाव
- Voters in **Kosovo** cast ballots on **Sunday** in snap parliamentary elections, hoping to end **10 months of political deadlock**.
 कोसोवो में मतदाताओं ने **रविवार** को अचानक संसदीय चुनावों में मतदान किया, ताकि **10 महीनों से चले आ रहे राजनीतिक गतिरोध** को समाप्त किया जा सके।
- **Vetevendosje (VV)**, the party of incumbent **Prime Minister Albin Kurti**, won the most votes in parliamentary elections held in **February**, but its **42%** was not enough to secure a **majority**.
 मौजूदा **प्रधानमंत्री अल्बिन कुर्ती** की पार्टी **वेतेवेन्दोशिये (VV)** ने **फरवरी** में हुए संसदीय चुनावों में सबसे अधिक वोट हासिल किए, लेकिन उसके **42%** वोट **बहुमत** सुनिश्चित करने के लिए पर्याप्त नहीं थे।

U.K. says has secured migrant return deal with Angola, Namibia

GS I: Geography: Mapping

LONDON

Angola and Namibia have agreed to accept the return of illegal migrants and criminals after the British government threatened visa penalties for countries refusing to cooperate, the U.K. Home Office said late on Saturday.

Curbs on DRC visas

The Democratic Republic of the Congo (DRC) has been stripped of fast-track visa services and preferential treatment for VIPs and decision-makers after failing to meet Britain's requirements to improve cooperation, the Home Office said.

Home Secretary Shabana Mahmood said Britain could escalate measures to a complete halting of visas for the DRC unless "co-operation rapidly improves."

"We expect countries to play by the rules. If one of their citizens has no right to be here, they must take them back," the Home Secretary added.

The Democratic Republic of the Congo said on Sunday it has started discussions with Britain to resolve the matter.

The agreements mark the first major change under reforms announced last month to make refugee status temporary and speed up the deportation of those who arrive illegally in Britain.

Foreign Secretary Yvette Cooper said the U.K. has "removed more than 50,000 people with no right to remain" since July last year, a 23% increase on the previous period.

U.K. says has secured migrant return deal with Angola, Namibia
ब्रिटेन ने कहा कि उसने अंगोला, नामीबिया के साथ प्रवासियों की वापसी का समझौता किया

- U.K. says has secured migrant return deal with Angola, Namibia
ब्रिटेन ने कहा कि उसने अंगोला, नामीबिया के साथ प्रवासियों की वापसी का समझौता किया

- **Angola** and **Namibia** have agreed to accept the return of **illegal migrants and criminals** after the **British government** threatened **visa penalties** for countries refusing to cooperate, the **U.K. The Home Office** said late on **Saturday**.

- The **Democratic Republic of the Congo (DRC)** has been stripped of **fast-track visa services** and **preferential treatment for VIPs and decision-makers** after failing to meet **Britain's requirements** to improve cooperation, the **Home Office** said.

- The agreements mark the **first major change** under reforms announced **last month** to make **refugee status temporary** and **speed up the deportation** of those who arrive **illegally** in Britain.
ये समझौते **पिछले महीने** घोषित सुधारों के तहत **पहला बड़ा बदलाव** हैं, जिनका उद्देश्य **शरणार्थी दर्जे को अस्थायी** बनाना और **अवैध रूप से** ब्रिटेन आने वालों के **निर्वासन की प्रक्रिया तेज करना** है।

- **Foreign Secretary Yvette Cooper** said the U.K. has "**removed more than 50,000 people with no right to remain**" since **July last year**, a **23% increase** on the previous period.
विदेश सचिव इवेट कूपर ने कहा कि **यू.के.** ने **पिछले वर्ष जुलाई** से अब तक "**50,000 से अधिक ऐसे लोगों को हटाया है जिनके पास रहने का अधिकार नहीं था**", जो पिछली अवधि की तुलना में **23% की वृद्धि** है।

GS Paper II: Polity,	
TOPICS COVERED	29 December 2025
1. Bihar's unrealised potential बिहार की अवास्तविकृत क्षमता	
2. Gaps in regulating digital campaigns डिजिटल अभियानों के विनियमन में अंतराल	

Bihar's unrealised potential

Its infrastructure story and women's empowerment narrative are under strain

GS II:Polity: Local Governance

STATE OF PLAY

M.R. Sharan
Munish Sharma

Last month, Nitish Kumar returned as Chief Minister of Bihar after the National Democratic Alliance swept the Assembly elections. Two explanations have featured prominently in much of the commentary by analysts: the State's improvements in basic infrastructure such as roads, piped water, drains, electricity; and women's empowerment through self-help groups, cycles for girls, and reservations in panchayats, police and State-level jobs. While both these narratives have merit, Bihar's infrastructure gains and some elements of its record on women's empowerment have been under quiet strain.

Take piped water and drains. During the first phase of Saat Nischay (Seven Resolves), rural tap water access increased from negligible levels in 2011 to nearly 30% of households and over 60% of villages by 2020. There were similar leaps in drainage and other small civic works. This transformation hinged on Panchayati Raj institutions: not just the mukhiyas, who head the Gram Panchayats, but also the 1.1 lakh ward members who directly implemented these projects.

Understanding Bihar's local government structure is key to grasping why this decentralisation was so remarkable. Its panchayats are large – an average Gram Panchayat covers approximately 12,000 people, around four times the national average. Historically, whatever powers were devolved were concentrated in the mukhiya. In 2016, Bihar made a radical departure from this model: the responsibility for implementing the Nal-Jal (piped water) and Naali-Gali (drains and lanes) schemes was handed over to ward members. Each ward – with a population of roughly 1,000 and a directly elected representative – received about ₹20 lakh to implement works.

Many ward members were political novices. Severe land constraints meant locating sites for tanks and drains often produced local disputes. Yet, they persevered. Their incentives were hyper-local: more than any other elected representative, ward members live among, and are in close contact with, their constituents. A direct consequence of this devolution was a change in where people chose to contest elections: between the 2016 and 2021, ward candidates nearly doubled, while competition for the mukhiya post declined by about 20%.

This decentralised model was abruptly dismantled in May 2023, when a rule change stripped ward members of all financial authority. Citing concerns about corruption, maintenance and implementation of tap-water projects were handed to the Public Health Engineering Department, whose unelected officials have no local presence in Gram Panchayats. Thousands of ward bank accounts now lie dormant, and ward members are frustrated.

These moves have direct consequences: expansion of piped water connections has stalled. Even mukhiyas, who now have the final word on drain constructions, complain of reduced autonomy under tighter bureaucratic control. This pattern extends to other public goods and services such as waste collection, solar and street lighting.

If the infrastructure story is fragile, so too is the women's empowerment narrative. Bihar was neither the pioneer nor is it unique in adopting 50% reservation in panchayats for women. Research suggests that many women representatives still operate as proxies for their husbands. More important, substantive empowerment requires strengthening the more than 55,000 women ward members who form the backbone of local governance – precisely the actors whose financial authority has been removed.

Jeevika, Bihar's self-help group movement, remains a success. But entrepreneurship cannot be catalysed through one-time transfers such as the Mukhyamantri Mahila Rozgar Yojana. The scheme cost roughly ₹15,600 crore – resources unavailable for health, education, or the physical infrastructure Bihar needs. Also, an over-reliance on direct transfers weakens the chain of accountability between citizens and their elected representatives. When higher tiers of the State bypass panchayats and send money directly to citizens, local democracy is hollowed out.

Bihar's greatest resource is its unrealised potential. Much of it can be unlocked ground-up.

M.R. Sharan is Assistant Professor at the University of Maryland, College Park; Munish Sharma leads GRAMA, a policy initiative based out of Patna

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Bihar's unrealised potential
बिहार की अवास्तविकृत क्षमता

- The State's **improvements in basic infrastructure** such as **roads**, **piped water**, **drains**, **electricity**
  राज्य में **मूलभूत अवसंरचना** जैसे **सड़कें**, **पाइप से पानी**, **नालियाँ**, **बिजली** में सुधार

- And **women's empowerment** through **self-help groups**, **cycles for girls**, and **reservations** in **panchayats**, **police** and **State-level jobs**

- During the **first phase of Saat Nischay (Seven Resolves)**, **rural tap water access** increased from **negligible levels in 2011** to **nearly 30% of households** and **over 60% of villages by 2020**
  सात निश्चय के **पहले चरण** के दौरान ग्रामीण नल जल पहुंच 2011 में नगण्य स्तर से बढ़कर **2020 तक लगभग 30% घरों** और **60% से अधिक गांवों** तक पहुँची

- Its **panchayats are large**
  इसकी **पंचायतें बड़ी** हैं
- An average **Gram Panchayat** covers approximately **12,000 people**, around **four times the national average**
- The responsibility for implementing the **Nal-Jal (piped water)** and **Naali-Gali (drains and lanes)** schemes was **handed over to ward members**
  नल-जल (पाइप से पानी) और **नाली-गली (नालियाँ और गलियाँ)** योजनाओं को लागू करने की जिम्मेदारी **वार्ड सदस्यों** को सौंपी गई
- Each **ward** with a population of roughly **1,000** and a **directly elected representative** received about **₹20 lakh** to implement works
  प्रत्येक **वार्ड**, जिसकी आबादी लगभग **1,000** है और जिसमें **प्रत्यक्ष निर्वाचित प्रतिनिधि** होता है, को कार्यों के लिए लगभग **₹20 लाख** दिए गए
- This **decentralised model** was **abruptly dismantled** in **May 2023**, when a **rule change** stripped **ward members** of **all financial authority**
  यह **विकेंद्रीकृत मॉडल मई 2023** में **अचानक समाप्त** कर दिया गया, जब एक **नियम परिवर्तन** के तहत **वार्ड सदस्यों** से **सारी वित्तीय शक्तियाँ** छीन ली गईं
- Citing concerns about **corruption**, **maintenance** and **implementation of tap-water projects** were handed to the **Public Health Engineering Department**, whose **unelected officials** have **no local presence** in **Gram Panchayats**
  भ्रष्टाचार का हवाला देते हुए **नल-जल परियोजनाओं** के **रखरखाव और क्रियान्वयन** की जिम्मेदारी **लोक स्वास्थ्य अभियंत्रण विभाग** को दे दी गई, जिसके **गैर-निर्वाचित अधिकारी ग्राम पंचायतों** में **स्थानीय उपस्थिति** नहीं रखते
- Thousands of **ward bank accounts** now lie **dormant**, and **ward members are frustrated**
  हज़ारों **वार्ड बैंक खाते** अब **निष्क्रिय** पड़े हैं, और **वार्ड सदस्य निराश** हैं
- These moves have **direct consequences**
  इन कदमों के **प्रत्यक्ष परिणाम** सामने आए हैं
- **Expansion of piped water connections** has **stalled**
  पाइप से जल कनेक्शन का विस्तार रुक गया है
- Even **mukhiyas**, who now have the **final word on drain constructions**, complain of **reduced autonomy** under **tighter bureaucratic control**
  यहाँ तक कि **मुखिया**, जिनके पास अब **नाली निर्माण** पर **अंतिम अधिकार** है, भी **कड़े नौकरशाही नियंत्रण** के तहत **स्वायत्तता में कमी** की शिकायत करते हैं
- This pattern extends to **other public goods and services** such as **waste collection**, **solar** and **street lighting**
- More important, **substantive empowerment** requires **strengthening** the more than **55,000 women ward members** who form the **backbone of local governance**
  इससे भी अधिक महत्वपूर्ण यह है कि **वास्तविक सशक्तिकरण** के लिए **55,000 से अधिक महिला वार्ड सदस्यों** को सशक्त बनाना आवश्यक है, जो **स्थानीय शासन की रीढ़** हैं
- Precisely the actors whose **financial authority has been removed**
  ठीक वही प्रतिनिधि जिनकी **वित्तीय शक्तियाँ हटा दी गई हैं**
- **Jeevika**, Bihar's **self-help group movement**, remains a **success**
  जीविका, बिहार का **स्वयं सहायता समूह आंदोलन**, अब भी एक **सफल पहल** है
- But **entrepreneurship** cannot be **catalysed** through **one-time transfers** such as the **Mukhyamantri Mahila Rozgar Yojana**
  लेकिन **मुख्यमंत्री महिला रोजगार योजना** जैसे **एकमुश्त हस्तांतरण** के माध्यम से **उद्यमिता** को **प्रोत्साहित** नहीं किया जा सकता
- The scheme cost roughly **₹15,600 crore** resources **unavailable for health education or physical infrastructure** Bihar needs
  इस योजना पर लगभग **₹15,600 करोड़** खर्च हुए, जो **स्वास्थ्य**, **शिक्षा**, या **भौतिक अवसंरचना** के लिए **उपलब्ध नहीं** रहे, जिनकी बिहार को आवश्यकता है
- Also, an **over-reliance on direct transfers** weakens the **chain of accountability** between **citizens and their elected representatives**
  इसके अलावा, **प्रत्यक्ष हस्तांतरण** पर **अत्यधिक निर्भरता** नागरिकों और उनके निर्वाचित प्रतिनिधियों के बीच **जवाबदेही की कड़ी** को कमजोर करती है

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- When **higher tiers of the State** bypass **panchayats** and send money **directly to citizens**, **local democracy is hollowed out**

Gaps in regulating digital campaigns

An analysis of digital political advertisements during the Bihar Assembly election shows that third-party actors outspend official parties and candidates and achieve far greater visibility; this creates an accountability gap, allowing opaque funding and influence to persist beyond regulatory oversight

GS II: Polity: Elections

LETTER & SPIRIT

Abhishek Sharma
Vandita Gupta

India's election rulebook is governing a campaign ecosystem that no longer runs only on parties and candidates. As political persuasion shifts to platforms and intermediaries, regulation is struggling to keep pace with how votes are actually influenced. This disjunction surfaced in the Election Commission's (EC) press note of October 14 on the Bihar Assembly elections, which mandated pre-certification of political advertisements by the Media Certification and Monitoring Committee (MCMC) and reiterated the requirement under Section 77(1) of the Representation of the People Act, 1951, that political parties disclose social media campaign expenditure.

Limited lens
What unites these directives is their point of address. They remain focused on parties and candidates, even as electoral outreach is increasingly mediated by third-party actors such as campaign firms, influencers, and interest groups operating outside formal regulatory structures.

A subsequent notification issued by the EC on October 21 sought to widen the regulatory net by requiring that no political party, candidate, organisation, or individual publish political advertisements in the print media on polling day or the preceding day without prior MCMC certification. While this acknowledged the changing campaign environment by including entities other than parties or candidates, it also exposed the limits of the Commission's regulatory imagination. The restriction applies only to a narrow pre-poll window and remains confined to print media, even as electoral influence has decisively migrated to digital platforms.

Read together, these advisories foreground two unresolved questions: time, in an era where digital campaigns peak well before polling, and stakeholders, in a system shaped by actors beyond those formally regulated.

This analysis uses the Bihar Assembly election as a case study. Using Meta's Ads Library, it examines digital political advertisements by advertisers spending over one lakh in Bihar during the 30 days ending on November 10, the day before the final phase of polling, distinguishing between official party, candidate pages, and third-party actors.

Who pays, who persuades
An analysis of party expenditure reports, published by *The Hindu* on May 6, 2024, shows that digital campaigning now dominates election spending. What remains less visible is how this expenditure is distributed beyond parties and candidates, a gap that becomes evident from digital advertising data from the Bihar Assembly elections.

On Meta, 55 campaigners spent more than ₹1 lakh on digital political advertisements nationally during the period under analysis. Of these, only 23 were official parties or candidates. The remaining 32 were third-party or surrogate campaigners.

In digital elections, reach is shaped as much by who speaks as by how much is spent. Third-party actors not only outspent parties and candidates but also achieved far greater visibility. Despite near-identical average spending, their campaigns generated almost twice the average impressions of official parties and candidates (Table 1).

Election outreach: BJP supporters celebrating after the party's victory in Patna on November 14. R. V. MOORTHY

Table 1: Summary of digital advertising during the Bihar election on Meta

Stakeholders	Number	Total spend	Total impressions	Average spend	Average impressions
Parties/Candidates	23	₹5.55 crore	85.93 crore	₹24.16 lakh	3.74 crore
Third-parties	32	₹8.08 crore	210.84 crore	₹25.25 lakh	6.59 crore

Table 2: Age-wise consumption of political advertisements

Stakeholders	13-24	25-34	35-44	Above 44
Parties/Candidates	40.3%	36.1%	13.3%	10.2%
Third-parties	36.8%	37.7%	14.8%	10.6%

Table 3: Campaign efficiency of political advertisements

Stakeholders	Impressions per ₹10 lakh
Parties/Candidates	1.54 crore
Third-parties	2.60 crore

A clearer asymmetry between official, unofficial campaigning emerges when the efficiency is examined; it shows that in digital campaigns, comparable spending produces unequal circulation, raising questions about where communicative power in online elections actually resides

Nearly three-fourths of all digital outreach by parties and candidates (76.4%), as well as by third-party actors (74.5%), is consumed by individuals aged 13-34. However, the age-wise distribution of consumption diverges. Party and candidate advertisements remain sharply concentrated among the 13-24 and 25-34 age cohorts, while third-party advertisements show a more dispersed pattern, generating relatively higher impressions among those aged 25-44 and retaining a comparable presence beyond the age of 44 (Table 2).

A clearer asymmetry between official and unofficial campaigning emerges when campaign efficiency is examined. Measured as impressions per ₹10 lakh spent, third-party advertisers are markedly more cost-efficient, generating an average of 2.60 crore impressions compared to 1.54 crore for party or candidate pages (Table 3). This shows that in digital campaigns, comparable spending produces unequal circulation, raising questions about where communicative power in online elections actually resides.

An unaccountable nexus
Beyond differences in reach and efficiency, the analysis reveals direct financial entanglements between political parties and third-party actors. In some cases, advertisements on official party pages were funded by external entities. For instance, advertisements on the official Meta page of the Janata Dal (United) were sponsored by an entity identified as "The Spectrum".

This raises a deeper concern. Expenditure incurred by third-party entities to sponsor advertisements on official party pages may not be reflected in the expenditure statements submitted to the EC, risking an understatement of the true financial footprint of digital campaigning. More importantly, this pattern challenges the assumption that influence flows only from parties to third-party campaigners. Instead, it points to a dual-directional relationship in which third-party actors not only amplify political messaging but also directly finance it on official platforms, blurring the line between authorised expenditure and unaccounted influence.

Accountability gap
In *Secretary, Ministry of Information and Broadcasting v. M/s Gemini TV* (2004), the Supreme Court held that no individual or entity may publish advertisements for the benefit of any political party or candidate. By the same logic, advertisements directed against a party or candidate are equally impermissible, as such messaging inevitably benefits electoral competitors. Yet the guidelines issued by the EC ahead of the Bihar Assembly elections fall short of applying this standard to third-party actors, many of whom continued campaigning even on the evening of polling and on polling day itself.

Addressing this gap requires a recalibration of how electoral stakeholders are understood. Political campaigns are no longer confined to parties and candidates alone, but are shaped by a wider ecosystem of actors involved in content dissemination and campaign finance.

Unless regulatory obligations are extended – both in substance and scope – beyond parties and candidates, space will continue to exist for opaque, bi-directional arrangements that escape scrutiny.

The problem is compounded in the context of campaign finance. While parties are legally required to submit expenditure statements to the EC, digital spending is often disclosed ambiguously, with payments listed under platform names such as 'Facebook' rather than the specific entities that design or fund advertisements. More troubling still is the reverse flow of funding, where third-party entities pay for advertisements on the official page of a political party. Parties are required to report what they spend; they are not required to disclose what others spend on their behalf. This inversion poses an equal, if not greater, threat to the principles of transparency and fairness, allowing political influence to remain formally invisible.

Delayed regulation
Finally, the temporal framing of regulation remains inadequate. Electoral influence now builds over months through sustained digital exposure, rendering rules that activate only on the eve of polling ineffective against harms already set in motion. Each election conducted without a framework attuned to this reality carries clear costs in terms of the gradual erosion of trust in a fair digital democracy. The challenge now is no longer one of recognition, but of resolve.

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THE GIST

▼
India's election rulebook governs a campaign ecosystem that no longer runs only on parties and candidates, as political persuasion shifts to platforms and intermediaries operating outside formal regulatory structures.

▼
Digital advertising data from the Bihar Assembly elections shows that third-party actors outspend official parties and candidates and operate with higher campaign efficiency.

▼
The absence of regulatory obligations for these actors creates an accountability gap, allowing opaque financial entanglements and unaccounted influence to persist.

Gaps in regulating digital campaigns
डिजिटल अभियानों के विनियमन में अंतराल

- An analysis of digital political advertisements during the Bihar Assembly election shows that **third-party actors** outspend official parties and candidates and achieve far greater visibility; this creates an accountability gap, allowing opaque funding and influence to persist beyond regulatory oversight

- India's election rulebook is governing a **campaign ecosystem** that no longer runs only on **parties and candidates**
  भारत की चुनावी नियम-पुस्तिका अब ऐसे **चुनावी अभियान तंत्र** को नियंत्रित कर रही है जो केवल **राजनीतिक दलों और उम्मीदवारों** पर आधारित नहीं रहा है

- As political **persuasion shifts to platforms and intermediaries**, regulation is struggling to **keep pace** with how votes are actually **influenced**

-

- The press note mandated **pre-certification of political advertisements** by the **Media Certification and Monitoring Committee (MCMC)**
  इस प्रेस नोट में **राजनीतिक विज्ञापनों के पूर्व-प्रमाणीकरण** को **मीडिया प्रमाणन और निगरानी समिति (MCMC)** द्वारा अनिवार्य किया गया

- It also reiterated the requirement under **Section 77(1) of the Representation of the People Act, 1951**
  इसमें **जन प्रतिनिधित्व अधिनियम, 1951 की धारा 77(1)** के तहत प्रावधान को भी दोहराया गया

- That **political parties disclose social media campaign expenditure**
  कि **राजनीतिक दलों** को **सोशल मीडिया अभियान के खर्च** का खुलासा करना होगा

- It required that **no political party, candidate, organisation, or individual** publish **political advertisements** in the **print media**
  इसके अनुसार **कोई भी राजनीतिक दल, उम्मीदवार, संगठन या व्यक्ति प्रिंट मीडिया** में **राजनीतिक विज्ञापन** प्रकाशित नहीं कर सकता

- On **polling day or the preceding day** without **prior MCMC certification**

- Even as electoral influence has **decisively migrated to digital platforms**

- On **Meta**, **55 campaigners** spent more than **₹1 lakh** on **digital political advertisements** nationally during the period under analysis
  Meta पर, विश्लेषण अवधि के दौरान **55 प्रचारकों** ने राष्ट्रीय स्तर पर **डिजिटल राजनीतिक विज्ञापनों** पर **₹1 लाख से अधिक** खर्च किया

- Of these, only **23** were **official parties or candidates**
  इनमें से केवल **23 आधिकारिक दल या उम्मीदवार** थे

- The remaining **32** were **third-party or surrogate campaigners**
  शेष **32 तृतीय-पक्ष या प्रतिनिधि प्रचारक** थे

- In **digital elections**, reach is shaped as much by **who speaks** as by **how much is spent**
  डिजिटल चुनावों में पहुँच उतनी ही **किसके द्वारा बोला जाता है** से तय होती है जितनी **कितना खर्च किया जाता है** से

- **Third-party actors** not only **outspent parties and candidates** but also achieved **far greater visibility**
  तृतीय-पक्ष अभिनेता न केवल **दल और उम्मीदवारों से अधिक खर्च** करते हैं बल्कि **काफी अधिक दृश्यता** भी हासिल करते हैं

- Despite **near-identical average spending**, their campaigns generated **almost twice the average impressions** of **official parties and candidates** (**Table 1**)
  लगभग समान औसत खर्च के बावजूद, उनके अभियानों ने **आधिकारिक दलों और उम्मीदवारों** की तुलना में **लगभग दोगुने औसत इम्प्रेशन** उत्पन्न किए (**तालिका 1**)

- Nearly **three-fourths** of all **digital outreach** by **parties and candidates (76.4%)**, as well as by **third-party actors (74.5%)**, is consumed by individuals aged **13–34**

-

- A clearer **asymmetry** between **official and unofficial campaigning** emerges when **campaign efficiency** is examined
- In some cases, **advertisements on official party pages** were **funded by external entities**
  कुछ मामलों में **आधिकारिक पार्टी पेजों** पर **विज्ञापनों** को **बाहरी संस्थाओं** ने वित्तपोषित किया
- For instance, advertisements on the **official Meta page of the Janata Dal (United)** were sponsored by an entity identified as **"The Spectrum"**
  उदाहरण के लिए, **जनता दल (यूनाइटेड)** के **आधिकारिक Meta पेज** पर विज्ञापनों को **"The Spectrum"** नामक इकाई ने प्रायोजित किया
- This raises a **deeper concern**
  यह एक **गहरी चिंता** को जन्म देता है
- Expenditure incurred by **third-party entities** to sponsor advertisements on **official party pages** may not be **reflected in expenditure statements** submitted to the **EC**
  तृतीय-पक्ष इकाइयों द्वारा **आधिकारिक पार्टी पेजों** पर विज्ञापन प्रायोजित करने में किया गया खर्च **चुनाव आयोग (EC)** को सौंपे गए **व्यय विवरणों** में प्रतिबिंबित न भी हो
- Risking an **understatement of the true financial footprint** of **digital campaigning**
-
- In which **third-party actors** not only **amplify political messaging** but also **directly finance it** on official platforms
  जिसमें **तृतीय-पक्ष अभिनेता** न केवल **राजनीतिक संदेशों को बढ़ाते** हैं बल्कि **आधिकारिक प्लेटफॉर्मों** पर उन्हें **प्रत्यक्ष रूप से वित्तपोषित** भी करते हैं
- Blurring the line between **authorised expenditure** and **unaccounted influence**
  और इस प्रकार **अधिकृत खर्च** तथा **अघोषित प्रभाव** के बीच की रेखा **धुंधली** हो जाती है

