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PCS Special:	23 February
23F	Manipuri Im Boong creates history with BAFTA win मणिपुरी फ़िल्म बूंग ने BAFTA जीतकर इतिहास रचा
23F	I whipped up some dessert for the evening मैंने शाम के लिए जल्दी से कुछ मिठाई बना ली
23F	Vaishnavi goes down to Vandewinkel in final फाइनल में वैडेविकेल के खिलाफ वैष्णवी को हार का सामना करना पड़ा

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Stealing the spotlight



Alan McAlex, Farhan Akhtar, Lakshmi Priya Devi and Ritesh Sidhwani pose with the award for children's and family film for Boong at the 79th British Academy Film Awards (BAFTA) in London on Sunday. AP (REPORT ON PAGE 4)

Alan McAlex, Farhan Akhtar, Lakshmi Priya Devi and Ritesh Sidhwani pose with the award for children's and family film for **Boong** at the **79th British Academy Film Awards (BAFTA)** in London on Sunday.

Manipuri film Boong creates history with BAFTA win

PCS

The Hindu Bureau
CHENNAI

India created history at the 79th British Academy of Film and Television Arts (BAFTA) on Sunday with *Boong*, a Manipuri film directed by Lakshmi Priya Devi, winning the country's first award on the prestigious stage, considered the British equivalent of the Oscars.

The movie won the award in the Best Children and Family Film category. The announcement was made by the official BAFTA page.

Boong was India's sole representation at this year's event in London, and beat high-profile and popular contenders such as *Lilo & Stitch*, and *Zootropolis 2* (*Zootopia 2*), and animated science fantasy *Arco*. Actor and producer Farhan Akhtar and Ritesh Sidhwani, who backed the movie, attended the event along with Ms. Devi.

23F. Manipuri Im Boong creates history with BAFTA win
मणिपुरी फ़िल्म बूँग ने BAFTA जीतकर इतिहास रचा

India created history at the **79th British Academy of Film and Television Arts (BAFTA)** on Sunday with **Boong**, a Manipuri film directed by **Lakshmi Priya Devi**, winning the country's first award on the prestigious stage, considered the **British equivalent of the Oscars**.

भारत ने रविवार को 79वें ब्रिटिश अकादमी ऑफ़ फ़िल्म एंड टेलीविज़न आर्ट्स (BAFTA) में इतिहास रचा, जब **लक्ष्मीप्रिया देवी** द्वारा निर्देशित मणिपुरी फ़िल्म **बूँग** ने इस प्रतिष्ठित मंच पर देश का पहला पुरस्कार जीता, जिसे **ऑस्कर का ब्रिटिश समकक्ष** माना जाता है।

- The **movie won the award in the Best Children and Family Film category**. फ़िल्म ने **बेस्ट चिल्ड्रन एंड फ़ैमिली फ़िल्म** श्रेणी में पुरस्कार जीता।
- The announcement was made by the **official BAFTA page**. इसकी घोषणा **आधिकारिक BAFTA पेज** द्वारा की गई।

Boong was India's sole representative at this year's event in **London**, and beat high-profile and popular contenders such as **Lilo & Stitch**, and **Zootropolis 2** (**Zootopia 2**), and animated science fantasy **Arco**.

इस वर्ष **लंदन** में आयोजित कार्यक्रम में **बूँग** भारत की एकमात्र प्रतिनिधि फ़िल्म थी, और इसने **Lilo & Stitch**, **Zootropolis 2** (**Zootopia 2**) तथा एनिमेटेड साइंस फ़ैटेसी **Arco** जैसी हाई-प्रोफ़ाइल और लोकप्रिय फ़िल्मों को हराया।

• Actor and producer **Farhan Akhtar** and **Ritesh Sidhwani**, who backed the movie, attended the event along with **Ms. Devi**.

फ़िल्म को समर्थन देने वाले अभिनेता और निर्माता **फ़रहान अख़्तर** और **रितेश सिधवानी**, **सुश्री देवी** के साथ इस कार्यक्रम में उपस्थित रहे।

23F. Vaishnavi goes down to Vandewinkel in final

फ़ाइनल में वैडेविकेल के खिलाफ़ वैष्णवी को हार का सामना करना पड़ा

• **Third seed and World No. 124 Hanne Vandewinkel of Belgium** capped a dominant week with a **6-0, 6-1 victory over wildcard Vaishnavi Adkar** in the final of the **KPB Trust ITF Women's Open W100 tournament** at the **S.M. Krishna Stadium** here on Sunday.

तीसरी वरीयता प्राप्त और **विश्व नंबर 124 बेल्जियम की हाने वैडेविकेल** ने रविवार को यहां **एस.एम. कृष्णा स्टेडियम** में आयोजित **केपीबी ट्रस्ट आईटीएफ महिला ओपन W100 टूर्नामेंट** के **फ़ाइनल** में **वाइल्डकार्ड वैष्णवी अडकर** पर **6-0, 6-1 की जीत** के साथ एक **प्रभावशाली सप्ताह** का समापन किया।

- **Vaishnavi**, the **21-year-old from Pune** who entered the tournament **ranked 690**, will rise up **more than 200 places** to be ranked in the **460s**.

Vaishnavi goes down to Vandewinkel in final

PCS

Sports Bureau
BENGALURU

Third seed and World No. 124 Hanne Vandewinkel of Belgium capped a dominant week with a 6-0, 6-1 victory over wildcard Vaishnavi Adkar in the final of the KPB Trust ITF Women's Open W100 tournament at the S.M. Krishna Stadium here on Sunday.

Vaishnavi, the 21-year-old from Pune who entered the tournament ranked 690, will rise up more than 200 places to be ranked in the 460s.

On Saturday, she had become the first Indian



Vaishnavi with the champion Vandewinkel.

woman since Sania Mirza to reach an ITF W100 Final.

For her runner-up finish, Vaishnavi will gain 65 points and be richer by \$8,147.



पुणे की 21 वर्षीय वैष्णवी, जो टूर्नामेंट में 690वीं रैंक के साथ उतरी थीं, 200 से अधिक स्थान ऊपर चढ़कर 460 के आसपास रैंकिंग हासिल करेंगी।

- On Saturday, she became the first Indian woman since Sania Mirza to reach an ITF W100 Final.
शनिवार को वह सानिया मिर्जा के बाद पहली भारतीय महिला बनी थीं जिन्होंने आईटीएफ W100 फाइनल में जगह बनाई।
- For her runner-up finish, Vaishnavi will gain 65 points and be richer by \$8,147.
अपने उपविजेता स्थान के लिए वैष्णवी को 65 अंक मिलेंगे और वह \$8,147 की इनामी राशि प्राप्त करेंगी।

GS Paper 1: Society

TOPICS COVERED

23 February 2026

23F Before death, Manipur MLA wrote to PM, sought probe into mob attack
मृत्यु से पहले, मणिपुर के विधायक ने पीएम को लिखा पत्र, भीड़ के हमले की जांच की मांग

Before death, Manipur MLA wrote to PM, sought probe into mob attack

GS I: Society

Vijaita Singh
NEW DELHI

Five months before his death, Bharatiya Janata Party (BJP) MLA from Manipur Vungzagin Valte wrote to Prime Minister Narendra Modi detailing how he was brutally attacked by the "Meitei militia [Arambai Tenggol]".

Valte had said that the attack left him with severe injuries that paralysed him, and despite the gravity of the incident, no special inquiry, either by the Central Bureau of Investigation (CBI) or the National Investigation Agency (NIA), was ever initiated.

The letter was sent on September 13, 2025, when Mr. Modi made his maiden visit to Manipur after the ethnic violence broke out on May 3, 2023. Arambai Tenggol, a relatively new radical Meitei armed group, gained notoriety after the conflict between the Meitei and Kuki-Zo communities started.



Vungzagin Valte

Valte, who never recovered from the life-threatening injuries after being assaulted by a mob on May 4, 2023, passed away at a private hospital in Gurugram, Haryana, on Friday. "The arrest may take time as he was attacked by a mob. We are pursuing all leads," Losii Dikho, Deputy Chief Minister, Manipur told *The Hindu*.

In the letter, Valte had said that as a three-term MLA and BJP adviser to former Chief Minister N. Biren Singh, he had "wit-

nessed firsthand the challenges faced by the Zomi-Kuki-Hmar community".

"On May 4, 2023, after attending security meeting at CM's office, to discuss the safe transportation of my people especially Churachandpurians stranded in Imphal due to the ethnic violence, I was brutally attacked on my way back home at RIMS Road by the Meitei militia [Arambai Tenggol], resulting in severe injuries that have left me paralysed and handicapped till date. Despite the gravity of this incident, no special inquiry [CBI/NIA] has been initiated, and the community remains marginalised," the letter said.

He added that the Zomi-Kuki-Hmar community had been driven out of the State capital Imphal and from the valley, leading to complete physical and social divide. "In light of this, I humbly request that a Separate Administration, preferably a Union Territo-

ry with a legislature under the Indian Constitution, be granted to the indigenous tribal community as mentioned above," the letter said.

'Lasting solution'

Valte had said that a separate administration would ensure justice, administrative convenience, and a lasting solution. He had said that his appeal aligned with the demands of the Kuki National Organisation and the United People's Front, who are seeking a political solution through Suspension of Operations talks. "I urge you to consider this request at the highest level, as forced imposition of peace has proven unsustainable in Manipur's history," his letter said.

On the fateful day, when Valte was going to his official residence at Lamphelap in Imphal, his car was stopped by a group of people. He and his driver, Thanghoulal, were physically assaulted.

23F. Before death, Manipur MLA wrote to PM, sought probe into mob attack

मृत्यु से पहले, मणिपुर के विधायक ने पीएम को लिखा पत्र, भीड़ के हमले की जांच की मांग

- Arambai Tenggol, a relatively new radical Meitei armed group, gained notoriety after the conflict between the Meitei and Kuki-Zo communities started.

अरंबाई तेगगोल, एक अपेक्षाकृत नया कट्टरपंथी मैतेई सशस्त्र समूह, मैतेई और कुकी-जो समुदायों के बीच संघर्ष शुरू होने के बाद कुख्यात हो गया।

- In the letter, Valte had said that as a three-term MLA and BJP adviser to former Chief Minister N.

Biren Singh, he had "witnessed firsthand the challenges faced by the Zomi-Kuki-Hmar community".

पत्र में, वाLTE ने कहा था कि एक तीन बार के विधायक और पूर्व मुख्यमंत्री एन. बीरेन सिंह के BJP सलाहकार के रूप में उन्होंने "जोमी-कुकी-हमार समुदाय द्वारा झेली जा रही चुनौतियों को प्रत्यक्ष रूप से देखा है।"

- "On May 4, 2023, after attending security meeting at CM's office, to discuss the safe transportation of my people especially Churachandpurians stranded in Imphal due to the ethnic violence, I was brutally attacked on my way back home at RIMS Road by the Meitei militia [Arambai Tenggol], resulting in severe injuries that have left me paralysed and handicapped till date.

"4 मई 2023 को, मुख्यमंत्री कार्यालय में सुरक्षा बैठक में शामिल होने के बाद, जातीय हिंसा के कारण इंफाल में फंसे विशेषकर चुराचांदपुरियों के सुरक्षित परिवहन पर चर्चा करके, जब मैं RIMS रोड से घर लौट रहा था,



तब मैतेई मिलिशिया [अरंबाई तेंगगोल] ने मुझ पर बेरहमी से हमला किया, जिससे मुझे गंभीर चोटें आईं और मैं आज तक लकवाग्रस्त और विकलांग हो गया हूँ।

- He added that the **ZomiKuki-Hmar community** had been driven out of the **State capital Imphal** and from the valley, leading to complete physical and social divide.
उन्होंने आगे कहा कि **जोमी-कुकी-हमार समुदाय** को **राज्य की राजधानी इंफाल** और घाटी से बाहर खदेड़ दिया गया है, जिससे पूर्ण भौतिक और सामाजिक विभाजन हो गया है।

GS Paper 1: Geography

TOPICS COVERED

23 February 2026

23F South Korea condemns Japan for hosting event over disputed islands
विवादित द्वीपों पर कार्यक्रम आयोजित करने को लेकर दक्षिण कोरिया ने जापान की निंदा की

23F Land mine kills nine in Sudan's south Kordofan
सूडान के दक्षिण कोर्डोफान में लैंड माइन से नौ की मौत

SEOUL

South Korea condemns Japan for hosting event over disputed islands



REUTERS

GS I: Geography: Mapping

South Korea on Sunday objected to the Takeshima Day event held by Japan's Shimane prefecture, calling it an unjust assertion of sovereignty over its territory. The cluster of disputed islands, known as Takeshima in Japan and Dokdo in South Korea, have long been a source of tension between the two neighbours. REUTERS

23F. South Korea condemns Japan for hosting event over disputed islands

विवादित द्वीपों पर कार्यक्रम आयोजित करने को लेकर दक्षिण कोरिया ने जापान की निंदा की

- South Korea on Sunday objected to the **Takeshima Day** event held by **Japan's Shimane prefecture**, calling it an **unjust assertion of sovereignty** over its territory.

दक्षिण कोरिया ने रविवार को **जापान के शिमाने प्रीफेक्चर** द्वारा आयोजित **टेकशीमा डे** कार्यक्रम पर आपत्ति जताई और इसे अपने क्षेत्र पर **संप्रभुता का अनुचित दावा** बताया।

- The cluster of **disputed islands**, known as **Takeshima in Japan and Dokdo in South Korea**, have long been a **source of tension** between the two neighbours.

विवादित द्वीपों का यह समूह, जिसे जापान में **टेकशीमा** और दक्षिण कोरिया में **डोकडो** कहा जाता है, लंबे समय से दोनों पड़ोसी देशों के बीच **तनाव का कारण** रहा है।

Land mine kills nine in Sudan's south Kordofan

GS I: Geography: Mapping

KHARTOUM

A landmine explosion killed nine people in Sudan on Sunday, including three children in the front line region of Kordofan, a medical source said.

The war between the regular Army and the paramilitary Rapid Support Forces (RSF), which began in April 2023, has left Sudan strewn with mines and unexploded ordnance, though the explosive that caused Sunday's deaths could also have dated back to previous rebellions that have shaken South Kordofan state since 2011.

"Nine people, three of them children, were killed by a mine explosion," a medical source at Al-Abba-siya hospital said.

23F. Land mine kills nine in Sudan's south Kordofan

सूडान के दक्षिण कोर्डोफान में लैंड माइन से नौ की मौत

- A **landmine explosion** killed **nine people** in Sudan on **Sunday**, including **three children** in the front line region of **Kordofan**, a **medical source** said.

एक **लैंड माइन विस्फोट** में रविवार को **सूडान में नौ लोगों** की मौत हो गई, जिनमें **तीन बच्चे** शामिल थे, यह घटना **कोर्डोफान के फ्रंट लाइन क्षेत्र** में हुई, एक **चिकित्सकीय स्रोत** ने कहा।

- The **war between the regular Army and the paramilitary Rapid Support Forces (RSF)**, which began in **April 2023**, has left **Sudan strewn with mines and unexploded ordnance**, though the **explosive** that caused **Sunday's deaths** could also have **dated back to previous rebellions** that have shaken **South Kordofan state since 2011**.

नियमित सेना और अर्धसैनिक रैपिड सपोर्ट फोर्स (RSF) के बीच **युद्ध**, जो **अप्रैल 2023** में शुरू हुआ, ने **सूडान को बारूदी सुरंगों और अविस्फोटित गोला-बारूद** से भर दिया है, हालांकि **रविवार की मौतों का कारण बना विस्फोटक पहले के विद्रोहों से भी जुड़ा हो सकता है**, जिन्होंने **2011 से दक्षिण कोर्डोफान राज्य को हिला रखा है**।



GS Paper II: Polity,

TOPICS COVERED

23 February 2026

23F Protecting the freedom of speech of MPs

सांसदों की अभिव्यक्ति की स्वतंत्रता की रक्षा

Protecting the freedom of speech of MPs

GS II: Polity

MOB

Recent happenings in Parliament have brought into sharp focus the issue of freedom of speech in the Houses, guaranteed by Article 105 of the Constitution. Of course, this is subject to other provisions of the Constitution and the rules of the Houses. That the freedom of speech of MPs is subject to the rules of the Houses seems to have created the wrong impression that the provisions of the rules can in a way override constitutional rights. The root of the problem which the leaders of the Opposition face in Parliament lies in this erroneous impression. The Supreme Court has clarified on many occasions that the restrictions on the rights of citizens should not be such that they eclipse those very rights. This principle would apply to the freedom of speech of MPs in the Houses as well. The rules of the Houses are meant to regulate the conduct of the proceedings in accordance with the Constitution.



P.D.T. Achary

Former Secretary
General of the Lok
Sabha

sentences or paragraphs from the speech. Naturally, in a civilised debate in the Legislature, there should be no place for offending words which destroy the sanctity of debates and lower the dignity of the House. That is why rules confer the right on the presiding officers of the Houses to remove them from the records. But while exercising this right, the officers are duty-bound to ensure that the freedom of speech of MPs in the Houses is not diminished.

The Constitution adopted freedom of speech as the main privilege of MPs. As Erskine May, an authority on parliamentary system, says, these are special rights which are indispensable for members, for the smooth functioning of the legislature. Only the free, frank, and fearless expression of members' views enables the Legislature to perform its role effectively. If the rule on expunction is applied mindlessly to speeches made in the House, it will stifle the freedom of speech.

What are the constitutional provisions and the rules of the House to which the freedom of speech in the House is subject? Article 121 says no discussion can be held in Parliament on the conduct of a judge of the Supreme Court or of a High Court except when the House considers a motion for the removal of that judge. As regards the rules of the House, they impose certain restrictions on the freedom of speech, such as sub judice matters, personal allegations, questioning the bona fides of fellow members, reflecting on the conduct of persons in high authority, and defamatory or incriminatory allegations against any person without giving prior notice to the Speaker. These rules in no way stifle the freedom to speak in the House. The problem arises when these rules are sought to be weaponised. A mindless application of the expunction rule will make a speech incoherent. It must be kept in mind that speeches made in Parliament are preserved for posterity. Parliamentary conduct and

practices have a firm normative base. After independence, when India was transitioning to the post-colonial system, Prime Minister Jawaharlal Nehru reset the relationship between the government and Parliament and the government and the Opposition in Parliament. He would do two things in this context. First, he would be present during the question hour every day and supplement or even correct the answers given by ministers because he believed that Parliament should be given the correct and full information. Second, he would come to the House to listen to the speeches of the Opposition leaders because he believed that he would get to know the reality only from their speeches and not from the adulatory paeans from his own party members. There cannot be a democratic Parliament without an Opposition. As the constitutional lawyer Ivor Jennings said, "Attacks upon the government and upon individual ministers are the function of the Opposition. The duty of the Opposition is to oppose."