Accountability gap
जवाबदेही का अंतर

- In **Secretary, Ministry of Information and Broadcasting v. M/s Gemini TV (2004)**, the **Supreme Court** held that **no individual or entity** may publish advertisements for the **benefit of any political party or candidate**

- By the same logic, advertisements **directed against a party or candidate** are **equally impermissible**, as such messaging **inevitably benefits electoral competitors**

- Unless **regulatory obligations** are extended — both in **substance and scope** — beyond **parties and candidates**, space will continue to exist for **opaque, bi-directional arrangements** that **escape scrutiny**
  जब तक **नियामक दायित्वों** को **वस्तु और दायरे** दोनों में **दल और उम्मीदवारों से आगे** नहीं बढ़ाया जाता, तब तक **अपारदर्शी, द्वि-दिशात्मक व्यवस्थाओं** के लिए स्थान बना रहेगा जो **जांच से बच निकलती हैं**
- The problem is **compounded** in the context of **campaign • nance**
  यह समस्या **अभियान वित्त** के संदर्भ में और भी **गंभीर** हो जाती है
- While **parties are legally required** to submit **expenditure statements** to the **EC**, **digital spending** is often disclosed **ambiguously**
  हालाँकि **दल कानूनी रूप से बाध्य** हैं कि वे **चुनाव आयोग** को **व्यय विवरण** सौंपें, लेकिन **डिजिटल खर्च** अक्सर **अस्पष्ट रूप से** घोषित किया जाता है
- With payments listed under **platform names** such as **'Facebook'** rather than the **specific entities** that **design or fund advertisements**
  जहाँ भुगतान **'Facebook'** जैसे **प्लेटफॉर्म नामों** के अंतर्गत दिखाया जाता है, न कि उन **विशिष्ट संस्थाओं** के नाम से जो **विज्ञापन तैयार या वित्तपोषित** करती हैं
- More troubling still is the **reverse • ow of funding**, where **third-party entities** pay for advertisements on the **o• cial page of a political party**
  और भी अधिक चिंताजनक है **वित्त का उल्टा प्रवाह**, जहाँ **तृतीय-पक्ष संस्थाएँ** किसी **राजनीतिक दल के आधिकारिक पेज** पर विज्ञापनों के लिए भुगतान करती हैं
- **Parties are required to report what they spend**
  दल केवल वही रिपोर्ट करने के लिए बाध्य हैं जो वे स्वयं खर्च करते हैं
- They are **not required to disclose what others spend on their behalf**
  वे यह बताने के लिए **बाध्य नहीं** हैं कि **उनकी ओर से अन्य लोग** कितना खर्च करते हैं

- This **inversion** poses an **equal, if not greater, threat** to the principles of **transparency and fairness**
  यह **उलटाव पारदर्शिता और निष्पक्षता** के सिद्धांतों के लिए **समान, यदि अधिक नहीं, तो गंभीर खतरा** उत्पन्न करता है
- Allowing **political in• uence** to remain **formally invisible**
  और **राजनीतिक प्रभाव** को **औपचारिक रूप से अदृश्य** बने रहने देता है

Delayed regulation
विलंबित विनियमन

- Finally, the **temporal framing of regulation** remains **inadequate**
  अंततः, **विनियमन की समयगत रूपरेखा** अब भी **अपर्याप्त** बनी हुई है
- **Electoral in• uence** now builds over **months** through **sustained digital exposure**
  चुनावी प्रभाव अब **लगातार डिजिटल संपर्क** के माध्यम से **महीनों** में निर्मित होता है
- Rendering rules that **activate only on the eve of polling ine• ective** against harms **already set in motion**
  जिससे वे नियम जो केवल **मतदान की पूर्व संध्या** पर लागू होते हैं, **पहले से शुरू हो चुके नुकसान** के विरुद्ध **अप्रभावी** हो जाते हैं
- Each election conducted without a framework **attuned to this reality** carries **clear costs**
  इस वास्तविकता के अनुरूप ढाँचे के बिना आयोजित प्रत्येक चुनाव **स्पष्ट लागत** लेकर आता है
- In terms of the **gradual erosion of trust** in a **fair digital democracy**
  विशेषकर **निष्पक्ष डिजिटल लोकतंत्र में विश्वास के क्रमिक क्षरण** के रूप में
- The challenge now is **no longer one of recognition, but of resolve**
  अब चुनौती **पहचान की नहीं**, बल्कि **दृढ़ संकल्प** की है

GS Paper II: International Relations	
TOPICS COVERED	**29 December 2025**
1.	**Sham election** ढोंगपूर्ण चुनाव
2.	**Linked civilisations, a modern strategic partnership** जुड़ी हुई सभ्यताएँ, एक आधुनिक रणनीतिक साझेदारी
3.	**Venezuela's resource curse** वेनेजुएला का संसाधन अभिशाप
4.	**Russia likely placing new hypersonic missiles in Belarus: U.S. researchers** रूस द्वारा बेलारूस में नए हाइपरसोनिक मिसाइल तैनात किए जाने की संभावना: अमेरिकी शोधकर्ता

GS II: IR

Sham election

Myanmar's junta's search for legitimacy through controlled polls is futile

The core of electoral democracy is the institution of popular will through representation. When elections are merely held to subvert this will by imposing favoured candidates, they are clearly a sham. Such is the case with Myanmar's three-phase elections being conducted by the junta nearly five years after it upended a democratically elected government and precipitated a raging civil war. Sunday marked the first phase in 102 townships, with the subsequent phases on January 11 (100 townships) and January 25 (63 townships). The junta controls barely half the country's townships, with elections being skipped in at least 65 areas. None of the major parties from the 2020 elections is participating, including the winner, the National League for Democracy (NLD) led by imprisoned leader Daw Aung San Suu Kyi. Only the Union Solidarity and Development Party (USDP), stuffed with former junta figures, is a force. This reminds one of the 2010 elections under the 2008 constitution which the NLD boycotted and which the USDP swept. But the situation is worse now, with the junta bombing and killing thousands of citizens for five years. It also faced its strongest challenge since the early 1960s as ethnic armed organisations and the NLD-affiliated People's Defence Forces (PDF), loyal to the opposition National Unity Government formed by NLD exiles, won control of significant territory. By late-2023, this coalition, armed with Chinese weapons, dealt the biggest blow through the Three Brotherhood Alliance (TBA) in Shan State and Rakhine, seizing townships along the China border.

The junta, sustained by Russian and Belarusian weaponry, was on the back foot until China changed tack in 2025, prioritising its geo-economic interests, particularly access to the Indian Ocean. Beijing pressured the TBA to cease hostilities and return control to the junta, which two groups reluctantly did earlier this year. This shift, as well as the lack of centralised command among Bamar-dominated PDFs and other ethnic insurgent groups, have allowed the junta to regain lost territory. Yet, the junta faces pitched battles across Rakhine, Karenni, Karen, Chin States and the Sagaing Region where it has only nominal control. Only China, Russia and Belarus have endorsed these "elections", and reports from Myanmar's capital and junta-controlled areas suggest participation to be far lower than in 2020. For now, the junta seeks legitimacy as it has gained a semblance of control or managed a bloody stalemate in the civil war. The military, led by tinpot leader Min Aung Hlaing, will retain its constitutionally enshrined 25% non-elected quota of legislative seats, ensuring army dominance regardless of results. But if history is a guide, farcical elections will not win popular support and Myanmar must brace for more conflict.

Sham election
ढोंगपूर्ण चुनाव

- **Myanmar's junta's search for legitimacy through controlled polls is futile**
नियंत्रित चुनावों के माध्यम से वैधता पाने की म्यांमार की जुंटा की कोशिश व्यर्थ है

The core of electoral democracy
निर्वाचक लोकतंत्र का मूल तत्व

- The **core of electoral democracy** is the **institution of popular will through representation**
निर्वाचक लोकतंत्र का मूल प्रतिनिधित्व के माध्यम से जन-इच्छा की स्थापना है

- When **elections are merely held to subvert this will by imposing favoured candidates**, they are **clearly a sham**
जब **पसंदीदा उम्मीदवार थोपकर** इस जन-इच्छा को कमजोर करने के लिए केवल **चुनाव कराए जाते हैं**, तो वे **स्पष्ट रूप से एक दिखावा** होते हैं

- Such is the case with **Myanmar's three-phase elections** being conducted by the **junta** nearly **five years** after it **upended a democratically elected government** and precipitated a **raging civil war**
ऐसा ही मामला **Myanmar** में **सैन्य जुंटा** द्वारा कराए जा रहे **तीन-चरणीय चुनावों** का है, जो **लोकतांत्रिक रूप से चुनी गई सरकार को गिराने** और **भीषण गृहयुद्ध** शुरू होने के लगभग **पाँच वर्ष** बाद हो रहे हैं

- Sunday marked the **first phase** in **102 townships**, with the **subsequent phases** on **January 11 (100 townships)** and **January 25 (63 townships)**
रविवार को **102 टाउनशिप** में **पहला चरण** हुआ, इसके बाद **11 जनवरी (100 टाउनशिप)** और **25 जनवरी (63 टाउनशिप)** को अगले चरण होंगे

- The **junta controls barely half** the country's **townships**, with **elections being skipped in at least 65 areas**
जुंटा देश की **कुल टाउनशिप के केवल लगभग आधे हिस्से** को नियंत्रित करता है, और **कम से कम 65 क्षेत्रों में चुनाव कराए ही नहीं जा रहे**

- None of the **major parties from the 2020 elections** is participating, including the winner, the **National League for Democracy (NLD)** led by imprisoned leader **Daw Aung San Suu Kyi**
2020 के चुनावों की **कोई भी प्रमुख पार्टी** भाग नहीं ले रही है, जिसमें विजेता **एनएलडी** भी शामिल है, जिसका नेतृत्व **कारावास में बंद दॉ आंग सान सू की** कर रही थीं

- Only the **Union Solidarity and Development Party (USDP)**, **stuffed with former junta figures**, is a **force**
केवल **यूएसडीपी**, जिसमें **पूर्व जुंटा अधिकारी भरे हुए हैं**, ही एक **प्रभावी शक्ति** है

- This reminds one of the **2010 elections** under the **2008 constitution** which the **NLD boycotted** and which the **USDP swept**

- It also faced its **strongest challenge since the early 1960s** as **ethnic armed organisations** and the **NLD-affiliated People's Defence Forces (PDF)** loyal to the **opposition National Unity Government** formed by **NLD exiles**, **won control of significant territory**

  इसे **1960 के दशक की शुरुआत के बाद से सबसे बड़ी चुनौती** भी मिली, जब **जातीय सशस्त्र संगठनों** और एनएलडी से संबद्ध पीपल्स डिफेंस फोर्सेस, जो एनएलडी निर्वासितों द्वारा गठित विपक्षी राष्ट्रीय एकता सरकार के प्रति वफादार हैं, ने **महत्वपूर्ण क्षेत्रों पर नियंत्रण** हासिल किया

- By **late-2023**, this **coalition**, armed with **Chinese weapons**, dealt the **biggest blow** through the **Three Brotherhood Alliance (TBA)** in **Shan State and Rakhine**, seizing **townships along the China border**

  2023 के अंत तक, चीनी हथियारों से लैस इस **गठबंधन** ने **शान राज्य और रखाइन** में टीबीए के माध्यम से **सबसे बड़ा झटका** दिया और **चीन सीमा के साथ टाउनशिप पर कब्जा** किया

- The **junta**, sustained by **Russia and Belarus weaponry**, was on the **back foot** until **China changed tack in 2025**, prioritising its **geo-economic interests**, particularly **access to the Indian Ocean**

  रूस और बेलारूस के हथियारों से समर्थित **जुंटा** तब तक **रक्षात्मक स्थिति** में था, जब तक **2025 में चीन ने रुख नहीं बदला**, और अपने **भू-आर्थिक हितों**, विशेषकर **हिंद महासागर तक पहुँच**, को प्राथमिकता नहीं दी

- **Beijing pressured the TBA** to **cease hostilities** and **return control to the junta**, which **two groups reluctantly did earlier this year**

  बीजिंग ने टीबीए पर दबाव डाला कि वे **शत्रुता समाप्त करें** और **नियंत्रण जुंटा को लौटाएँ**, जिसे **इस वर्ष की शुरुआत में दो समूहों ने अनिच्छा से किया**

- This **shift**, as well as the **lack of centralised command** among **Bamar-dominated PDFs and other ethnic insurgent groups**, have allowed the **junta to regain lost territory**

  इस **बदलाव** और बमार-प्रधान पीडीएफ तथा अन्य जातीय विद्रोही समूहों में केंद्रीकृत कमान के अभाव ने **जुंटा को खोया हुआ क्षेत्र पुनः हासिल करने** में मदद की

- Yet, the **junta faces pitched battles** across **Rakhine, Karenni, Karen, Chin States** and the **Sagaing Region** where it has **only nominal control**

  फिर भी **जुंटा** को **रखाइन, करेननी, करेन, चिन राज्यों** और **सागाइंग क्षेत्र में कड़ी लड़ाइयों** का सामना करना पड़ रहा है, जहाँ उसका **केवल नाममात्र नियंत्रण** है

- Only **China, Russia and Belarus** have **endorsed these "elections"**, and reports from **Myanmar's capital and junta-controlled areas** suggest **participation to be far lower than in 2020**

- The **military**, led by **tinpot leader Min Aung Hlaing**, will retain its **constitutionally enshrined 25% non-elected quota of legislative seats**, ensuring **army dominance regardless of results**

Linked civilisations, a modern strategic partnership

GS II: IR

Relations between Iran and India transcend the boundaries of conventional diplomacy. They represent an ongoing dialogue between two ancient civilisations that emerged from a shared cultural womb at the dawn of human history. Long before the Aryan tribes divided – one settling on the Iranian plateau and the other in the fertile plains of the Indus and Ganges – they spoke related languages, worshipped through similar myths, and held a common worldview.

The profound resemblance between the Avesta and the Rigveda stands as clear testimony to this shared origin. Through centuries of political change, this civilizational affinity has nurtured a deep reservoir of trust and cultural understanding – never completely severed despite periods of distance and turmoil.

Nowhere is this historical bond more vividly reflected than in the enduring presence of Persian in the Indian subcontinent. India embraced Persian for centuries – not merely as a language, but as a vessel of art, diplomacy and poetry. This cultural hospitality gave rise to the luminous "Indian Style" (Sabk-e Hendi) in Persian literature, shaped by the imagination and creativity of Indo-Persian poets. Among them, Mirza Abdul-Qadir Bedil Dehlavi shines as the most illustrious figure – a poet whose philosophical depth and boundless imagination expanded the horizons of Persian poetry and continues to inspire scholars and writers across generations.

The modern drivers of ties
In today's world, nostalgia alone cannot sustain bilateral relations. Fortunately, the evolving geopolitical environment and economic needs have drawn Tehran and New Delhi closer than ever. As the global order tilts toward multipolarity, the Iran-India axis is positioned to assume a strategic role in shaping regional stability and economic architecture.

Energy security remains a central pillar. India, one of the fastest-growing economies globally, continues to rely significantly on oil and gas to fuel its industries. With extensive hydrocarbon reserves, Iran stands as a natural partner in securing India's long-term energy needs.

Perhaps the most consequential arena of cooperation is transport and connectivity. India's participation in the development of the Chabahar Port signals the strategic weight both nations attach to this maritime gateway. Complementing this, Iran forms a vital link in the International North-South Transport Corridor (INSTC) – a multimodal route connecting India to Russia and Northern Europe through Iran. This corridor is approximately 40% shorter and 30% more cost-efficient when compared to the traditional Suez Canal route, granting both countries a competitive advantage in Eurasian trade.

Security and technology
Beyond commerce, Iran and India share mutual concerns regarding regional security. The rise of extremism and terrorism in West and South Asia threatens both nations, making intelligence cooperation a discreet yet essential foundation of bilateral ties.

Challenges remain. Historically, third-party pressures have influenced the trajectory of relations. Yet, India has often navigated these complexities by prioritising its national interest with strategic prudence. In an era marked by shifting power centres and the rise of Asia, it is imperative for both countries to strengthen flexible financial mechanisms – such as trade through local currencies – to reduce vulnerability to external constraints.

The future demands diversification beyond traditional oil trade. Cooperation in knowledge-based industries, information technology – where India holds significant comparative advantage – and in nanotechnology and the medical sciences (fields in which Iran has made remarkable progress), can open new horizons of economic partnership.

Such collaboration can transform the relationship from transactional to innovation-driven, benefiting both societies.

A shared future built on an ancient past
Iran and India may rightly be described as one soul in two bodies – united by history, enriched by culture, and positioned by geography to complement one another. If the Silk Road and Persian language once formed the bridge between them, today, energy cooperation, counterterrorism and strategic transit connectivity serve as the new pillars of partnership.

As the two nations mark the 75th anniversary of diplomatic relations, the moment is ripe for Tehran and New Delhi to transform historical goodwill into a bold, forward-looking alliance. A revitalised partnership will not only enhance the prosperity of their peoples but also anchor stability in the turbulent landscape of West Asia.

The time has come for Iran and India, guided by their shared legacy and mutual interests, to design a future that is collaborative, resilient, and independent, echoing the ancient symphony of civilisations that still binds them today.

Mohammad Fathali

is Ambassador of the Islamic Republic of Iran in India

A revitalised partnership between Iran and India will aid economic partnership and ensure stability in West Asia

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Linked civilisations, a modern strategic partnership
जुड़ी हुई सभ्यताएँ, एक आधुनिक रणनीतिक साझेदारी

- Relations between **Iran** and **India** transcend the boundaries of **conventional diplomacy**
  ईरान और **भारत** के बीच संबंध **पारंपरिक कूटनीति** की सीमाओं से परे हैं

- They represent an **ongoing dialogue** between **two ancient civilisations** that emerged from a **shared cultural womb** at the **dawn of human history**
  वे **मानव इतिहास की शुरुआत** में एक **साझा सांस्कृतिक स्रोत** से निकली **दो प्राचीन सभ्यताओं** के बीच **निरंतर संवाद** का प्रतिनिधित्व करते हैं

- Long before the **Aryan tribes divided** one settling on the **Iranian plateau** and the other in the **fertile plains of the Indus and Ganges** they spoke **related languages**, worshipped through **similar myths**, and held a **common worldview**
  आर्य जनजातियों के विभाजन से बहुत पहले जब एक **ईरानी पठार** पर और दूसरा **सिंधु और गंगा के उपजाऊ मैदानों** में बसा तब वे **संबंधित भाषाएँ** बोलते थे, **समान मिथकों** के माध्यम से पूजा करते थे और एक **साझा विश्वदृष्टि** रखते थे

- The profound resemblance between the **Avesta** and the **Rigveda** stands as **clear testimony** to this **shared origin**

- India embraced **Persian** for centuries not merely as a **language** but as a **vessel of art diplomacy and poetry**
  भारत ने सदियों तक **फ़ारसी** को केवल **भाषा** के रूप में नहीं बल्कि **कला कूटनीति और काव्य** के माध्यम के रूप में अपनाया

- This cultural hospitality gave rise to the luminous **Indian Style Sabk-e Hendi** in **Persian literature**, shaped by the **imagination and creativity of Indo-Persian poets**
  इस सांस्कृतिक आतिथ्य ने **फ़ारसी साहित्य** में दीप्तिमान **इंडियन स्टाइल सब्क-ए-हिंदी** को जन्म दिया जिसे **इंडो-फ़ारसी कवियों** की **कल्पना और सृजनशीलता** ने आकार दिया

- Among them **Mirza Abdul-Qadir Bedil Dehlavi** shines as the **most illustrious figure** a poet whose **philosophical depth and boundless imagination** expanded the **horizons of Persian poetry** and continues to **inspire scholars and writers across generations**

The modern drivers of ties
संबंधों के आधुनिक प्रेरक तत्व

- In today's world **nostalgia alone** cannot sustain **bilateral relations**
  आज की दुनिया में **केवल स्मृतियाँ द्विपक्षीय संबंधों** को बनाए नहीं रख सकतीं
- Fortunately the **evolving geopolitical environment** and **economic needs** have drawn **Tehran and New Delhi** closer than ever
  सौभाग्य से **बदलता भू-राजनीतिक परिवेश** और **आर्थिक आवश्यकताएँ तेहरान और नई दिल्ली** को पहले से कहीं अधिक निकट ले आई हैं
- As the **global order** tilts toward **multipolarity**, the **Iran-India axis** is positioned to assume a **strategic role** in shaping **regional stability and economic architecture**
  जैसे-जैसे **वैश्विक व्यवस्था बहुध्रुवीयता** की ओर झुक रही है **ईरान-भारत धुरी क्षेत्रीय स्थिरता और आर्थिक संरचना** को आकार देने में **रणनीतिक भूमिका** निभाने की स्थिति में है
- **Energy security** remains a **central pillar**
  ऊर्जा सुरक्षा एक **केंद्रीय स्तंभ** बनी हुई है
- India one of the **fastest-growing economies globally** continues to rely significantly on **oil and gas** to fuel its **industries**
  भारत जो **वैश्विक स्तर पर सबसे तेजी से बढ़ती अर्थव्यवस्थाओं** में से एक है अपनी **उद्योगों** को चलाने के लिए **तेल और गैस** पर काफी निर्भर है
- With **extensive hydrocarbon reserves**, Iran stands as a **natural partner** in securing India's **long-term energy needs**
  विशाल हाइड्रोकार्बन भंडार के साथ **ईरान** भारत की **दीर्घकालिक ऊर्जा आवश्यकताओं** को सुरक्षित करने में एक **स्वाभाविक साझेदार** है
- Perhaps the most **consequential arena of cooperation** is **transport and connectivity**
  संभवतः सहयोग का सबसे **महत्वपूर्ण क्षेत्र परिवहन और संपर्क** है
- India's participation in the development of the **Chabahar Port** signals the **strategic weight** both nations attach to this **maritime gateway**
  चाबहार बंदरगाह के विकास में भारत की भागीदारी इस **समुद्री द्वार** को दोनों देशों द्वारा दिए गए **रणनीतिक महत्व** को दर्शाती है
- Complementing this Iran forms a **vital link** in the **International North-South Transport Corridor** a **multimodal route** connecting **India to Russia and Northern Europe through Iran**
  इसके पूरक के रूप में **ईरान अंतरराष्ट्रीय उत्तर-दक्षिण परिवहन गलियारे** में एक **महत्वपूर्ण कड़ी** बनता है जो **भारत को ईरान के माध्यम से रूस और उत्तरी यूरोप** से जोड़ता है
- This corridor is approximately **40% shorter** and **30% more cost-efficient** when compared to the **traditional Suez Canal route** granting both countries a **competitive advantage in Eurasian trade**
  यह गलियारा **पारंपरिक स्वेज नहर मार्ग** की तुलना में लगभग **40% छोटा** और **30% अधिक लागत-कुशल** है जिससे दोनों देशों को **यूरेशियाई व्यापार** में **प्रतिस्पर्धात्मक लाभ** मिलता है

Security and technology
सुरक्षा और प्रौद्योगिकी

- Beyond **commerce**, **Iran** and **India** share **mutual concerns** regarding **regional security**
  व्यापार से परे **ईरान** और **भारत क्षेत्रीय सुरक्षा** को लेकर **साझा चिंताएँ** रखते हैं
- The rise of **extremism and terrorism** in **West and South Asia** threatens **both nations**, making **intelligence cooperation** a **discreet yet essential foundation** of **bilateral ties**
  पश्चिम और दक्षिण एशिया में **उग्रवाद और आतंकवाद** का बढ़ना **दोनों देशों** के लिए खतरा है, जिससे **खुफिया सहयोग द्विपक्षीय संबंधों** की **गोपनीय लेकिन आवश्यक आधारशिला** बनता है

Challenges remain
चुनौतियाँ बनी हुई हैं

- Historically, **third-party pressures** have **influenced the trajectory** of relations
  ऐतिहासिक रूप से **तीसरे पक्ष का दबाव** संबंधों की **दिशा** को **प्रभावित** करता रहा है

- Yet, **India** has often navigated these **complexities** by prioritising its **national interest** with **strategic prudence**
  फिर भी **भारत** ने इन **जटिलताओं** को **रणनीतिक विवेक** के साथ अपने **राष्ट्रीय हित** को प्राथमिकता देकर संभाला है

- In an era marked by **shifting power centres** and the **rise of Asia**, it is **imperative** for both countries to strengthen **flexible financial mechanisms** such as **trade through local currencies** to **reduce vulnerability** to **external constraints**

- The future demands **diversification beyond traditional oil trade**
  भविष्य **पारंपरिक तेल व्यापार से आगे विविधीकरण** की माँग करता है

- Cooperation in **knowledge-based industries**, **information technology** where **India holds significant comparative advantage**, and in **nanotechnology** and the **medical sciences** fields in which **Iran has made remarkable progress** can **open new horizons** of **economic partnership**
  ज्ञान-आधारित उद्योगों, **सूचना प्रौद्योगिकी** जहाँ **भारत को महत्वपूर्ण तुलनात्मक लाभ** है, तथा **नैनोप्रौद्योगिकी** और **चिकित्सा विज्ञान** जिन क्षेत्रों में **ईरान ने उल्लेखनीय प्रगति** की है, में सहयोग **आर्थिक साझेदारी** के **नए क्षितिज** खोल सकता है

- Such **collaboration** can **transform** the relationship from **transactional** to **innovation-driven**, **benefiting both societies**
  ऐसा **सहयोग** संबंधों को **लेन-देन आधारित** से **नवाचार-प्रेरित** बना सकता है और **दोनों समाजों** को **लाभ** पहुँचा सकता है

A shared future built on an ancient past
प्राचीन अतीत पर आधारित साझा भविष्य

- **Iran and India** may rightly be described as **one soul in two bodies** united by **history**, enriched by **culture**, and positioned by **geography** to **complement one another**
  ईरान और भारत को उचित ही **दो शरीरों में एक आत्मा** कहा जा सकता है जो **इतिहास** से जुड़े, **संस्कृति** से समृद्ध और **भूगोल** द्वारा एक-दूसरे के **पूरक** हैं

- If the **Silk Road** and **Persian language** once formed the **bridge** between them, today **energy cooperation**, **counterterrorism** and **strategic transit connectivity** serve as the **new pillars** of **partnership**
  यदि कभी **रेशम मार्ग** और **फ़ारसी भाषा** उनके बीच **सेतु** थे, तो आज **ऊर्जा सहयोग**, **आतंकवाद-रोधी प्रयास** और **रणनीतिक परिवहन संपर्क साझेदारी** के **नए स्तंभ** हैं

- As the two nations mark the **75th anniversary of diplomatic relations**, the moment is **ripe** for **Tehran** and **New Delhi** to **transform historical goodwill** into a **bold forward-looking alliance**
  जब दोनों देश **राजनयिक संबंधों की 75वीं वर्षगांठ** मना रहे हैं, तो **तेहरान** और **नई दिल्ली** के लिए **ऐतिहासिक सद्भावना** को **साहसी और भविष्यदृष्टि** वाले **गठबंधन** में बदलने का समय **उपयुक्त** है

- A **revitalised partnership** will not only **enhance prosperity** of their peoples but also **anchor stability** in the **turbulent landscape of West Asia**
  एक **पुनर्जीवित साझेदारी** न केवल **जनसमृद्धि** बढ़ाएगी बल्कि **पश्चिम एशिया** के **अशांत परिदृश्य में स्थिरता** भी स्थापित करेगी

- The **time has come** for **Iran and India**, guided by their **shared legacy and mutual interests**, to **design a future** that is **collaborative**, **resilient**, and **independent**, echoing the **ancient symphony of civilisations** that still **binds them today**

Venezuela's resource curse

Despite having the world's most proven oil resources, the country has a strained economy

DATA POINT

Sambavi Parthasarathy

After announcing a naval blockade and seizing two oil tankers, the Donald Trump administration has now ordered U.S. military forces to focus on enforcing a 'quarantine' of Venezuelan oil for at least the next two months, amping up economic pressure on Caracas. The impact of this imperialist step could worsen the already weak Venezuelan economy. But how did a petrostate with the most proven resources end up with a strained economy in the first place?

Venezuela has the largest proven reserves of crude oil in the world at 303 billion barrels (2023). Yet, it ranks much lower in the production and refining of oil. Most of its resources are extra-heavy crude oil, whose extraction and processing require specialised technology and refineries. However, internal issues and international sanctions have starved it of the capital required for this.

While the state-run oil company Petroleos de Venezuela, S.A. (PDVSA) owns and operates five refineries in Venezuela, it also suffers from years of under investment, mismanagement, and a lack of technical expertise. Specifically, following a failed coup attempt in April 2002 and the subsequent general strike/oil lockout in December 2002-February 2003, the then President, Hugo Chavez, was forced to replace PDVSA's management. Critics say this led to a bureaucratisation of the company.

In 2024, the country produced 9,21,000 barrels of crude oil per day, at least 56% lower than its production in the 1980s. In the 1970s, Venezuela benefited when oil prices soared due to the Yom Kippur War, and its per capita income became the highest in Latin America. It was then a largely unequal country. However, the figure has only dwindled since 2014 following sanctions and the oil downturn (Chart 2). Venezuela's GDP per capita in recent years has become almost similar to what it was three decades ago. No other country's GDP per capita has slid to this extent in this period.

Consequently, despite being a founding member of the Organisation of the Petroleum Exporting Countries (OPEC), Venezuela has the highest general government gross debt compared to other OPEC members (Chart 3). While others have steered through global oil price crashes, the country continues to reel under economic pressure. This points to the fact that the economic crisis in Venezuela cannot be attributed to global crude factors alone.

U.S. sanctions have played a major role in curbing the petroleum sector in Venezuela. The first Trump administration imposed sanctions in August 2017, prohibiting Caracas from accessing U.S. financial markets. It then imposed more sanctions in 2019, on PDVSA, preventing it from being paid for exports to the U.S. The sanctions also froze PDVSA's U.S. assets and disallowed the supply of diluents. There was some easing in 2023 under the Joe Biden regime, but sanctions were reinstated later, before the naval blockade imposed by the second Trump regime.

The slump can also partly be explained by the country's lack of diversification. While many other OPEC countries have diversified to non-oil exports, Venezuela has failed to do so. As seen in Chart 4, Venezuela has largely continued to rely on its mineral (oil) exports.

Despite Venezuela exporting mostly only oil, the country's share in global exports of oil fell drastically due to these internal and external factors. Chart 5 shows the share of select countries' share in global exports of crude oil over time. Venezuela formed over 4% of the global oil exports in the 1990s, second only to Saudi Arabia's share. However, this dwindled to around 0.35% in 2023.

Unfulfilled potential

The data were sourced from the World Bank, the U.S. Energy Information Administration, OPEC reports and Harvard Atlas Lab

Table 1: Venezuela's rank among crude oil reserves (2023), crude oil production (2024) and refinery throughput (2024). B/D: barrels/day

Rank	Country	Reserves (in billion barrels)
1	Venezuela	303
2	Saudi Arabia	267
3	Iran	209

Rank	Country	Production (1,000 B/D)
1	U.S.	13,208
2	Russia	9,193
3	Saudi Arabia	8,955
..		
16	Venezuela	921

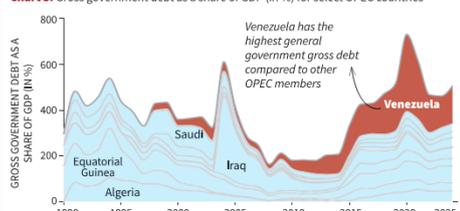| Rank	Country	Refinery throughput (1,000 B/D)
1	U.S.	16,623
2	China	14,250
3	Russia	5,347
..		
35	Venezuela	335

Venezuela has the largest proven reserves of crude oil in the world. Yet it ranks much lower when it comes to production and refining
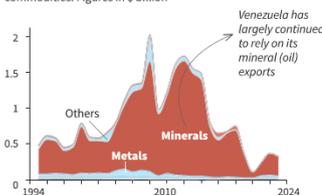
**Chart 2:** Venezuela's GDP per capita since the 1980s. The figure is in PPP terms and current international $

GDP per capita has now almost become similar to what it was three decades ago
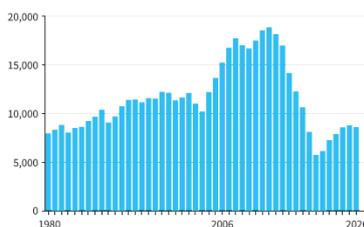
Chart 3: Gross government debt as a share of GDP (in %) for select OPEC countries

Venezuela has the highest general government gross debt compared to other OPEC members

Chart 4: Venezuela's exports over time across different commodities. Figures in $ billion

Venezuela has largely continued to rely on its mineral (oil) exports

Chart 5: Select OPEC countries' share in global exports of crude oil over time. Figures in %
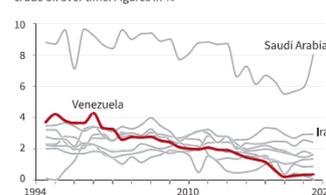
Venezuela's resource curse
वेनेजुएला का संसाधन अभिशाप

- **Despite having the world's most proven oil resources, the country has a strained economy**
दुनिया के सबसे अधिक प्रमाणित तेल संसाधन होने के बावजूद, देश की अर्थव्यवस्था दबाव में है

- After announcing a **naval blockade** and **seizing two oil tankers**, the **Donald Trump administration** has now ordered **U.S. military forces** to focus on enforcing a **'quarantine' of Venezuelan oil** for at least the next **two months**, amping up **economic pressure** on **Venezuela**
नौसैनिक **नाकाबंदी** की घोषणा करने और **दो तेल टैंकरों को जब्त** करने के बाद, **डोनाल्ड ट्रंप प्रशासन** ने अब **अमेरिकी सैन्य बलों** को कम से कम अगले **दो महीनों** तक **वेनेजुएला के तेल के 'क्वारंटीन'** को लागू करने पर ध्यान केंद्रित करने का आदेश दिया है, जिससे **आर्थिक दबाव** बढ़ गया है

- The impact of this **imperialist step** could worsen the already **weak Venezuelan economy**
इस **साम्राज्यवादी कदम** का प्रभाव पहले से ही **कमज़ोर वेनेजुएला की अर्थव्यवस्था** को और बिगाड़ सकता है

- But how did a **petrostate** with the **most proven resources** end up with a **strained economy** in the first place
लेकिन सबसे अधिक **प्रमाणित संसाधनों** वाले एक **पेट्रोस्टेट** की अर्थव्यवस्था शुरू से ही **तनावग्रस्त** कैसे हो गई

- Venezuela has the **largest proven reserves of crude oil** in the world at **303 billion barrels (2023)**
  वेनेजुएला के पास दुनिया में **कच्चे तेल का सबसे बड़ा प्रमाणित भंडार** है, जो **303 अरब बैरल (2023)** है
- Yet it ranks much lower in the **production and refining of oil**
  फिर भी यह **तेल उत्पादन और परिशोधन** में कहीं नीचे स्थान पर है
- Most of its resources are **extra-heavy crude oil**, whose **extraction and processing** require **specialised technology and refineries**
  इसके अधिकांश संसाधन **अत्यधिक भारी कच्चा तेल** हैं, जिनके **उत्खनन और प्रसंस्करण** के लिए **विशेष तकनीक और रिफाइनरियों** की आवश्यकता होती है
- However **internal issues** and **international sanctions** have starved it of the **capital required** for this
  हालांकि **आंतरिक समस्याओं** और **अंतरराष्ट्रीय प्रतिबंधों** ने इसके लिए आवश्यक **पूंजी** की कमी पैदा कर दी है
- While the state-run oil company **Petroleos de Venezuela S.A. (PDVSA)** owns and operates **five refineries** in Venezuela
  हालाँकि राज्य संचालित तेल कंपनी **पेट्रोलियोस डी वेनेजुएला एसए (PDVSA)** वेनेजुएला में **पाँच रिफाइनरियाँ** संचालित करती है
- It also **suffers from years of underinvestment**, **mismanagement**, and a **lack of technical expertise**
  फिर भी यह वर्षों से **कम निवेश**, **कुप्रबंधन**, और **तकनीकी विशेषज्ञता की कमी** से ग्रस्त है
- Specifically following a **failed coup attempt in April 2002** and the **general strike or oil lockout in December 2002–February 2003**
  विशेष रूप से **अप्रैल 2002 में विफल तख्तापलट प्रयास** और **दिसंबर 2002–फरवरी 2003 के आम हड़ताल या तेल तालाबंदी** के बाद
- The then President **Hugo Chavez** was forced to **replace PDVSA's management**
  तत्कालीन राष्ट्रपति **ह्यूगो चावेज़** को **PDVSA के प्रबंधन को बदलने** के लिए मजबूर होना पड़ा
- Critics say this led to a **bureaucratisation of the company**
  आलोचकों का कहना है कि इससे कंपनी का **नौकरशाहीकरण** हो गया
- In **2024**, the country produced **9,21,000 barrels of crude oil per day**
  2024 में देश ने प्रतिदिन **9,21,000 बैरल कच्चे तेल** का उत्पादन किया
- This was at least **56% lower** than its production in the **1980s**
  यह **1980 के दशक** के उत्पादन से कम से कम **56% कम** था
- In the **1970s**, Venezuela benefited when **oil prices soared** due to the **Yom Kippur War**
  1970 के दशक में **योम किप्पुर युद्ध** के कारण जब **तेल की कीमतें बढ़ीं**, तो वेनेजुएला को लाभ हुआ
- Its **per capita income** became the **highest in Latin America**
  उस समय इसकी **प्रति व्यक्ति आय लैटिन अमेरिका में सबसे अधिक** हो गई
- It was then a **largely unequal country**
  हालाँकि तब यह एक **अत्यधिक असमान देश** था
- However the figure has only **dwindled since 2014** following **sanctions and the oil downturn**
  हालाँकि **2014 के बाद प्रतिबंधों और तेल मंदी** के चलते यह आंकड़ा लगातार **घटता गया**
- Venezuela's **GDP per capita** in recent years has become **almost similar to what it was three decades ago**
  हाल के वर्षों में वेनेजुएला की **प्रति व्यक्ति GDP** लगभग **तीन दशक पहले के स्तर** के समान हो गई है
- No other country's **GDP per capita** has **slid to this extent** in this period
  इस अवधि में किसी अन्य देश की **प्रति व्यक्ति GDP** इतनी अधिक **गिरी नहीं** है
- Consequently despite being a **founding member** of the **Organization of the Petroleum Exporting Countries (OPEC)**
  परिणामस्वरूप **तेल निर्यातक देशों के संगठन (OPEC)** का **संस्थापक सदस्य** होने के बावजूद
- Venezuela has the **highest general government gross debt** compared to other **OPEC members**
  वेनेजुएला के पास अन्य **OPEC सदस्यों** की तुलना में **सबसे अधिक कुल सरकारी ऋण** है
- While others have **steered through global oil price crashes**
  जहाँ अन्य देशों ने **वैश्विक तेल मूल्य संकटों** को पार कर लिया

- The country continues to **reel under economic pressure**
  वहीं यह देश अब भी **आर्थिक दबाव** से जूझ रहा है
- This points to the fact that the **economic crisis** in Venezuela cannot be attributed to **global crude factors alone**
  यह दर्शाता है कि वेनेज़ुएला का **आर्थिक संकट** केवल **वैश्विक कच्चे तेल कारकों** से नहीं समझाया जा सकता
- **U.S. sanctions** have played a **major role** in curbing the **petroleum sector** in Venezuela
  अमेरिकी प्रतिबंधों ने वेनेज़ुएला के **पेट्रोलियम क्षेत्र** को सीमित करने में **मुख्य भूमिका** निभाई है
- The **first Trump administration** imposed sanctions in **August 2017**
  पहले ट्रंप प्रशासन ने **अगस्त 2017** में प्रतिबंध लगाए
- These prohibited **Caracas** from accessing **U.S. financial markets**
  इन प्रतिबंधों ने **काराकास** को **अमेरिकी वित्तीय बाज़ारों** तक पहुँच से वंचित कर दिया
- More sanctions were imposed in **2019** on PDVSA
  2019 में PDVSA पर और प्रतिबंध लगाए गए
- These prevented it from being **paid for exports to the U.S.**
  इनसे उसे **अमेरिका को निर्यात के लिए भुगतान** मिलना बंद हो गया
- The sanctions also **froze PDVSA's U.S. assets** and **disallowed the supply of diluents**
  प्रतिबंधों ने **PDVSA की अमेरिकी संपत्तियाँ फ़्रीज़** कर दीं और **डाइल्यूएंट्स की आपूर्ति** भी रोक दी
- There was some **easing in 2023** under the **Joe Biden regime**
  जो बाइडेन प्रशासन के तहत **2023** में कुछ **ढील** दी गई
- But sanctions were **reinstated later** before the **naval blockade** imposed by the **second Trump regime**
  लेकिन बाद में **दूसरे ट्रंप शासन** द्वारा लगाए गए **नौसैनिक नाकाबंदी** से पहले प्रतिबंध फिर से **लागू** कर दिए गए
- The slump can also partly be explained by the country's **lack of diversification**
  यह गिरावट आंशिक रूप से देश की **विविधीकरण की कमी** से भी समझाई जा सकती है
- While many other **OPEC countries** have diversified to **non-oil exports**
  जहाँ अन्य कई **OPEC देशों** ने **गैर-तेल निर्यात** में विविधीकरण किया
- Venezuela has **failed to do so**
  वहीं वेनेज़ुएला ऐसा करने में **असफल** रहा है
- Venezuela has largely continued to **rely on mineral (oil) exports**
  वेनेज़ुएला ने मुख्य रूप से **खनिज (तेल) निर्यात** पर ही निर्भरता बनाए रखी है
- Despite exporting mostly only **oil**, the country's **share in global oil exports fell drastically**
  मुख्य रूप से **तेल** ही निर्यात करने के बावजूद, वैश्विक तेल निर्यात में देश की **हिस्सेदारी तेज़ी से घट गई**
- Venezuela formed **over 4% of global oil exports in the 1990s**
  1990 के दशक में वेनेज़ुएला वैश्विक तेल निर्यात का **4% से अधिक** था
- Second only to **Saudi Arabia's share**
  जो केवल **सऊदी अरब** से कम था
- However this dwindled to around **0.35% in 2023**
  हालाँकि यह घटकर **2023 में लगभग 0.35%** रह गया

Russia likely placing new hypersonic missiles in Belarus: U.S. researchers

Moscow likely stationing Oreshnik missiles, with an estimated range of up to 5,500 km, at a former airbase near Krichev, two researchers have found by studying satellite imagery; the stationing of the nuclear-capable warheads could bolster Russia's ability to deliver missiles across Europe, they say

GS II: IR

Reuters
WASHINGTON

Moscow is likely stationing new nuclear-capable hypersonic ballistic missiles at a former airbase in eastern Belarus, a development that could bolster Russia's ability to deliver missiles across Europe, two U.S. researchers have found by studying satellite imagery.

The researcher's assessment broadly aligns with U.S. intelligence findings, said a person familiar with the matter who spoke on the condition of anonymity to share information not authorised for public release.

Russian President Vladimir Putin has made clear his intention to place intermediate-range Oreshnik missiles, with an estimated range of up to 5,500 km, in Belarus, but the exact location has not been previously reported.

Deployment of the Oreshnik would underscore the Kremlin's growing reliance on the threat of nuclear weapons as it seeks to deter NATO members from supplying Kyiv with weapons that can strike deep inside Russia, some experts said.

The Russian Embassy in Washington did not immediately respond to a request for comment. The Belarus Embassy declined to comment. The state-run Belta news agency quoted Defence Minister Viktor Khrenin on Wednesday as saying that the Oreshnik's deployment would not alter the balance of power in Europe and was "our response" to the West's "aggressive actions."

The White House did not immediately respond to a request for comment and the CIA declined to comment.

Revised strategy

Researchers Jeffrey Lewis of the Middlebury Institute of International Studies, in California, and Decker Eveleth of the CNA research and analysis organisation in Virginia, said they based their finding regarding the deployment of Oreshniks on imagery from Planet Labs, a commercial satellite firm, that showed features consistent with a Russian strategic missile base.

Mr. Lewis and Mr. Eveleth said they were 90% certain that mobile Oreshnik launchers would be stationed at the former airbase near Krichev, some 307 km east of the Belarus capital of Minsk, and 478 km southwest of Moscow.

Moscow tested a conventionally armed Oreshnik – Russian for Hazel tree – against a target in Ukraine in November 2024. Mr. Putin boasts that it is impossible to intercept because of velocities reportedly exceeding Mach 10.

Mr. Putin plans to deploy the weapon "in Belarus to extend its range further into Europe," said John Foreman, an expert with the Chatham House who served as a British defence attache in Moscow and Kyiv.

Foreman said he also sees such a move as a reaction to the planned stationing in Germany next year by the U.S. of conventional missiles that include the intermediate-range hypersonic Dark Eagle.

The Oreshnik's deployment would come with only weeks left before the expiration of 2010 New START pact, the last U.S.-Russia treaty limiting deployments of strategic nuclear weapons by the world's biggest nuclear powers.

Mr. Putin said after a December 2024 meeting with his Belarusian counterpart, Alexander Lukashenko, that the Oreshnik could be stationed in Belarus in the second half of this year – part of a revised strategy in which Moscow is basing nuclear weapons outside its territory for the first time since the Cold War.

Mr. Lukashenko last week said that the first batch of missiles had been deployed without mentioning a location.

Mr. Lukashenko said up to 10 Oreshniks would be based in Belarus. The American researchers assessed that the site is large enough to accommodate only three launchers and that others may be based at another location.

U.S. President Donald Trump works to reach a deal with Moscow to end its war in Ukraine, which has been urging its Western allies to send weapons that can reach deep inside Russia.

Mr. Trump for now has rejected Kyiv's request for Tomahawk cruise missiles, capable of striking Moscow. Britain and France have supplied cruise missiles to Ukraine. Germany in May announced it will co-produce long-range missiles with Ukraine with no limits on their range or targeting.

Hurried construction

The American researchers said reviews of the Planet Labs imagery revealed a hurried construction project that began between August 4 and 12 and showed features consistent with those of a Russian strategic missile base.

One "dead giveaway" in a November 19 photo is a "military-grade rail transfer point" enclosed by a security fence to which missiles, their mobile launchers and other components could be delivered by train, said Mr. Eveleth.

Another feature, said Mr. Lewis, is the pouring at the end of the runway of a concrete pad that then was covered with earth that he called "consistent with a camouflaged launch point."

Pavel Podvig, a Geneva-based expert on Russia's nuclear forces, said he was sceptical that deploying the Oreshnik would provide Moscow with any additional military or political advantages than reassuring Belarus of its protection.

POSSIBLE ORESHNIK DEPLOYMENT SITE
Former Krichev-6 Aerodrome • 63.73°N, 31.91°E • November 16, 2025

A satellite image from Planet Labs taken on November 16 shows where the U.S. researchers believe that Russia is likely stationing its new nuclear-capable Oreshnik hypersonic cruise missile. REUTERS

Russia likely placing new hypersonic missiles in Belarus: U.S. researchers
रूस द्वारा बेलारूस में नए हाइपरसोनिक मिसाइल तैनात किए जाने की संभावना: अमेरिकी शोधकर्ता

- Moscow likely stationing **Oreshnik missiles**, with an estimated range of up to **5,500 km**, at a former airbase near **Krichev**, two researchers have found by studying **satellite imagery**; the stationing of the **nuclear-capable warheads** could bolster Russia's ability to deliver missiles across **Europe**, they say

- Deployment of the **Oreshnik** would underscore the **Kremlin's** growing reliance on the threat of **nuclear weapons** as it seeks to deter **NATO members** from supplying **Kyiv** with weapons that can strike deep inside Russia, some experts said.
  कुछ विशेषज्ञों ने कहा कि **Oreshnik** की तैनाती **Kremlin** की **nuclear weapons** की धमकी पर बढ़ती निर्भरता को दर्शाएगी, क्योंकि वह **NATO members** को **Kyiv** को ऐसे हथियार देने से रोकना चाहता है जो रूस के भीतर गहराई तक हमला कर सकें।

- Mr. Lewis and Mr. Eveleth said they were **90% certain** that mobile **Oreshnik launchers** would be stationed at the former airbase near **Krichev**, some **307 km** east of the Belarus capital of **Minsk**, and **478 km** southwest of **Moscow**.
  श्री **Lewis** और श्री **Eveleth** ने कहा कि वे **90%** निश्चित हैं कि मोबाइल **Oreshnik launchers Krichev**

TELEGRAM CHANNEL: https://t.me/patrioticIAS
YOUTUBE CHANNEL: https://www.youtube.com/@PatrioticIAS
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के पास पूर्व एयरबेस पर तैनात होंगे, जो **Minsk** से **307 km** पूर्व और **Moscow** से **478 km** दक्षिण-पश्चिम में है।

- Moscow tested a conventionally armed **Oreshnik** — Russian for **Hazel tree** — against a target in **Ukraine** in **November 2024**.

  मॉस्को ने पारंपरिक हथियारों से लैस **Oreshnik** — जिसका रूसी अर्थ **Hazel tree** है — का परीक्षण **November 2024** में **Ukraine** के एक लक्ष्य पर किया था।

- Mr. Putin boasts that it is **impossible to intercept** because of velocities reportedly exceeding **Mach 10**.

  श्री पुतिन का दावा है कि इसकी गति कथित रूप से **Mach 10** से अधिक होने के कारण इसे **intercept** करना असंभव है।

- Mr. Putin plans to deploy the weapon "in **Belarus** to extend its range further into **Europe**," said **John Foreman**, an expert with the **Chatham House** who served as a British defence attache in **Moscow** and **Kyiv**.

  Chatham House के विशेषज्ञ और **Moscow** तथा **Kyiv** में ब्रिटिश रक्षा अताशे रह चुके **John Foreman** ने कहा कि श्री पुतिन इस हथियार को **Belarus** में तैनात कर **Europe** तक इसकी पहुंच और बढ़ाना चाहते हैं।

- Foreman said he also sees such a move as a reaction to the planned stationing in **Germany next year** by the **U.S.** of conventional missiles that include the intermediate-range hypersonic **Dark Eagle**.