A tragic development

The Parliament of the day seems to be losing this perspective. Ours is perhaps the only Parliament in the democratic world where a leader of the Opposition is effectively prevented from speaking in the House and against whom a motion is brought to have him disqualified for life. It is tragic that such an attempt is being made by a senior member of the House when it should be clear that Parliament has no power to disqualify a member. But this move is a pointer to the irretrievable breakdown of the relationship between the government and the Opposition. Jennings' words are prophetic: "The minority agrees that the majority must govern and the majority agrees that the minority should criticise. The process of parliamentary government would breakdown if there were no mutual forbearance."

23F. Protecting the freedom of speech of MPs सांसदों की अभिव्यक्ति की स्वतंत्रता की रक्षा

Recent happenings in Parliament have brought into sharp focus the issue of freedom of speech in the Houses, guaranteed by Article 105 of the Constitution.

हाल की संसद की घटनाओं ने सदनों में वाक् स्वतंत्रता के मुद्दे को प्रमुखता से उजागर किया है, जो संविधान के अनुच्छेद 105 द्वारा सुनिश्चित की गई है।

Of course, this is subject to other provisions of the Constitution and the rules of the Houses. बेशक, यह संविधान के अन्य प्रावधानों और सदनों के नियमों के अधीन है।

That the freedom of speech of MPs is subject to the rules of the Houses seems to have created the wrong impression that the provisions of the rules

Expunging words

The question which has arisen in the first part of the Budget Session of Parliament is whether there were too many restrictions imposed on the freedom of speech of the members of the Houses, in particular, the leaders of the Opposition. The Leader of the Opposition in the Rajya Sabha, Mallikarjun Kharge, reportedly wrote to the Chairman about the expunction of many portions of his speech and requested him to restore what was cut. His complaint is that after these cuts, his speeches made little sense.

An MP has the right to speak freely in the House and to have their remarks entered into the official records of the House. If the speech is not recorded, is partially recorded, or if many portions are arbitrarily deleted, the MP's right under Article 105 is infringed. Of course, Rule 380 permits the Speaker to expunge words if they are unparliamentary, defamatory, indecent, or undignified. But it permits the Speaker to expunge only the offending word and not

The freedom of speech of MPs is subject to the rules of the Houses. This seems to have created the wrong impression that the provisions of the rules can override constitutional rights

can in a way override constitutional rights.

कि सांसदों की वाक् स्वतंत्रता सदनों के नियमों के अधीन है, इससे गलत धारणा बनी है कि नियमों के प्रावधान किसी तरह संवैधानिक अधिकारों को निरस्त कर सकते हैं।

- The root of the problem which the leaders of the Opposition face in Parliament lies in this erroneous impression. संसद में विपक्ष के नेताओं के सामने जो समस्या है, उसकी जड़ इसी गलत धारणा में है।
- The Supreme Court has clarified on many occasions that the restrictions on the rights of citizens should not be such that they eclipse those very rights.



सुप्रीम कोर्ट ने कई बार स्पष्ट किया है कि नागरिकों के अधिकारों पर प्रतिबंध ऐसे नहीं होने चाहिए कि वे उन्हीं अधिकारों को समाप्त कर दें।

- The Leader of the Opposition in the **Rajya Sabha, Mallikarjun Kharge**, reportedly wrote to the **Chairman** about the **expunction of many portions of his speech** and requested him to restore what was cut.

राज्यसभा में विपक्ष के नेता **मल्लिकार्जुन खड़गे** ने कथित रूप से **सभापति** को अपने भाषण के कई हिस्सों के विलोपन के बारे में पत्र लिखा और हटाए गए अंशों को बहाल करने का अनुरोध किया।

- His complaint is that after these cuts, his speeches made little sense. उनकी शिकायत है कि इन कटौती के बाद उनके भाषण का अर्थ कम रह गया।
- An MP has the right to speak freely in the House and to have their remarks entered into the official records of the House.**

एक **सांसद** को सदन में स्वतंत्र रूप से बोलने और अपनी टिप्पणियों को सदन के **आधिकारिक अभिलेख** में दर्ज कराने का अधिकार है।

- If the speech is not recorded, is partially recorded, or if many portions are arbitrarily deleted, the **MP's right under Article 105 is infringed.**

यदि भाषण दर्ज नहीं होता, आंशिक रूप से दर्ज होता है या कई हिस्से मनमाने ढंग से हटाए जाते हैं, तो **अनुच्छेद 105** के तहत सांसद का अधिकार उल्लंघित होता है।

- Of course, **Rule 380 permits the Speaker to expunge words if they are unparliamentary, defamatory, indecent, or undignified.**

बेशक, **नियम 380** अध्यक्ष को शब्द हटाने की अनुमति देता है यदि वे **असंसदीय, मानहानिकारक, अशोभनीय या गरिमा-हीन** हों।

- Article 121** says no discussion can be held in Parliament on the conduct of a judge of the **Supreme Court** or of a **High Court** except when the House considers a motion for the removal of that judge.

अनुच्छेद 121 कहता है कि संसद में **सुप्रीम कोर्ट** या **हाई कोर्ट** के न्यायाधीश के आचरण पर चर्चा नहीं की जा सकती, सिवाय तब जब उस न्यायाधीश को हटाने का प्रस्ताव विचाराधीन हो।

- First, he would be present during the question hour every day and supplement or even correct the answers given by ministers because he believed that Parliament should be given the correct and full information.**

पहला, वे प्रतिदिन **प्रश्नकाल** में उपस्थित रहते थे और मंत्रियों द्वारा दिए गए उत्तरों को पूरक या संशोधित करते थे क्योंकि उनका विश्वास था कि संसद को सही और पूर्ण जानकारी दी जानी चाहिए।

- Second, he would come to the House to listen to the speeches of the Opposition leaders because he believed that he would get to know the reality only from their speeches and not from the adulatory paeans from his own party members.**

दूसरा, वे **विपक्ष के नेताओं** के भाषण सुनने के लिए सदन में आते थे क्योंकि उनका मानना था कि उन्हें वास्तविकता का ज्ञान उनके भाषणों से मिलेगा, न कि अपनी पार्टी के सदस्यों की प्रशंसा से।

- There cannot be a democratic Parliament without an **Opposition.**

विपक्ष के बिना लोकतांत्रिक संसद नहीं हो सकती।

- As the constitutional lawyer **Ivor Jennings** said, "Attacks upon the government and upon individual ministers are the function of the Opposition. The duty of the Opposition is to oppose."

जैसा कि संवैधानिक विधिवेत्ता **Ivor Jennings** ने कहा, "सरकार और व्यक्तिगत मंत्रियों पर आक्रमण करना विपक्ष का कार्य है। विपक्ष का कर्तव्य विरोध करना है।"

GS Paper II: International Relations

TOPICS COVERED

23 February 2026

23F Lines in the sand
रेत में खींची गई रेखाएँ

23F Why did the U.S. drop a core radiation safety rule?
अमेरिका ने एक प्रमुख विकिरण सुरक्षा नियम क्यों हटाया?



GS II: IR

Lines in the sand

The Pax Silica alliance holds benefits, but could also tie India down

India's entry into the Pax Silica alliance represents a strategic manoeuvre to secure its technological future by aligning with a U.S.-led coalition focused on the infrastructure for Artificial Intelligence (AI) and critical minerals. Its membership could boost domestic industrial goals by complementing initiatives such as India Semiconductor, IndiaAI, and National Critical Mineral Missions. By joining this ecosystem, India will aim to secure raw materials supply and advanced equipment, attract investment, and influence global tech and security standards. India does not currently possess significant capacity in processing critical minerals nor does it extract them in large quantities. That said, for the rest of the world, including the Pax Silica group, the more important implication is in India's potential to shift the centre of gravity for global manufacturing and consumption. India's massive demand can be useful to financially justify new supply chains, especially ones not pegged to China; the country can also provide the engineering talent and assembly capacity required to diversify the global technology supply chain. India's participation could also add significant geopolitical weight to the bloc's efforts to establish democratic governance for critical technologies, rendering the coalition's standards more viable.

Of course, there is no such thing as a free lunch. The implications for India include potential economic retaliation from China, such as trade friction, slower market access, or pressure on upstream inputs such as minerals and active pharmaceutical ingredients. The Pax Silica partnership's focus on "trusted ecosystems" could also translate into rigid expectations regarding export controls and technology-transfer guardrails, which could clash with India's preference for not locking itself into alliances but, instead, pursuing what External Affairs Minister S. Jaishankar has called "issue-based alignments". The government could open itself up to more criticism at home particularly if the U.S.-led bloc also begins to shape India's domestic AI rules in ways that look externally driven. Smaller Indian firms attempting to join global value chains could also face significant financial burdens and longer timelines due to stricter security audit requirements. In the end, the success of Pax Silica will depend on whether its partners go beyond talks to build a real-world supply chain where raw minerals are mined, refined, turned into chips, and used to power AI systems, all among the pact's members, creating a secure technology network that drives India's economic growth while protecting the alliance from disruptions.

23F. Lines in the sand रेत में खींची गई रेखाएँ

• The Pax Silica alliance holds benefits, but could also tie India down

पैक्स सिलिका गठबंधन में लाभ हैं, लेकिन यह भारत को बांध भी सकता है

• India's entry into the Pax Silica alliance represents a strategic manoeuvre to secure its technological future by aligning with a U.S.-led coalition focused on the infrastructure for Artificial Intelligence (AI) and critical minerals.

Pax Silica गठबंधन में भारत का प्रवेश उसके तकनीकी भविष्य को सुरक्षित करने के लिए एक रणनीतिक कदम है, जो Artificial Intelligence (AI) और महत्वपूर्ण खनिजों के बुनियादी ढाँचे पर केंद्रित अमेरिका-नेतृत्व वाले गठबंधन के साथ संरेखण द्वारा किया गया है।

• Its membership could boost domestic industrial goals by complementing initiatives such as India Semiconductor, IndiaAI, and National Critical Mineral Missions.

इसकी सदस्यता India Semiconductor, IndiaAI, और National Critical Mineral Missions जैसी पहलों को पूरक बनाकर घरेलू औद्योगिक लक्ष्यों को बढ़ावा दे सकती है।

• In the end, the success of Pax Silica will depend on whether its partners go beyond talks to build a real-world supply chain where raw minerals are mined, refined, turned into chips, and used to power AI systems, all among the pact's members, creating a secure technology network that drives India's economic growth while protecting the alliance from disruptions.

अंततः, Pax Silica की सफलता इस बात पर निर्भर करेगी कि उसके साझेदार केवल वार्ता तक सीमित रहते हैं या वास्तविक सप्लाय चेन का निर्माण करते हैं जहाँ कच्चे खनिज निकाले जाएँ, परिष्कृत किए जाएँ, चिप्स में बदले जाएँ और AI प्रणालियों को संचालित करने में उपयोग हों, और यह सब समझौते के सदस्यों के बीच हो, जिससे एक सुरक्षित तकनीकी नेटवर्क बने जो भारत की आर्थिक वृद्धि को आगे बढ़ाए और गठबंधन को व्यवधानों से बचाए।



Why did the U.S. drop a core radiation safety rule?

What is the ALARA principle? What has the U.S. Department of Energy said?

SS IAS

K.S. Parthasarathy

The story so far:

The Linear No-Threshold (LNT) model and the ALARA principle have served as the conceptual and operational foundations of the global radiation protection framework for many decades. But, on January 12, the U.S. Department of Energy (DOE) "eliminated" ALARA from its directives and regulations, departing significantly from longstanding national and international practices.

What is the LNT model?

The LNT model is a risk estimation framework that says any amount of ionising radiation, no matter how small, carries some risk of causing harm, especially cancer. In other words, there is no threshold below which radiation is considered completely risk-free. And the risk increases linearly with dose. ALARA, short for "as low as reasonably

achievable", is the operational philosophy of radiation protection. "Reasonably" is the most important condition. The philosophy balances safety with feasibility, cost, and societal need, and its aim is to improve continuously, including better shielding, administrative procedures, and training. Thus, in practice ALARA aims to reduce unnecessary exposure using engineering controls and encourages a safety culture. Unfortunately, when these principles are misapplied, as they have often been, they create a baggage of woes. The International Commission on Radiological Protection (ICRP) and other stakeholders are realising that modern radiological protection requires a different approach.

Why has the U.S. eliminated ALARA?

"The DOE's decades of nuclear facility operating experience confirms that DOE's mission to foster nuclear innovation and advanced nuclear technologies could be met more effectively if the current

radiation framework were reformed," a Department memorandum said in a follow-up to U.S. President Donald Trump's orders. Critics have argued that the shift appears politically motivated and relies on non-peer-reviewed internal reports, and risks undermining worker protection, public trust, and regulatory coherence. Indeed, the U.S. is now at odds with international bodies such as the ICRP, the UN Scientific Committee on the Effects of Atomic Radiation, the World Health Organization, etc. all of which continue to rely on LNT as a basis for radiation protection. No large-scale, high-quality epidemiological or mechanistic evidence has emerged to justify replacing LNT with alternative dose-response models, including hormesis (which says low dose radiation is okay). While hormesis remains biologically plausible, its variability across populations, ethical limitations, and lack of reproducible human data render it unsuitable for regulatory use.

What lies ahead?

The ICRP hasn't shown any indication that the dose limits will be revised. There may be a renewed effort to accept a low dose level below which no regulation is required. However, critics have emphasised the importance of public perception. Even if some experts believe higher dose thresholds could be justified scientifically, the optics of abandoning ALARA and LNT are problematic. For those living near nuclear facilities, the change may look like a lowering of safety standards rather than a refinement of scientific assumptions. Without broad scientific consensus, transparent communication, and meaningful public engagement, critics fear that the policy shift will deepen mistrust, and fuel opposition to nuclear projects and existing and future facilities.

Possible evidence of cancer and non-cancer effects at low doses have also appeared in more recent studies, such as the ongoing 'Million Person Study'. Another study of nearly a million young individuals revealed that a few of them may suffer blood related cancers at very low doses (*Nature Medicine*, 2023). One expects the ICRP will take note of such work.

India has been at the forefront of complying with internationally accepted radiation protection practices and must continue to do so.

K.S. Parthasarathy is former secretary, Atomic Energy Regulatory Board.

THE GIST

The LNT model is a risk estimation framework that says any amount of ionising radiation, no matter how small, carries some risk of causing harm, especially cancer. ALARA, short for "as low as reasonably achievable", is the operational philosophy of radiation protection.

On January 12, the U.S. Department of Energy (DOE) "eliminated" ALARA from its directives and regulations.

Even if some experts believe higher dose thresholds could be justified scientifically, the optics of abandoning ALARA and LNT are problematic.

23F. Why did the U.S. drop a core radiation safety rule?

अमेरिका ने एक प्रमुख विकिरण सुरक्षा नियम क्यों हटाया?

- The **Linear No-Threshold (LNT) model** and the **ALARA principle** have served as the conceptual and operational foundations of the **global radiation protection framework** for many decades.

लीनियर नो-थ्रेशोल्ड (LNT) मॉडल और ALARA सिद्धांत कई दशकों से वैश्विक विकिरण सुरक्षा ढाँचे की वैचारिक और परिचालन नींव रहे हैं।

- But, on **January 12**, the **U.S. Department of Energy (DOE)** "**eliminated**" **ALARA** from its **directives and regulations**, departing significantly from longstanding national and international practices.

लेकिन 12 जनवरी को अमेरिकी ऊर्जा विभाग (DOE) ने अपने निर्देशों और नियमों से ALARA को "समाप्त" कर दिया, जो लंबे समय से चली आ रही राष्ट्रीय और अंतरराष्ट्रीय प्रथाओं से महत्वपूर्ण विचलन है।

What is the LNT model?

LNT मॉडल क्या है?

- The **LNT model** is a risk estimation framework that says any amount of **ionising radiation**, no matter how small, carries some risk of causing harm, especially **cancer**.

LNT मॉडल एक जोखिम आकलन ढाँचा है जो कहता है कि आयनीकरण विकिरण की कोई भी मात्रा, चाहे कितनी भी कम हो, नुकसान विशेषकर **कैंसर** का कुछ जोखिम रखती है।

- In other words, there is **no threshold** below which radiation is considered completely risk-free.

दूसरे शब्दों में, ऐसा कोई **सीमा स्तर नहीं** है जिसके नीचे विकिरण को पूरी तरह सुरक्षित माना जाए।

- And the risk increases **linearly with dose**. और जोखिम **डोज के साथ रैखिक रूप से बढ़ता** है।

- ALARA**, short for "**as low as reasonably achievable**", is the operational philosophy of **radiation protection**.

ALARA, जिसका अर्थ है "जितना संभव हो उतना कम", विकिरण सुरक्षा की परिचालन नीति है।

- '**Reasonably**' is the most important condition. 'उचित रूप से' सबसे महत्वपूर्ण शर्त है।

- The **philosophy balances safety with feasibility, cost, and societal need**, and its aim is to **improve continuously, including better shielding, administrative procedures, and training**.

यह दर्शन सुरक्षा, व्यवहार्यता, लागत और सामाजिक आवश्यकता के बीच संतुलन बनाता है तथा निरंतर सुधार का लक्ष्य रखता है, जिसमें बेहतर **शील्डिंग, प्रशासनिक प्रक्रियाएँ और प्रशिक्षण** शामिल हैं।

- Thus, in practice **ALARA** aims to reduce **unnecessary exposure** using **engineering controls** and encourages a **safety culture**.