  Foreman ने कहा कि वह इस कदम को **U.S.** द्वारा **Germany next year** में मध्यम दूरी के हाइपरसोनिक **Dark Eagle** सहित पारंपरिक मिसाइलों की प्रस्तावित तैनाती के प्रति प्रतिक्रिया के रूप में भी देखते हैं।

- The **Oreshnik's deployment** would come with only weeks left before the expiration of the **2010 New START pact**, the last **U.S.-Russia treaty** limiting deployments of strategic nuclear weapons by the world's biggest nuclear powers.

  Oreshnik's deployment ऐसे समय में होगी जब **2010 New START pact** की समाप्ति में केवल कुछ ही सप्ताह शेष होंगे, जो दुनिया की सबसे बड़ी परमाणु शक्तियों के बीच रणनीतिक परमाणु हथियारों की तैनाती सीमित करने वाली अंतिम **U.S.-Russia treaty** है।

- Mr. Putin said after a **December 2024** meeting with his Belarusian counterpart, **Alexander Lukashenko**, that the Oreshnik could be stationed in Belarus in the **second half of this year** — part of a revised strategy in which Moscow is basing nuclear weapons outside its territory for the **first time since the Cold War**.

  श्री पुतिन ने **December 2024** में बेलारूसी समकक्ष **Alexander Lukashenko** के साथ बैठक के बाद कहा कि Oreshnik को **second half of this year** में Belarus में तैनात किया जा सकता है — यह एक संशोधित रणनीति का हिस्सा है, जिसके तहत मॉस्को **Cold War** के बाद पहली बार अपने क्षेत्र से बाहर परमाणु हथियार तैनात कर रहा है।

- Mr. Lukashenko last week said that the **first batch of missiles** had been deployed without mentioning a location.

  श्री Lukashenko ने पिछले सप्ताह कहा कि **first batch of missiles** तैनात कर दी गई है, लेकिन स्थान का उल्लेख नहीं किया।

- Mr. Lukashenko said up to **10 Oreshniks** would be based in Belarus. The American researchers assessed that the site is large enough to accommodate only **three launchers** and that others may be based at another location.

  श्री Lukashenko ने कहा कि Belarus में अधिकतम **10 Oreshniks** तैनात किए जाएंगे। अमेरिकी शोधकर्ताओं ने आकलन किया कि यह स्थल केवल **three launchers** के लिए पर्याप्त बड़ा है और अन्य किसी अन्य स्थान पर हो सकते हैं।

- **U.S. President Donald Trump** works to reach a deal with Moscow to end its war in **Ukraine**, which has been urging its Western allies to send weapons that can reach deep inside **Russia**.

  U.S. President Donald Trump मॉस्को के साथ **Ukraine** युद्ध समाप्त करने के लिए समझौते तक पहुंचने का प्रयास कर रहे हैं, जबकि यूक्रेन अपने पश्चिमी सहयोगियों से ऐसे हथियार भेजने का आग्रह कर रहा है जो **Russia** के भीतर गहराई तक पहुंच सकें।

- Mr. Trump for now has rejected **Kyiv's request** for **Tomahawk cruise missiles**, capable of striking **Moscow**. **Britain and France** have supplied cruise missiles to Ukraine. **Germany** in **May** announced it will co-produce long-range missiles with Ukraine with no limits on their range or targeting.

GS Paper III: Economy,	
TOPICS COVERED	**29 December 2025**
1.	World is looking at India with great hope, says PM दुनिया भारत को बड़ी आशा से देख रही है, कहते हैं पीएम
2.	What are rare-earth elements and why is everyone looking for them? दुर्लभ मृदा तत्त्व क्या हैं और हर कोई इन्हें क्यों खोज रहा है?
3.	Vizhinjam's millionth feat in record time विझिंजम की रिकॉर्ड समय में दस लाख की उपलब्धि
4.	Best of times, worst of times... to come सबसे अच्छे समय, सबसे बुरे समय… जो आने वाले हैं

World is looking at India with great hope, says PM

In his *Mann Ki Baat* address, Modi highlights achievements of 2025, says youth can contribute to nation-building via platforms like Viksit Bharat Young Leaders Dialogue, Smart India Hackathon

GS III: Economy

The Hindu Bureau
NEW DELHI

Prime Minister Narendra Modi on Sunday said 2025 had been a year of proud achievements for India, with the country making its presence felt across sectors, inspiring citizens to look forward to 2026 with confidence.

"From national security to the sports field, from science laboratories to the world's biggest platforms, India left a strong mark everywhere," Mr. Modi said during the year-ending *Mann Ki Baat* episode.

Terming Operation Sindoor a symbol of pride, he said the world saw that India does not compromise on its security. "The same spirit was also visible when *Vande Mataram* completed 150 years," he added.

He highlighted achievements in sports, including victories in the men's ICC Champions Trophy, the women's Cricket World Cup, and the Women's Blind T20 World Cup, as well as successes in the Asia Cup T20 and the World Para Athletics Championships.

Shubhanshu Shukla be-

> **" From national security to the sports field, from science laboratories to the world's biggest platforms, India left a strong mark everywhere**
> **NARENDRA MODI**
> Prime MInister

came the first Indian to reach the International Space Station, he said. On environment conservation, the Prime Minister noted that the number of cheetahs in India had risen to over 30.

"In 2025, faith, culture, and heritage came together," he said, citing the Prayagraj Maha Kumbh and the flag-hoisting ceremony at the Ram Mandir in Ayodhya, and noting the growing enthusiasm for *swadeshi* (self-reliance).

Stating that, today, the world was looking at India with great hope, especially owing to youth power in the areas of science, new innovations, and technology, Mr. Modi said the youth can contribute to nation-building via platforms like the 'Viksit Bharat Young Leaders Dialogue' and the 'Smart India Hackathon'.

This year, student participants in the hackathon worked on more than 270 problems of over 80 government departments, he said, and over 13 lakh students and about 6,000 institutes have participated in the event in the last seven to eight years.

The Prime Minister also spoke about a music class started at the Indian Institute of Science (IISc) via research and innovation a few years ago, and now established as a cultural centre named 'Geetanjali IISc', where students together practise Hindustani classical music, folk traditions, and classical genres.

Indians living in different parts of the world were also making efforts to stay connected to their roots. In Dubai, Kannada families took the initiative to teach Kannada to chil-

dren. "The land and language of Kannada are our pride," Mr. Modi said in Kannada.

The Prime Minister praised a young man from Manipur, Moirangthem Seth, for launching a campaign to install solar panels in remote areas, particularly health centres. Under the 'PM Surya Ghar Muft Bijli Yojana', the government is providing ₹75,000 to ₹80,000 to each beneficiary family for installing solar panels.

Antibiotic use
He expressed concern over an Indian Council of Medical Research report that antibiotics are proving ineffective against many diseases such as pneumonia and urinary tract infection. He urged people to refrain from using medicines at their own discretion.

Mr. Modi highlighted the lace craft of Narasapuram in Andhra Pradesh, saying that the State government and NABARD (National Bank for Agriculture and Rural Development) were jointly teaching artisans new designs, providing better skill training, and connecting them with new markets.

World is looking at India with great hope, says PM
दुनिया भारत को बड़ी आशा से देख रही है, कहते हैं पीएम

In his Mann Ki Baat address, Modi highlights achievements of 2025, says youth can contribute to nation-building via platforms like Viksit Bharat Young Leaders Dialogue, Smart India Hackathon

अपने मन की बात संबोधन में, मोदी ने 2025 की उपलब्धियों को रेखांकित किया, कहा कि युवा 'विकसित भारत यंग लीडर्स डायलॉग', 'स्मार्ट इंडिया हैकाथॉन' जैसे मंचों के माध्यम से राष्ट्र निर्माण में योगदान दे सकते हैं

- Prime Minister Narendra Modi on Sunday said 2025 had been a year of proud achievements for India, with the country making its presence felt across sectors, inspiring citizens to look forward to 2026 with confidence.

  प्रधानमंत्री **नरेंद्र मोदी** ने रविवार को कहा कि **2025** भारत के लिए गर्वपूर्ण उपलब्धियों का वर्ष रहा, जिसमें देश ने विभिन्न क्षेत्रों में अपनी मौजूदगी दर्ज कराई और नागरिकों को **2026** की ओर **confidence** के साथ देखने के लिए प्रेरित किया।

- "From national security to the sports field, from science laboratories to the world's biggest platforms, India left a strong mark everywhere," Mr. Modi said during the year-ending Mann Ki Baat episode.

  "**national security** से लेकर **sports field** तक, **science laboratories** से लेकर दुनिया के सबसे बड़े मंचों तक, भारत ने हर जगह एक मजबूत छाप छोड़ी," श्री मोदी ने वर्ष के अंतिम **Mann Ki Baat** एपिसोड में कहा।

- Terming Operation Sindoor a symbol of pride, he said the world saw that India does not compromise on its security.

  Operation Sindoor को गर्व का प्रतीक बताते हुए उन्होंने कहा कि दुनिया ने देखा कि भारत अपनी **security** से समझौता नहीं करता।

- "The same spirit was also visible when Vande Mataram completed 150 years," he added.

  "जब **Vande Mataram** ने **150 years** पूरे किए, तब भी वही भावना दिखाई दी," उन्होंने जोड़ा।

- He highlighted achievements in sports, including victories in the men's ICC Champions Trophy, the women's Cricket World Cup, and the Women's Blind T20 World Cup, as well as successes in the Asia Cup T20 and the World Para Athletics Championships.

  उन्होंने खेलों में उपलब्धियों को रेखांकित किया, जिनमें **men's ICC Champions Trophy**, **women's Cricket World Cup**, **Women's Blind T20 World Cup** में जीत, साथ ही **Asia Cup T20** और **World Para Athletics Championships** में सफलताएँ शामिल हैं।

- Shubhanshu Shukla became the first Indian to reach the International Space Station, he said.

  उन्होंने कहा कि **Shubhanshu Shukla International Space Station** तक पहुँचने वाले पहले भारतीय बने।

- On environment conservation, the Prime Minister noted that the number of cheetahs in India had risen to over 30.

  पर्यावरण संरक्षण पर प्रधानमंत्री ने कहा कि भारत में **cheetahs** की संख्या बढ़कर **30** से अधिक हो गई है।

- "In 2025, faith, culture, and heritage came together," he said, citing the Prayagraj Maha Kumbh and the flag-hoisting ceremony at the Ram Mandir in Ayodhya, and noting the growing enthusiasm for swadeshi (self-reliance).

  उन्होंने कहा, "**2025** में **faith, culture, and heritage** एक साथ आए," और **Prayagraj Maha Kumbh**, **Ayodhya** में **Ram Mandir** पर **flag-hoisting ceremony**, तथा **swadeshi (self-reliance)** के प्रति बढ़ते उत्साह का उल्लेख किया।

- Stating that, today, the world was looking at India with great hope, especially owing to youth power in the areas of science, new innovations, and technology, Mr. Modi said the youth can contribute to nation-building via platforms like the 'Viksit Bharat Young Leaders Dialogue' and the 'Smart India Hackathon'.

  यह कहते हुए कि आज दुनिया भारत को बड़ी आशा से देख रही है, विशेषकर **science**, **new innovations**, और **technology** के क्षेत्रों में **youth power** के कारण, श्री मोदी ने कहा कि युवा '**Viksit Bharat Young Leaders Dialogue**' और '**Smart India Hackathon**' जैसे मंचों के माध्यम से **nation-building** में योगदान दे सकते हैं।

- This year, student participants in the hackathon worked on more than 270 problems of over 80 government departments, he said, and over 13 lakh students and about 6,000 institutes have participated in the event in the last seven to eight years.

  उन्होंने कहा कि इस वर्ष हैकाथॉन में छात्र प्रतिभागियों ने **80 से अधिक सरकारी विभागों** की **270 से ज्यादा** समस्याओं पर काम किया, और पिछले **seven to eight years** में **13 lakh** से अधिक छात्र तथा लगभग **6,000 institutes** इस आयोजन में भाग ले चुके हैं।

- The Prime Minister also spoke about a music class started at the Indian Institute of Science (IISc) via research and innovation a few years ago, and now established as a cultural centre named 'Geetanjali IISc', where students together practise Hindustani classical music, folk traditions, and classical genres.

  प्रधानमंत्री ने **Indian Institute of Science (IISc)** में कुछ वर्ष पहले **research and innovation** के माध्यम से शुरू की गई एक **music class** का भी उल्लेख किया, जो अब **'Geetanjali IISc'** नामक **cultural centre** के रूप में स्थापित है, जहाँ छात्र मिलकर **Hindustani classical music**, **folk traditions**, और **classical genres** का अभ्यास करते हैं।

- Indians living in different parts of the world were also making efforts to stay connected to their roots.

  दुनिया के विभिन्न हिस्सों में रहने वाले भारतीय भी अपनी **roots** से जुड़े रहने के प्रयास कर रहे थे।

- In Dubai, Kannada families took the initiative to teach Kannada to children.

  Dubai में **Kannada families** ने बच्चों को **Kannada** सिखाने की पहल की।

- "The land and language of Kannada are our pride," Mr. Modi said in Kannada.

  "**Kannada** की भूमि और भाषा हमारा गर्व हैं," श्री मोदी ने **Kannada** में कहा।

- The Prime Minister praised a young man from Manipur, Moirangthem Seth, for launching a campaign to install solar panels in remote areas, particularly health centres.

  प्रधानमंत्री ने **Manipur** के एक युवा **Moirangthem Seth** की सराहना की, जिन्होंने दूरदराज़ क्षेत्रों, विशेषकर **health centres**, में **solar panels** लगाने के लिए अभियान शुरू किया।

- Under the **'PM Surya Ghar Muft Bijli Yojana'**, the **government is providing ₹75,000 to ₹80,000 to each beneficiary family for installing solar panels**.

  'PM Surya Ghar Muft Bijli Yojana' के तहत सरकार प्रत्येक **beneficiary family** को **₹75,000** से **₹80,000** तक की राशि **solar panels** लगाने के लिए प्रदान कर रही है।

Antibiotic use
एंटीबायोटिक का उपयोग

- He expressed concern over an **Indian Council of Medical Research report that antibiotics are proving ineffective against many diseases such as pneumonia and urinary tract infection**.

  उन्होंने **Indian Council of Medical Research** की एक रिपोर्ट पर चिंता व्यक्त की कि **antibiotics** कई बीमारियों जैसे **pneumonia** और **urinary tract infection** के खिलाफ अप्रभावी साबित हो रही हैं।

- He urged people to refrain from using medicines at their own discretion.

  उन्होंने लोगों से अपने विवेक से **medicines** का उपयोग न करने का आग्रह किया।

- Mr. Modi highlighted the **lace craft of Narasapuram in Andhra Pradesh**, saying that the State government and NABARD (National Bank for Agriculture and Rural Development) were jointly teaching artisans new designs, providing better skill training, and connecting them with new markets.

What are rare-earth elements and why is everyone looking for them?

Even when they are not very scarce in the earth's crust, they tend to be spread out in low concentrations and mixed together in the same minerals, so they are difficult to separate; however, countries worldwide are interested in acquiring them because they are crucial for many green technologies

GS III: Economy

Vasudevan Mukunth

Rare-earth elements are a set of metallic elements in the periodic table. Chemists usually refer to a group of 17 elements when they use this label: the 15 lanthanides from lanthanum to lutetium, and scandium and yttrium. In most classroom periodic tables, the lanthanides are shown as a separate row placed beneath the main periodic table. Scandium and yttrium lie in the main table, in Group 3, above and near the transition metals.

Even when they're not very scarce in the earth's crust, they tend to be spread out in low concentrations and mixed together with each other in the same minerals, so they're difficult and expensive to separate. However, countries worldwide are interested in acquiring them because they're crucial for high-performance magnets, specialised lighting and optics, catalysts, and other components that underpin many green technologies and electronics.

History and technology

The rare-earth elements are scandium, yttrium, lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium.

They're called 'rare earths' for historical reasons. "Earth" was an old chemistry term for oxide powders and many of these elements were first identified as oxides from which they couldn't be isolated easily.

However, people often use the term 'rare-earth' loosely, leading to confusion. Some use 'rare-earths' to mean only the lanthanides. Some others bundle rare-earths with 'strategic' or 'critical' elements such as lithium, cobalt, gallium, and germanium even though the latter aren't rare-earth elements.

Rare-earth elements show up in many contemporary technologies because of their useful electrical, magnetic and/or optical behaviour. One particularly important application is as permanent magnets.

Neodymium-iron-boron magnets, which are the world's most common magnet type involving a rare-earth element, are used in motors and generators.

Phosphors – substances that emit light when irradiated – also incorporate europium and terbium while dopants in lasers and optical devices (including in fibre optics) use neodymium and erbium. Rare-earth elements are also used in catalysts, glass and ceramics, polishing powders, and other specialised materials.

Magnetic chemistry

In permanent magnets, rare-earth atoms have electrons in the 4f shell that behave differently from the other electrons. The 4f electrons are relatively more localised, meaning they stay close to the nucleus, whereas the other electrons become 'smeared out' when they become part of bonds in a solid. As a result, the 4f electrons maintain a strong magnetic moment, i.e., they behave very faithfully like small magnets. An atom with multiple electrons like this also behaves more strongly like a magnet.

Every good permanent magnet needs to have two things: a large magnetisation,

meaning many atomic magnetic moments can line up in the same direction to make a strong overall field; and stability, which means once the magnetic moments line up, they don't easily get knocked out of alignment by heat, vibrations or even an opposing magnetic field.

Rare-earth atoms have both. Their 4f electrons can carry relatively large magnetic moments, so they can contribute to strong magnetisation. And because these electrons are localised as well as closely align with the crystal's preferred direction (due to a property called magnetocrystalline anisotropy) they can 'pin' the magnetisation down. Motors and generators that use such magnets thus work efficiently even at high speeds and high temperatures.

Rare-elements are also good phosphors because they produce sharp, stable colours. The idea is to supply energy to such a phosphor at a frequency its 4f electrons are likely to absorb. When they do, the electrons get excited, then de-excited, reemitting the excess energy at a different (but fixed) frequency. We see this emission as light.

Because the 4f electrons sit relatively close to the nucleus, they're partly shielded from the surrounding solid by the outer electrons. So the exact energy levels of the 4f electrons aren't much affected by the crystal they're inside. The light the 4f electrons emit is also concentrated in a small slice of the visible spectrum instead of being a mix of colours.

Rare-earths v. oil

Rare-earth ore deposits that can be mined in an economically feasible way are usually found in a few pockets of rock and soil rather than being spread evenly. Companies start by looking for minerals that carry rare-earth elements in higher concentrations, such as bastnäsite and monazite, or for certain clay deposits in which rare-earth ions are loosely held on the surface of clay particles.

Many mines are open-pit since these minerals are usually dispersed through large volumes of rock and the ore has to be dug out, crushed, and moved in bulk. This is also where some of the environmental complications of rare-earth element value chains first appear: some minerals occur alongside

Rare-earth oxide powders are typically heavy and gritty; clockwise from top-centre: praseodymium, cerium, lanthanum, neodymium, samarium, and gadolinium. PUBLIC DOMAIN

thorium or uranium, so the waste rock needs to be handled carefully. Mines may also need copious amounts of water and specific chemicals to produce an initial concentrate.

This said, while both rare-earth elements and crude oil have to be extracted and processed before use, the processing step is significantly different – so much so that for rare-earth elements it has emerged as a strategic element.

A refinery uses physical separation plus some chemical reactions to refine crude. Fractional distillation, the main step, works because hydrocarbons' boiling points are spread out, so just heating and condensing the crude can separate its constituents efficiently at industrial scale.

On the other hand, rare-earth producers start with solids that contain many elements together, and they must be separated at very high purity for applications. The problem is that neighbouring rare-earth ions behave similarly in solution, so the corresponding separation process is voluminous and energy-intensive.

Second, a magnet maker doesn't want any or all rare-elements but a specific oxide or metal, of a minimum purity. If a separator is short on one element or can't deliver the required purity, the factory can't switch one element for another. In the oil industry, however, refineries can swap feedstocks and trade intermediates at scale.

Midstream menace

After mining, the first goal is to make a smaller, richer product. This begins with beneficiation: physically processing the ore to separate more valuable mineral grains from the less. Workers crush and grind the ore to free the grains, then use flotation, magnets or gravity to separately collect different concentrates. The resulting concentrate will still contain many rare-earth elements together, plus other unwanted elements.

Next is chemical cracking, where the producer breaks the rare-earth minerals apart using strong acids or bases or high temperature, converting them into a form that dissolves more easily.

Third is leaching. The cracked material is mixed with a liquid, often an acidic solution, so the rare-earth atoms move

into the liquid as ions. Then the producer separates the liquid from the remaining solids; this liquid contains a mixture of all rare-earth ions dissolved together plus some impurities.

The hardest step is separating this mixture into individual rare-earth elements of high purity because these elements often have the same common charge (usually +3) and their ions are similar in size. In a simple chemical reaction, then, the ions behave in roughly the same way.

Industry thus uses a technique called solvent extraction instead. The leach solution is repeatedly brought in contact with an organic solvent that doesn't mix with water. The solvent contains molecules that prefer to bind with certain rare-earth ions slightly more than others. When the two liquids touch and separate, a little more of one rare-earth element moves into the solvent than its neighbours do. The difference is small, so producers run the liquids through many stages in a row, until the process separates the elements one by one and each element has been collected in a separate stream at high purity.

Producers finally recover the elements from the liquid as a solid by precipitation: they add a compound that bonds with the rare-earth ions and becomes insoluble, falling out of the solution as a solid. The solids are filtered and washed, then heated to remove the water and some other substances, to finally yield a rare-earth oxide. The elements are usually stored and transported as these oxides.

If a manufacturer needs an element as a metal, the oxide is subjected to a reduction reaction in which the oxygen atoms react away from the oxide.

Some rare-earth ores contain thorium or uranium, which can make some waste streams radioactive and harder to store safely. Acids and bases can also create hazardous wastes if they aren't captured, treated, and recycled properly.

China's dominance

Because rare-earth elements' midstream refinement is so arduous, a country can have substantial deposits in the ground but still have to depend on other countries if it doesn't have the means to convert the ore into rare-earth oxides.

According to the U.S. Geological Survey's Mineral Commodity Summaries, the world has more than 90 million tonnes of rare-earth-oxide equivalent. Some notable national reserves include China (44 million tonnes, MT), Brazil (21 MT), India (6.9 MT), Australia (5.7 MT), Russia (3.8 MT), Vietnam (3.5 MT), the U.S. (1.9 MT), and Greenland (1.5 MT). Note: these estimates exclude scandium.

On December 23, Japan announced that in January and February 2026, it would excavate mud rich in rare-earth elements from 6 km underwater off Minamitori Island.

The International Energy Agency has estimated that China's position is especially strong in separation and refining, accounting for around 91% of global production, and around 94% of the production of sintered rare-earth permanent magnets.

Since many green technologies require motors, generators, and other hardware where high-performance magnets are crucial, countries are focusing on building refining and magnet-making capacity, rather than just approving new mines.

- Even when they are not very scarce in the earth's crust, they tend to be spread out in low concentrations and mixed together in the same minerals, so they are difficult to separate; however, countries worldwide are interested in acquiring them because they are crucial for many green technologies
  भले ही ये पृथ्वी की पर्पटी में बहुत दुर्लभ न हों, फिर भी ये आमतौर पर कम सांद्रता में फैले होते हैं और एक ही खनिजों में आपस में मिश्रित रहते हैं, इसलिए इन्हें अलग करना कठिन होता है; हालांकि, दुनिया भर के देश इन्हें प्राप्त करने में रुचि रखते हैं क्योंकि ये कई हरित प्रौद्योगिकियों के लिए अत्यंत महत्वपूर्ण हैं

Rare-earth elements
दुर्लभ मृदा तत्व

- Rare-earth elements are a set of **metallic elements** in the **periodic table**
  दुर्लभ मृदा तत्व **आवर्त सारणी** में पाए जाने वाले **धात्विक तत्वों** का एक समूह हैं
- Chemists usually refer to a group of **17 elements** when they use this label
  रसायनज्ञ आमतौर पर इस शब्द से **17 तत्वों** के समूह को संदर्भित करते हैं
- The **15 lanthanides** from **lanthanum to lutetium**, and **scandium and yttrium**
  इनमें लैंथेनम से ल्यूटेटियम तक के **15 लैंथेनाइड्स** तथा **स्कैन्डियम और इट्रियम** शामिल हैं
- In most classroom **periodic tables**, the **lanthanides** are shown as a **separate row** placed beneath the main periodic table
  अधिकांश कक्षा की **आवर्त सारणियों** में लैंथेनाइड्स को मुख्य सारणी के नीचे एक **अलग पंक्ति** के रूप में दिखाया जाता है
- **Scandium and yttrium** lie in the **main table**, in **Group 3**, above and near the **transition metals**
  स्कैन्डियम और इट्रियम मुख्य सारणी में **समूह 3** में, संक्रमण धातुओं के ऊपर और पास स्थित होते हैं
- Even when they're not very **scarce** in the **earth's crust**, they tend to be spread out in **low concentrations**
  भले ही ये **पृथ्वी की भूपर्पटी** में बहुत **दुर्लभ** न हों, फिर भी ये **कम सांद्रता** में फैले होते हैं
- They are often **mixed together** with each other in the same **minerals**, making them **difficult and expensive to separate**
  ये अक्सर एक ही **खनिज** में आपस में **मिले हुए** होते हैं, जिससे इन्हें **अलग करना कठिन और महँगा** हो जाता है
- However, countries worldwide are interested in acquiring them because they're **crucial** for **high-performance magnets**, **specialised lighting and optics**, **catalysts**, and other components
  फिर भी दुनिया भर के देश इन्हें प्राप्त करने में रुचि रखते हैं क्योंकि ये **उच्च-प्रदर्शन चुम्बकों**, **विशेष प्रकाश और ऑप्टिक्स**, उत्प्रेरकों तथा अन्य घटकों के लिए **अत्यंत आवश्यक** हैं
- These components underpin many **green technologies** and **electronics**
  ये घटक अनेक **हरित प्रौद्योगिकियों** और **इलेक्ट्रॉनिक्स** की आधारशिला हैं

History and technology
इतिहास और प्रौद्योगिकी

- The rare-earth elements are **scandium, yttrium, lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium**
  दुर्लभ मृदा तत्व हैं स्कैन्डियम, इट्रियम, लैंथेनम, सेरियम, प्रसीओडाइमियम, नियोडाइमियम, प्रोमेथियम, समेरियम, यूरोपियम, गैडोलिनियम, टर्बियम, डिस्प्रोसियम, होल्मियम, एर्बियम, थुलियम, इटरबियम और ल्यूटेटियम
- They're called **'rare earths'** for **historical reasons**
  इन्हें **'दुर्लभ मृदा'** कहा जाता है, इसके पीछे **ऐतिहासिक कारण** हैं
- **"Earth"** was an old chemistry term for **oxide powders**
  "अर्थ" रसायन विज्ञान में **ऑक्साइड पाउडर** के लिए प्रयुक्त एक पुराना शब्द था
- Many of these elements were **first identified as oxides** from which they couldn't be **isolated easily**

इनमें से कई तत्व पहले **ऑक्साइड** के रूप में पहचाने गए थे, जिनसे इन्हें **आसानी से अलग नहीं किया जा सकता था**

- However, people often use the term **'rare-earth'** loosely, leading to **confusion**
  हालाँकि लोग अक्सर **'रेयर-अर्थ'** शब्द का **ढीले तौर पर उपयोग** करते हैं, जिससे **भ्रम** उत्पन्न होता है

- Some use **'rare-earths'** to mean only the **lanthanides**
  कुछ लोग **'रेयर-अर्थ'** से केवल **लैंथेनाइड्स** का ही अर्थ लेते हैं

- Some others bundle rare-earths with **'strategic' or 'critical' elements** such as **lithium, cobalt, gallium, and germanium**
  कुछ अन्य लोग दुर्लभ मृदा तत्वों को **'रणनीतिक' या 'महत्वपूर्ण' तत्वों** जैसे **लिथियम, कोबाल्ट, गैलियम और जर्मेनियम** के साथ जोड़ देते हैं

- Even though the latter **aren't rare-earth elements**
  जबकि ये तत्व वास्तव में **दुर्लभ मृदा तत्व नहीं** हैं

- Rare-earth elements show up in many **contemporary technologies** because of their useful **electrical, magnetic and/or optical behaviour**
  दुर्लभ मृदा तत्व कई **आधुनिक प्रौद्योगिकियों** में पाए जाते हैं क्योंकि इनके **विद्युत, चुंबकीय और/या प्रकाशीय गुण** उपयोगी होते हैं

- One particularly **important application** is as **permanent magnets**
  इनका एक विशेष रूप से **महत्वपूर्ण उपयोग स्थायी चुम्बकों** के रूप में है

- **Neodymium-iron-boron magnets**, the world's most common magnet type involving a rare-earth element, are used in **motors and generators**
  नियोडाइमियम-आयरन-बोरॉन चुम्बक, जो दुर्लभ मृदा तत्वों से बने सबसे सामान्य चुम्बक हैं, **मोटरों और जनरेटरों** में उपयोग किए जाते हैं

- **Phosphors** — substances that emit light when **irradiated** — incorporate **europium and terbium**
  फॉस्फर, जो **विकिरण** होने पर प्रकाश उत्सर्जित करते हैं, उनमें **यूरोपियम और टर्बियम** शामिल होते हैं

- While **dopants** in **lasers and optical devices** (including in **fibre optics**) use **neodymium and erbium**
  जबकि **लेज़र और ऑप्टिकल उपकरणों** (जिसमें **फाइबर ऑप्टिक्स** शामिल हैं) में **डोपेंट्स** के रूप में **नियोडाइमियम और एर्बियम** का उपयोग होता है

- Rare-earth elements are also used in **catalysts, glass and ceramics, polishing powders**, and other **specialised materials**
  दुर्लभ मृदा तत्वों का उपयोग **उत्प्रेरकों, कांच और सिरेमिक, पॉलिशिंग पाउडर** तथा अन्य **विशेषीकृत सामग्रियों** में भी किया जाता है

Magnetic chemistry
चुंबकीय रसायन

- In permanent magnets, **rare-earth atoms** have electrons in the **4f shell** that behave differently from the other electrons
  स्थायी चुम्बकों में **दुर्लभ मृदा परमाणुओं** के **4f शेल** में इलेक्ट्रॉन होते हैं जो अन्य इलेक्ट्रॉनों से **भिन्न व्यवहार** करते हैं

- The **4f electrons** are relatively more **localised**, meaning they stay **close to the nucleus**
  4f इलेक्ट्रॉन अपेक्षाकृत अधिक **स्थानीयकृत** होते हैं, अर्थात वे **नाभिक के पास** रहते हैं

- Whereas the other electrons become **'smeared out'** when they become part of **bonds in a solid**
  जबकि अन्य इलेक्ट्रॉन **ठोस में बंधों** का हिस्सा बनने पर **फैल जाते हैं**

- As a result, the **4f electrons** maintain a **strong magnetic moment**, behaving like **small magnets**
  परिणामस्वरूप **4f इलेक्ट्रॉन** एक **मजबूत चुंबकीय आघूर्ण** बनाए रखते हैं और **छोटे चुम्बकों** की तरह व्यवहार करते हैं

- An atom with **multiple electrons** like this behaves more strongly like a **magnet**
  इस प्रकार **कई इलेक्ट्रॉनों** वाला परमाणु और अधिक **चुंबकीय** व्यवहार करता है

- Every good **permanent magnet** needs two things
  हर अच्छे **स्थायी चुम्बक** को दो चीज़ों की आवश्यकता होती है

- A large **magnetisation**, meaning many **atomic magnetic moments** line up in the **same direction**
  एक बड़ा **चुंबकीकरण**, अर्थात कई **परमाणवीय चुंबकीय आघूर्ण** एक ही **दिशा** में संरेखित हों
- And **stability**, meaning once aligned they are not easily disturbed by **heat, vibrations or opposing magnetic field**
  और **स्थिरता**, अर्थात एक बार संरेखित होने के बाद वे **ऊष्मा, कंपन या विपरीत चुंबकीय क्षेत्र** से आसानी से विचलित न हों
- **Rare-earth atoms** have both
  दुर्लभ मृदा परमाणुओं में ये दोनों गुण होते हैं
- Their **4f electrons** carry **large magnetic moments**, contributing to **strong magnetisation**
  उनके **4f इलेक्ट्रॉन** बड़े **चुंबकीय आघूर्ण** वहन करते हैं, जिससे **मजबूत चुंबकीकरण** होता है
- Because these electrons are **localised** and align with the **crystal's preferred direction** due to **magnetocrystalline anisotropy**
  क्योंकि ये इलेक्ट्रॉन **स्थानीयकृत** होते हैं और **मैग्नेटोक्रिस्टलाइन एनिसोट्रॉपी** के कारण **क्रिस्टल की पसंदीदा दिशा** में संरेखित होते हैं
- They can **'pin'** the magnetisation down
  वे **चुंबकीकरण को स्थिर** कर सकते हैं
- Motors and generators using such magnets work e•ciently even at **high speeds and high temperatures**
  ऐसे चुम्बकों का उपयोग करने वाले **मोटर और जनरेटर उच्च गति और उच्च तापमान** पर भी **कुशलता से** कार्य करते हैं
- Rare-elements are also good **phosphors** because they produce **sharp, stable colours**
  दुर्लभ तत्व अच्छे **फॉस्फर** भी होते हैं क्योंकि वे **तेज़ और स्थिर रंग** उत्पन्न करते हैं
- Energy is supplied at a **frequency** the 4f electrons are likely to absorb
  ऊर्जा उस **आवृत्ति** पर दी जाती है जिसे **4f इलेक्ट्रॉन** आसानी से अवशोषित करते हैं
- The electrons get **excited**, then **de-excited**, reemitting energy at a **fixed frequency**
  इलेक्ट्रॉन **उत्तेजित** होते हैं फिर **शांत** होते हैं और ऊर्जा को **निश्चित आवृत्ति** पर पुनः उत्सर्जित करते हैं
- We see this emission as **light**
  हम इस उत्सर्जन को **प्रकाश** के रूप में देखते हैं
- Because **4f electrons** sit close to the **nucleus**, they are partly **shielded** by outer electrons
  क्योंकि **4f इलेक्ट्रॉन नाभिक** के पास होते हैं, वे बाहरी इलेक्ट्रॉनों द्वारा आंशिक रूप से **संरक्षित** रहते हैं
- Their **energy levels** are not much a•ected by the surrounding **crystal**
  उनके **ऊर्जा स्तर** आसपास के **क्रिस्टल** से बहुत अधिक प्रभावित नहीं होते
- The emitted light is concentrated in a **narrow slice of the visible spectrum**
  उत्सर्जित प्रकाश **दृश्य वर्णक्रम** के एक **संकीर्ण भाग** में केंद्रित होता है

Rare-earths v. oil
दुर्लभ मृदा बनाम तेल

- Rare-earth **ore deposits** are found in **limited pockets**, not evenly spread
  दुर्लभ मृदा के **अयस्क भंडार** सीमित **क्षेत्रों** में पाए जाते हैं, समान रूप से फैले नहीं होते
- Companies look for minerals with **higher concentrations** like **bastnäsite and monazite**
  कंपनियाँ **बास्टनैसाइट और मोनाज़ाइट** जैसे **अधिक सांद्रता** वाले खनिज खोजती हैं
- Or **clay deposits** where rare-earth ions are **loosely held**
  या ऐसे **मृत्तिका भंडार** जहाँ दुर्लभ मृदा आयन **ढीले रूप से जुड़े** होते हैं
- Many mines are **open-pit** because ore is spread through **large rock volumes**
  कई खदानें **ओपन-पिट** होती हैं क्योंकि अयस्क **बड़े चट्टानी आयतन** में फैला होता है
- Ore must be **dug out, crushed, and moved in bulk**
  अयस्क को **खोदकर निकालना, कुचलना और बड़े पैमाने पर ढोना** पड़ता है
- Environmental complications arise because some minerals occur with **thorium or uranium**
  पर्यावरणीय जटिलताएँ इसलिए होती हैं क्योंकि कुछ खनिज **थोरियम या यूरेनियम** के साथ पाए जाते हैं
- Waste rock needs **careful handling**
  अपशिष्ट चट्टानों को **सावधानी से संभालना** पड़ता है
- Mines may need **large amounts of water** and speci•c chemicals
  खदानों को **बहुत अधिक पानी** और **विशिष्ट रसायनों** की आवश्यकता हो सकती है

- While both **rare-earths and crude oil** need extraction and processing
  हालाँकि **दुर्लभ मृदा तत्व** और **कच्चा तेल** दोनों को निष्कर्षण और प्रसंस्करण की आवश्यकता होती है
- The **processing step** is fundamentally di•erent
  लेकिन **प्रसंस्करण चरण** मूल रूप से **भिन्न** होता है
- For rare-earths, processing has become a **strategic element**
  दुर्लभ मृदा तत्वों के लिए प्रसंस्करण एक **रणनीतिक तत्व** बन गया है
- An oil re•nery uses **fractional distillation** based on **boiling points**
  तेल रिफाइनरी **उबाल बिंदुओं** के आधार पर **आंशिक आसवन** का उपयोग करती है
- Heating and condensing can separate constituents e•ciently at scale
  गर्म करने और संघनन से घटकों को **औद्योगिक स्तर पर कुशलता से** अलग किया जा सकता है
- Rare-earth producers start with **solids containing many elements together**
  दुर्लभ मृदा उत्पादक ऐसे **ठोस पदार्थों** से शुरुआत करते हैं जिनमें **कई तत्व साथ होते हैं**
- They must be separated at **very high purity**
  इन्हें **अत्यंत उच्च शुद्धता** पर अलग करना पड़ता है
- Neighbouring rare-earth ions behave **similarly in solution**
  पड़ोसी दुर्लभ मृदा आयन **विलयन में समान व्यवहार** करते हैं
- So separation is **voluminous and energy-intensive**
  इसलिए पृथक्करण प्रक्रिया **बड़ी और ऊर्जा-गहन** होती है
- A magnet maker needs a **speci•c element or oxide** of **minimum purity**
  चुम्बक निर्माता को **न्यूनतम शुद्धता** वाला **विशिष्ट तत्व या ऑक्साइड** चाहिए
- If one element is missing or impure, the factory **cannot substitute**
  यदि कोई तत्व कम या अशुद्ध हो तो कारखाना **प्रतिस्थापन नहीं कर सकता**
- In the **oil industry**, re•neries can **swap feedstocks and trade intermediates** at scale
  लेकिन **तेल उद्योग** में रिफाइनरियाँ **फीडस्टॉक बदल सकती हैं** और **मध्यवर्ती उत्पादों का बड़े पैमाने पर व्यापार** कर सकती हैं

Midstream menace
मिडस्ट्रीम संकट

- After **mining**, the •rst goal is to make a **smaller, richer product**
  खनन के बाद पहला उद्देश्य एक **छोटा लेकिन अधिक समृद्ध उत्पाद** बनाना होता है
- This begins with **bene•ciation**, physically processing the ore to separate **valuable mineral grains** from the less valuable ones
  यह **बेनिफिशिएशन** से शुरू होता है, जिसमें अयस्क को भौतिक रूप से संसाधित कर **मूल्यवान खनिज कणों** को कम मूल्य वाले कणों से अलग किया जाता है
- Workers **crush and grind** the ore to free the grains
  श्रमिक अयस्क को **कुचलते और पीसते हैं** ताकि खनिज कण मुक्त हो सकें
- Then they use •otation, **magnets or gravity** to collect di•erent concentrates separately
  फिर वे **फ्लोटेशन, चुंबक या गुरुत्वाकर्षण** का उपयोग कर अलग-अलग सांद्रण एकत्र करते हैं
- The resulting **concentrate** still contains many **rare-earth elements together**, plus other unwanted elements
  प्राप्त **कंसन्ट्रेट** में अभी भी कई **दुर्लभ मृदा तत्व एक साथ**, तथा अन्य अवांछित तत्व होते हैं
- Next is **chemical cracking**, where rare-earth minerals are broken apart using **strong acids or bases or high temperature**
  इसके बाद **रासायनिक क्रैकिंग** होती है, जिसमें **मजबूत अम्लों, क्षारों या उच्च तापमान** से दुर्लभ मृदा खनिजों को तोड़ा जाता है
- This converts them into a form that **dissolves more easily**
  इससे वे ऐसे रूप में बदल जाते हैं जो **आसानी से घुल** सकें
- Third is **leaching**
  तीसरा चरण **लीचिंग** है
- The cracked material is mixed with a **liquid**, often an **acidic solution**
  क्रैक की गई सामग्री को एक **तरल**, अक्सर **अम्लीय घोल**, के साथ मिलाया जाता है
- Rare-earth atoms move into the liquid as **ions**
  दुर्लभ मृदा परमाणु **आयन** के रूप में तरल में चले जाते हैं

- The liquid is separated from remaining solids and contains a **mixture of rare-earth ions** plus impurities
  तरल को शेष ठोस से अलग किया जाता है और इसमें **दुर्लभ मृदा आयनों का मिश्रण** तथा अशुद्धियाँ होती हैं
- The **hardest step** is separating this mixture into **individual rare-earth elements of high purity**
  सबसे **कठिन चरण** इस मिश्रण को **उच्च शुद्धता वाले अलग-अलग दुर्लभ मृदा तत्वों** में विभाजित करना है
- These elements usually have the **same charge (+3)** and similar **ion size**
  इन तत्वों पर सामान्यतः **समान आवेश (+3)** होता है और उनके **आयन आकार** भी समान होते हैं
- Thus, in simple reactions, the ions behave in **roughly the same way**
  इसलिए साधारण अभिक्रियाओं में आयन **लगभग समान व्यवहार** करते हैं
- Industry uses **solvent extraction** instead
  इसलिए उद्योग **सॉल्वेंट एक्सट्रैक्शन** तकनीक का उपयोग करता है
- The leach solution is repeatedly contacted with an **organic solvent** that doesn't mix with water
  लीच घोल को बार-बार एक **कार्बनिक विलायक** के संपर्क में लाया जाता है जो पानी से नहीं मिलता
- The solvent contains molecules that bind **slightly more** with certain rare-earth ions
  विलायक में ऐसे अणु होते हैं जो कुछ दुर्लभ मृदा आयनों से **थोड़ा अधिक** जुड़ते हैं
- Each contact transfers a **small difference** of one element into the solvent
  हर संपर्क में एक तत्व की **थोड़ी अधिक मात्रा** विलायक में चली जाती है
- Because the difference is small, many **stages in a row** are required
  क्योंकि अंतर छोटा होता है, इसलिए **कई चरण क्रमशः** चलाने पड़ते हैं
- Eventually, elements are separated **one by one** into **high-purity streams**
  अंततः तत्व **एक-एक कर** उच्च शुद्धता की धाराओं में अलग हो जाते हैं
- Producers recover elements as **solids by precipitation**
  उत्पादक तत्वों को **अवक्षेपण द्वारा ठोस** रूप में प्राप्त करते हैं
- A compound is added that becomes **insoluble** and falls out as a **solid**
  एक यौगिक जोड़ा जाता है जो **अघुलनशील** बनकर **ठोस** के रूप में बाहर आ जाता है
- The solids are • ltered, washed, and heated to remove water and impurities
  ठोस को **छाना, धोया और गर्म** किया जाता है ताकि पानी और अशुद्धियाँ हटें
- This yields a **rare-earth oxide**
  इससे अंततः **दुर्लभ मृदा ऑक्साइड** प्राप्त होता है
- Elements are usually **stored and transported as oxides**
  तत्वों को सामान्यतः **ऑक्साइड के रूप में संग्रहीत और परिवहन** किया जाता है
- If metal is required, the oxide undergoes a **reduction reaction**
  यदि धातु चाहिए, तो ऑक्साइड को **अपचयन अभिक्रिया** से गुजारा जाता है
- Some ores contain **thorium or uranium**, making waste **radioactive**
  कुछ अयस्कों में **थोरियम या यूरेनियम** होते हैं, जिससे अपशिष्ट **रेडियोधर्मी** हो सकता है
- Acids and bases can create **hazardous wastes** if not properly treated
  यदि सही ढंग से उपचार न हो, तो अम्ल और क्षार **खतरनाक अपशिष्ट** उत्पन्न कर सकते हैं

China's dominance
चीन का प्रभुत्व

- Because midstream re• nement is arduous, deposits alone are not enough
  क्योंकि मिडस्ट्रीम **रिफाइनमेंट कठिन** है, केवल भंडार होना पर्याप्त नहीं है
- Countries without processing capacity must **depend on others**
  प्रसंस्करण क्षमता न होने पर देशों को **अन्य देशों पर निर्भर** रहना पड़ता है
- According to the **U.S. Geological Survey**, the world has over **90 million tonnes** of rare-earth-oxide equivalent
  अमेरिकी भूवैज्ञानिक सर्वेक्षण के अनुसार दुनिया में **90 मिलियन टन से अधिक** दुर्लभ मृदा ऑक्साइड समतुल्य भंडार है
- Major reserves include **China (44 MT), Brazil (21 MT), India (6.9 MT), Australia (5.7 MT)**
  प्रमुख भंडारों में **चीन (44 MT), ब्राज़ील (21 MT), भारत (6.9 MT), ऑस्ट्रेलिया (5.7 MT)** शामिल हैं
- Other reserves include **Russia, Vietnam, the U.S., and Greenland**
  अन्य भंडार **रूस, वियतनाम, अमेरिका और ग्रीनलैंड** में हैं

- These estimates **exclude scandium**
  इन अनुमानों में **स्कैंडियम शामिल नहीं** है

- On **December 23**, Japan announced plans to excavate rare-earth-rich mud from **6 km underwater** near **Minamitori Island** in **January–February 2026**
  23 दिसंबर को जापान ने **जनवरी–फरवरी 2026** में **मिनामितोरी द्वीप** के पास **6 किमी गहराई** से दुर्लभ मृदा युक्त कीचड़ निकालने की घोषणा की

- The **International Energy Agency** estimates China controls about **91%** of global separation and re• ning
  अंतरराष्ट्रीय ऊर्जा एजेंसी के अनुसार चीन वैश्विक पृथक्करण और रिफाइनिंग का लगभग **91%** नियंत्रित करता है

- China also accounts for around **94%** of **sintered rare-earth permanent magnets** production
  चीन **सिंटर्ड दुर्लभ मृदा स्थायी चुम्बकों** के उत्पादन का लगभग **94%** हिस्सा रखता है

- Since **green technologies** rely on high-performance magnets
  क्योंकि **हरित प्रौद्योगिकियाँ** उच्च प्रदर्शन वाले चुम्बकों पर निर्भर हैं

- Countries are focusing on **re• ning and magnet-making capacity**, not just new mines
  इसलिए देश केवल नई खदानों के बजाय **रिफाइनिंग और चुम्बक निर्माण क्षमता** विकसित करने पर ध्यान दे रहे हैं

Vizhinjam's millionth feat in record time

Scorching pace: A container ship arrives at Vizhinjam International Seaport in Thiruvananthapuram. PTI FILE

GS III: Economy

V. Sajeev Kumar

Vizhinjam International Seaport, developed and operated by Adani Ports and Special Economic Zone Ltd. in partnership with the Kerala government, has handled a record one million TEU (twenty-foot equivalent unit) cargo within just 10 months of operations.

Located close to major east-west shipping lanes, it is emerging as a premier deep-water transshipment hub that is capable of handling the world's largest vessels, thereby strengthening India's presence in global logistics and maritime trade. The exceptional first year not only elevates the port's global standing but also reinforces India's growing influence in international shipping – unlocking new opportunities for economic growth and supply-chain competitiveness.

Second phase in January

Kerala Ports Minister V.N. Vasavan, after reviewing the performance, said the second phase of the port development work is likely to be inaugurated in mid-January. The launch of the second, third and fourth phases of construction would see an investment of ₹9,700 crore by Adani Group. The existing 800 m berth will be increased to 2,000 m and the 2.96 km breakwater will be increased by another 9.2 m, Mr. Vasavan said. The port handled 650 vessels and 1.4 million TEU cargo in inaugural year; this includes 43 ultra-large container vessels between December 2024 and 2025 – the highest at any Indian port and 154 ships above 300 m length.

Vizhinjam's millionth feat in record time
विझिंजम की रिकॉर्ड समय में दस लाख की उपलब्धि

- Vizhinjam International Seaport, developed and operated by **Adani Ports and Special Economic Zone Ltd.** in partnership with the **Kerala government**, has handled a record **one million TEU (twenty-foot equivalent unit)** cargo within just **10 months** of operations.
  विझिंजम इंटरनेशनल सीपोर्ट, जिसे **अडानी पोर्ट्स एंड स्पेशल इकोनॉमिक ज़ोन लिमिटेड** ने **केरल सरकार** के साथ साझेदारी में विकसित और संचालित किया है, ने संचालन के मात्र **10 महीनों** में रिकॉर्ड **one million TEU (twenty-foot equivalent unit)** कार्गो संभाला है।
- Located close to major **east–west shipping lanes**, it is emerging as a premier **deep-water transshipment hub** that is capable of handling the world's **largest vessels**, thereby strengthening **India's presence** in global logistics and maritime trade.
  प्रमुख **east–west shipping lanes** के निकट स्थित यह बंदरगाह एक प्रमुख **deep-water transshipment hub** के रूप में उभर रहा है, जो दुनिया के **largest vessels** को संभालने में सक्षम है, जिससे वैश्विक लॉजिस्टिक्स और समुद्री व्यापार में **India's presence** मजबूत हो रही है।
- The exceptional first year not only elevates the port's **global standing** but also reinforces **India's growing influence** in international shipping — unlocking new opportunities for **economic growth** and **supply-chain competitiveness**.
  यह असाधारण पहला वर्ष न केवल बंदरगाह की **global standing** को बढ़ाता है बल्कि अंतरराष्ट्रीय शिपिंग में **India's growing influence** को भी सुदृढ़ करता है — जिससे **economic growth** और **supply-chain competitiveness** के नए अवसर खुलते हैं।

Second phase in January
जनवरी में दूसरा चरण

- Kerala Ports Minister **V.N. Vasavan**, after reviewing the performance, said the **second phase** of the port development work is likely to be inaugurated in **mid-January**.
  केरल बंदरगाह मंत्री वी.एन. वासवन ने प्रदर्शन की समीक्षा के बाद कहा कि बंदरगाह विकास कार्य का **second phase** संभवतः **mid-January** में उद्घाटित किया जाएगा।
- The launch of the **second, third and fourth phases** of construction would see an investment of **₹9,700 crore** by **Adani Group**.
  निर्माण के **second, third and fourth phases** की शुरुआत के साथ **Adani Group** द्वारा **₹9,700 crore** का निवेश किया जाएगा।
- The existing **800 m berth** will be increased to **2,000 m** and the **2.96 km breakwater** will be increased by another **9.2 m**, Mr. Vasavan said.
  श्री वासवन ने कहा कि मौजूदा **800 m berth** को बढ़ाकर **2,000 m** किया जाएगा और **2.96 km breakwater** को और **9.2 m** बढ़ाया जाएगा।
- The port handled **650 vessels** and **1.4 million TEU cargo** in its inaugural year; this includes **43 ultra-large container vessels** between **December 2024 and 2025** — the highest at any **Indian port** and **154 ships** above **300 m length**.
  उद्घाटन वर्ष में बंदरगाह ने **650 vessels** और **1.4 million TEU cargo** संभाला; इसमें **December 2024 and 2025** के बीच **43 ultra-large container vessels** शामिल हैं — जो किसी भी **Indian port** पर सबसे अधिक है — और **300 m length** से अधिक के **154 ships** भी शामिल हैं।

GS Paper III: S&T,	
TOPICS COVERED	29 December 2025
1.	Alaknanda: Indian astronomers spot implausibly old spiral galaxy अलकनंदा: भारतीय खगोलविदों ने असंभव रूप से पुरानी सर्पिल आकाशगंगा की खोज की
2.	Frequency comb: colour referenc फ्रीक्वेंसी कॉम्ब: रंग संदर्भ
3.	A grand vision and the great Indian research deficit एक भव्य दृष्टि और भारत का बड़ा अनुसंधान अभाव

Alaknanda: Indian astronomers spot implausibly old spiral galaxy

Alaknanda's existence poses a significant puzzle for astronomers: it took shape when the universe was only about 1.5 billion years old, defying current models of galaxy formation; according to one expert, either the galaxy grew steadily by drawing in cold gas or it interacted or merged with a smaller companion galaxy

GS III: S&T

Shreejaya Karantha

Astronomers from India have discovered the second farthest spiral galaxy in the depths of the universe, using the powerful James Webb Space Telescope (JWST), and have named it Alaknanda.