इस प्रकार व्यवहार में **ALARA इंजीनियरिंग नियंत्रणों** के माध्यम से **अनावश्यक एक्सपोजर** कम करने और **सुरक्षा संस्कृति** को बढ़ावा देने का लक्ष्य रखता है।

- Unfortunately, when these principles are **misapplied**, as they have often been, they create a baggage of woes.

दुर्भाग्य से, जब इन सिद्धांतों का **गलत उपयोग** होता है, जैसा अक्सर हुआ है, तो ये कई समस्याएँ उत्पन्न करते हैं।

- The **International Commission on Radiological Protection (ICRP)** and other stakeholders are realising that modern **radiological protection** requires a different approach.

इंटरनेशनल कमीशन ऑन रेडियोलॉजिकल प्रोटेक्शन (ICRP) और अन्य हितधारक महसूस कर रहे हैं कि आधुनिक **विकिरण सुरक्षा** के लिए अलग दृष्टिकोण आवश्यक है।

- **No large-scale, high-quality epidemiological or mechanistic evidence has emerged to justify replacing LNT with alternative models including hormesis.**

LNT को बदलने के लिए **एपिडेमियोलॉजिकल या यांत्रिक प्रमाण** का कोई बड़ा और उच्च गुणवत्ता वाला साक्ष्य नहीं मिला है, जिसमें **हॉर्मिसिस** भी शामिल है।

- Even if higher dose thresholds are scientifically justified, **abandoning ALARA and LNT may appear as lowering safety standards.**

भले ही उच्च डोज सीमा वैज्ञानिक रूप से उचित हो, लेकिन **ALARA और LNT** को छोड़ना **सुरक्षा मानकों को कम करना** प्रतीत हो सकता है।

- Without **scientific consensus, transparent communication, and public engagement**, critics fear mistrust and opposition to **nuclear projects** will grow.

वैज्ञानिक सहमति, पारदर्शी संवाद और जन सहभागिता के बिना आलोचकों को डर है कि **परमाणु परियोजनाओं** के प्रति अविश्वास और विरोध बढ़ेगा।

- Possible evidence of **cancer and non-cancer effects at low doses** has appeared in studies such as the ongoing **Million Person Study**.

कम डोज पर कैंसर और गैर-कैंसर प्रभावों के संभावित प्रमाण **मिलियन पर्सन स्टडी** जैसे अध्ययनों में सामने आए हैं।

- Another study of nearly **one million young individuals** showed some may suffer **blood-related cancers at very low doses (Nature Medicine, 2023)**.

लगभग **दस लाख युवाओं** के एक अन्य अध्ययन में पाया गया कि कुछ लोग **बहुत कम डोज पर रक्त संबंधी कैंसर (नेचर मेडिसिन, 2023)** से प्रभावित हो सकते हैं।

- One expects the **ICRP** will take note of such work.

उम्मीद है कि **ICRP** इस कार्य पर ध्यान देगा।

- **India has been at the forefront of complying with international radiation protection practices and must continue to do so.**

भारत अंतरराष्ट्रीय विकिरण सुरक्षा प्रथाओं का पालन करने में अग्रणी रहा है और इसे जारी रखना चाहिए।

GS Paper III: Economy,

TOPICS COVERED

23 February 2026

23F Prime Minister launches full Delhi-Meerut RRTS corridor
प्रधानमंत्री ने पूर्ण दिल्ली-मेरठ RRTS कॉरिडोर का शुभारंभ किया

23F A new CPI base, a clearer inflation signal
नया CPI आधार, महंगाई का अधिक स्पष्ट संकेत

23F Why are apple traders in J&K worried?
जम्मू-कश्मीर में सेब व्यापारी क्यों चिंतित हैं?

23F Boosting environmentally-friendly growth through inland waterways
आंतरिक जलमार्गों के माध्यम से पर्यावरण-अनुकूल विकास को बढ़ावा



Prime Minister launches full Delhi-Meerut RRTS corridor

GS III: Economy
The Hindu Bureau
NEW DELHI

Prime Minister Narendra Modi on Sunday inaugurated the remaining sections of the **Namo Bharat Regional Rapid Transit System (RRTS)**, including the 5-km stretch between Sarai Kale Khan and New Ashok Nagar in Delhi and the 21-km stretch between Meerut South and Modipuram in Uttar Pradesh. The RRTS has been integrated with the Meerut Metro, which was also launched.

Mr. Modi said the entire 82-km corridor of the RRTS project provided a glimpse of what connectivity would look like in a developed India that used Metro rail for intra-city travel and the **Namo Bharat** trains to accelerate the “twin cities” vision. “This integration allows commuters to travel within the city or go directly to Delhi, thus ending the compulsion for many workers and students to live in rented houses in Delhi. A unique feature of the project is the integration of Indian Railways, Metro, and bus stands at Sarai Kale Khan, Anand Vihar, Ghaziabad, and Meerut,” he said.

Talking about development in the regions, Mr. Modi said, “The govern-



Prime Minister Narendra Modi waves to the gathering during the launch of the Meerut Metro and Namoo Bharat services. PTI

ment’s investment in modern infrastructure, including expressways, freight corridors, and the Jewar International Airport is creating vast employment opportunities.”

Union Housing and Urban Affairs Minister Manohar Lal, speaking at the inauguration, said the proposal for two new rapid rail corridors starting from Sarai Kale Khan was expected to be approved soon.

“One corridor is planned from Sarai Kale Khan to Karnal in Haryana, covering a distance of 125-130 km, which can be completed in about an hour and a half. Another route is proposed to connect Sarai Kale Khan with Babarpur in Haryana and Neemrana in Rajasthan,” he said.

The Sarai Kale Khan station, the originating station

of the corridor, is strategically located as a major multi-modal hub, seamlessly connecting the Hazrat Nizamuddin railway station, Delhi Metro’s Pink Line, Veer Haqueeqat Rai ISBT, and Ring Road.

Delhi Chief Minister Rekha Gupta, commenting on the launch, said the Delhi-Meerut corridor will transform the capital’s pace of development and stimulate economic activity in the Delhi-NCR region.

“The corridor will help passengers save time and resources, marking a historic milestone for Delhi and the surrounding region as the project is expected to ease traffic congestion and reduce carbon emissions by reducing the number of private vehicles on the roads, thereby creating a positive environmental impact,” she said.

23F. Prime Minister launches full Delhi-Meerut RRTS corridor

प्रधानमंत्री ने पूर्ण दिल्ली-मेरठ RRTS कॉरिडोर का शुभारंभ किया

• Prime Minister **Narendra Modi** on Sunday inaugurated the remaining sections of the **Namo Bharat Regional Rapid Transit System (RRTS)**, including the 5-km stretch between Sarai Kale Khan and New Ashok Nagar in Delhi and the 21-km stretch between Meerut South and Modipuram in Uttar Pradesh.

प्रधानमंत्री नरेंद्र मोदी ने रविवार को नमो भारत रीजनल रैपिड ट्रांजिट सिस्टम (RRTS) के शेष हिस्सों का उद्घाटन किया, जिसमें दिल्ली में सराय काले खान और न्यू अशोक नगर के बीच 5 किलोमीटर का खंड तथा उत्तर प्रदेश में मेरठ साउथ और मोदीपुरम के बीच 21 किलोमीटर का खंड शामिल है।

• Mr. Modi said the **entire 82-km corridor** of the RRTS project provided a glimpse of what connectivity would look like in a **developed India** that used **Metro rail** for intra-city travel and the **Namo Bharat** trains to accelerate the “twin cities” vision.

श्री मोदी ने कहा कि RRTS परियोजना का पूरा 82 किलोमीटर का कॉरिडोर यह दिखाता है कि विकसित भारत में कनेक्टिविटी कैसी होगी, जहाँ शहर के भीतर यात्रा के लिए मेट्रो रेल और “ट्विन सिटीज़” की परिकल्पना

को गति देने के लिए नमो भारत ट्रेनें होंगी।

- “The corridor will help passengers save **time and resources**, marking a **historic milestone** for Delhi and the surrounding region as the project is expected to ease **traffic congestion** and reduce **carbon emissions** by reducing the number of **private vehicles** on the roads, thereby creating a positive **environmental impact**,” she said.

उन्होंने कहा, “यह कॉरिडोर यात्रियों को **समय और संसाधन** बचाने में मदद करेगा, और दिल्ली तथा आसपास के क्षेत्र के लिए एक **ऐतिहासिक उपलब्धि** साबित होगा, क्योंकि इस परियोजना से **यातायात जाम** कम होने, **कार्बन उत्सर्जन** घटने और सड़कों पर **निजी वाहनों** की संख्या कम होने की उम्मीद है, जिससे सकारात्मक **पर्यावरणीय प्रभाव** पड़ेगा।”



A new CPI base, a clearer inflation signal

Under the new CPI, when States such as Telangana, Kerala, Tamil Nadu, Rajasthan, and Karnataka show higher inflation, it points to rising costs in services

GS III: Economy

DATA POINT

Chandrasekar K.

India's inflation index has been updated to reflect better how households allocate their spending today.

Under the earlier Consumer Price Index (CPI), consumption was grouped into six broad categories, with a wide range of everyday services — such as health, education, transport, and personal care — aggregated into a single head. The revised CPI, shown in **Chart 1**, re-organises the basket into 12 distinct categories in accordance with the Classification of Individual Consumption According to Purpose (COICOP) 2018. This improves the visibility of individual components of household expenditure. As a result, the weight of food has declined, while housing and services account for a larger share, in line with long-term changes in consumption patterns. The revision does not alter what households spend; it refines how that spending is measured for inflation.

The intellectual foundation of this approach dates back more than two centuries. In 1822, Joseph Lowe developed the idea of measuring inflation in England during the Napoleonic wars, arguing that treating all prices equally was mistaken and that goods and services should be weighted according to their importance in everyday consumption. The modern Consumer Price Index continues to follow this principle: prices change, but the basket remains fixed for a given base period. The latest revision updates the basket using Household Consumption Expenditure Survey (HCES) data and aligns weights with current spending patterns. How this works in practice is illustrated in **Chart 2**.

What does CPI General (Combined) mean? **Chart 2** shows the monthly trends of CPI General

(Combined), with the base year at 2024. When the report states that the CPI General (Combined) stood at 104.46 in January 2026, consider a simple example. Let us suppose Usha bought a fixed basket of goods in the same proportions covering all 12 CPI categories for ₹100 in January 2024. This year is treated as the base year, so CPI 2024 is set at 100. When Usha returns to the market in January 2026 and buys the same basket of goods in the same quantities, she now has to pay ₹104.46. That is why the CPI for January 2026 is shown as 104.46. In plain terms, CPI 104.46 means that the same basket of goods that cost ₹100 in the base year now costs ₹104.46. Therefore, the CPI indicates how expensive life has become compared to the base year. It reflects the price level, not how fast prices are rising.

The inflation rate explains the pace of price increases. Using the same example, an inflation rate of 2.75% compares prices in January 2026 with prices in January 2025, not with the base year. If Usha bought the same basket for about ₹101.60 in January 2025 and it now costs ₹104.46 in January 2026, the increase over one year is 2.75%. This is why inflation is reported at 2.75%. Simply put, the inflation rate shows how fast prices have risen over the past year. It does not indicate how expensive things already are; it only shows how quickly prices have gone up recently.

Chart 3 highlights the top five States (with a population above 50 lakh as per the last conducted Census in 2011) recording the highest inflation in January 2026 — Telangana, Kerala, Tamil Nadu, Rajasthan, and Karnataka. This reflects structural differences in household spending that are captured more clearly under CPI 2024. With the revised index reducing the weight of food and raising the weight of housing and services — based on updated Household Consumption Expenditure Survey data — price pressures in non-food

categories now have a greater influence on headline inflation.

In services-intensive States such as Telangana, Kerala, Tamil Nadu, and Karnataka, higher costs for housing, health, education, transport, and personal services translate more directly into higher inflation. Telangana recorded an inflation of 5% last month. The figures are followed by Kerala and Tamil Nadu, which recorded an inflation of 3.67% and 3.36%, respectively.

Rajasthan's inclusion among the higher-inflation States is linked to a key methodological change: CPI 2024 explicitly includes rural housing and utilities, which were not fully captured earlier, thereby correcting an understatement of non-food inflation in largely rural States. Rajasthan recorded an inflation of 3.17% in January this year.

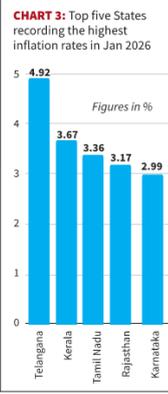
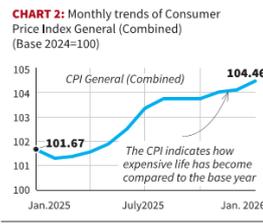
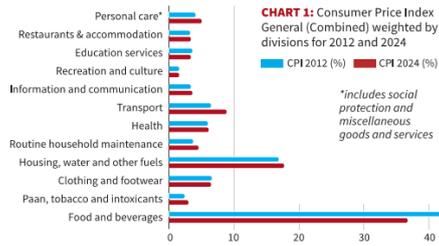
Overall, the chart shows that under the new CPI, State-level inflation is shaped less by food price movements alone and more by differences in consumption structure, a contrast that was less visible under the earlier CPI base.

It also helps explain how the Reserve Bank of India looks at inflation. Under the new CPI, when States such as Telangana, Kerala, Tamil Nadu, Rajasthan, and Karnataka show higher inflation, it points to rising costs in services such as rent, health care, education and transport, not just short-term food price changes. This is important for the RBI because food prices often rise and fall quickly, while service prices generally remain high for longer. The CPI 2024 thus enables the RBI to judge whether price pressures are transitory or persistent, a key input for interest-rate decisions.

Chandrasekar K. is with the Indian Statistical Service. The views expressed are personal. Both the figures CPI General (Combined) and the inflation rate of January 2026, using which calculations were made, are only provisional figures

A revised basket

The data for the charts were sourced from the Ministry of Statistics and Programme Implementation (MOSPI)



23F. A new CPI base, a clearer inflation signal नया CPI आधार, महंगाई का अधिक स्पष्ट संकेत

- Under the new CPI, when States such as Telangana, Kerala, Tamil Nadu, Rajasthan, and Karnataka show higher inflation, it points to rising costs in services
नए CPI के तहत, जब तेलंगाना, केरल, तमिलनाडु, राजस्थान और कर्नाटक जैसे राज्य उच्च महंगाई दिखाते हैं, तो यह सेवाओं में बढ़ती लागत की ओर संकेत करता है
- India's inflation index has been updated to reflect better how households allocate their spending today.
भारत का मुद्रास्फीति सूचकांक अब अद्यतन किया गया है ताकि यह बेहतर दर्शा सके कि परिवार आज अपना खर्च कैसे आवंटित करते हैं।
- Under the earlier Consumer Price Index (CPI), consumption was grouped into six broad categories, with a wide range of everyday services — such as health, education, transport, and personal care — aggregated into a single head.
पहले के उपभोक्ता मूल्य सूचकांक (CPI) में उपभोग को छह व्यापक श्रेणियों में रखा गया था, जहाँ दैनिक सेवाएँ — जैसे स्वास्थ्य, शिक्षा, परिवहन और व्यक्तिगत देखभाल — को एक ही श्रेणी में जोड़ा गया था।
- As a result, the weight of food has declined, while housing and services account for a larger share, in line with long-term changes in consumption patterns.
इसके परिणामस्वरूप खाद्य का भार घटा है, जबकि आवास और सेवाओं का हिस्सा बढ़ा है, जो दीर्घकालिक उपभोग प्रवृत्तियों के अनुरूप है।



- Overall, the chart shows that under the **new CPI, State-level inflation** is shaped less by **food price movements alone** and more by differences in **consumption structure**, a contrast that was less visible under the **earlier CPI base**.
कुल मिलाकर, चार्ट दिखाता है कि **नए CPI** के तहत **राज्य-स्तरीय मुद्रास्फीति** केवल **खाद्य कीमतों** से कम और **उपभोग संरचना** के अंतर से अधिक प्रभावित होती है, जो **पुराने CPI आधार** में कम स्पष्ट था।
- It also helps explain how the **Reserve Bank of India (RBI)** looks at inflation. यह यह भी स्पष्ट करता है कि **भारतीय रिज़र्व बैंक (RBI)** मुद्रास्फीति को कैसे देखता है।
- This is important for the **RBI** because **food prices** often rise and fall quickly, while **service prices** generally remain high for longer. यह **RBI** के लिए महत्वपूर्ण है क्योंकि **खाद्य कीमतें** अक्सर तेजी से ऊपर-नीचे होती हैं, जबकि **सेवा कीमतें** सामान्यतः लंबे समय तक उँची रहती हैं।
- The **CPI 2024** thus enables the **RBI** to judge whether **price pressures** are **transitory or persistent**, a key input for **interest-rate decisions**. इस प्रकार **CPI 2024** **RBI** को यह तय करने में सक्षम बनाता है कि **मूल्य दबाव अस्थायी हैं या स्थायी**, जो **ब्याज दर निर्णयों** के लिए एक महत्वपूर्ण आधार है।

Why are apple traders in J&K worried?

Why are apple producers concerned about the trade deals with the U.S. and the EU? Why are countries in the West able to produce a better yield of apples? What about controlled-atmosphere cold storage prices? Why are party leaders urging the Union government to re-evaluate the deal?

GS III: Economy

EXPLAINER

Peerzada Ashiq

The story so far:

Jammu and Kashmir Chief Minister Omar Abdullah and Leader of the Opposition in J&K Mehbooba Mufti have termed the India-U.S. trade deal as a death knell for the horticulture sector, especially for apple production in Kashmir. The criticism has grown shriller in the backdrop of India's decision to reduce basic customs duty on apples imported from the U.S. from 50% to 25%, even though the Minimum Import Price (MIP) was set at ₹80 per kilogram. Under the new India-European Union trade deal, import duty on fresh fruits was reduced to 20% under a Tariff Rate Quota (TRQ) system. Only 50,000 tonnes per year of apples will be allowed from the EU at this reduced duty, to avoid the sudden flooding of Indian markets. However, the deal agrees to increase the quota to 1,00,000 tonnes over the next 10 years.