The galaxy was an unexpected sight during a broader study of galaxy shapes in the early universe. The findings were published in *Astronomy & Astrophysics* in November.

The study's lead author Rashi Jain, a PhD student at the National Centre for Radio Astrophysics in Pune, was analysing public JWST data from the UNCOVER survey, which contains about 70,000 objects, to understand the morphologies of galaxies in the early universe. That's when she stumbled on the galaxy with two perfectly symmetrical spiral arms. The first question that popped into her mind was: "Should this exist so early in the universe?"

'Meticulous analysis'

Ms. Jain and her doctoral advisor Yogesh Wadadekar undertook a detailed study to determine the galaxy's nature. They found it had a prominent disk with two clear spiral arms and a small central bulge. When they removed the smooth light from the disk and the bulge, the spiral arms remained visible, confirming they were real and not an artifact in the light data.

They also found that new stars formed along the spiral arms at about equivalent of 60 stars of our sun's mass every year. This confirmed Alaknanda was a fully developed spiral galaxy, and only 1.5 billion years after the Big Bang.
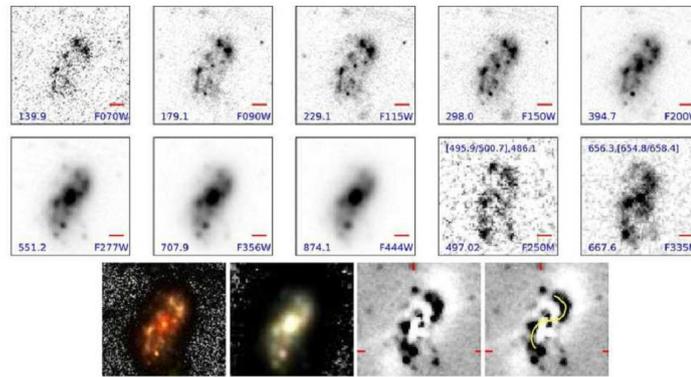
Ms. Jain named the galaxy Alaknanda for the river in Uttarakhand. She was looking for a female name to be consistent with how galaxies are often referred to in Indian languages.

"I remembered seeing Alaknanda and Mandakini, both tributaries of the Ganga, flowing together during my visit to Uttarakhand. Since our own Milky Way is called Mandakini in Hindi and is also a spiral galaxy, I named this one Alaknanda," she said.

"The discovery is serendipitous and the result reflects the power of JWST-quality data and meticulous analysis," Girish Kulkarni, a professor at the Department of Theoretical Physics at the Tata Institute of Fundamental Research, Mumbai, said. "It's not so much a brand-new technique as careful work making the most of the observations."

Prof. Kulkarni wasn't involved in the study.

Too soon, too ready

Alaknanda's existence poses a significant puzzle for astronomers.

"Current models suggest it takes billions of years for the stable, rotating disks necessary for spiral arms to form," said Ms. Jain.

However, Alaknanda took shape when the universe was only about 1.5 billion years old, defying the current models of galaxy formation.

According to Prof. Kulkarni, understanding galaxy formation is a "complex system problem," akin to predicting the weather or the climate. Unlike "simple" physics problems, where fundamental principles might be unknown, complex problems involve known principles but have too many interacting parts to be modelled perfectly.

"Current simulations don't yield spiral galaxies with this degree of structure at z - 4, and when observations disagree with simulations, it usually tells us which ingredients need refinement," Prof. Kulkarni said. This means any mismatch is scientifically more useful rather than troubling.

('z - 4' is a reference to the redshift, which is the stretching of light to longer wavelengths as the light source recedes from the observer, in this case the earth. The 'z' measures the fractional increase in wavelength.)

So how did Alaknanda manage to form a mature spiral disk in such a short time?

According to Ms. Jain, there are two theories about the formation of spiral arms. One is that the galaxy grew steadily by drawing in cold gas, allowing it to settle into a stable, rotating disk in which density waves could form and sustain the spiral patterns. The other is that

Greyscale cutouts of Alaknanda in all JWST broadband filters (top two rows). The red horizontal bar in the bottom right corner shows a 6,500-lightyear scale at the galaxy's redshift. The bottom row shows two composite images of the galaxy; the last two images show an algorithm's fitting of the telescope data. A&A, 703 (2025) A96

> The discovery is serendipitous and the result reflects the power of JWST-quality data and meticulous analysis

GIRISH KULKARNI
TATA INSTITUTE OF FUNDAMENTAL RESEARCH, MUMBAI

Alaknanda interacted or merged with a smaller companion galaxy, causing the arms to form. Even so, astronomers believe spiral arms would have needed more time to form in such a young universe.

"There could be some factor accelerating this process," Ms. Jain said.

'Robust findings'

Astronomers usually study galaxies in the distant universe using the energies of light they emit, which reveal the chemical composition and physical conditions in the galaxy. In the absence of such data, as in the new study, they measure the galaxy's brightness at different wavelengths to reconstruct its overall energy distribution. This is called photometric analysis. Jain *et al.* did this using data from the JWST. And with the reconstructed spectrum, they were able to estimate its redshift, stellar mass, and star-formation history.

Prof. Kulkarni said that while the study relied on photometric analysis, its findings appear robust as the team carried out three independent and consistent redshift measurements. However, he suggested the researchers also examine detailed spectroscopic data, such as JWST's Integral Field Unit images, to ensure the observed structure is not caused by clumpy features and to confirm Alaknanda is truly spiral rather than a chance alignment.

The current observations are also insufficient to determine which of the two plausible mechanisms is responsible for Alaknanda's arms. To this end the team plans to propose further observations with JWST or with the Atacama Large Millimeter/submillimeter Array in Chile.

Indian astronomy

Finally, the discovery of Alaknanda is also a significant achievement for Indian science. Prof. Kulkarni said India's presence in major JWST discoveries has been limited by a smaller astronomy workforce, fewer dedicated training programmes, and lower funding compared to that in the bigger research economies, as well as less sustained participation in large international survey collaborations.

To catch up, the Indian astronomy community is pursuing a two-pronged strategy: to build domestic facilities, like the proposed 10-metre optical telescope in Hanle, to train the next generation of scientists, and to join large, multinational projects like the Square Kilometer Array (SKA) and LIGO, which can guarantee access to world-class instruments.

(*Shreejaya Karantha is a freelance science writer.* shreejayakaranth@gmail.com)

THE GIST

▼ Researchers at the National Centre for Radio Astrophysics in Pune stumbled on the galaxy with two perfectly symmetrical spiral arms while analysing public JWST data from the UNCOVER survey to understand the morphologies of galaxies in the early universe

▼ Galaxy formation is a complex system problem, akin to predicting the weather or the climate. Unlike physics problems, where fundamental principles might be unknown, complex problems involve known principles but have too many interacting parts to be modelled perfectly

▼ Researchers have been advised to examine spectroscopic data to ensure there are no clumpy features. Also, since observations are insufficient to support the two plausible mechanisms, the team plans to propose further studies with the Atacama Large Millimeter/submillimeter Array in Chile

Alaknanda: Indian astronomers spot implausibly old spiral galaxy
अलकनंदा: भारतीय खगोलविदों ने असंभव रूप से पुरानी सर्पिल आकाशगंगा की खोज की

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- **Astronomers from India have discovered the second farthest spiral galaxy in the depths of the universe, using the powerful James Webb Space Telescope (JWST), and have named it Alaknanda**
  भारत के खगोलविदों ने शक्तिशाली जेम्स वेब स्पेस टेलीस्कोप (JWST) का उपयोग करते हुए **ब्रह्मांड की गहराइयों में दूसरी सबसे दूर स्थित सर्पिल आकाशगंगा** की खोज की है और इसका नाम **अलकनंदा** रखा है

- The galaxy was an **unexpected sight** during a broader study of **galaxy shapes in the early universe**
  यह आकाशगंगा **प्रारंभिक ब्रह्मांड में आकाशगंगाओं के आकारों** के व्यापक अध्ययन के दौरान एक **अप्रत्याशित दृश्य** थी

- The **findings were published** in Astronomy & Astrophysics in **November**
  ये **निष्कर्ष नवंबर** में Astronomy & Astrophysics में प्रकाशित किए गए

- The study's **lead author Rashi Jain**, a PhD student at the **National Centre for Radio Astrophysics in Pune**, was analysing **public JWST data** from the **UNCOVER survey**, which contains about **70,000 objects**, to understand the **morphologies of galaxies in the early universe**
  इस अध्ययन की **मुख्य लेखिका राशि जैन**, जो पुणे स्थित नेशनल सेंटर फॉर रेडियो एस्ट्रोफिजिक्स में **पीएचडी छात्रा हैं**, UNCOVER सर्वे से प्राप्त **सार्वजनिक JWST डेटा** का विश्लेषण कर रही थीं, जिसमें लगभग **70,000 वस्तुएँ** शामिल हैं, ताकि **प्रारंभिक ब्रह्मांड में आकाशगंगाओं की संरचनाओं** को समझा जा सके

- That's when she **stumbled on the galaxy** with **two perfectly symmetrical spiral arms**
  इसी दौरान उन्हें **दो पूरी तरह सममित सर्पिल भुजाओं** वाली यह **आकाशगंगा** दिखाई दी

- The **first question** that popped into her mind was **"Should this exist so early in the universe?"**
  उनके मन में आया **पहला प्रश्न** था **"क्या यह ब्रह्मांड में इतनी जल्दी अस्तित्व में हो सकती है?"**

'Meticulous analysis'
'सूक्ष्म और सावधानीपूर्ण विश्लेषण'

- **Ms. Jain and her doctoral advisor Yogesh Wadadekar** undertook a **detailed study** to determine the **galaxy's nature**
  सुश्री जैन और उनके शोध-निर्देशक योगेश वडाडेकर ने आकाशगंगा की **प्रकृति** निर्धारित करने के लिए **विस्तृत अध्ययन** किया

- They found it had a **prominent disk** with **two clear spiral arms** and a **small central bulge**
  उन्होंने पाया कि इसमें **स्पष्ट डिस्क, दो स्पष्ट सर्पिल भुजाएँ** और एक **छोटा केंद्रीय उभार** है

- When they **removed the smooth light** from the **disk and the bulge**, the **spiral arms remained visible**, confirming they were **real and not an artifact** in the light data
  जब उन्होंने **डिस्क और उभार से चिकनी रोशनी हटाई**, तब भी **सर्पिल भुजाएँ स्पष्ट दिखीं**, जिससे पुष्टि हुई कि वे **वास्तविक हैं** और प्रकाश डेटा की कोई **त्रुटि** नहीं हैं

- They also found that **new stars formed along the spiral arms** at about equivalent of **60 stars of our sun's mass every year**
  उन्होंने यह भी पाया कि **सर्पिल भुजाओं के साथ नए तारे** लगभग **हर वर्ष सूर्य के द्रव्यमान के 60 तारों** के बराबर बन रहे थे

- This confirmed **Alaknanda was a fully developed spiral galaxy**, and only **1.5 billion years after the Big Bang**
  इससे पुष्टि हुई कि **अलकनंदा एक पूर्ण विकसित सर्पिल आकाशगंगा है** और यह **बिग बैंग के केवल 1.5 अरब वर्ष बाद** अस्तित्व में थी

- **Ms. Jain named the galaxy Alaknanda for the river in Uttarakhand**
  सुश्री जैन ने इस आकाशगंगा का नाम **उत्तराखंड की नदी अलकनंदा** के नाम पर रखा

- She was looking for a **female name** to be **consistent with how galaxies are often referred to in Indian languages**
  वह एक **महिला नाम** चाहती थीं ताकि यह **भारतीय भाषाओं में आकाशगंगाओं को संबोधित करने की परंपरा** के अनुरूप हो

- "I remembered seeing **Alaknanda and Mandakini**, both **tributaries of the Ganga**, flowing together during my visit to **Uttarakhand**

"मुझे **उत्तराखंड** यात्रा के दौरान **अलकनंदा और मंदाकिनी**, जो **गंगा की सहायक नदियाँ** हैं, को एक साथ बहते देखना याद आया

- Since our own **Milky Way is called Mandakini in Hindi** and is also a **spiral galaxy**, I named this one **Alaknanda**," she said
  चूंकि हमारी अपनी **मिल्की वे को हिंदी में मंदाकिनी** कहा जाता है और वह भी एक **सर्पिल आकाशगंगा** है, इसलिए मैंने इसका नाम **अलकनंदा** रखा," उन्होंने कहा

- "The discovery is **serendipitous** and the result reflects the **power of JWST-quality data and meticulous analysis**," Girish Kulkarni, a **professor** at the **Department of Theoretical Physics at the Tata Institute of Fundamental Research, Mumbai**, said
  "यह खोज **संयोगवश** हुई है और यह **JWST-स्तरीय डेटा और सूक्ष्म विश्लेषण की शक्ति** को दर्शाती है," **टाटा इंस्टीट्यूट ऑफ फंडामेंटल रिसर्च, मुंबई** के **सैद्धांतिक भौतिकी विभाग** के **प्रोफेसर गिरीश कुलकर्णी** ने कहा

Too soon, too ready
बहुत जल्दी, बहुत तैयार

- Alaknanda's existence poses a **significant puzzle** for **astronomers**
  अलकनंदा का अस्तित्व **खगोलविदों** के लिए एक **महत्वपूर्ण पहेली** प्रस्तुत करता है
- "Current models suggest it takes **billions of years** for the **stable, rotating disks** necessary for **spiral arms** to form," said **Ms. Jain**
  सुश्री जैन ने कहा कि "वर्तमान मॉडल बताते हैं कि **सर्पिल भुजाओं** के निर्माण के लिए आवश्यक **स्थिर, घूर्णनशील डिस्क** बनने में **अरबों वर्ष** लगते हैं"
- However, **Alaknanda** took shape when the universe was only about **1.5 billion years old**, **defying the current models of galaxy formation**
  हालांकि **अलकनंदा** तब बनी जब ब्रह्मांड की आयु केवल लगभग **1.5 अरब वर्ष** थी, जो **आकाशगंगा निर्माण के वर्तमान मॉडलों** को चुनौती देती है
- According to **Prof. Kulkarni**, understanding **galaxy formation** is a **"complex system problem,"** akin to predicting the **weather or the climate**
  प्रोफेसर कुलकर्णी के अनुसार **आकाशगंगा निर्माण** को समझना एक **"जटिल प्रणाली समस्या"** है, जो **मौसम या जलवायु** की भविष्यवाणी के समान है
- Unlike **"simple" physics problems**, where **fundamental principles** might be unknown, **complex problems** involve **known principles** but have **too many interacting parts** to be **modelled perfectly**
  "सरल" भौतिकी समस्याओं के विपरीत, जहाँ **मूलभूत सिद्धांत** अज्ञात हो सकते हैं, **जटिल समस्याओं** में **ज्ञात सिद्धांत** होते हैं लेकिन **बहुत अधिक परस्पर क्रियाशील घटक** होते हैं जिन्हें **पूरी तरह मॉडल** नहीं किया जा सकता
- "Current simulations don't yield **spiral galaxies with this degree of structure at z ~ 4**, and when **observations disagree with simulations**, it usually tells us which **ingredients need refinement**," **Prof. Kulkarni** said
  प्रोफेसर कुलकर्णी ने कहा कि "वर्तमान सिमुलेशन **z ~ 4** पर इस स्तर की संरचना वाली **सर्पिल आकाशगंगाएँ** उत्पन्न नहीं करते, और जब **अवलोकन सिमुलेशन से असहमत** होते हैं, तो यह आमतौर पर बताता है कि किन **घटकों में सुधार** की आवश्यकता है"
- This means any **mismatch** is **scientifically more useful** rather than **troubling**
  इसका अर्थ है कि कोई भी **असंगति वैज्ञानिक दृष्टि से अधिक उपयोगी** होती है न कि **चिंताजनक**
- (**'z ~ 4' is a reference to the redshift, which is the stretching of light to longer wavelengths as the light source recedes from the observer, in this case the earth The 'z' measures the fractional increase in wavelength**)
  (**'z ~ 4'** रेडशिफ्ट का संदर्भ है, जो प्रकाश के लंबे तरंगदैर्घ्य की ओर खिंचने को दर्शाता है जब प्रकाश स्रोत पर्यवेक्षक से दूर जाता है, इस मामले में पृथ्वी **'z'** तरंगदैर्घ्य में अंशात्मक वृद्धि को मापता है)
- So how did **Alaknanda** manage to form a **mature spiral disk** in such a **short time**
  तो **अलकनंदा** इतनी **कम अवधि** में एक **परिपक्व सर्पिल डिस्क** कैसे बना पाई
- According to **Ms. Jain**, there are **two theories** about the **formation of spiral arms**
  सुश्री जैन के अनुसार **सर्पिल भुजाओं के निर्माण** को लेकर **दो सिद्धांत** हैं
- One is that the galaxy **grew steadily by drawing in cold gas**, allowing it to settle into a **stable, rotating disk** in which **density waves** could form and sustain the **spiral patterns**

एक यह है कि आकाशगंगा ने **ठंडी गैस को खींचकर धीरे-धीरे वृद्धि** की जिससे वह एक **स्थिर, घूर्णनशील डिस्क** में स्थापित हो गई जिसमें **घनत्व तरंगें** बन सकीं और **सर्पिल संरचनाएँ** बनी रहीं

- The other is that **Alaknanda interacted or merged with a smaller companion galaxy**, causing the **arms to form**
  दूसरा यह है कि **अलकनंदा** ने किसी **छोटी सहचर आकाशगंगा** के साथ **परस्पर क्रिया या विलय** किया जिससे **भुजाओं का निर्माण** हुआ

- Even so, astronomers believe **spiral arms would have needed more time to form** in such a **young universe**
  फिर भी खगोलविदों का मानना है कि इतने **युवा ब्रह्मांड** में **सर्पिल भुजाओं** के बनने में **और अधिक समय** लगता

- "There could be some **factor accelerating this process**," **Ms. Jain** said
  "इस प्रक्रिया को तेज करने वाला कोई **कारक** हो सकता है," **सुश्री जैन** ने कहा

'Robust findings'
'मज़बूत निष्कर्ष'

- Astronomers usually study galaxies in the **distant universe** using the **energies of light they emit**, which reveal the **chemical composition and physical conditions** in the galaxy
  खगोलविद आमतौर पर **दूरस्थ ब्रह्मांड** की आकाशगंगाओं का अध्ययन उनके द्वारा उत्सर्जित **प्रकाश की ऊर्जाओं** से करते हैं जो आकाशगंगा की **रासायनिक संरचना और भौतिक स्थितियों** को प्रकट करती हैं

- In the absence of such data, as in the **new study**, they measure the **galaxy's brightness at different wavelengths** to reconstruct its **overall energy distribution**
  ऐसे डेटा के अभाव में, जैसा कि **नए अध्ययन** में था, वे **विभिन्न तरंगदैर्घ्यों** पर आकाशगंगा की **चमक** मापकर उसकी **समग्र ऊर्जा वितरण** का पुनर्निर्माण करते हैं

- This is called **photometric analysis**
  इसे **फोटोमेट्रिक विश्लेषण** कहा जाता है

- **Jain et al** did this using data from the **JWST**
  जैन एवं सहकर्मियों ने यह कार्य **JWST** के डेटा का उपयोग करके किया

- And with the **reconstructed spectrum**, they were able to estimate its **redshift, stellar mass, and star-formation history**
  और **पुनर्निर्मित स्पेक्ट्रम** के साथ वे इसका **रेडशिफ्ट, तारकीय द्रव्यमान और तारा-निर्माण इतिहास** का अनुमान लगा सके

- **Prof. Kulkarni** said that while the study relied on **photometric analysis**, its **findings appear robust** as the team carried out **three independent and consistent redshift measurements**
  प्रोफेसर कुलकर्णी ने कहा कि यद्यपि अध्ययन **फोटोमेट्रिक विश्लेषण** पर आधारित था, इसके **निष्कर्ष मज़बूत** प्रतीत होते हैं क्योंकि टीम ने **तीन स्वतंत्र और सुसंगत रेडशिफ्ट मापन** किए

- However, he suggested the researchers also examine **detailed spectroscopic data**, such as **JWST's Integral Field Unit images**, to ensure the **observed structure** is not caused by **clumpy features** and to confirm **Alaknanda is truly spiral** rather than a **chance alignment**
  हालांकि उन्होंने सुझाव दिया कि शोधकर्ता **विस्तृत स्पेक्ट्रोस्कोपिक डेटा**, जैसे **JWST की इंटीग्रल फील्ड यूनिट छवियाँ**, भी जाँचें ताकि यह सुनिश्चित हो सके कि **देखी गई संरचना** किसी **गुच्छेदार विशेषता** के कारण नहीं है और यह पुष्टि हो सके कि **अलकनंदा वास्तव में सर्पिल है** न कि कोई **संयोगजन्य संरेखण**

- The current observations are also **insufficient** to determine which of the **two plausible mechanisms** is responsible for **Alaknanda's arms**
  वर्तमान अवलोकन यह निर्धारित करने के लिए भी **अपर्याप्त** हैं कि **दो संभावित तंत्रों** में से कौन **अलकनंदा की भुजाओं** के लिए जिम्मेदार है

- To this end the team plans to propose **further observations** with JWST or with the **Atacama Large Millimeter/submillimeter Array in Chile**
  इस उद्देश्य से टीम **JWST** या **चिली स्थित अटाकामा लार्ज मिलीमीटर सबमिलीमीटर एरे** के साथ **आगे के अवलोकन** प्रस्तावित करने की योजना बना रही है

Indian astronomy
भारतीय खगोल विज्ञान

- To catch up, the **Indian astronomy community** is pursuing a **two-pronged strategy** to build **domestic facilities**, like the **proposed 10-metre optical telescope in Hanle**, to **train the next generation of scientists**, and to join **large, multinational projects** like the **Square Kilometer Array (SKA)** and **LIGO**, which can guarantee **access to world-class instruments**

Frequency comb: colour reference
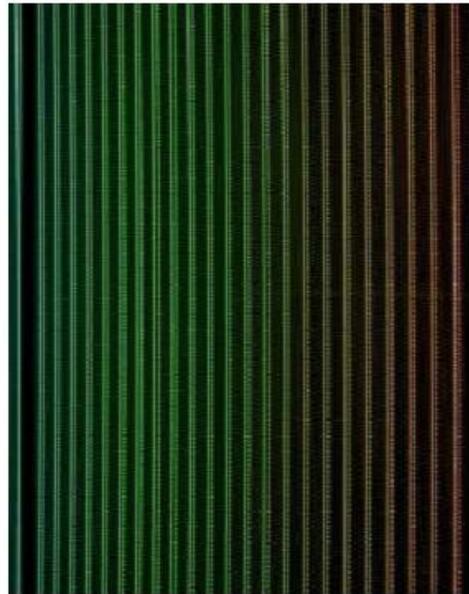
Vasudevan Mukunth

GS III: S&T

A frequency comb is a special kind of laser light whose spectrum, or set of frequencies, resembles the teeth of a comb. Instead of containing just one colour (one frequency), it emits a large number of evenly spaced frequencies. The spacing is extremely regular.

One way to make a frequency comb is using a mode-locked laser that emits very short pulses of light, repeating again and again at a steady rate.

A frequency comb is useful because it lets scientists compare an unknown light frequency to a stable reference with extraordinary precision. Say you have some mystery light, e.g. light produced by a new laser that you have built, and you need to find out its exact frequency. You can shine the new laser light and light from a frequency comb on a common light sensor.

The sensor will produce an electrical signal. If one comb tooth is very close in colour to your unknown laser, the two light waves don't line up perfectly. Sometimes their peaks line up, so the sensor signal gets stronger; sometimes they don't and the signal gets weaker. You can thus figure out what colour your laser is producing by combining the frequency (or tooth) it's closest to

Spectrum of light from a frequency comb installed on the High Accuracy Radial Velocity Planet Searcher, Chile. ESO

with how much it is off by. The sensor signal will reveal both these details.

Frequency combs are an important modern tool to calibrate atomic clocks and measure shifts in light caused by gravity, among various other applications.

For feedback and suggestions for 'Science', please write to **science@thehindu.co.in** with the subject 'Daily page'

Frequency comb: colour reference
फ्रीक्वेंसी कॉम्ब: रंग संदर्भ

- A **frequency comb** is a **special kind of laser light** whose **spectrum**, or set of **frequencies**, resembles the **teeth of a comb**

फ्रीक्वेंसी कॉम्ब एक **विशेष प्रकार की लेज़र रोशनी** है जिसका **स्पेक्ट्रम** या **आवृत्तियों** का समूह **कंघी के दाँतों** जैसा दिखाई देता है

- Instead of containing just **one colour (one frequency)**, it emits a **large number of evenly spaced frequencies**
  केवल **एक रंग (एक आवृत्ति)** होने के बजाय यह **समान अंतराल पर स्थित बड़ी संख्या में आवृत्तियाँ** उत्सर्जित करता है

- The **spacing is extremely regular**
  इन आवृत्तियों के बीच का **अंतर अत्यंत नियमित** होता है

- One way to make a **frequency comb** is using a **mode-locked laser** that emits **very short pulses of light**, repeating again and again at a **steady rate**
  फ्रीक्वेंसी कॉम्ब बनाने का एक तरीका **मोड-लॉक्ड लेज़र** का उपयोग करना है जो **बहुत छोटी रोशनी की पल्सें** एक **स्थिर दर** से बार-बार उत्सर्जित करता है

- A **frequency comb** is useful because it lets scientists **compare an unknown light frequency to a stable reference** with **extraordinary precision**
  फ्रीक्वेंसी कॉम्ब उपयोगी है क्योंकि यह वैज्ञानिकों को **अज्ञात प्रकाश आवृत्ति** की तुलना **स्थिर संदर्भ** से **असाधारण सटीकता** के साथ करने देता है

- Say you have some **mystery light**, e g **light produced by a new laser that you have built**, and you need to find out its **exact frequency**
  मान लीजिए आपके पास कोई **रहस्यमय रोशनी** है जैसे कि **आपके द्वारा बनाए गए नए लेज़र से उत्पन्न प्रकाश**, और आपको उसकी **सटीक आवृत्ति** पता करनी है

- You can shine the **new laser light** and **light from a frequency comb** on a **common light sensor**
  आप **नए लेज़र की रोशनी** और **फ्रीक्वेंसी कॉम्ब की रोशनी** को एक ही **सामान्य प्रकाश सेंसर** पर डाल सकते हैं

- The **sensor will produce an electrical signal**
  यह **सेंसर एक विद्युत संकेत** उत्पन्न करेगा

- If one **comb tooth** is very close in **colour** to your **unknown laser**, the two **light waves** don't line up perfectly
  यदि कोई **कॉम्ब दाँत** आपके **अज्ञात लेज़र** के **रंग** के बहुत पास है तो दोनों **प्रकाश तरंगें** पूरी तरह से मेल नहीं खातीं

- Sometimes their **peaks line up**, so the **sensor signal gets stronger** sometimes they don't and the **signal gets weaker**
  कभी उनके **शिखर मेल खाते हैं** जिससे **सेंसर संकेत मजबूत** हो जाता है और कभी वे मेल नहीं खाते जिससे **संकेत कमजोर** हो जाता है

- You can thus figure out what **colour your laser is producing** by combining the **frequency (or tooth) it's closest to** with **how much it is off by**
  इस प्रकार आप यह पता लगा सकते हैं कि आपका **लेज़र कौन सा रंग उत्पन्न कर रहा है** इसके सबसे निकट की **आवृत्ति (या दाँत)** और उससे **कितना अंतर है** इन दोनों को मिलाकर

- The **sensor signal will reveal both these details**
  सेंसर संकेत ये **दोनों जानकारियाँ** प्रकट कर देगा

- **Frequency combs** are an **important modern tool** to **calibrate atomic clocks** and **measure shifts in light caused by gravity**, among **various other applications**
  फ्रीक्वेंसी कॉम्ब एक **महत्वपूर्ण आधुनिक उपकरण** हैं जिनका उपयोग **परमाणु घड़ियों के अंशांकन** और **गुरुत्वाकर्षण के कारण प्रकाश में होने वाले परिवर्तन** मापने सहित **अन्य कई अनुप्रयोगों** में किया जाता है

A grand vision and the great Indian research deficit

GS III: S&T

India stands at a pivotal moment in its economic and technological trajectory. With its vast human capital and a rapidly expanding economy, it harbours ambitions of becoming a global power. Yet, this grand vision is significantly hampered by a deep-seated and chronic insufficiency in research and development (R&D).

The scale in numbers

The scale of India's R&D deficit is best illustrated by a few stark numbers. Despite having 17.5% of the world's brains (since it is home to 17.5% of the world's population), India produces only a meagre 3% of the world's research output. This disparity highlights a fundamental failure in leveraging its massive demographic dividend to generate high-value research.

The situation is not much better on intellectual property creation. Recent reports from the World Intellectual Property Organization (WIPO) suggest a mixed picture: dramatic growth from a very low base, but overall an unimpressive performance. In 2023, India was ranked sixth globally for total patent filings, recording 64,480 applications. This represents the fastest growth (+15.7%) among the top 20 countries and is a significant figure. However, in the context of the total 3.55 million patent applications filed globally in 2023, India's share is still low, at approximately 1.8% of the global total. Critically, when measuring resident applications per million inhabitants, a truer reflection of domestic innovation intensity, India ranks significantly lower (47th), underscoring that the overall growth is not yet translating into widespread, population-level innovation dominance.

The most damning evidence of India's R&D gap lies in R&D expenditure. Gross Expenditure on R&D in India, covering both private and public sectors, has consistently hovered between 0.6% and 0.7% of GDP in recent years (and is slipping as GDP grows). This figure pales in comparison to major economies and innovation hubs: China spends around 2.4%, the United States is at approximately 3.5%, and Israel leads globally at over 5.4%. To grasp the magnitude of underinvestment, one only needs to compare India's entire national R&D spend with that of a single multinational corporation. In 2023, the Chinese technology giant, Huawei, invested a colossal CNY 164.7 billion (approximately $23.4 billion) into R&D. This amount of spending from just one company – no doubt driven by intense global competition and U.S. sanctions, particularly focusing on crucial areas such as semiconductor technology – exceeds the total combined R&D expenditure of all public and private entities in India, a nation of more than 1.4 billion people. As Nvidia Chairman Jensen Huang noted, Huawei's relentless investment has propelled them to be "nanoseconds" behind the U.S. in advanced semiconductor capabilities. This

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The current deficit in R&D investment cannot sustain India's ambition to become a global innovation leader

corporate-level intensity of R&D is the engine of next-generation technological power. India's inability to muster even a fraction of this kind of concentrated, strategic investment speaks volumes about the challenge ahead for it.

So much for the numbers. They are merely symptoms of deeper, structural problems within the Indian innovation ecosystem that it must tackle on a war footing.

The government sector is the funds driver

Most disappointingly, private sector participation in R&D spending is abysmal. A global hallmark of a mature innovation economy is the dominant role of the private sector in R&D. In developed nations, industry typically accounts for two-thirds or more of such expenditure. In India, however, the government sector (central, State, higher education, and public sector industry) remains the main driver, contributing approximately 63.6% of R&D funds, with the private industrial sector contributing only around 36.4%. India's business tycoons need to rise to the R&D challenge, but they are instead largely complacent and myopic about it. Indian industry's low investment is driven by a focus on incremental improvements over disruptive innovation, a preference for technology licensing over domestic development, and a general risk-averse culture.

The second dismaying feature is one we had already identified in the second tenure of the United Progressive Alliance: a persistent academia-industry disconnect, the subject of a report N.R. Narayana Murthy wrote for us more than a decade ago that is sadly gathering dust. Indian academia, despite producing millions of highly skilled graduates, often operates in a silo. Research is frequently theoretical and disconnected from the immediate, market-driven needs of the industry. The mechanisms for technology transfer, commercialisation of research, and joint industry-academic projects remain underdeveloped. Nor do Indian companies look to the world of academia for help. In the U.S., companies commonly bring ideas to universities and give grants for student researchers to develop them into marketable innovations. There is no such culture in India. This gulf prevents valuable research from crossing the "valley of death" between the laboratory and the marketplace.

And there is no escaping the brain drain. While India produces a vast number of PhDs and engineers, the most ambitious and the talented often seek better infrastructure, funding, and career progression opportunities abroad. The domestic R&D environment struggles to attract and retain world-class researchers due to limited high-end research facilities and lower salary benchmarks compared to the rest of the world.

The allocation of public R&D funds is often constrained by slow bureaucratic processes.

Project approval times can be excessively long, and the release of funds is frequently staggered and unpredictable, impeding the smooth execution of ambitious, long-term research programmes.

What, then, is the path forward?

The goal of building comprehensive tech and economic muscle, worthy of a "Viksit Bharat", is not a sprint but a marathon. To achieve it, India must engineer a fundamental shift in its approach. The most immediate and critical step is to raise the R&D expenditure to GDP ratio to at least 2% within the next five to seven years. This requires a massive public spending commitment, coupled with substantial tax incentives and grants to encourage the private sector to ramp up its contribution to at least 50% of the total R&D spend. The launch of the ₹1 lakh crore Research, Development and Innovation (RDI) Fund by the government is a step in the right direction, provided it is disbursed efficiently and targeted towards frontier technologies.

An ambitious India needs to move away from scattered research efforts and focus on national missions in strategic, high-value domains: semiconductors, artificial intelligence (AI), quantum computing, advanced materials and green energy. These missions require long-term, uninterrupted funding and clear, measurable outcomes tied to national security and economic sovereignty.

Universities and research

And there is no escaping India's obligation to reform higher education. Universities must transition from being purely teaching institutions to also becoming centres of excellence in research. This involves significantly boosting funding for PhD programmes, creating competitive research faculty positions, and building world-class research infrastructure. Furthermore, mandatory and structured mechanisms for industry-sponsored research chairs and joint incubation centres must be established to bridge the academic-industry gap.

India must also inculcate a robust intellectual property culture in the country. This means simplifying patent filing processes, strengthening enforcement, and creating attractive financial incentives for inventors (both academic and corporate) whose patents are commercialised.

India possesses the intellectual capital and the aspiration to become a global innovation leader. However, the current deficit in R&D investment – so glaringly exposed by the comparison to a single company such as Huawei – cannot sustain this ambition. The next decade must be dedicated to creating the structural, financial and cultural foundations for innovation. If these fundamental changes are not executed with political will and unwavering commitment, the goal of Viksit Bharat will recede well beyond 2047.

A grand vision and the great Indian research deficit
एक भव्य दृष्टि और भारत का बड़ा अनुसंधान अभाव

- India stands at a **pivotal moment** in its **economic and technological trajectory**
  भारत अपनी **आर्थिक और तकनीकी दिशा** में एक **निर्णायक मोड़** पर खड़ा है
- With its **vast human capital** and a **rapidly expanding economy**, it harbours ambitions of becoming a **global power**
  अपने **विशाल मानव संसाधन** और **तेजी से विस्तार करती अर्थव्यवस्था** के साथ यह **वैश्विक शक्ति** बनने की महत्वाकांक्षा रखता है
- Yet, this **grand vision** is significantly hampered by a **deep-seated and chronic insufficiency** in **research and development (R&D)**
  फिर भी यह **महान दृष्टि अनुसंधान और विकास (R&D)** में **गंभीर और दीर्घकालिक कमी** के कारण बुरी तरह प्रभावित है

The scale in numbers
आँकड़ों में पैमाना

- The scale of India's **R&D deficit** is best illustrated by a few **stark numbers**
  भारत की **R&D कमी** का पैमाना कुछ **कठोर आँकड़ों** से सबसे अच्छी तरह समझा जा सकता है

- Despite having **17.5% of the world's brains** since it is home to **17.5% of the world's population**, India produces only a **meagre 3% of the world's research output**
  दुनिया की **17.5% जनसंख्या** होने के कारण **17.5% वैश्विक मस्तिष्क शक्ति** होने के बावजूद भारत दुनिया के **केवल 3% शोध उत्पादन** करता है

- This **disparity** highlights a **fundamental failure** in leveraging its **massive demographic dividend** to generate **high-value research**
  यह **असमानता** अपने **विशाल जनसांख्यिकीय लाभ** का उपयोग कर **उच्च-मूल्य शोध** उत्पन्न करने में **मूलभूत विफलता** को दर्शाती है

- The situation is not much better on **intellectual property creation**
  बौद्धिक संपदा सृजन के मोर्चे पर स्थिति बहुत बेहतर नहीं है

- Recent reports from the **World Intellectual Property Organization (WIPO)** suggest a **mixed picture** dramatic growth from a **very low base**, but overall an **unimpressive performance**
  विश्व बौद्धिक संपदा संगठन (WIPO) की हालिया रिपोर्टें **मिश्रित तस्वीर** दिखाती हैं बहुत **निम्न आधार** से तेज वृद्धि, लेकिन कुल मिलाकर **अप्रभावशाली प्रदर्शन**

- In **2023**, India was ranked **sixth globally** for **total patent filings**, recording **64,480 applications**
  2023 में भारत **कुल पेटेंट फाइलिंग** में **वैश्विक स्तर पर छठे स्थान** पर रहा और **64,480 आवेदन** दर्ज किए

- This represents the **fastest growth (+15.7%)** among the **top 20 countries** and is a **significant figure**
  यह **शीर्ष 20 देशों** में **सबसे तेज वृद्धि (+15.7%)** को दर्शाता है और एक **महत्वपूर्ण आँकड़ा** है

- However, in the context of the **total 3.55 million patent applications** filed **globally in 2023**, India's share is still **low**, at approximately **1.8% of the global total**
  हालांकि **2023** में वैश्विक स्तर पर दायर **3.55 मिलियन पेटेंट आवेदनों** के संदर्भ में भारत की हिस्सेदारी अब भी **कम**, लगभग **1.8%** ही है

- Critically, when measuring **resident applications per million inhabitants**, a truer reflection of **domestic innovation intensity**, India ranks **significantly lower (47th)**
  महत्वपूर्ण रूप से, जब **प्रति दस लाख आबादी पर घरेलू पेटेंट आवेदनों** को मापा जाता है जो **घरेलू नवाचार तीव्रता** का बेहतर संकेतक है, तो भारत का स्थान **काफी नीचे (47वाँ)** है

- This underscores that the **overall growth** is not yet translating into **widespread, population-level innovation dominance**
  यह दर्शाता है कि **कुल वृद्धि** अभी तक **जनसंख्या स्तर पर व्यापक नवाचार प्रभुत्व** में परिवर्तित नहीं हो रही है

- The most **damning evidence** of India's **R&D gap** lies in **R&D expenditure**
  भारत के **R&D अंतर** का सबसे **कठोर प्रमाण R&D व्यय** में दिखाई देता है

- **Gross Expenditure on R&D** in India, covering both **private and public sectors**, has consistently hovered between **0.6% and 0.7% of GDP** in recent years and is **slipping as GDP grows**
  भारत में **कुल R&D व्यय**, जो **निजी और सार्वजनिक दोनों क्षेत्रों** को कवर करता है, हाल के वर्षों में लगातार **GDP के 0.6% से 0.7%** के बीच रहा है और **GDP बढ़ने के साथ घट रहा है**

- This figure **pales in comparison** to major economies and **innovation hubs**
  यह आँकड़ा प्रमुख अर्थव्यवस्थाओं और **नवाचार केंद्रों** की तुलना में **बहुत कम** है

- **China** spends around **2.4%**, the **United States** is at approximately **3.5%**, and **Israel** leads globally at over **5.4%**
  चीन लगभग **2.4%**, **संयुक्त राज्य अमेरिका** लगभग **3.5%**, और **इज़राइल** वैश्विक स्तर पर **5.4% से अधिक** खर्च करता है

- To grasp the magnitude of **underinvestment**, one only needs to compare India's **entire national R&D spend** with that of a **single multinational corporation**
  कम निवेश की गंभीरता समझने के लिए भारत के **कुल राष्ट्रीय R&D खर्च** की तुलना केवल **एक बहुराष्ट्रीय कंपनी** से करना पर्याप्त है

- In **2023**, the **Chinese technology giant Huawei** invested a **colossal CNY 164.7 billion** approximately **$23.4 billion** into **R&D**
  2023 में चीनी तकनीकी दिग्गज **हुआवेई** ने **R&D** में **164.7 अरब CNY**, लगभग **23.4 अरब डॉलर**, का **विशाल निवेश** किया

- This amount of spending from **just one company** exceeds the **total combined R&D expenditure** of all **public and private entities in India**, a nation of more than **1.4 billion people**

केवल **एक कंपनी** द्वारा किया गया यह खर्च **1.4 अरब से अधिक जनसंख्या** वाले भारत के सभी **सार्वजनिक और निजी संस्थानों के संयुक्त R&D खर्च** से भी अधिक है

- As **Nvidia Chairman Jensen Huang** noted, Huawei's **relentless investment** has propelled them to be **"nanoseconds"** behind the U.S. in **advanced semiconductor capabilities**

  जैसा कि **एनवीडिया के चेयरमैन जेनसन हुआंग** ने कहा, हुआवेई के **निरंतर निवेश** ने उसे **उन्नत सेमीकंडक्टर क्षमताओं** में अमेरिका से केवल **"नैनोसेकंड"** पीछे पहुँचा दिया है

- This **corporate-level intensity of R&D** is the **engine of next-generation technological power**

  R&D की यह **कॉर्पोरेट-स्तरीय तीव्रता** ही अगली पीढ़ी की **तकनीकी शक्ति** का **इंजन** है

- India's **inability** to muster even a **fraction** of this kind of **concentrated, strategic investment** speaks **volumes** about the challenge ahead

  इस प्रकार के **केंद्रित और रणनीतिक निवेश** का **एक अंश भी** जुटाने में भारत की **असमर्थता** उसके सामने खड़ी **चुनौती की गंभीरता** को दर्शाती है

- So much for the **numbers**

  आँकड़ों की बात यहीं तक

- They are merely **symptoms** of **deeper, structural problems** within the **Indian innovation ecosystem** that it must tackle on a **war footing**

  ये केवल **लक्षण** हैं **भारतीय नवाचार पारिस्थितिकी तंत्र** में मौजूद **गहरे, संरचनात्मक समस्याओं** के, जिन्हें **युद्धस्तर** पर सुलझाना होगा

The government sector is the funds driver
सरकारी क्षेत्र ही धन का मुख्य चालक है

- Most disappointingly, **private sector participation in R&D spending is abysmal**

  सबसे निराशाजनक रूप से **R&D खर्च में निजी क्षेत्र की भागीदारी अत्यंत दयनीय** है

- A global hallmark of a **mature innovation economy** is the **dominant role of the private sector in R&D**

  एक **परिपक्व नवाचार अर्थव्यवस्था** की वैश्विक पहचान **R&D में निजी क्षेत्र की प्रमुख भूमिका** है

- In **developed nations**, industry typically accounts for **two-thirds or more** of such expenditure

  विकसित देशों में उद्योग आमतौर पर ऐसे खर्च का **दो-तिहाई या उससे अधिक** हिस्सा वहन करता है

- In **India**, however, the **government sector** central, State, higher education, and public sector industry **remains the main driver**

  लेकिन **भारत** में **सरकारी क्षेत्र** केंद्र, राज्य, उच्च शिक्षा और सार्वजनिक क्षेत्र उद्योग **अब भी मुख्य चालक** बना हुआ है

- It contributes approximately **63.6% of R&D funds**, with the **private industrial sector contributing only around 36.4%**

  यह **R&D फंड का लगभग 63.6%** योगदान देता है, जबकि **निजी औद्योगिक क्षेत्र** केवल **लगभग 36.4%** योगदान करता है

- India's **business tycoons** need to rise to the **R&D challenge**, but they are instead largely **complacent and myopic** about it

  भारत के **व्यापारिक दिग्गजों** को **R&D की चुनौती** का सामना करना चाहिए, लेकिन वे इसके प्रति बड़े पैमाने पर **आत्मसंतुष्ट और अल्पदृष्टि** वाले बने हुए हैं

- Indian industry's **low investment** is driven by a focus on **incremental improvements** over **disruptive innovation**, a preference for **technology licensing** over **domestic development**, and a **general risk-averse culture**

  भारतीय उद्योग का **कम निवेश विघटनकारी नवाचार** के बजाय **क्रमिक सुधारों** पर ध्यान, **घरेलू विकास** की तुलना में **प्रौद्योगिकी लाइसेंसिंग** की प्राथमिकता, और एक **सामान्य जोखिम-टालू संस्कृति** से प्रेरित है

- The **second dismaying feature** is one we had already identified in the **second tenure of the United Progressive Alliance**

  दूसरी निराशाजनक विशेषता वह है जिसे हमने पहले ही **संयुक्त प्रगतिशील गठबंधन के दूसरे कार्यकाल** में पहचाना था

- A persistent academia-industry disconnect, the subject of a report **N.R. Narayana Murthy** wrote for us **more than a decade ago**, that is **sadly gathering dust**

एक लगातार बना रहने वाला **शैक्षणिक जगत और उद्योग के बीच अंतर**, जिस पर **एन. आर. नारायण मूर्ति** ने **एक दशक से अधिक पहले** हमारे लिए एक रिपोर्ट लिखी थी, जो **दुखद रूप से धूल फांक रही है**

- Indian **academia**, despite producing **millions of highly skilled graduates**, often operates in a **silo**
  भारतीय **शैक्षणिक संस्थान**, **लाखों उच्च-कुशल स्नातक** तैयार करने के बावजूद, अक्सर **एकांत में** काम करते हैं

- Research is frequently **theoretical** and **disconnected from immediate, market-driven needs** of the industry
  अनुसंधान अक्सर **सैद्धांतिक** होता है और उद्योग की **तत्काल, बाजार-प्रेरित आवश्यकताओं से कटा हुआ** रहता है

- The mechanisms for **technology transfer**, **commercialisation of research**, and **joint industry-academic projects** remain **underdeveloped**
  प्रौद्योगिकी हस्तांतरण, अनुसंधान के व्यावसायीकरण, और संयुक्त उद्योग-शैक्षणिक परियोजनाओं के तंत्र **अपर्याप्त रूप से विकसित** हैं

- Nor do **Indian companies** look to the **world of academia** for help
  और **भारतीय कंपनियाँ** भी सहायता के लिए **शैक्षणिक जगत** की ओर नहीं देखतीं

- In the **U.S.**, companies commonly bring **ideas to universities** and give **grants for student researchers** to develop them into **marketable innovations**
  अमेरिका में कंपनियाँ आमतौर पर **विचार विश्वविद्यालयों** में लाती हैं और **छात्र शोधकर्ताओं को अनुदान** देती हैं ताकि वे उन्हें **बाजार योग्य नवाचारों** में विकसित कर सकें

- There is **no such culture in India**
  भारत में ऐसी कोई संस्कृति नहीं है

- This **gulf** prevents valuable research from crossing the **"valley of death"** between the **laboratory and the marketplace**
  यह **खाई** मूल्यवान अनुसंधान को **प्रयोगशाला और बाजार** के बीच की **"वैली ऑफ डेथ"** पार करने से रोकती है

- And there is **no escaping the brain drain**
  और **ब्रेन ड्रेन** से **कोई बचाव नहीं** है

- While India produces a **vast number of PhDs and engineers**, the **most ambitious and talented** often seek **better infrastructure, funding, and career progression** abroad
  जबकि भारत **बड़ी संख्या में पीएचडी और इंजीनियर** तैयार करता है, **सबसे महत्वाकांक्षी और प्रतिभाशाली** लोग अक्सर विदेशों में **बेहतर अवसंरचना, फंडिंग और करियर प्रगति** की तलाश करते हैं

- The **domestic R&D environment** struggles to **attract and retain world-class researchers** due to **limited high-end research facilities** and **lower salary benchmarks** compared to the rest of the world
  घरेलू R&D वातावरण विश्व-स्तरीय शोधकर्ताओं को आकर्षित और बनाए रखने में संघर्ष करता है क्योंकि **उच्च-स्तरीय शोध सुविधाएँ** सीमित हैं और **वैश्विक मानकों की तुलना में वेतन कम** है

- The **allocation of public R&D funds** is often constrained by **slow bureaucratic processes**
  सार्वजनिक R&D फंड का आवंटन अक्सर **धीमी नौकरशाही प्रक्रियाओं** से बाधित रहता है