How important is apple production? According to the J&K Economic Survey 2025-26, apple production comprises 50% of the total horticulture production of J&K against pear, apricot, peach, plum, cherry, citrus, mango, walnut, almond etc. The horticulture sector produces roughly ₹10,000 crore in revenue and employs about 35 lakh individuals, either directly or indirectly, thereby supporting approximately seven lakh families, the official survey suggested.

In 2024, apple production in J&K stood at 21 lakh metric tonnes. Over 173.07 lakh hectares of land in J&K are under apple orchards. J&K contributes to over 70% of the total apple production in the country. The apple is the fourth most important fruit crop in India.

Besides J&K, Tamil Nadu, Himachal Pradesh, Uttarakhand, Nagaland, and Sikkim also produce apples.



Precarious trade: Workers separating rotten apples in Pulwama, Srinagar in 2025. IMRAN NISSAR

Why are there fears?

Kashmir cannot compete with apples produced in Western countries due to their farming practices, favourable government policy and technological intervention. One estimate suggests that orchardists in New Zealand, the U.S., and in the EU on an average operate on 50-plus hectare farms against an average of 0.40 hectares in J&K. Only 7-8 tonnes of apples per hectare can be produced in India, whereas 40-70 tonnes per hectare are produced in countries like the U.S., Iran, New Zealand and China owing to better geography, advanced technology and mechanisation, says Nasir Hamid Khan, former vice-president of the Kashmir Chamber of Commerce and Industries (KCCI), a pan-Valley traders body. Moreover, Western countries have already introduced AI system technologies for pruning, pollination,

harvesting, infield-sorting and bagging.

How will it impact off-season pricing?

Nations in the West have also mastered many popular varieties of apples such as gala apples. India introduced the gala variety only very recently and it is yet to reach its optimum production quality in terms of colour, taste, juice, shape as well as yield. Orchardists in Kashmir fear apples from the West will enter India at cheaper prices and in turn hit controlled-atmosphere cold storage prices the most. With reduced import duty, fresh New Zealand apples will enter Indian markets at cheaper prices, directly undercutting Indian apples stored in cold facilities, says Izhaz Javed, a senior member of the J&K Fruits and Vegetables Processing and Integrated Cold Chain Association. Kashmir stores 397.08 lakh metric tonnes of apples in 92 cold

storages currently. Local orchardists in Kashmir have invested heavily in cold storage infrastructure. "The trade deals threaten to make these investments economically unviable, endangering the entire post-harvest ecosystem built with public and private capital. The trade deal has the potential to destroy off-season price stability and push farmers back into distress sales," warns Mr. Javed.

What are J&K parties demanding?

J&K parties and traders are urging the Centre to relook the deal and ensure safeguards for apple producers. In J&K, parties are clamouring for a joint strategy to pressure the Centre to exclude apples from the deal. The Peoples Democratic Party (PDP) leader and legislator Waheed-ur-Rehman Parra has sought an all-party meeting "to devise a collective strategy". "Out of 30 lakh kanals of orchard land, only 30,000 kanals are under high-density cultivation. There is a need to have interest-free loans for farmers under Holistic Agriculture Development Programme (HADP) to compete globally," says Mr. Parra.

The PDP also pitched for the expansion of cold storage and controlled-atmosphere storage infrastructure "to prevent distress sales". It demanded the activation of dry port projects in J&K for the smooth ferrying of apples from the Valley to the markets outside.

Chief Minister Omar Abdullah has also echoed these concerns. He said the trade deal will "spell disaster for the horticulture sector if left unaddressed". Mr. Abdullah says time has come to invest in improving productivity and quality before the market is flooded by cheaper apples. We don't know what the benefits will be in the rest of the country, but we are seeing a loss, Mr. Abdullah warned. He underlined that the deals have paved an "uneven playing field for local orchardists and better-quality imports will dominate the market and the local produce will get devalued".

THE GIST

According to the J&K Economic Survey 2025-26, apple production comprises 50% of the total horticulture production of J&K against pear, apricot, peach, plum, cherry, citrus, mango, walnut, almond etc.

Kashmir cannot compete with apples produced in Western countries due to their farming practices, favourable government policy and technological intervention.

J&K parties and traders are urging the Centre to relook the deal and ensure safeguards for apple producers.

23F. Why are apple traders in J&K worried?

जम्मू-कश्मीर में सेब व्यापारी क्यों चिंतित हैं?

- The criticism has grown shriller in the backdrop of India's decision to reduce **basic customs duty** on apples imported from the **U.S. from 50% to 25%**, even though the **Minimum Import Price (MIP) was set at ₹80 per kilogram**.

आलोचना तब और तेज हो गई जब भारत ने अमेरिका से आयातित सेब पर मूल सीमा शुल्क 50% से घटाकर 25% कर दिया, जबकि न्यूनतम आयात मूल्य (MIP) ₹80 प्रति किलोग्राम निर्धारित किया गया था।



- Under the new **India-European Union trade deal**, import duty on fresh fruits was reduced to **20% under a Tariff Rate Quota (TRQ) system**.
नए भारत-यूरोपीय संघ व्यापार समझौते के तहत ताजे फलों पर आयात शुल्क टैरिफ रेट कोटा (TRQ) प्रणाली के अंतर्गत **20%** कर दिया गया।
- **Only 50,000 tonnes per year of apples will be allowed from the EU** at this reduced duty, to avoid the sudden flooding of Indian markets.
भारतीय बाजार में अचानक बाढ़ से बचने के लिए **EU से प्रति वर्ष केवल 50,000 टन** सेब इस कम शुल्क पर आयात की अनुमति होगी।
- However, the deal agrees to increase the quota to **1,00,000 tonnes over the next 10 years**.
हालाँकि, समझौते के अनुसार अगले **10 वर्षों में कोटा 1,00,000 टन** तक बढ़ाया जाएगा।
- According to the **J&K Economic Survey 2025-26**, apple production comprises **50% of the total horticulture production of J&K** against pear, apricot, peach, plum, cherry, citrus, mango, walnut, almond etc.
जम्मू-कश्मीर आर्थिक सर्वेक्षण 2025-26 के अनुसार सेब उत्पादन **कुल बागवानी उत्पादन का 50%** है, जो नाशपाती, खुबानी, आड़ू, प्लम, चेरी, साइट्रस, आम, अखरोट, बादाम आदि के मुकाबले है।
- The horticulture sector produces roughly **₹10,000 crore in revenue** and employs about **35 lakh individuals**, either directly or indirectly, thereby supporting approximately **seven lakh families**.
बागवानी क्षेत्र लगभग **₹10,000 करोड़ का राजस्व** उत्पन्न करता है और लगभग **35 लाख लोगों** को प्रत्यक्ष या अप्रत्यक्ष रूप से रोजगार देता है, जिससे लगभग **7 लाख परिवारों** का समर्थन होता है।
- In **2024**, apple production in **J&K stood at 21 lakh metric tonnes**.
2024 में जम्मू-कश्मीर में सेब उत्पादन 21 लाख मीट्रिक टन रहा।
- Over **173.07 lakh hectares** of land in J&K are under **apple orchards**.
जम्मू-कश्मीर में **173.07 लाख हेक्टेयर** भूमि **सेब के बागानों** के अंतर्गत है।
- J&K contributes to over **70% of the total apple production in the country**.
जम्मू-कश्मीर देश के कुल सेब उत्पादन में **70% से अधिक योगदान** देता है।
- The apple is the **fourth most important fruit crop in India**.
सेब भारत की **चौथी सबसे महत्वपूर्ण फल फसल** है।
- Besides J&K, **Tamil Nadu, Himachal Pradesh, Uttarakhand, Nagaland, and Sikkim** also produce apples.
जम्मू-कश्मीर के अलावा **तमिलनाडु, हिमाचल प्रदेश, उत्तराखंड, नागालैंड और सिक्किम** में भी सेब का उत्पादन होता है।

Why are there fears? डर क्यों है?

- Kashmir cannot compete with apples produced in **Western countries** due to their **farming practices, favourable government policy and technological intervention**.
कश्मीर **पश्चिमी देशों** में उत्पादित सेबों से प्रतिस्पर्धा नहीं कर सकता क्योंकि वहाँ **खेती की पद्धतियाँ, अनुकूल सरकारी नीतियाँ और तकनीकी हस्तक्षेप** बेहतर हैं।
- One estimate suggests that orchardists in **New Zealand, the U.S., and the EU** on an average operate on **50-plus hectare farms** against an average of **0.40 hectares in J&K**.
एक अनुमान के अनुसार **न्यूजीलैंड, अमेरिका और EU** के बागवान औसतन **50 हेक्टेयर से अधिक** भूमि पर खेती करते हैं, जबकि **जम्मू-कश्मीर में औसत केवल 0.40 हेक्टेयर** है।
- Only **7-8 tonnes of apples per hectare** can be produced in India, whereas **40-70 tonnes per hectare** are produced in countries like **the U.S., Iran, New Zealand and China** owing to **better geography, advanced technology and mechanisation**.
भारत में केवल **7-8 टन प्रति हेक्टेयर** सेब उत्पादन होता है, जबकि **अमेरिका, ईरान, न्यूजीलैंड और चीन** जैसे देशों में **40-70 टन प्रति हेक्टेयर** उत्पादन होता है, जिसका कारण **बेहतर भौगोलिक स्थिति, उन्नत तकनीक और मशीनीकरण** है।
- Moreover, **Western countries** have already introduced **AI system technologies** for **pruning, pollination, harvesting, in-field sorting and bagging**.
इसके अलावा **पश्चिमी देशों** ने पहले ही **छंटाई, परागण, कटाई, खेत में छंटाई और बैगिंग** के लिए **AI आधारित तकनीक** लागू कर दी है।



How will it impact off-season pricing? ऑफ-सीजन कीमतों पर इसका क्या प्रभाव पड़ेगा?

- Nations in the **West** have also mastered many popular varieties of apples such as **gala apples**.
पश्चिमी देशों ने गाला सेब जैसी कई लोकप्रिय किस्मों में महारत हासिल कर ली है।
- India introduced the **gala variety** only very recently and it is yet to reach its optimum production quality in terms of **colour, taste, juice, shape as well as yield**.
भारत ने गाला किस्म को हाल ही में शुरू किया है और यह अभी रंग, स्वाद, रस, आकार तथा उत्पादन के मामले में सर्वोत्तम गुणवत्ता तक नहीं पहुँची है।
- Orchardists in **Kashmir** fear apples from the **West** will enter India at **cheaper prices** and in turn hit **controlled-atmosphere cold storage prices** the most.
कश्मीर के बागवानों को डर है कि पश्चिम से आने वाले सेब कम कीमत पर भारत में आएंगे और इससे कंट्रोल-एटमोस्फियर कोल्ड स्टोरेज कीमतों पर सबसे अधिक असर पड़ेगा।
- With reduced **import duty**, fresh **New Zealand apples** will enter Indian markets at cheaper prices, directly undercutting Indian apples stored in **cold facilities**, says **Izhan Javed**, a senior member of the **J&K Fruits and Vegetables Processing and Integrated Cold Chain Association**.
कम आयात शुल्क के कारण ताजे न्यूजीलैंड सेब भारतीय बाजार में सस्ते दाम पर आएंगे, जिससे कोल्ड स्टोरेज में रखे भारतीय सेब की कीमतें सीधे प्रभावित होंगी, ऐसा जे&के फ्रूट्स एंड वेजिटेबल्स प्रोसेसिंग एंड इंटीग्रेटेड कोल्ड चेन एसोसिएशन के वरिष्ठ सदस्य इज़हान जावेद ने कहा।
- Kashmir stores **397.08 lakh metric tonnes** of apples in **92 cold storages** currently.
कश्मीर में वर्तमान में 92 कोल्ड स्टोरेज में 397.08 लाख मीट्रिक टन सेब संग्रहित हैं।
- Local orchardists in Kashmir have **invested heavily in cold storage infrastructure**.
कश्मीर के स्थानीय बागवानों ने कोल्ड स्टोरेज ढाँचे में भारी निवेश किया है।
- "The **trade deals** threaten to make these investments **economically unviable**, endangering the entire **post-harvest ecosystem** built with public and private capital.
"ये व्यापार समझौते इन निवेशों को आर्थिक रूप से अव्यवहार्य बना सकते हैं और सार्वजनिक तथा निजी पूंजी से बने पूरे कटाई के बाद के तंत्र को खतरे में डाल सकते हैं।
- The trade deal has the potential to destroy **off-season price stability** and push farmers back into **distress sales**," warns Mr. Javed.
यह व्यापार समझौता ऑफ-सीजन मूल्य स्थिरता को नष्ट कर सकता है और किसानों को फिर से मजबूरी में बिक्री की ओर धकेल सकता है," श्री जावेद ने चेतावनी दी।

What are J&K parties demanding? जे&के की पार्टियाँ क्या मांग कर रही हैं?

- J&K parties and traders are urging the **Centre** to relook the deal and ensure **safeguards for apple producers**.
जे&के की पार्टियाँ और व्यापारी केंद्र से समझौते की पुनः समीक्षा करने और सेब उत्पादकों के लिए सुरक्षा उपाय सुनिश्चित करने की मांग कर रहे हैं।
- In J&K, parties are clamouring for a **joint strategy** to pressure the Centre to **exclude apples from the deal**.
जे&के में पार्टियाँ संयुक्त रणनीति बनाकर केंद्र पर सेब को समझौते से बाहर रखने का दबाव बना रही हैं।
- The **Peoples Democratic Party (PDP)** leader and legislator **Waheed-ur-Rehman Parra** has sought an **all-party meeting** "to devise a collective strategy".
पीपुल्स डेमोक्रेटिक पार्टी (PDP) के नेता और विधायक वहीद-उर-रहमान पर्रा ने "सामूहिक रणनीति बनाने" के लिए सर्वदलीय बैठक की मांग की है।
- "Out of **30 lakh kanals** of orchard land, only **30,000 kanals** are under **high-density cultivation**.
"30 लाख कनाल बागवानी भूमि में से केवल 30,000 कनाल ही हाई-डेंसिटी खेती के अंतर्गत है।
- There is a need to have **interest-free loans** for farmers under **Holistic Agriculture Development Programme (HADP)** to compete globally," says Mr. Parra.
वैश्विक प्रतिस्पर्धा के लिए किसानों को होलिस्टिक एग्रीकल्चर डेवलपमेंट प्रोग्राम (HADP) के तहत ब्याज-मुक्त ऋण देने की आवश्यकता है," श्री पर्रा ने कहा।



- The PDP also pitched for the expansion of **cold storage and controlled-atmosphere storage infrastructure** “to prevent distress sales”.
PDP ने कोल्ड स्टोरेज और कंट्रोल-एटमॉस्फियर स्टोरेज ढाँचे के विस्तार की भी मांग की ताकि मजबूरी में बिक्री रोकी जा सके।
- It demanded the activation of **dry port projects in J&K** for the smooth ferrying of apples from the **Valley to the markets outside**.
इसने जे&के में ड्राई पोर्ट परियोजनाओं को सक्रिय करने की मांग की ताकि घाटी से बाहर के बाजारों तक सेब की सुगम ढुलाई हो सके।
- **Chief Minister Omar Abdullah** has also echoed these concerns.
मुख्यमंत्री उमर अब्दुल्ला ने भी इन चिंताओं को दोहराया।
- He said the trade deal will “**spell disaster for the horticulture sector if left unaddressed**”.
उन्होंने कहा कि यह व्यापार समझौता “यदि अनदेखा किया गया तो बागवानी क्षेत्र के लिए विनाशकारी साबित होगा।”
- Mr. Abdullah says time has come to **invest in improving productivity and quality** before the market is **flooded by cheaper apples**.
श्री अब्दुल्ला ने कहा कि बाजार में सस्ते सेबों की बाढ़ आने से पहले उत्पादकता और गुणवत्ता सुधार में निवेश करने का समय आ गया है।
- We don’t know what the benefits will be in the rest of the country, but we are seeing a **loss**, Mr. Abdullah warned.
उन्होंने चेतावनी दी कि देश के बाकी हिस्सों में क्या लाभ होगा यह स्पष्ट नहीं है, लेकिन हम **नुकसान** देख रहे हैं।
- He underlined that the deals have paved an **uneven playing field for local orchardists** and **better-quality imports will dominate the market and the local produce will get devalued**.
उन्होंने कहा कि इन समझौतों ने स्थानीय बागवानों के लिए असमान प्रतिस्पर्धा का मैदान बना दिया है और बेहतर गुणवत्ता वाले आयात बाजार पर हावी होंगे तथा स्थानीय उत्पादन का अवमूल्यन होगा।

Boosting environmentally-friendly growth through inland waterways

With the rapid expansion in cargo movement, passenger services and cruise tourism, the country’s rivers are becoming engines of sustainable mobility and economic opportunity; Inland Waterways Development Council seeks to boost the economic potential of riverine transport

GS III: Economy
Transportation
NEWS ANALYSIS

V. Sajeev Kumar

Aimed at accelerating green mobility, strengthening multi-modal logistics and promoting river-led economic development, the Inland Waterways Development Council (IWDC) unveiled a comprehensive roadmap to expand the country’s inland water transport network, facilitate major infrastructure investments and enhance Centre-State coordination to unlock full economic potential of local river systems.

The IWDC 3.0 meeting, held recently in Kochi, identified projects worth more than ₹1,500 crore; foundation stones were laid for projects worth more than ₹150 crore, including river cruise jetties in Kerala, Gujarat, Karnataka, Odisha and Telangana to expand cruise tourism circuits across the country.

Union Minister of Ports, Shipping and Waterways Sarbananda Sonowal said inland waterways are emerging as a powerful multiplier of green growth, digital transformation and tourism-led development.

With the rapid expansion in cargo movement, passenger services and cruise tourism, the country’s rivers are becoming engines of sustainable mobility and economic



Vast potential: A tourist boat operates through the backwaters off Marine Drive in Kochi.

opportunity.

IWDC is entrusted with the development of inland water transport, cargo movement, and river tourism in the country.

The council seeks to boost the economic potential of riverine transport and enhance infrastructure in a sustainable, eco-friendly manner.

Jetties for North-East

Major new projects worth over ₹900 crore include the development of a slipway facility in Kochi, construction of 110 jetties across Odisha (25) and the North-East (85), and implementation of the National River Traffic and Navigation System (NRTNS) in Maharashtra.

According to officials, the development of 85 jet-



The State emerged as a key focus area at IWDC 3.0 with a series of major announcements to strengthen inland water transport and logistics.

ties with an investment of ₹500 crore will significantly strengthen connectivity, integrate regional logistics and create new livelihood opportunities for riverine communities in the North-East. For Assam, the council has earmarked the ₹70-crore cruise terminal at Uzan Bazar Ghat in Guwahati, and a ₹144-crore road connectivity project for the Bogibeel river port in Dibrugarh on the Brahma-

putra (NW-2). The council also noted the efforts of the Inland Waterways Authority of India (IWAI) to conduct a feasibility study for urban water transport in 18 cities, including Guwahati, Varanasi, Patna, Tezpur and Dibrugarh.

Backwater muscle

Kerala’s vast backwater and canal network was highlighted as a major opportunity for inland waterways development. The State emerged as a key focus area at IWDC 3.0 with a series of major announcements to strengthen inland water transport and logistics. A decision was made to implement the *Jal Vahak* cargo promotion scheme in Kerala, offering reimbursement of up to 35% of the total operating expendi-

ture incurred on cargo movement through inland waterways. The scheme is expected to encourage private sector participation by enabling cargo owners to hire vessels operated by entities other than the government bodies IWAI or Inland and Coastal Shipping Ltd (ICSL), making it particularly attractive for major shipping companies, freight forwarders, trade bodies, and operators handling bulk and containerised cargo. Valid initially for three years, the initiative will help optimise supply chain networks and the commercial viability of water-based logistics.

The meeting highlighted the fact that cargo movement on national waterways increased from 18 million tonne in 2013-14 to

145.84 million tonne in 2024-25, while the number of operational national waterways grew more than tenfold from three to 32. The number of luxury river cruise vessels rose from five to 25, reflecting growing confidence among the industry, investors and State governments. The number of operational terminals has increased from 15 to 25, and floating jetties from 30 to 100.

Fast-track execution

With 111 national waterways spread across 23 States and four Union territories, inland waterways are increasingly supporting initiatives such as Ro-Ro (roll-on, roll-off) vehicle movement and cruise tourism.

IWAI Chairperson Sunil Paliwal said IWDC 3.0 builds on the momentum generated by previous council meetings in Kolkata and Kaziranga (Assam). “It reinforces our resolve to fast-track execution of projects through close coordination with States and the adoption of clean, hybrid and smart digital systems,” he said. The meeting ended with a shared commitment by Centre and states to scale up inland water transport, boosting regional connectivity, promote cleaner transport solutions and position rivers as engines of economic growth. (The writer is with *The Hindu businessline*)



23F. Boosting environmentally-friendly growth through inland waterways आंतरिक जलमार्गों के माध्यम से पर्यावरण-अनुकूल विकास को बढ़ावा

- With the rapid expansion in cargo movement, passenger services and cruise tourism, the country's rivers are becoming engines of **sustainable mobility** and **economic opportunity**; **Inland Waterways Development Council** seeks to boost the economic potential of riverine transport.

कार्गो आवागमन, यात्री सेवाओं और कूज़ पर्यटन के तेज़ विस्तार के साथ, देश की नदियाँ **सतत गतिशीलता** और **आर्थिक अवसर** के इंजन बनती जा रही हैं; **इनलैंड वाटरवेज़ डेवलपमेंट काउंसिल** नदी-आधारित परिवहन की आर्थिक क्षमता बढ़ाने का प्रयास कर रही है।

- Aimed at accelerating **green mobility**, strengthening **multi-modal logistics** and promoting **river-led economic development**, the Inland Waterways Development Council (IWDC) unveiled a comprehensive roadmap to expand the country's inland water transport network, facilitate major infrastructure investments and enhance **Centre-State coordination** to unlock full economic potential of local river systems.

हरित गतिशीलता को तेज़ करने, **मल्टी-मॉडल लॉजिस्टिक्स** को सशक्त बनाने और **नदी-आधारित आर्थिक विकास** को बढ़ावा देने के उद्देश्य से, इनलैंड वाटरवेज़ डेवलपमेंट काउंसिल (IWDC) ने देश के आंतरिक जल परिवहन नेटवर्क के विस्तार, बड़े अवसंरचना निवेश को सुविधाजनक बनाने और स्थानीय नदी प्रणालियों की पूर्ण आर्थिक क्षमता को खोलने के लिए **केंद्र-राज्य समन्वय** बढ़ाने हेतु एक व्यापक रोडमैप प्रस्तुत किया।

- The **IWDC 3.0 meeting**, held recently in **Kochi**, identified projects worth more than **₹1,500 crore**; foundation stones were laid for projects worth more than **₹150 crore**, including river cruise jetties in **Kerala, Gujarat, Karnataka, Odisha and Telangana** to expand cruise tourism circuits across the country.

हाल ही में **कोच्चि** में आयोजित **IWDC 3.0 बैठक** में **₹1,500 करोड़** से अधिक की परियोजनाओं की पहचान की गई; देशभर में कूज़ पर्यटन सर्किट के विस्तार के लिए **केरल, गुजरात, कर्नाटक, ओडिशा और तेलंगाना** में नदी कूज़ जेट्टियों सहित **₹150 करोड़** से अधिक की परियोजनाओं के शिलान्यास किए गए।

- Union Minister of **Ports, Shipping and Waterways Sarbananda Sonowal** said inland waterways are emerging as a powerful multiplier of **green growth, digital transformation** and **tourism-led development**.

केंद्रीय पत्तन, पोत परिवहन और जलमार्ग मंत्री **सर्बानंद सोनोवाल** ने कहा कि आंतरिक जलमार्ग **हरित विकास, डिजिटल परिवर्तन और पर्यटन-आधारित विकास** के एक शक्तिशाली गुणक के रूप में उभर रहे हैं।

- With the rapid expansion in cargo movement, passenger services and cruise tourism, the country's rivers are becoming engines of **sustainable mobility** and **economic opportunity**. कार्गो आवागमन, यात्री सेवाओं और कूज़ पर्यटन के तेज़ विस्तार के साथ, देश की नदियाँ **सतत गतिशीलता** और **आर्थिक अवसर** के इंजन बनती जा रही हैं।

- IWDC is entrusted with the development of inland water transport, cargo movement, and river tourism in the country.

IWDC को देश में आंतरिक जल परिवहन, कार्गो आवागमन और नदी पर्यटन के विकास की ज़िम्मेदारी सौंपी गई है।

- The council seeks to boost the **economic potential** of riverine transport and enhance infrastructure in a **sustainable, eco-friendly** manner.

परिषद नदी-आधारित परिवहन की **आर्थिक क्षमता** बढ़ाने और **सतत, पर्यावरण-अनुकूल** तरीके से अवसंरचना को सुदृढ़ करने का प्रयास कर रही है।

Jetties for North-East पूर्वोत्तर के लिए जेट्टियाँ

- Major new projects worth over **₹900 crore** include the development of a **slipway facility** in Kochi, construction of **110 jetties** across **Odisha (25)** and the **North-East (85)**, and implementation of the **National River Traffic and Navigation System (NRTNS)** in **Maharashtra**.



₹900 करोड़ से अधिक की प्रमुख नई परियोजनाओं में कोच्चि में स्लिपवे सुविधा का विकास, ओडिशा (25) और पूर्वोत्तर (85) में 110 जेट्टियों का निर्माण तथा महाराष्ट्र में नेशनल रिवर ट्रैफिक एंड नेविगेशन सिस्टम (NRTNS) का कार्यान्वयन शामिल है।

- According to officials, the development of **85 jetties** with an investment of **₹500 crore** will significantly strengthen connectivity, integrate **regional logistics** and create new **livelihood opportunities** for riverine communities in the **North-East**.
अधिकारियों के अनुसार, ₹500 करोड़ के निवेश से 85 जेट्टियों का विकास संपर्कता को काफ़ी मज़बूत करेगा, क्षेत्रीय लॉजिस्टिक्स का एकीकरण करेगा और पूर्वोत्तर की नदी-आधारित समुदायों के लिए नए रोज़गार अवसर पैदा करेगा।
- For **Assam**, the council has earmarked the **₹70-crore cruise terminal at Uzan Bazar Ghat in Guwahati**, and a **₹144-crore road connectivity project** for the **Bogibeel river port in Dibrugarh** on the **Brahmaputra (NW-2)**.
असम के लिए, परिषद ने गुवाहाटी के उजान बाज़ार घाट पर ₹70 करोड़ के कूज़ टर्मिनल और ब्रह्मपुत्र (NW-2) पर डिब्रूगढ़ के बोगीबील नदी बंदरगाह के लिए ₹144 करोड़ की सड़क संपर्क परियोजना निर्धारित की है।
- The council also noted the efforts of the **Inland Waterways Authority of India (IWAI)** to conduct a **feasibility study** for **urban water transport** in **18 cities**, including **Guwahati, Varanasi, Patna, Tezpur and Dibrugarh**.
परिषद ने इनलैंड वाटरवेज़ अथॉरिटी ऑफ़ इंडिया (IWAI) के 18 शहरों—जिसमें गुवाहाटी, वाराणसी, पटना, तेज़पुर और डिब्रूगढ़ शामिल हैं—में शहरी जल परिवहन के लिए व्यवहार्यता अध्ययन करने के प्रयासों का भी उल्लेख किया।

Backwater muscle बैकवॉटर की ताकत

- **Kerala's vast backwater and canal network** was highlighted as a major opportunity for inland waterways development.
केरल के विशाल बैकवॉटर और नहर नेटवर्क को आंतरिक जलमार्ग विकास के लिए एक बड़ा अवसर बताया गया।
- The State emerged as a key focus area at **IWDC 3.0** with a series of major announcements to strengthen inland water transport and logistics.
IWDC 3.0 में राज्य आंतरिक जल परिवहन और लॉजिस्टिक्स को सुदृढ़ करने के लिए प्रमुख घोषणाओं के साथ एक मुख्य फोकस क्षेत्र के रूप में उभरा।
- A decision was made to implement the **Jal Vahak cargo promotion scheme** in **Kerala**, offering reimbursement of up to **35%** of the total operating expenditure incurred on cargo movement through inland waterways.
केरल में जल वाहक कार्गो प्रोत्साहन योजना लागू करने का निर्णय लिया गया, जिसके तहत आंतरिक जलमार्गों से कार्गो आवागमन पर होने वाले कुल परिचालन व्यय का 35% तक प्रतिपूर्ति दी जाएगी।
- The scheme is expected to encourage **private sector participation** by enabling cargo owners to hire vessels operated by entities other than the government bodies **IWAI** or **Inland and Coastal Shipping Ltd (ICSL)**, making it particularly attractive for **major shipping companies, freight forwarders, trade bodies**, and operators handling **bulk and containerised cargo**.
यह योजना निजी क्षेत्र की भागीदारी को बढ़ावा देगी, क्योंकि इससे कार्गो मालिक IWAI या इनलैंड एंड कोस्टल शिपिंग लिमिटेड (ICSL) के अलावा अन्य संस्थाओं द्वारा संचालित जहाज़ किराए पर ले सकेंगे, जिससे यह प्रमुख शिपिंग कंपनियों, फ्रेट फ़ॉरवर्डर्स, व्यापार संगठनों और थोक व कंटेनरीकृत कार्गो संभालने वाले ऑपरेटरों के लिए विशेष रूप से आकर्षक बनेगी।
- Valid initially for **three years**, the initiative will help optimize **supply chain networks** and the **commercial viability** of water-based logistics.
प्रारंभ में तीन वर्षों के लिए मान्य यह पहल सप्लाई चेन नेटवर्क को अनुकूलित करने और जल-आधारित लॉजिस्टिक्स की व्यावसायिक व्यवहार्यता बढ़ाने में मदद करेगी।
- The meeting highlighted the fact that cargo movement on **national waterways** increased from **18 million tonnes** in **2013-14** to **145.84 million tonnes** in **2024-25**, while the number of operational national waterways grew more than tenfold from **three to 32**.
बैठक में बताया गया कि राष्ट्रीय जलमार्गों पर कार्गो आवागमन 2013-14 में 18 मिलियन टन से बढ़कर



2024-25 में 145.84 मिलियन टन हो गया, जबकि परिचालन में राष्ट्रीय जलमार्गों की संख्या तीन से बढ़कर 32 हो गई।

- The number of **luxury river cruise vessels** rose from **five to 25**, reflecting growing confidence among the **industry, investors and State governments**.
लक्जरी नदी क्रूज़ जहाज़ों की संख्या पाँच से बढ़कर 25 हो गई, जो उद्योग, निवेशकों और राज्य सरकारों के बढ़ते भरोसे को दर्शाती है।
- The number of operational **terminals** has increased from **15 to 25**, and **floating jetties** from **30 to 100**.
परिचालन टर्मिनलों की संख्या 15 से बढ़कर 25 और फ़्लोटिंग जेटियों की संख्या 30 से बढ़कर 100 हो गई है।

Fast-track execution तेज़-तरार क्रियान्वयन

- With **111 national waterways** spread across **23 States** and **four Union territories**, inland waterways are increasingly supporting initiatives such as **Ro-Ro (roll-on, roll-off) vehicle movement and cruise tourism**.
23 राज्यों और चार केंद्र शासित प्रदेशों में फैले 111 राष्ट्रीय जलमार्गों के साथ, आंतरिक जलमार्ग Ro-Ro (रोल-ऑन, रोल-ऑफ़) वाहन आवागमन और क्रूज़ पर्यटन जैसी पहलों का बढ़ता समर्थन कर रहे हैं।
- IWAI Chairperson Sunil Paliwal** said **IWDC 3.0** builds on the momentum generated by previous council meetings in **Kolkata and Kaziranga (Assam)**.
IWAI के अध्यक्ष सुनील पालिवाल ने कहा कि **IWDC 3.0**, कोलकाता और काज़ीरंगा (असम) में हुई पूर्व परिषद बैठकों से बने momentum पर आगे बढ़ता है।
- "It reinforces our resolve to **fast-track execution** of projects through close coordination with States and the adoption of **clean, hybrid and smart digital systems**," he said.
उन्होंने कहा, "यह राज्यों के साथ घनिष्ठ समन्वय और **स्वच्छ, हाइब्रिड तथा स्मार्ट डिजिटल प्रणालियों** को अपनाकर परियोजनाओं के तेज़ क्रियान्वयन के हमारे संकल्प को मज़बूत करता है।"
- The meeting ended with a shared commitment by **Centre and States** to scale up **inland water transport**, boosting **regional connectivity**, promote **cleaner transport solutions** and position **rivers as engines of economic growth**.
बैठक का समापन **केंद्र और राज्यों** की साझा प्रतिबद्धता के साथ हुआ—आंतरिक जल परिवहन का विस्तार, क्षेत्रीय संपर्कता को बढ़ावा, **स्वच्छ परिवहन समाधानों** को प्रोत्साहन और **नदियों को आर्थिक विकास के इंजन** के रूप में स्थापित करना।

GS Paper III: S&T,	
TOPICS COVERED	23 February 2026
23F	AI Impact Summit is a 'turning point' in use of tech: Modi AI इम्पैक्ट समिट तकनीक के उपयोग में 'मोड़ बिंदु': मोदी
23F	How proteins are being tweaked to be quantum sensors inside the body शरीर के अंदर क्वांटम सेंसर बनने के लिए प्रोटीन को कैसे बदला जा रहा है
23F	Why does wildfire smoke swirl only one way in the air? जंगल की आग का धुआँ हवा में केवल एक ही दिशा में क्यों घूमता है?
23F	India's leap, from back office to global brain trust भारत की छलांग, बैक ऑफिस से वैश्विक मस्तिष्क केंद्र तक
23F	AI and the brain: similar in scale, different in design एआई और मस्तिष्क: पैमाने में समान, डिजाइन में अलग
23F	QUIZ
23F	Behind scenes, quiet threshold moments at AI Impact Summit AI इम्पैक्ट समिट में परदे के पीछे, शांत लेकिन निर्णायक क्षण
23F	In manifesto, scientists oppose 'militarisation' of research into quantum science



घोषणापत्र में वैज्ञानिकों ने क्वांटम विज्ञान अनुसंधान के 'सैन्यीकरण' का विरोध किया

BIG SHOT



A closeup of a small section of the Helix Nebula, an expanding shell of gas and dust, by the James Webb Space Telescope. Winds of hot gas stream upwards from the bottom, like a thin liquid blown up a sheet of glass. NASA, ESA, CSA, STScI

A closeup of a small section of the Helix Nebula, an expanding shell of gas and dust, by the James Webb Space Telescope. Winds of hot gas stream upwards from the bottom, like a thin liquid blown up a sheet of glass.

AI Impact Summit is a 'turning point' in use of tech: Modi

GS III: S&T

The Hindu Bureau
NEW DELHI

The India AI Impact Summit "proved to be a turning point in the trajectory of how the world will utilise the power of AI in the future", Prime Minister Narendra Modi said on Sunday, adding that global leaders were impressed by India's progress in the domain.

In his *Mann ki Baat* address, Mr. Modi — who met global leaders and tech CEOs and showed them India's innovations — said leaders from many countries and industries, innovators, and people from the start-up sector came together at the summit.

Eighty-five countries and three international organisations signed the New Delhi Declaration. "Guided by the principle of 'Sarvajana Hitaya, Sarvajana Sukhaya' [Welfare for all, Happiness for all], the Declaration underscores that the benefits of AI must be equitably shared across humanity," the government had said.

'Impressed by exhibits'
Mr. Modi said world leaders were impressed by two exhibits. The first one showed how use of AI helped people in the treatment of animals, and how farmers tracked their livestock with 24x7 assistance.

The second product was related to Indian culture and heritage. Mr. Modi said leaders were amazed at how with the help of AI, India is preserving ancient texts, knowledge, manuscripts and adapting them in accordance with today's generation.

The AI summit, which ended in Delhi on Friday, attracted five lakh visitors.