- **Project approval times** can be **excessively long**, and the **release of funds** is frequently **staggered and unpredictable**, impeding the **smooth execution** of **ambitious, long-term research programmes**
  परियोजना स्वीकृति का समय अत्यधिक **लंबा** हो सकता है और **फंड जारी होना** अक्सर **टुकड़ों में और अनिश्चित** रहता है, जिससे **महत्वाकांक्षी, दीर्घकालिक शोध कार्यक्रमों** का **सुचारु क्रियान्वयन** बाधित होता है

- What, then, is the **path forward**
  तो आगे का **रास्ता** क्या है

- The goal of building **comprehensive tech and economic muscle**, worthy of a **"Viksit Bharat"**, is **not a sprint but a marathon**
  "विकसित भारत" के योग्य **समग्र तकनीकी और आर्थिक क्षमता** बनाने का लक्ष्य **दौड़ नहीं बल्कि मैराथन** है

- To achieve it, India must **engineer a fundamental shift** in its **approach**
  इसे हासिल करने के लिए भारत को अपने **दृष्टिकोण में मूलभूत बदलाव** लाना होगा

- The most **immediate and critical step** is to **raise the R&D expenditure to GDP ratio to at least 2%** within the next **five to seven years**

सबसे **तत्काल और महत्वपूर्ण कदम** अगले **पाँच से सात वर्षों** में **R&D व्यय का GDP अनुपात कम से कम 2%** तक बढ़ाना है

- This requires a **massive public spending commitment**, coupled with **substantial tax incentives and grants** to encourage the **private sector** to ramp up its contribution to **at least 50% of the total R&D spend**

  इसके लिए **बड़े पैमाने पर सार्वजनिक खर्च की प्रतिबद्धता**, साथ ही **निजी क्षेत्र** को **कुल R&D खर्च का कम से कम 50%** योगदान देने के लिए **महत्वपूर्ण कर प्रोत्साहन और अनुदान** आवश्यक हैं

- The launch of the ₹1 lakh crore Research, Development and Innovation (RDI) Fund by the **government** is a **step in the right direction**, provided it is **disbursed efficiently** and **targeted towards frontier technologies**

  सरकार द्वारा **₹1 लाख करोड़ के रिसर्च, डेवलपमेंट और इनोवेशन (RDI) फंड** की शुरुआत **सही दिशा में कदम** है, बशर्ते इसे **कुशलता से वितरित** किया जाए और **फ्रंटियर प्रौद्योगिकियों** की ओर **लक्षित** किया जाए

- An **ambitious India** needs to move away from **scattered research efforts** and focus on **national missions** in **strategic, high-value domains**

  एक **महत्वाकांक्षी भारत** को **बिखरे हुए शोध प्रयासों** से हटकर **रणनीतिक, उच्च-मूल्य क्षेत्रों** में **राष्ट्रीय मिशनों** पर ध्यान केंद्रित करना होगा

- These include semiconductors, artificial intelligence (AI), quantum computing, advanced materials and green energy

  इनमें **सेमीकंडक्टर, कृत्रिम बुद्धिमत्ता (AI), क्वांटम कंप्यूटिंग, उन्नत सामग्री** और **हरित ऊर्जा** शामिल हैं

- These missions require **long-term, uninterrupted funding** and **clear, measurable outcomes** tied to **national security and economic sovereignty**

  इन मिशनों के लिए **दीर्घकालिक, निर्बाध फंडिंग** और **राष्ट्रीय सुरक्षा तथा आर्थिक संप्रभुता** से जुड़े **स्पष्ट, मापनीय परिणाम** आवश्यक हैं

Universities and research
विश्वविद्यालय और अनुसंधान

- And there is **no escaping India's obligation to reform higher education**

  और **उच्च शिक्षा में सुधार की भारत की जिम्मेदारी** से **कोई बचाव नहीं** है

- Universities must **transition from being purely teaching institutions** to also becoming **centres of excellence in research**

  विश्वविद्यालयों को **केवल शिक्षण संस्थान** होने से आगे बढ़कर **अनुसंधान में उत्कृष्टता के केंद्र** बनना होगा

- This involves **significantly boosting funding for PhD programmes**, creating **competitive research faculty positions**, and building **world-class research infrastructure**

  इसके लिए **पीएचडी कार्यक्रमों के लिए फंडिंग में उल्लेखनीय वृद्धि, प्रतिस्पर्धी शोध संकाय पदों** का सृजन, और **विश्व-स्तरीय शोध अवसंरचना** का निर्माण आवश्यक है

- Furthermore, **mandatory and structured mechanisms** for **industry-sponsored research chairs** and **joint incubation centres** must be established to **bridge the academic-industry gap**

  इसके अतिरिक्त **उद्योग-प्रायोजित शोध चेयर्स** और **संयुक्त इनक्यूबेशन केंद्रों** के लिए **अनिवार्य और संरचित तंत्र** स्थापित किए जाने चाहिए ताकि **शैक्षणिक-उद्योग अंतर** को पाटा जा सके

- India must also **inculcate a robust intellectual property culture** in the country

  भारत को देश में **मजबूत बौद्धिक संपदा संस्कृति** भी विकसित करनी होगी

- This means **simplifying patent filing processes**, **strengthening enforcement**, and creating **attractive financial incentives** for **inventors** both **academic and corporate** whose **patents are commercialised**

  इसका अर्थ है **पेटेंट फाइलिंग प्रक्रियाओं को सरल बनाना, प्रवर्तन को मजबूत करना**, और **शैक्षणिक तथा कॉर्पोरेट आविष्कारकों** के लिए **आकर्षक वित्तीय प्रोत्साहन** बनाना जिनके **पेटेंट का व्यावसायीकरण** होता है

- India possesses the **intellectual capital** and the **aspiration** to become a **global innovation leader**

  भारत के पास **बौद्धिक पूंजी** और **वैश्विक नवाचार नेता** बनने की **आकांक्षा** दोनों हैं

- However, the current **deficit in R&D investment** so **glaringly exposed** by the comparison to a **single company such as Huawei** cannot **sustain this ambition**

  हालांकि **R&D निवेश में वर्तमान कमी**, जो **हुआवेई जैसी एकल कंपनी** से तुलना में **स्पष्ट रूप से उजागर** होती है, इस **महत्वाकांक्षा को टिकाए नहीं रख सकती**

- The **next decade** must be dedicated to creating the **structural, financial and cultural foundations** for **innovation**
  अगला दशक नवाचार के लिए **संरचनात्मक, वित्तीय और सांस्कृतिक आधार** बनाने को समर्पित होना चाहिए
- If these **fundamental changes** are not executed with **political will** and **unwavering commitment**, the goal of **Viksit Bharat** will **recede well beyond 2047**
  यदि ये **मूलभूत परिवर्तन राजनीतिक इच्छाशक्ति** और **अडिग प्रतिबद्धता** के साथ लागू नहीं किए गए, तो **विकसित भारत** का लक्ष्य **2047** से बहुत आगे खिसक जाएगा

GS Paper III: IS	
TOPICS COVERED	**29 December 2025**
1. The new world of surrendered left-wing extremists आत्मसमर्पित वामपंथी उग्रवादियों की नई दुनिया	

The new world of surrendered left-wing extremists

The lives of those involved in the Naxal movement remain largely hidden, shaped by a culture of secrecy. Satyasundar Barik speaks to several surrendered red-corridor workers, who describe how their lives have changed since giving up arms and what life inside the Naxal ranks truly looks like

A surrendered Naxal woman in Phulbani town in Kandhamal district of Odisha, one of the 625 left-wing extremists who have given up arms since 2008 in the State. BISWARANJAN ROUT

Lakhan is immersed in diagnosing faults in a motorbike. He barely finds a moment to attend to the growing line of customers waiting outside his cramped cabin in Phulbani town, the district headquarters in Odisha's Kandhamal. Locals know little about what Lakhan did or where he came from. What they do know is that he is among the most sought-after bike mechanics in this corner of Odisha town.

Only a handful of people around him, along with the local police, are aware of the life he once lived. Five years ago, Lakhan was far more familiar with firearms than screwdrivers.

Karuna, meanwhile, sits at a ticket counter in the urban forest park, greeting visitors eager to learn about the diverse plant species on display. Few would guess that this soft-spoken woman once spent 13 years deep inside the forests of Odisha and Chhattisgarh, trekking across hills, living off the wilderness, and surviving on wild animals and plants when food was scarce.

What unites Lakhan and Karuna is their decision to abandon their past association with the CPI (Maoist), the outlawed group once described by former Prime Minister Manmohan Singh as India's "greatest internal security threat".

With Union Home Minister Amit Shah vowing to eliminate the remnants of this violent movement by March 2026, both Lakhan and Karuna stand as reminders of those who have chosen a different path.

While frequent skirmishes in Chhattisgarh continue to dominate headlines, a quieter but steady stream of Maoists is choosing to surrender. In November, the Odisha government significantly increased the reward for those willing to lay down arms and return to the mainstream.

A central committee, politburo or central military commission member who surrenders can now receive up to ₹1.10 crore, while state committee members are eligible for ₹55 lakh — about 10% higher than what Chhattisgarh offers surrendered cadres.

"There are about 80 Naxal cadres active in Odisha, and nearly 75 of them are from Chhattisgarh. Naturally, they prefer surrendering in their home State. So, we added a 10% top-up to make Odisha's package more attractive," says Sanjeeb Panda, who heads anti-Naxal operations in the State. Odisha at one point time had 800 active cadres.

Terms and conditions

Surrender comes with money, but also conditions. Every surrendered member must disclose the identity of their associates, financiers, harbourers, and couriers, and share details of the organisation's supply chain, including sources of arms, ammunition, and funds. They are treated as "assets" once they surrender to the police. "Surrendered cadres bring a wealth of information that gives us a tactical advantage. The more informers we get, the faster and more accurate our operations become," Panda says.

For those who have left the outlawed organisation, life has taken a turn towards stability, even if the road is uneven.

At a Kandhamal police transit camp, Champa, a divisional committee member (DCM) in her 30s, is recovering from a bullet injury that damaged her internal organs. "In 2016, police bullets hit me. Our cadre doctor removed it, but the injury never healed. When I came to a hospital for treatment, a villager informed the police. I was caught. The arrest was converted to a surrender in July this year," Champa recounts.

As a former DCM, Champa has already provided substantial intelligence to security forces. "I am being taken care of. Police have assured me treatment at AIIMS, Bhubaneswar" she says.

Ajay and Manju, in their 20s, both from Chhattisgarh, echo similar relief. "During our days in Kandhamal, we became close. One night, we escaped from the camp. But when we reached Phulbani, we were arrested and then allowed to surrender," Ajay says. The couple were area committee members (ACM). Manju speaks about how she once stopped a group of security forces from advancing in the jungle by spraying them with bullets.

Lakhan and Ajay once served in the protection team of Nambala Keshava Rao alias Basavaraju,

> Surrendered cadres bring a wealth of information that gives us a tactical advantage. The more informers we get, the faster and more accurate our operations become
> **SANJEEB PANDA**
> Head of anti-Naxal operations, Odisha

the general secretary of the banned CPI (Maoist), who was killed in Chhattisgarh on May 21, 2025. Their lives now stand in stark contrast to the years spent guarding one of the organisation's most powerful leaders. "I would like to return to my home in Bijapur district of Chhattisgarh," says Lakhan.

Since 2008, as many as 1,364 ultras have been arrested by security forces in Odisha; 2009 saw the highest number, when 221 were arrested. Only 625 Naxalites have surrendered during this period in the State. This December, 22 armed Maoists laid down their arms before the Director General of Police in Malkangiri district.

The secret book

The Special Intelligence Wing of the Odisha police have a book with the names of Naxals. Only once a name is matched to the person surrendering is the money paid out.

The inner workings of the Naxalite movement is opaque, an ecosystem of secrecy where the outside world does not see the workings of the organisation: who belongs to which unit, who commands who, how decisions are relayed down the chain of command. After any incident of violence, whether an attack on security forces or a retaliatory strike, the claim of responsibility comes from a division of the Left-Wing Extremists (LWEs).

Over the years, the SIW has quietly built and maintained the secret book, a constantly updating registry of Maoist cadres across ranks. It has become the ready reckoner for anti-Maoist operations in Odisha.

For two decades, the Odisha Police has engaged the Maoists in an extended battle. Many cadres have surrendered; many have been arrested. Each time a Naxalite is taken into custody, interrogators prepare a detailed Interrogation Report (IR), documenting everything, from the food they ate in the forests to the routes they travelled and the names of fellow cadres. These confessions, when cross-verified, become raw data for the book.

Over time, this has helped intelligence agencies map the organisational pyramid: from the Central Committee Members (CCMs) at the top, followed by State Zonal Committee Members (SZCMs), Divisional Committee Members (DCMs), Area Committee Members (ACMs) and, finally, Party Members (PMs).

Central Committee Member, Ganesh Uike, who was heading the Odisha operation, was killed in an encounter on December 25. Another senior leader, Modem Balakrishna, was killed in an encounter in Chhattisgarh's Garlabandh district in September this year.

Home Minister Shah wrote on 'X', saying, "In a major operation in Kandhamal, Odisha, 6 Naxalites, including CC member Ganesh Uike, have been neutralized. With this major breakthrough, Odisha stands at the threshold of becoming completely free from Naxalism. We are resolved to eliminate Naxalism before the March 31, 2026."

Laptops, hard drives, and handwritten letters seized in camp raids provide further clues. The letters often list sentry duties or supply responsibilities, revealing names that are meticulously cross-matched with the secret book. Since 2021, at least 15 Maoists have surrendered in Kandhamal alone.

Security forces also infer the presence of senior leaders from the nature of recoveries. Camps occupied by Central Committee members typically contain milk powder for tea, branded shoes, dry fruits, and medicines for diabetes that are indicators of older, high-ranking leadership.

Asset creation

A few years ago, Surjang, an ACM from Chhattisgarh, surrendered. After a few months, Amita, originally from Kandhamal, also laid down arms. After the formalities, police helped solemnise their wedding. Today, police personnel claim they still celebrate their daughter's birthday. Surjang briefly worked as a security guard at an orphanage on a monthly salary of ₹15,000 before returning to Chhattisgarh.

In 2018, during an encounter, a DCM-level cadre named Badal was killed. His wife, Jyoti, surrendered soon after. She said she wanted to begin life anew, as per the police. Today, she is married to a home guard and lives peacefully in Baliguda, "an Odia daughter-in-law," locals say.

Karuna, ex-cadre and a forest watcher is back with her family in Tikabali, with police facilitating medical support for her. "My family has accepted me. I am not looked at with suspicion," she says.

Ashok, another surrendered Naxal cadre from Chhattisgarh, has been adopted as a son by a person in Kandhamal district. He now works as a mason.

"The closeness between two cadres is not always a contributing factor for the decision to surrender. Many cadres have over the years become disillusioned as they have achieved nothing against what they aspired for," says Akhileshwar Singh, Deputy Inspector General of Special Intelligence Wing.

Nervous days and nights

Police press releases often portray the transition of surrendered Naxalites as swift and seamless from a violence-ridden life to a new, law-abiding one. On the ground, the reality is far more complex. Cadres who lay down arms can still make a U-turn and slip back into CPI (Maoist) ranks. They cannot be chained or confined. They can only be watched, closely and continuously.

For many of them, money is not an incentive. They have lived austere lives for years, often without wages, surviving on whatever the organisation provided. The world outside their forests is unfamiliar. Something as simple as sleeping under a light becomes a struggle. Most cadres are used to pitch-dark nights and have cultivated a sense for navigating through the darkness.

"We constantly observe how they respond to this new life. Those who surrender or are arrested are assigned guards who stay with them round the clock," said A.C. Sarkar, assistant commandant of the Special Operation Group.

In the first few days or months, small requests become big indicators. When a former cadre asks for a mobile phone, a jacket, help tracing a relative, or expresses a desire to ride a motorcycle, security personnel feel a sense of relief. These are signs that the person is beginning to lean towards the mainstream.

But the risks remain. If a cadre escapes back to the CPI (Maoist), they carry back intelligence, including the layout of police camps. They may not be walkable either. After a CPI (Maoist) member. After spending two to three months in the Rayagada police transit camp, he could not adjust to life outside the outfit and slipped away. Coincidentally, an exchange of fire occurred soon after. Suspicious of his disappearance, the party suspected he had shared information and executed him.

The elusive top tier

Central Committee members remain the most shadowy ring. They rarely come into the open and are heavily insulated. Once numbering around 21, their strength has dwindled to three or four. Police rely on surrendered cadres to help identify them through photos recovered from hard drives or phones.

CC members travel with three to four layers of protection: an inner cordon, an outer cordon, sentries, and a civil patrol party – those who mingle among villagers to detect security forces. Alerts are passed through walkie-talkies, cracker blasts, or distinct calls. Militia relay messages rapidly, enabling swift escapes.

Below them, SZCMs, DCMs, and ACMs also have personal security officers. In Kandhamal, three SZCMs – Nikhil and Indu (both from Jagatsinghpur) and Sukru from Malkangiri – remain active across Kandhamal, Rayagada, Kalahandi, and Gajapati.

While the CPI (Maoist) claims to fight for a communist order, its newest recruits are often young, rural, and minimally educated, say those rehabilitated. Their exposure to ideology is largely shaped by senior cadres' discourse. Many know little about national events; their primary impulse is rebellion against perceived or real injustices.

Although most Central Committee leaders hail from Andhra Pradesh and Telangana, they now struggle to recruit in their home states. New cadres mostly come from tribal regions of Chhattisgarh, say the police. According to Panda, there has been no fresh recruitment by the CPI (Maoist) from Odisha in the past seven years.

Intelligence agencies believe that once the remaining CC leadership is neutralised, the organisation will begin collapsing due to lack of continuity and experience. With leadership thinning, SZCMs may be rapidly elevated to CCM positions, but they lack the battle-hardened experience of their predecessors.

Life in a Maoist camp

Constant movement is a way of life. Camps shift frequently to evade security forces. Solar panels now supply power for torches and phones, though phones, usually without SIM cards, are used mainly to watch downloaded videos on communism or motivational songs.

The Maoists know the risks of carrying digital devices; retrieving data from hard disks is often extremely difficult. Their once-vast human intelligence network, robust in the early 2000s, has weakened considerably. Earlier, information on security movement flowed instantly. Today, with four battalions stationed in Kandhamal and central forces dominating former Maoist strongholds, village meetings and gatherings have become nearly impossible.

"The situation is now favourable for a complete end to left-wing extremism. We appeal to all cadres to return to the mainstream. We shall take care of, not merely as subjects of law enforcement, but with a sense of responsibility to rehabilitate those who have strayed," said Harish B.C., Superintendent of Police, Kandhamal.

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After his surrender, Lakhan has become one of the most skilled bike mechanics in Phulbani, Odisha. BISWARANJAN ROUT

The new world of surrendered left-wing extremists
आत्मसमर्पित वामपंथी उग्रवादियों की नई दुनिया

- The lives of those involved in the **Naxal movement** remain largely hidden, shaped by a culture of secrecy.
  नक्सल आंदोलन से जुड़े लोगों का जीवन काफी हद तक छिपा रहता है, जो गोपनीयता की संस्कृति से आकार लेता है।

- **Satyasundar Barik** speaks to several surrendered red-corridor workers, who describe how their lives have changed since giving up arms and what life inside the Naxal ranks truly looks like
  सत्यसुंदर बारिक ने कई आत्मसमर्पित रेड-कॉरिडोर कार्यकर्ताओं से बात की, जिन्होंने हथियार छोड़ने के बाद अपने जीवन में आए बदलावों और नक्सल पंक्तियों के भीतर के जीवन का वर्णन किया।

- Lakhan is immersed in diagnosing faults in a motorbike.
  लखन एक मोटरसाइकिल की खराबी पहचानने में व्यस्त है।

- He barely finds a moment to attend to the growing line of customers waiting outside his cramped cabin in **Phulbani town**, the district headquarters in **Odisha's Kandhamal**.
  उसे **ओडिशा के कंधमाल** जिले के मुख्यालय **फुलबानी शहर** में अपनी तंग दुकान के बाहर खड़े ग्राहकों की बढ़ती कतार को देखने तक का समय मुश्किल से मिलता है।

- Locals know little about what Lakhan did or where he came from.
  स्थानीय लोग लखन के अतीत या उसके आने-जाने के बारे में बहुत कम जानते हैं।

- What they do know is that he is among the most sought-after bike mechanics in this central Odisha town.
  वे बस इतना जानते हैं कि वह इस मध्य ओडिशा शहर के सबसे मांग वाले बाइक मैकेनिकों में से एक है।

- Only a handful of people around him, along with the local police, are aware of the life he once lived.
  उसके आसपास के कुछ ही लोग और स्थानीय पुलिस उसके पुराने जीवन के बारे में जानते हैं।

- Five years ago, Lakhan was far more familiar with firearms than screwdrivers.
  पांच साल पहले लखन स्क्रूड्राइवर से ज्यादा आग्नेयास्त्रों से परिचित था।

- Karuna, meanwhile, sits at a ticket counter in the urban forest park, greeting visitors eager to learn about the diverse plant species on display.
  इस बीच, करुणा शहरी वन पार्क के टिकट काउंटर पर बैठी आगंतुकों का स्वागत करती है।

- Few would guess that this soft-spoken woman once spent **13 years** deep inside the forests of **Odisha and Chhattisgarh**, trekking across hills, living off the wilderness, and surviving on wild animals and plants when food was scarce.
  बहुत कम लोग अनुमान लगा पाएंगे कि यह शांत स्वभाव की महिला कभी **ओडिशा और छत्तीसगढ़** के जंगलों में **13 साल** तक रही।

- What unites Lakhan and Karuna is their decision to abandon their past association with the **CPI (Maoist)**, the outlawed group once described by former Prime Minister **Manmohan Singh** as India's **"greatest internal security threat"**.
  लखन और करुणा को जोड़ने वाली बात है **सीपीआई (माओवादी)** से नाता तोड़ने का उनका फैसला।

- With **Union Home Minister Amit Shah** vowing to eliminate the remnants of this violent movement by **March 2026**, both Lakhan and Karuna stand as reminders of those who have chosen a different path.
  केंद्रीय गृह मंत्री अमित शाह द्वारा **मार्च 2026** तक इस आंदोलन को खत्म करने की घोषणा के बीच, लखन और करुणा एक अलग रास्ता चुनने वालों की मिसाल हैं।

- While frequent skirmishes in **Chhattisgarh** continue to dominate headlines, a quieter but steady stream of Maoists is choosing to surrender.
  जहां **छत्तीसगढ़** में मुठभेड़ें सुर्खियों में रहती हैं, वहीं कई माओवादी चुपचाप आत्मसमर्पण कर रहे हैं।

- In **November**, the **Odisha government** significantly increased the reward for those willing to lay down arms and return to the mainstream.
  नवंबर में **ओडिशा सरकार** ने आत्मसमर्पण करने वालों के लिए इनाम बढ़ाया।

- A central committee, politburo or central military commission member who surrenders can now receive up to **₹1.10 crore**.
  केंद्रीय समिति या पोलित ब्यूरो का सदस्य आत्मसमर्पण पर **₹1.10 करोड़** तक पा सकता है।

- State committee members are eligible for **₹55 lakh** — about **10%** higher than what **Chhattisgarh** offers surrendered cadres.
राज्य समिति सदस्य **₹55 लाख** के पात्र हैं।
- "There are about **80 Naxal cadres** active in Odisha, and nearly **75** of them are from **Chhattisgarh**," says **Sanjeeb Panda**.
संजिब पांडा के अनुसार ओडिशा में करीब **80 नक्सली कैडर** सक्रिय हैं।

Terms and conditions
शर्तें और नियम

- Surrender comes with money, but also conditions.
आत्मसमर्पण के साथ धन तो मिलता है, लेकिन शर्तें भी होती हैं।
- Every surrendered member must disclose the identity of their associates, financiers, harbourers, and couriers.
हर आत्मसमर्पित सदस्य को सहयोगियों और फंडिंग नेटवर्क की जानकारी देनी होती है।
- They are treated as "**assets**" once they surrender to the police.
आत्मसमर्पण के बाद उन्हें "**एसेट**" माना जाता है।
- For those who have left the outlawed organisation, life has taken a turn towards stability.
प्रतिबंधित संगठन छोड़ने वालों के लिए जीवन स्थिरता की ओर मुड़ा है।

The secret book
गुप्त किताब

- The **Special Intelligence Wing** of the Odisha police have a book with the names of Naxals.
ओडिशा पुलिस की **विशेष खुफिया शाखा** के पास नक्सलियों की एक गुप्त किताब है।
- Only once a name is matched to the person surrendering is the money paid out.
नाम मिलान के बाद ही राशि दी जाती है।

Asset creation
एसेट निर्माण

- Police helped solemnise their wedding.
पुलिस ने उनकी शादी कराने में मदद की।

Nervous days and nights
डर भरे दिन और रातें

- Cadres who lay down arms can still make a U-turn and slip back into **CPI (Maoist)** ranks.
आत्मसमर्पण के बाद भी कुछ लोग फिर **सीपीआई (माओवादी)** में लौट जाते हैं।

The elusive top tier
शीर्ष नेतृत्व की रहस्यमय परत

- Central Committee members remain the most shadowy rung.
केंद्रीय समिति सदस्य सबसे रहस्यमय रहते हैं।

Life in a Maoist camp
माओवादी शिविर में जीवन

- Constant movement is a way of life.
लगातार स्थान बदलना जीवन का हिस्सा है।
- "The situation is now favourable for a complete end to **left-wing extremism**," said **Harish B.C.**, Superintendent of Police, Kandhamal.