Mr. Modi urged people to remain vigilant against online financial fraud and digital arrests. He appealed for complete KYC compliance saying it is crucial for the safety of an individual's bank account.

Highlighting the significance of organ donation,

Lutyens's statue to be replaced by Rajagopalachari's

NEW DELHI

Ahead of the 'Rajaji Utsav' celebration on Monday, Prime Minister Narendra Modi said on Sunday that a statue of British architect Edwin Lutyens in Rashtrapati Bhavan will be replaced by that of C. Rajagopalachari, the first Indian Governor-General of independent India.

Mr. Modi noted how 10-month-old Aalin Sherin Abraham from Kerala saved lives even in death. "Even amid such profound pain, Aalin's father Arun Abraham and mother Sherin decided to donate Aalin's organs. This decision reveals the expanse of their thinking and the magnitude of their personality... Aalin is no longer with us, but her name has joined the ranks of the nation's youngest organ donors," he said.

Hails farmers

In the backdrop of the opposition's allegations that the India had compromised the interests of farmers during trade negotiations with the U.S., he said farmers were not just food providers, but true "devotees" of the earth. He highlighted how farmers are blending tradition with technology and cited the example of Hirod Patel in Odisha who has installed a mesh over a pond and is growing vegetables on it. He said in Kerala's Thrissur, 570 varieties of rice are grown in a single field.

"Today, India has become the world's largest rice producer... agricultural products are now reaching foreign countries more easily by air," he said.

The Prime Minister also addressed students who are appearing for examinations and greeted people on Ramzan and the upcoming Holi festival. He urged them to buy made-in-India products.

23F. AI Impact Summit is a 'turning point' in use of tech: Modi

AI इम्पैक्ट समिट तकनीक के उपयोग में 'मोड़ बिंदु': मोदी

- The India AI Impact Summit "proved to be a turning point in the trajectory of how the world will utilise the power of AI in the future", Prime Minister Narendra Modi said on Sunday, adding that global leaders were impressed by India's progress in the domain.

इंडिया AI इम्पैक्ट समिट ने भविष्य में दुनिया AI की शक्ति का कैसे उपयोग करेगी, इस दिशा में एक मोड़ बिंदु साबित किया, प्रधानमंत्री नरेंद्र मोदी ने रविवार को कहा, और जोड़ा कि वैश्विक नेता इस क्षेत्र में भारत की प्रगति से प्रभावित हुए हैं।

- In his *Mann ki Baat* address, Mr. Modi — who met global leaders and tech CEOs and showed them India's innovations — said leaders from many countries and industries, innovators, and people from the start-up sector came together at the summit.

अपने मन की बात संबोधन में श्री मोदी — जिन्होंने वैश्विक नेताओं और टेक सीईओ से मुलाकात की और उन्हें भारत के नवाचार दिखाए — ने कहा कि कई देशों और उद्योगों के नेता, नवोन्मेषक और स्टार्ट-अप क्षेत्र से जुड़े लोग इस समिट में एकत्र हुए।

- Eighty-five countries and three international organisations signed the New Delhi Declaration.

पचासी देशों और तीन अंतरराष्ट्रीय संगठनों ने नई दिल्ली घोषणा पर हस्ताक्षर किए।

- "Guided by the principle of 'Sarvajana Hitaya, Sarvajana Sukhaya' [Welfare for all, Happiness for all], the Declaration underscores that the benefits of AI must be equitably shared across humanity," the government had said.

सरकार ने कहा कि 'सर्वजन हिताय, सर्वजन सुखाय' [सबका कल्याण, सबका सुख] के सिद्धांत से प्रेरित यह घोषणा इस बात पर ज़ोर देती है कि AI के लाभ पूरे मानव समाज में समान रूप से साझा किए जाने चाहिए।

'Impressed by exhibits' 'प्रदर्शनों से प्रभावित'



- Mr. Modi said world leaders were impressed by **two exhibits**.
श्री मोदी ने कहा कि विश्व नेता **दो प्रदर्शनों** से प्रभावित हुए।
- The first one showed how use of **AI** helped people in the **treatment of animals**, and how **farmers** tracked their **livestock** with **24x7 assistance**.
पहले प्रदर्शन में दिखाया गया कि **AI** का उपयोग **पशुओं के उपचार** में लोगों की कैसे मदद करता है और **किसान 24x7 सहायता** के साथ अपने **पशुधन** की निगरानी कैसे करते हैं।
- The second product was related to **Indian culture and heritage**.
दूसरा उत्पाद **भारतीय संस्कृति और विरासत** से संबंधित था।
- Mr. Modi said leaders were amazed at how with the help of **AI**, India is preserving **ancient texts, knowledge, manuscripts** and adapting them in accordance with today's generation.
श्री मोदी ने कहा कि नेता इस बात से चकित थे कि **AI** की मदद से भारत **प्राचीन ग्रंथों, ज्ञान और पांडुलिपियों** को संरक्षित कर रहा है और उन्हें आज की पीढ़ी के अनुसार ढाल रहा है।
- The **AI summit**, which ended in **Delhi** on Friday, attracted **five lakh visitors**.
दिल्ली में शुक्रवार को समाप्त हुए **AI समिट** में **पाँच लाख आगंतुक** आए।
- Mr. Modi urged people to remain vigilant against **online financial fraud and digital arrests**.
श्री मोदी ने लोगों से **ऑनलाइन वित्तीय धोखाधड़ी** और **डिजिटल गिरफ्तारी** के खिलाफ सतर्क रहने का आग्रह किया।
- He appealed for complete **KYC compliance** saying it is crucial for the **safety of an individual's bank account**.
उन्होंने पूर्ण **KYC अनुपालन** की अपील करते हुए कहा कि यह किसी व्यक्ति के **बैंक खाते की सुरक्षा** के लिए अत्यंत आवश्यक है।
- Highlighting the **significance of organ donation**, Mr. Modi noted how **10-month-old Aalin Sherin Abraham** from **Kerala** saved lives even in death.
अंगदान के महत्व को रेखांकित करते हुए श्री मोदी ने बताया कि **केरल** की **10 महीने की एलिन शेरिन अब्राहम** ने मृत्यु के बाद भी कई ज़िंदगियाँ बचाईं।
- "Even amid such profound pain, **Aalin's father Arun Abraham and mother Sherin** decided to donate Aalin's organs.
"इतने गहरे दुख के बीच भी **एलिन के पिता अरुण अब्राहम और माता शेरिन** ने एलिन के अंग दान करने का निर्णय लिया।
- This decision reveals the expanse of their thinking and the magnitude of their personality...
यह निर्णय उनकी सोच की व्यापकता और उनके व्यक्तित्व की महानता को दर्शाता है...
- Aalin is no longer with us, but her name has joined the ranks of the nation's **youngest organ donors**," he said.
एलिन अब हमारे बीच नहीं है, लेकिन उसका नाम देश के **सबसे कम उम्र के अंगदाताओं** की सूची में शामिल हो गया है," उन्होंने कहा।

Hails farmers किसानों की सराहना

- In the backdrop of the Opposition's allegations that India had compromised the interests of **farmers** during trade negotiations with the **U.S.**, he said farmers were not just food providers, but true **"devotees"** of the earth.
अमेरिका के साथ व्यापार वार्ताओं के दौरान **किसानों** के हितों से समझौता करने के विपक्ष के आरोपों की पृष्ठभूमि में उन्होंने कहा कि किसान केवल अन्नदाता नहीं, बल्कि धरती के सच्चे **"भक्त"** हैं।
- He highlighted how farmers are blending **tradition with technology** and cited the example of **Hirod Patel in Odisha** who has installed a **mesh over a pond** and is growing **vegetables** on it.
उन्होंने बताया कि किसान कैसे **परंपरा और तकनीक** का मेल कर रहे हैं और **ओडिशा के हीरोद पटेल** का उदाहरण दिया, जिन्होंने **तालाब पर जाल** लगाकर उस पर **सब्जियाँ** उगाई हैं।
- He said in **Kerala's Thrissur**, **570 varieties of rice** are grown in a **single field**.
उन्होंने कहा कि **केरल के त्रिशूर** में **एक ही खेत** में **चावल की 570 किस्में** उगाई जाती हैं।
- "Today, India has become the world's **largest rice producer**... agricultural products are now reaching **foreign countries** more easily by **air**," he said.
"आज भारत दुनिया का **सबसे बड़ा चावल उत्पादक** बन गया है... कृषि उत्पाद अब **हवाई मार्ग** से अधिक आसानी से **विदेशी देशों** तक पहुँच रहे हैं," उन्होंने कहा।



- The Prime Minister also addressed **students** who are appearing for **examinations** and greeted people on **Ramzan** and the upcoming **Holi festival**.
प्रधानमंत्री ने **परीक्षाओं** में शामिल होने वाले **छात्रों** को भी संबोधित किया और **रमज़ान** तथा आगामी **होली पर्व** की शुभकामनाएँ दीं।
- He urged them to buy **made-in-India products**.
उन्होंने लोगों से **मेड-इन-इंडिया उत्पाद** खरीदने का आग्रह किया।

How proteins are being tweaked to be quantum sensors inside the body

Most existing quantum sensors are made from solid materials such as diamond, which are difficult to place inside cells; however, cells can produce proteins naturally, with the correct genetic instructions, and they can also be fused to other proteins, allowing researchers to position them at precise locations inside a body

ISS III: S&T
Manjeera Gowravaram

For decades, fluorescent proteins have been among the most powerful tools in biology. They glow when illuminated, allowing scientists to see where molecules are inside cells and how they move. From tracking cancer cells to mapping neural circuits, these luminous markers transformed the life sciences, work recognised with a Nobel Prize in 2008.

Now, two major studies published in *Nature* suggest that fluorescent proteins can do more than glow. Certain fluorescent proteins can be modified to detect magnetic fields and radio waves from inside living cells. In effect they behave as quantum sensors, devices whose operation depends on the behaviour of electrons at the smallest scales.

Until recently, quantum technologies were confined to ultra-cold laboratories filled with specialised equipment. Biology by contrast has been viewed as an unlikely home for quantum effects. Living cells are warm, crowded, and constantly in motion – conditions thought to destroy fragile quantum states.

The new results challenge that assumption, opening a path towards genetically encoded quantum sensors and a new class of hybrid quantum-biological technologies.

Hidden sensitivity
When a fluorescent protein absorbs light, one of its electrons is pushed into a higher-energy state. Usually, the electron quickly returns to its original state and releases energy as light. That simple process is what makes the protein glow.

In some proteins, however, this journey is more complicated. The excited electron can briefly interact with a nearby molecule inside the protein, forming what scientists call a radical pair, two molecules that each carry an unpaired electron.

For a short time, the spins of these electrons are linked. The outcome of their interaction depends on weak magnetic influences around them. Even weak magnetic fields can change how the pair behaves, which in turn alters how much light the protein emits.

Chemists have known about this effect for decades, and it has been proposed as a possible explanation for how some animals sense Earth's magnetic field. What had been missing was a way to reliably harness this phenomenon inside living cells.

Protein sensors
Researchers at the University of Chicago's

Pritzker School of Molecular Engineering focused on a variant of enhanced yellow fluorescent protein (EYFP), a close relative of green fluorescent protein. They discovered that EYFP possesses a metastable triplet state – a temporary electronic configuration in which an electron's magnetic spin can be isolated and controlled.

Using carefully timed laser pulses, the team initialised the spin state of EYFP, manipulated it with microwave fields, and read it out optically, completing the full sequence required of a qubit.

They also detected optically driven magnetic resonance signals from EYFP inside living cells. These effects appeared in human kidney cells at low temperature and in *Escherichia coli* bacteria even at room temperature, showing that the protein's quantum behaviour survives in biology's noisy environment.

A second research group at the University of Oxford took a different approach. Working with a plant light-sensing protein, they used genetic engineering to create a family of magneto-sensitive fluorescent proteins called MagLOV. Through repeated rounds of mutation and selection, they produced versions with stronger and more stable magnetic responses.

The researchers showed that MagLOV

The studies demonstrate that proteins can be programmed through DNA to act as quantum sensors and point to a future in which these sensors reshape how scientists probe living systems enabling nanoscale measurements

proteins exhibit optically detected magnetic resonance in living bacterial cells at room temperature. In other words, radio waves at specific frequencies can predictably change fluorescence, directly revealing electron-spin behaviour.

Historically, biological candidates for quantum sensors were limited to purified, in-vitro systems, showed weak responses, or degraded quickly under light exposure. The engineered MagLOV proteins overcome many of these obstacles by combining stability, sensitivity, and genetic compatibility. Together, the studies demonstrate that proteins can be programmed through DNA to act as quantum sensors.

Why inside cells matters

Most existing quantum sensors are made from solid materials such as diamond. These devices can be extraordinarily sensitive, but they are difficult to place inside cells or attach to specific biological targets.

Protein sensors are fundamentally different. Cells can produce them naturally once given the correct genetic instructions. The sensors can also be fused to other proteins, allowing researchers to position them at precise locations inside the cell.

This matters because many crucial biological processes involve subtle magnetic or electronic effects, including enzyme reactions with metal atoms, formation of short-lived free radicals, and electron transfer during respiration and photosynthesis.

Until now, studying these phenomena inside living cells has been nearly impossible. Protein-based quantum sensors offer a potential solution.

More than detection

The MagLOV researchers also showed that magnetic modulation can improve conventional fluorescence imaging. By switching a magnetic field on and off, they separated the MagLOV signal from background fluorescence and cellular autofluorescence. This technique, known as lock-in detection, enhances weak signals in noisy environments.

They further demonstrated a form of spatial localization based on magnetic resonance. Using magnetic field gradients, they could determine the position of MagLOV-expressing cells within a three-dimensional sample, even when light scattering would normally blur the image.

The approach resembles some principles of magnetic resonance imaging (MRI), but uses genetically encoded fluorescent proteins as the signal source.

New ways of seeing

These studies point to a future in which genetically encodable quantum sensors reshape how scientists probe living systems. As sensitivities improve, protein-based qubits and magnetic-resonance probes could enable nanoscale measurements of magnetic fields, electric fields, temperature, and chemical environments directly inside cells.

Such sensors might track protein shape changes, monitor biochemical reactions in real time, or reveal how drugs bind to their targets with unprecedented precision.

Important challenges remain, though. Protein-based quantum sensors are currently less sensitive than solid-state devices, coherence times are shorter, and photobleaching remains a concern. Yet fluorescent proteins themselves took decades to become routine tools, and similar improvement could steadily close the gap.

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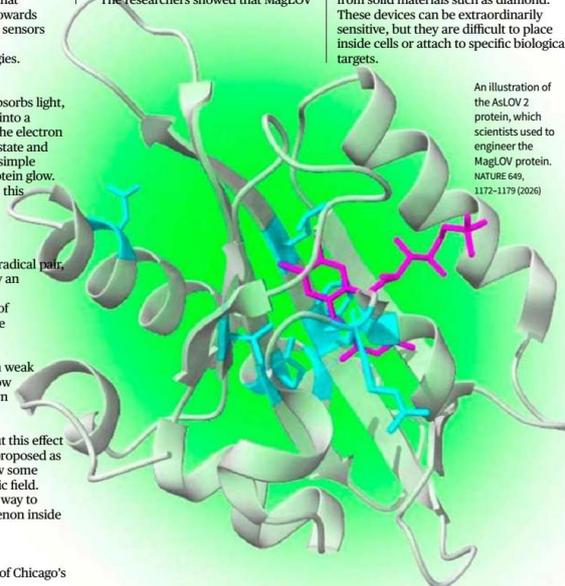
THE GIST

Two major studies published in *Nature* suggest that fluorescent proteins can detect magnetic fields and radio waves from inside living cells. In effect they behave as quantum sensors

The new results open a path towards genetically encoded quantum sensors and a new class of hybrid quantum-biological technologies

Scientists found that genetically encoded proteins could be sensors in *Escherichia coli* bacteria even at room temperature, showing that their quantum behaviour could survive a noisy environment

Such sensors might track protein shape changes, monitor biochemical reactions in real time, or reveal how drugs bind to their targets with unprecedented precision



23F. How proteins are being tweaked to be quantum sensors inside the body शरीर के अंदर क्वांटम सेंसर बनने के लिए प्रोटीन को कैसे बदला जा रहा है

- Most existing **quantum sensors** are made from **solid materials** such as **diamond**, which are **difficult to place inside cells**.; however, cells can produce **proteins** naturally, with the correct **genetic instructions**, and they can also be **fused** to other proteins, allowing researchers to



position them at **precise locations** inside a **body**

अधिकांश मौजूदा **क्वांटम सेंसर ठोस पदार्थों** जैसे **हीरा** से बने होते हैं, जिन्हें **कोशिकाओं** के अंदर रखना **कठिन** होता है। हालांकि, कोशिकाएं सही **आनुवंशिक निर्देशों** के साथ स्वाभाविक रूप से **प्रोटीन** बना सकती हैं, और उन्हें अन्य प्रोटीन के साथ **जोड़** भी सकती हैं, जिससे शोधकर्ताओं को उन्हें **सटीक स्थानों** पर **शरीर** के अंदर स्थापित करने की अनुमति मिलती है।

- For **decades, fluorescent proteins have been among the most powerful tools in biology.** दशकों से, **फ्लोरोसेंट प्रोटीन जीवविज्ञान** के सबसे **शक्तिशाली उपकरणों** में रहे हैं।

- They **glow** when illuminated, allowing **scientists** to see where **molecules** are inside **cells** and how they move.

वे प्रकाश पड़ने पर **चमकते** हैं, जिससे **वैज्ञानिकों** को यह देखने में मदद मिलती है कि **कोशिकाओं** के अंदर **अणु** कहाँ हैं और कैसे चलते हैं।

- **From tracking cancer cells to mapping neural circuits, these luminous markers transformed the life sciences,** work recognised with a **Nobel Prize in 2008.**

कैंसर कोशिकाओं को ट्रैक करने से लेकर **न्यूरल सर्किट्स का मानचित्रण** करने तक, इन प्रकाशमान **मार्करों** ने **जीवन विज्ञान** को बदल दिया, और इस कार्य को **2008 में नोबेल पुरस्कार** से सम्मानित किया गया।

- Now, two major studies published in **Nature** suggest that **fluorescent proteins** can do more than **glow.**

अब **Nature** में प्रकाशित दो प्रमुख अध्ययनों से पता चलता है कि **फ्लोरोसेंट प्रोटीन** केवल **चमकने** से अधिक कार्य कर सकते हैं।

- **Certain fluorescent proteins can be modified to detect magnetic fields and radio waves from inside living cells.**

कुछ **फ्लोरोसेंट प्रोटीन** को **संशोधित** करके **जीवित कोशिकाओं** के अंदर से **चुंबकीय क्षेत्र** और **रेडियो तरंगों** का पता लगाया जा सकता है।

- **In effect they behave as quantum sensors, devices whose operation depends on the behaviour of electrons at the smallest scales.**

वास्तव में वे **क्वांटम सेंसर** की तरह कार्य करते हैं, ऐसे उपकरण जिनका संचालन **इलेक्ट्रॉनों** के **सबसे छोटे स्तर** पर व्यवहार पर निर्भर करता है।

- **When a fluorescent protein absorbs light, one of its electrons is pushed into a higher-energy state.**

जब एक **फ्लोरोसेंट प्रोटीन प्रकाश** को अवशोषित करता है, तो उसका एक **इलेक्ट्रॉन उच्च-ऊर्जा अवस्था** में चला जाता है।

- Usually, the **electron quickly returns to its original state and releases energy as light.**

सामान्यतः **इलेक्ट्रॉन** जल्दी अपनी मूल अवस्था में लौट आता है और **प्रकाश के रूप में ऊर्जा** छोड़ता है।

- **That simple process is what makes the protein glow.**

यही सरल प्रक्रिया **प्रोटीन को चमकदार** बनाती है।

- These **effects** appeared in **human kidney cells at low temperature** and in **Escherichia coli bacteria** even at **room temperature**, showing that the **protein's quantum behaviour survives in biology's noisy environment.**

ये **प्रभाव कम तापमान पर मानव किडनी कोशिकाओं** में और **कमरे के तापमान पर भी**

Escherichia coli बैक्टीरिया में दिखाई दिए, जिससे पता चलता है कि प्रोटीन का **क्वांटम व्यवहार** जीवविज्ञान के **शोरयुक्त वातावरण** में भी बना रहता है।

Smoke vortex

IGS III: S&T



Q: Why does wildfire smoke swirl only one way in the air?

A: Sometimes wildfire smoke in the stratosphere collects into a compact bubble

of smoke that spins in a coherent vortex, clockwise in the northern hemisphere and counter-clockwise in the southern hemisphere.

Two new studies, published in *Weather and Climate Dynamics* and presented at a recent meeting of the American Meteorological Society, have found why. The smoke particles absorb sunlight and warm the air around them. That makes the air buoyant, and it rises through the smoky core, pushing the clump of smoke particles up over time.

Earth's atmosphere is rotating and has many layers. If you warmed one patch of stratospheric air and kept the warming at the same height, the air just above will start swirling one way and the air just below, the other way.

Because the smoke particles are rising, the heating pattern also moves up with the smoke. This matters because the atmosphere's 'push' to make the air rotate also moves upwards. As the warm core passes through a layer, it will briefly nudge the air into rotating one way. Once it has moved on, the later push in that same layer will undo much of the earlier



Wildfire smoke in the northeast Pacific Ocean, September 2020. NASA

change. As a result the most coherent rotation is wrapped around the smoke bubble itself, like a collar that travels upwards with it.

The rotating bubble also acts like a container, keeping the warmer smoke concentrated near its centre, rather than mixing with the surroundings, and allowing it to keep rising.

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



23F. Why does wildfire smoke swirl only one way in the air? जंगल की आग का धुआँ हवा में केवल एक ही दिशा में क्यों घूमता है?

- Sometimes **wildfire smoke** in the **stratosphere** collects into a **compact bubble of smoke** that spins in a **coherent vortex**, **clockwise** in the **northern hemisphere** and **counter-clockwise** in the **southern hemisphere**.
कभी-कभी **समताप मंडल** में **जंगल की आग का धुआँ** एक **सघन धुँ के बुलबुले** में इकट्ठा हो जाता है जो **सुसंगत भंवर** में घूमता है, **उत्तरी गोलार्ध** में **घड़ी की दिशा** में और **दक्षिणी गोलार्ध** में **घड़ी की विपरीत दिशा** में।
- Two new studies, published in **Weather and Climate Dynamics** and presented at a recent meeting of the **American Meteorological Society**, have found why.
Weather and Climate Dynamics में प्रकाशित और **American Meteorological Society** की हाल की बैठक में प्रस्तुत दो नए अध्ययनों ने इसका कारण बताया है।
- The **smoke particles** absorb **sunlight** and warm the **air** around them.
धुँ के कण सूर्य प्रकाश को अवशोषित करते हैं और अपने आसपास की **हवा** को गर्म कर देते हैं।
- That makes the **air buoyant**, and it **rises** through the **smoky core**, pushing the **clump of smoke particles** up over time.
इससे **हवा हल्की** हो जाती है और **धुँ के केंद्र** से होकर **ऊपर उठती** है, जिससे **धुँ के कणों का समूह** समय के साथ **ऊपर** की ओर धकेलता है।
- **Earth's atmosphere** is **rotating** and has many **layers**.
पृथ्वी का वायुमंडल घूम रहा है और इसकी कई **परतें** हैं।
- If you warmed one **patch of stratospheric air** and kept the warming at the same **height**, the **air just above** will start **swirling one way** and the **air just below**, the **other way**.
यदि आप **समताप मंडल की हवा** के एक **भाग** को गर्म करें और गर्मी को उसी **ऊँचाई** पर बनाए रखें, तो **ऊपर की हवा** एक दिशा में और **नीचे की हवा** दूसरी दिशा में **घूमने** लगेगी।
- Because the **smoke particles** are **rising**, the **heating pattern** also moves **up** with the **smoke**.
क्योंकि **धुँ के कण ऊपर उठ रहे** हैं, इसलिए **गर्मी का पैटर्न** भी **धुँ के साथ ऊपर** की ओर बढ़ता है।
- This matters because the **atmosphere's 'push'** to make the **air rotate** also moves **upwards**.
यह महत्वपूर्ण है क्योंकि **हवा को घुमाने** के लिए **वायुमंडल का 'धक्का'** भी **ऊपर की ओर** बढ़ता है।
- As the **warm core** passes through a **layer**, it will briefly **nudge the air** into **rotating one way**.
जब **गर्म केंद्र** किसी **परत** से गुजरता है, तो वह थोड़े समय के लिए **हवा को** एक दिशा में **घूमने** के लिए प्रेरित करता है।
- Once it has **moved on**, the later **push** in that same **layer** will **undo much** of the earlier **change**.
एक बार जब वह **आगे बढ़ जाता** है, तो उसी **परत** में बाद का **धक्का** पहले हुए **परिवर्तन** का अधिकांश **प्रभाव समाप्त** कर देता है।
- As a result the most **coherent rotation** is wrapped around the **smoke bubble** itself, like a **collar** that travels **upwards** with it.
परिणामस्वरूप सबसे **सुसंगत घूर्णन** स्वयं **धुँ के बुलबुले** के चारों ओर लिपटा रहता है, जैसे एक **कॉलर** जो उसके साथ **ऊपर** की ओर चलता है।
- The **rotating bubble** also acts like a **container**, keeping the **warmer smoke** concentrated near its **centre**, rather than **mixing** with the **surroundings**, and allowing it to keep **rising**.
यह **घूमता हुआ बुलबुला** एक **कंटेनर** की तरह भी काम करता है, जिससे **गर्म धुआँ** उसके **केंद्र** के पास केंद्रित रहता है, **आसपास** के साथ **मिश्रित** होने के बजाय, और उसे लगातार **ऊपर उठने** में मदद मिलती है।



India's leap, from back office to global brain trust

ISS III: S&T

The narrative of India as the 'world's back office' has been officially retired. By early 2026, a profound transformation had occurred. India has become a strategic nerve-centre for the global corporate elite. What were once known as captive centres are now Global Capability Centres (GCCs), which are sophisticated hubs that do not merely support the parent company but also define its future. This transition from cost-cutting centres to global growth engines marks a watershed moment in India's economic history.

The evolution of Indian GCCs has progressed through four distinct waves, culminating in the current GCC 4.0 era. Initially, centres were established to exploit labour arbitrage and handle routine IT and business process tasks. However, in the last few years, there has been a decisive move toward end-to-end product ownership.

Today, nearly 58% of GCCs in India are investing heavily in Agentic AI, which are autonomous Artificial Intelligence (AI) systems that can reason and execute complex tasks, thereby moving beyond mere experimentation to enterprise-scale deployment. These centres now manage global strategy leadership, high-end research and development (R&D), and proprietary intellectual property (IP) creation, making them indispensable nodes in the global value chain.

Benefits for companies and the nation

For multinational corporations (MNCs), the Indian GCC offers a unique competitive advantage: access to a multi-dimensional talent pool at a scale found nowhere else. With India housing over 1,800 GCCs and employing nearly two million professionals, companies can now drive faster innovation cycles through a follow-the-sun model. Beyond technology, these centres have become global "Centres of Excellence" (CoEs) for finance, legal, and human resources, allowing parent companies to centralise their most critical functions in a high-skill, high-efficiency environment.

Today, Indian GCCs act as global CoEs that



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India's Global Capability Centre revolution is drawing eyeballs, but there are challenges as talent gaps, cyber threats and fiscal pressures

drive high-end R&D in fields such as quantum computing, semiconductor design, and Agentic AI. These centres no longer support the parent company. They have end-to-end product lifecycles, from initial conceptualisation and architecture to global deployment and customer feedback loops. This evolution means that the shadow leadership housed in Indian GCCs often possesses greater technical depth and execution power than the traditional headquarters.

For the Indian population, the GCC boom has catalysed high-value employment and regional development. These roles are intellectually stimulating and offer compensation far above that of traditional service-sector jobs, creating a new class of global professionals. Perhaps, most significantly, growth is finally trickling down into Tier-II and Tier-III cities such as Coimbatore (Tamil Nadu), Indore (Madhya Pradesh), and Kochi (Kerala). This geographic diversification reduces the strain on saturated metros such as Bengaluru and Hyderabad while stimulating local real estate, infrastructure, and retail economies across India.

Steering through challenges

Despite the record growth, the GCC ecosystem faces challenges that could threaten its momentum. The primary risk is the widening of the talent gap. Although India produces millions of engineers, the demand for niche skills in AI security, cloud architecture and quantum-resistant cryptography vastly outstrips the supply. This has triggered a fierce war for talent, leading to wage inflation that could eventually erode the value proposition of multinational corporations (MNC).

Furthermore, GCCs hold more critical global data and have become prime targets for state-sponsored cyber-attacks. With the implementation of the Digital Personal Data Protection (DPDP) Act, the pressure on GCCs to maintain flawless cybersecurity governance has reached unprecedented levels. Simultaneously, the introduction of the Organisation for Economic Co-operation and Development's

Global Minimum Tax (Pillar Two) fundamentally alters the tax arbitrage benefit that many MNCs previously enjoyed. With a global floor of 15% tax and the continued bone of contention regarding India's 24% markup for software R&D under Safe Harbour rules, fiscal predictability has become a top-tier board concern.

Finally, geopolitical volatility and protectionism pose long-term risks to investment. As of early 2026, global trade professionals are increasingly wary of United States tariff volatility and reshoring policies that encourage MNCs to return critical data operations to their home markets.

While India remains an attractive destination, owing to its scale, any shift toward digital sovereignty in western nations could slow the pace of new GCC setups. Additionally, as India-based centres now handle 13.7% of global cyber-attack incidents (Cyfirma Report, 2023), the threat of state-sponsored espionage and intellectual property theft has made cybersecurity the most expensive operational mandate for modern GCCs.

Need for proactive policymaking

To secure India's position as the world's innovation capital, policymakers must transition from regulators to active facilitators. The National GCC Policy Framework, proposed in the 2026-27 Budget cycle, is a step in the right direction, but execution is the key. The government should introduce a "Single-Window Clearance" system specifically for GCCs to streamline the establishment of legal entities. Additionally, rationalising transfer pricing norms and providing tax safe harbours for R&D-intensive operations will provide the fiscal certainty that global boards demand. By fostering deeper industry-academia collaborations to upskill the workforce in deep tech and offering capital subsidies for Tier-II expansion, India can ensure that its GCC revolution remains sustainable for the next decade.

The views expressed are personal

23F. India's leap, from back office to global brain trust भारत की छलांग, बैक ऑफिस से वैश्विक मस्तिष्क केंद्र तक

- The narrative of India as the 'world's back office' has been officially retired. भारत को 'दुनिया का बैक ऑफिस' कहने की धारणा अब आधिकारिक रूप से समाप्त हो चुकी है।
- By early 2026, a profound transformation had occurred. 2026 की शुरुआत तक एक गहरा परिवर्तन हो चुका था।
- India has become a **strategic nerve-centre** for the **global corporate elite**. भारत वैश्विक कॉर्पोरेट अभिजात वर्ग के लिए एक रणनीतिक केंद्र बन गया है।
- What were once known as **captive centres** are now **Global Capability Centres (GCCs)**, which are sophisticated hubs that do not merely support the parent company but also define its **future**. जो पहले कैप्टिव सेंटर कहलाते थे, वे अब **Global Capability Centres (GCCs)** बन गए हैं, जो केवल मूल कंपनी का समर्थन ही नहीं करते बल्कि उसका भविष्य भी निर्धारित करते हैं।
- This transition from **cost-cutting centres** to **global growth engines** marks a **watershed moment** in India's economic history. लागत-कटौती केंद्रों से वैश्विक विकास इंजन बनने का यह परिवर्तन भारत के आर्थिक इतिहास में एक महत्वपूर्ण मोड़ है।
- The evolution of Indian **GCCs** has progressed through **four distinct waves**, culminating in the current **GCC 4.0 era**. भारतीय **GCCs** का विकास चार अलग-अलग चरणों से गुजरते हुए वर्तमान **GCC 4.0 युग** तक पहुँचा है।
- Initially, centres were established to exploit **labour arbitrage** and handle routine **IT and business process tasks**. शुरुआत में केंद्रों की स्थापना श्रम लागत अंतर का लाभ उठाने और नियमित आईटी एवं व्यावसायिक प्रक्रिया कार्यों को संभालने के लिए हुई थी।



- However, in the last few years, there has been a decisive move toward **end-to-end product ownership**.
लेकिन पिछले कुछ वर्षों में **एंड-टू-एंड उत्पाद स्वामित्व** की ओर निर्णायक बदलाव हुआ है।
- Today, nearly **58% of GCCs in India** are investing heavily in **Agentic AI**, which are autonomous **Artificial Intelligence (AI)** systems that can reason and execute complex tasks, thereby moving beyond mere experimentation to **enterprise-scale deployment**.
आज भारत में लगभग **58% GCCs Agentic AI** में भारी निवेश कर रहे हैं, जो स्वायत्त **Artificial Intelligence (AI)** प्रणालियाँ हैं और जटिल कार्यों को समझकर निष्पादित कर सकती हैं, जिससे प्रयोग के स्तर से आगे बढ़कर **एंटरप्राइज स्तर पर तैनाती** हो रही है।
- These centres now manage **global strategy leadership**, high-end **research and development (R&D)**, and proprietary **intellectual property (IP)** creation, making them indispensable nodes in the **global value chain**.
ये केंद्र अब **वैश्विक रणनीतिक नेतृत्व**, उच्च स्तरीय **अनुसंधान एवं विकास (R&D)** और स्वामित्व वाली **बौद्धिक संपदा (IP)** के निर्माण का प्रबंधन करते हैं, जिससे वे **वैश्विक मूल्य शृंखला** में अपरिहार्य बन गए हैं।

Benefits for companies and the nation कंपनियों और राष्ट्र के लिए लाभ

- For **multinational corporations (MNCs)**, the Indian **GCC** offers a unique **competitive advantage**: access to a **multi-dimensional talent pool** at a scale found nowhere else.
बहुराष्ट्रीय कंपनियों (MNCs) के लिए भारतीय **GCC** एक अनूठा **प्रतिस्पर्धात्मक लाभ** प्रदान करता है: ऐसा **बहुआयामी प्रतिभा पूल** जिसकी व्यापकता कहीं और नहीं मिलती।
- With India housing over **1,800 GCCs** and employing nearly **two million professionals**, companies can now drive faster **innovation cycles** through a **follow-the-sun model**.
भारत में **1,800 से अधिक GCCs** और लगभग **20 लाख पेशेवरों** के साथ, कंपनियाँ अब **फॉलो-द-सन मॉडल** के माध्यम से तेज **नवाचार चक्र** चला सकती हैं।
- Beyond technology, these centres have become global **“Centres of Excellence (CoEs)”** for **finance, legal, and human resources**, allowing parent companies to centralise their most critical functions in a **high-skill, high-efficiency environment**.
तकनीक से परे, ये केंद्र **वित्त, विधि और मानव संसाधन** के लिए वैश्विक **“सेंटर ऑफ एक्सीलेंस (CoEs)”** बन गए हैं, जिससे मूल कंपनियाँ अपने सबसे महत्वपूर्ण कार्यों को **उच्च कौशल और उच्च दक्षता वाले वातावरण** में केंद्रीकृत कर सकती हैं।
- Today, Indian **GCCs** act as global **CoEs** that drive high-end **R&D** in fields such as **quantum computing, semiconductor design, and Agentic AI**.
आज भारतीय **GCCs** वैश्विक **CoEs** के रूप में कार्य करते हैं जो **क्वांटम कंप्यूटिंग, सेमीकंडक्टर डिज़ाइन** और **Agentic AI** जैसे क्षेत्रों में उच्च स्तरीय **R&D** को आगे बढ़ाते हैं।
- These centres no longer support the parent company.
ये केंद्र अब केवल मूल कंपनी का समर्थन नहीं करते।
- They have **end-to-end product lifecycles**, from initial **conceptualisation and architecture** to **global deployment and customer feedback loops**.
इनके पास **एंड-टू-एंड उत्पाद जीवनचक्र** है, जिसमें प्रारंभिक **कल्पना और आर्किटेक्चर** से लेकर **वैश्विक तैनाती और ग्राहक प्रतिक्रिया चक्र** शामिल हैं।
- This evolution means that the **shadow leadership** housed in Indian **GCCs** often possesses greater **technical depth** and **execution power** than the traditional headquarters.
इस विकास का अर्थ है कि भारतीय **GCCs** में स्थित **छाया नेतृत्व** के पास अक्सर पारंपरिक मुख्यालय से अधिक **तकनीकी गहराई और क्रियान्वयन क्षमता** होती है।
- For the Indian population, the **GCC boom** has catalysed **high-value employment** and **regional development**.
भारतीय जनसंख्या के लिए, **GCC उछाल** ने **उच्च-मूल्य रोजगार** और **क्षेत्रीय विकास** को बढ़ावा दिया है।
- These roles are **intellectually stimulating** and offer **compensation far above** that of traditional service-sector jobs, creating a new class of **global professionals**.
ये भूमिकाएँ **बौद्धिक रूप से प्रेरक** हैं और पारंपरिक सेवा-क्षेत्र की नौकरियों से कहीं अधिक **उच्च वेतन** प्रदान करती हैं, जिससे **वैश्विक पेशेवरों** का नया वर्ग बन रहा है।
- Perhaps, most significantly, growth is finally trickling down into **Tier-II and Tier-III cities** such as **Coimbatore (Tamil Nadu), Indore (Madhya Pradesh), and Kochi (Kerala)**.



शायद सबसे महत्वपूर्ण रूप से, विकास अब टियर-II और टियर-III शहरों जैसे कोयंबटूर (तमिलनाडु), इंदौर (मध्य प्रदेश) और कोच्चि (केरल) तक पहुँच रहा है।

- This geographic diversification reduces the strain on saturated metros such as Bengaluru and Hyderabad while stimulating local real estate, infrastructure, and retail economies across India.

यह भौगोलिक विविधीकरण बेंगलुरु और हैदराबाद जैसे संतृप्त महानगरों पर दबाव कम करता है और पूरे भारत में स्थानीय रियल एस्टेट, बुनियादी ढाँचा और खुदरा अर्थव्यवस्था को प्रोत्साहित करता है।

Steering through challenges चुनौतियों के बीच दिशा निर्धारण

- Despite the record growth, the GCC ecosystem faces challenges that could threaten its momentum.
रिकॉर्ड वृद्धि के बावजूद, GCC पारिस्थितिकी तंत्र ऐसी चुनौतियों का सामना कर रहा है जो इसकी गति को प्रभावित कर सकती हैं।
- The primary risk is the widening of the talent gap.
मुख्य जोखिम प्रतिभा अंतराल का बढ़ना है।
- Although India produces millions of engineers, the demand for niche skills in AI security, cloud architecture and quantum-resistant cryptography vastly outstrips the supply.
हालाँकि भारत लाखों इंजीनियर तैयार करता है, लेकिन AI सुरक्षा, क्लाउड आर्किटेक्चर और क्वांटम-प्रतिरोधी क्रिप्टोग्राफी जैसे विशिष्ट कौशलों की मांग आपूर्ति से कहीं अधिक है।
- This has triggered a fierce war for talent, leading to wage inflation that could eventually erode the value proposition of multinational corporations (MNCs).
इससे तीव्र प्रतिभा युद्ध शुरू हुआ है, जिससे वेतन मुद्रास्फीति बढ़ रही है और अंततः बहुराष्ट्रीय कंपनियों (MNCs) के मूल्य प्रस्ताव को प्रभावित कर सकती हैं।
- Furthermore, GCCs hold more critical global data and have become prime targets for state-sponsored cyber-attacks.
इसके अलावा, GCCs अधिक महत्वपूर्ण वैश्विक डेटा रखते हैं और राज्य-प्रायोजित साइबर हमलों के प्रमुख लक्ष्य बन गए हैं।
- With the implementation of the Digital Personal Data Protection (DPDP) Act, the pressure on GCCs to maintain flawless cybersecurity governance has reached unprecedented levels.
Digital Personal Data Protection (DPDP) Act के लागू होने के साथ, निर्दोष साइबर सुरक्षा शासन बनाए रखने का दबाव अभूतपूर्व स्तर पर पहुँच गया है।
- Simultaneously, the introduction of the Organisation for Economic Co-operation and Development's Global Minimum Tax (Pillar Two) fundamentally alters the tax arbitrage benefit that many MNCs previously enjoyed.
साथ ही, Organisation for Economic Co-operation and Development के Global Minimum Tax (Pillar Two) की शुरुआत ने उन कर लाभों को मूल रूप से बदल दिया है जिनका कई MNCs पहले लाभ उठाते थे।
- With a global floor of 15% tax and the continued bone of contention regarding India's 24% markup for software R&D under Safe Harbour rules, fiscal predictability has become a top-tier board concern.
15% वैश्विक न्यूनतम कर और Safe Harbour नियमों के तहत भारत के 24% सॉफ्टवेयर R&D मार्कअप पर जारी विवाद के साथ, वित्तीय पूर्वानुमेयता शीर्ष स्तर की बोर्ड चिंता बन गई है।
- Finally, geopolitical volatility and protectionism pose long-term risks to investment.
अंततः, भूराजनीतिक अस्थिरता और संरक्षणवाद निवेश के लिए दीर्घकालिक जोखिम पैदा करते हैं।
- As of early 2026, global trade professionals are increasingly wary of United States tariff volatility and reshoring policies that encourage MNCs to return critical data operations to their home markets.
2026 की शुरुआत तक, वैश्विक व्यापार विशेषज्ञ संयुक्त राज्य अमेरिका के टैरिफ अस्थिरता और रीशोरिंग नीतियों से चिंतित हैं जो MNCs को अपने महत्वपूर्ण डेटा संचालन को घरेलू बाजारों में वापस लाने के लिए प्रोत्साहित करती हैं।
- While India remains an attractive destination, owing to its scale, any shift toward digital sovereignty in western nations could slow the pace of new GCC setups.



यद्यपि भारत अपने पैमाने के कारण आकर्षक गंतव्य बना हुआ है, पश्चिमी देशों में डिजिटल संप्रभुता की ओर कोई भी झुकाव नए **GCC स्थापना** की गति को धीमा कर सकता है।

- Additionally, as India-based centres now handle **13.7% of global cyber-attack incidents (Cyfirma Report, 2023)**, the threat of **state-sponsored espionage and intellectual property theft** has made cybersecurity the most expensive operational mandate for modern GCCs.

इसके अतिरिक्त, भारत-आधारित केंद्र अब **वैश्विक साइबर हमलों के 13.7% (Cyfirma Report, 2023)** को संभालते हैं, जिससे **राज्य-प्रायोजित जासूसी** और **बौद्धिक संपदा चोरी** का खतरा बढ़ गया है और साइबर सुरक्षा आधुनिक GCCs के लिए सबसे महंगा परिचालन दायित्व बन गया है।

Need for proactive policymaking सक्रिय नीतिनिर्माण की आवश्यकता

- To secure India's position as the world's **innovation capital**, policymakers must transition from regulators to active **facilitators**.
भारत को विश्व की **नवाचार राजधानी** के रूप में स्थापित रखने के लिए नीति-निर्माताओं को नियामक से सक्रिय **सुविधादाता** की भूमिका में आना होगा।
- The **National GCC Policy Framework**, proposed in the **2026-27 Budget cycle**, is a step in the right direction, but execution is the key.
2026-27 के बजट चक्र में प्रस्तावित **National GCC Policy Framework** सही दिशा में कदम है, लेकिन क्रियान्वयन ही मुख्य है।
- The government should introduce a **"Single-Window Clearance"** system specifically for GCCs to streamline the establishment of legal entities.
सरकार को GCCs के लिए विशेष रूप से **"सिंगल-विंडो क्लियरेंस"** प्रणाली शुरू करनी चाहिए ताकि कानूनी इकाइयों की स्थापना को सुगम बनाया जा सके।
- Additionally, rationalising **transfer pricing norms** and providing tax **safe harbours** for R&D-intensive operations will provide the fiscal certainty that global boards demand.
इसके अतिरिक्त, **ट्रांसफर प्राइसिंग मानकों** का युक्तिकरण और R&D-गहन संचालन के लिए कर **सेफ हार्बर** प्रदान करने से वैश्विक बोर्डों को अपेक्षित वित्तीय निश्चितता मिलेगी।
- By fostering deeper **industry-academia collaborations** to upskill the workforce in **deep tech** and offering **capital subsidies** for Tier-II expansion, India can ensure that its GCC revolution remains sustainable for the next decade.
डीप टेक में कार्यबल को उन्नत करने के लिए गहरे **उद्योग-शैक्षणिक सहयोग** को बढ़ावा देकर और टियर-II विस्तार के लिए **पूंजी सब्सिडी** प्रदान करके, भारत यह सुनिश्चित कर सकता है कि उसकी GCC क्रांति अगले दशक तक टिकाऊ बनी रहे।



AI and the brain: similar in scale, different in design

GPT-4 introduced mixture-of-experts architectures that activate only specialised portions of a network for a given task. This resembles the brain's selective recruitment of different regions

GS III: S&T
Sabyasachi Shrivastava

In recent years, Artificial Intelligence (AI) has undergone a massive growth spurt. However, not so long ago, Large Language Models (LLMs) such as ChatGPT, Gemini, and Claude were curiosities. You could trick them, confuse them, or make them contradict themselves. Today, they have evolved into versatile companions that can write software, assist scientific research, extract insights from a large set of documents, and offer structured guidance across a wide range of domains. Today's multi-modal AI systems no longer operate on text alone; they interpret images, analyse audio, generate video, and combine these streams in seamless ways. Language, reasoning, and creativity, capacities we associated with ourselves are now appearing, at least on the surface, in machines.

Scaling a neuron

Tracing the foundations of these AI systems, one can observe that the core idea behind them is not new. Artificial neural networks have existed since the late 20th century, and their conceptual roots go back even further. In 1943, Warren McCulloch and Walter Pitts proposed a simple mathematical model of a neuron. The McCulloch-Pitts neuron takes numerical inputs, multiplies them by adjustable weights, sums the results, and applies a non-linear function to produce an output. This is similar to how one takes input from multiple people and makes a decision if enough people agree on a course of action. Individually, such units are extremely simple. Yet a powerful mathematical insight, known as the universal approximation theorem, shows that networks composed of enough of these simple units can approximate virtually any function connecting input to output. With sufficient scale, they can process remarkably complex patterns.

For a long time, that was the limiting factor. Neural networks existed, but the hardware and data required to make them powerful were not available. What changed over the past 15 years was not the invention of neural networks but the availability of enormous computational power and data. Graphics Processing Units (GPUs), originally developed for video games, enabled researchers to train networks with millions and eventually billions of parameters. At the same time, new architectural ideas improved how these networks were organised. Convolutional neural networks proved effective for image recognition by exploiting spatial structure. Recurrent neural networks were designed to handle sequences such as speech and text by allowing information to persist over time. The major breakthrough, however, came with the transformer architecture, which introduced attention mechanisms that allow models to dynamically weigh which parts of their input matter most at any given moment.

GPT, short for Generative Pre-trained Transformer, builds on this architecture. It is trained on vast collections of text to predict the next word in a sequence. Although this objective appears simple, when implemented at an enormous scale and trained on extensive datasets, the model begins to capture grammar, facts,



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stylistic patterns, conceptual relationships, and even fragments of reasoning embedded in language. Intelligence, in this framework, emerges from the statistical regularities underlying the text the model is trained on.

On the artificial and biological

As these systems grow, they are beginning to rival the human brain in sheer numbers. GPT-3 contained 175 billion parameters, while newer models are estimated to reach into the trillions, approaching the roughly 100 trillion synapses in the human brain. Despite this apparent convergence in scale, AI and biological intelligence operate on fundamentally different principles.

To take advantage of modern computing hardware, models such as GPT-3 process information in a strictly feed-forward manner. Input enters the network, flows through stacked layers, and produces an output. Each layer transforms the representation and passes it forward without revisiting earlier computations during the same pass. This design enables efficient training across thousands of GPUs simultaneously and allows rapid scaling.

The human brain operates differently. Constrained by biology and metabolism, it cannot rely on brute-force parallel computation. Instead, it is built around dense feedback loops. Signals in the cortex flow forward from sensory areas to higher regions, but also backward and laterally. Perception is therefore not a one-way processing of the world but an ongoing dialogue between incoming information and prior knowledge. A simple example makes this clear. When you read the name "Harry" in a story about wizards, you probably think of Harry Potter. In a newspaper article about the British royal family, you would think of Prince Harry. Context shapes

perception almost immediately. The brain does not first register a neutral word and then decide what it means. Meaning is built into perception itself. In ambiguous sentences, visual illusions, or noisy environments, expectations strongly influence what we see and hear. The brain constantly predicts and then updates those predictions based on incoming signals.

For example, when searching for a friend in a crowded space, the brain enhances features associated with that person while suppressing irrelevant details. Neuromodulatory systems carry out this selective attention by changing the input-output gains of the synapses instead of actually changing the hard-wired connections. Acetylcholine, a neurotransmitter tracks the uncertainty of different cues adjusting the reliance accordingly. Norepinephrine, another neurotransmitter, indicates when context changes abruptly and suppresses the feedback strength allowing the circuits to shift activity to a different behavioural mode. Dopamine conveys reward prediction errors, modulating synaptic plasticity to form behaviourally relevant representations.

At the cellular level, the brain achieves efficiency through event-driven signalling. Neurons communicate using brief electrical spikes. If a neuron does not spike, it consumes minimal energy. At any moment, only a small fraction of neurons are active. This natural sparsity ensures that energy is expended only when meaningful events occur. Memory and computation are co-located at synapses. The same molecular structures that transmit signals also store the history of past interactions. Learning occurs locally at individual connections rather than through a global optimisation signal sweeping across the entire brain. This feedback-rich and chemically

regulated architecture allows the brain to perform perception and reasoning using roughly 20 watts of power, roughly what a couple of LED bulbs consume. Large AI systems, in contrast, activate vast numerical matrices for every input and rely on high-precision digital arithmetic. Training and operating them requires data centres consuming megawatts of electricity. They are also far more data-intensive. Modern LLMs are trained on trillions of words, whereas humans encounter only a fraction of that amount over a lifetime, yet develop flexible understanding and generalisation.

Mirroring the brain

Researchers are increasingly attempting to borrow insights from biology. GPT-4 introduced mixture-of-experts architectures that activate only specialised portions of a network for a given task. This resembles the brain's modularity and selective recruitment of different regions for language, vision, or movement. Newer models now adjust computational effort based on task difficulty. Recent hardware developments include changes in the fundamental chip design to build neuromorphic chips that use spike-like operations to reduce energy consumption. At the same time, researchers are also exploring richer training methods that move beyond mere next-word prediction, allowing machines to learn complex concepts from far less data.

Yet these advances remain approximations. Neural networks implement sparsity through engineered routing rather than metabolic constraint. They approximate feedback using attention mechanisms and deep layering rather than through densely interwoven recurrent circuits. True recurrence, in which activity loops continuously between layers, is computationally difficult to train and challenging to parallelise efficiently at scale. As a result, most LLMs rely primarily on deep feed-forward structures that simulate certain effects of feedback without fully embodying it.

Moreover, biological neurons are far more complex than artificial ones. A single cortical neuron contains branching dendrites that perform intricate nonlinear computations before producing a spike. In some respects, the many stacked layers of a deep network attempt collectively to approximate the internal processing that fewer biological neurons accomplish individually. Artificial neurons are simplified mathematical constructs. Biological neurons are biochemical systems embedded in a constantly changing chemical environment.

Where this leads remains uncertain. Machines are not bound by the evolutionary and size constraints that shaped our brains. They can scale in ways biology cannot. It is possible that AI systems will gradually bridge and perhaps even surpass the brain in terms of computational power, energy efficiency and learning efficiency. But it is equally possible that machines will diverge further from biological intelligence, evolving architectures better suited to processing information at scales far beyond human experience. In the end, intelligent behaviour does not have to be implemented in brain-like circuits. A pacemaker supports the function of the heart without resembling cardiac tissue. Similarly, AI may one day mimic, extend, or augment human cognition without replicating its biological substrate. In the end, it is intelligence itself, not its resemblance to the brain, that matters.

Sabyasachi Shrivastava is a computational cognitive neuroscientist who recently completed his postdoctoral training at Columbia University working on understanding behaviour through computational models.

23F. AI and the brain: similar in scale, different in design एआई और मस्तिष्क: पैमाने में समान, डिजाइन में अलग

- GPT-4 introduced mixture-of-experts architectures that activate only specialised portions of a network for a given task
GPT-4 ने मिश्रण-ऑफ-एक्सपर्ट्स आर्किटेक्चर प्रस्तुत किया जो किसी विशेष कार्य के लिए नेटवर्क के केवल विशेषीकृत हिस्सों को सक्रिय करता है



- This resembles the **brain's selective recruitment** of different **regions**
यह मस्तिष्क के विभिन्न क्षेत्रों की चयनात्मक सक्रियता से मिलता-जुलता है

Artificial Intelligence (AI) and the Rise of Large Language Models (LLMs) कृत्रिम बुद्धिमत्ता (AI) और बड़े भाषा मॉडल (LLMs) का उदय

- In recent years, **Artificial Intelligence (AI)** has undergone a massive growth spurt.
हाल के वर्षों में **कृत्रिम बुद्धिमत्ता (AI)** ने तीव्र विकास किया है।
- Not so long ago, **Large Language Models (LLMs)** such as **ChatGPT, Gemini, and Claude** were curiosities.
कुछ समय पहले तक **बड़े भाषा मॉडल (LLMs)** जैसे **ChatGPT, Gemini और Claude** केवल जिज्ञासा का विषय थे।
- You could trick them, confuse them, or make them contradict themselves.
आप उन्हें भ्रमित कर सकते थे या उनसे विरोधाभासी उत्तर दिला सकते थे।
- Today, they have evolved into versatile companions that can **write software, assist scientific research, extract insights from large document sets, and offer structured guidance** across domains.
आज वे ऐसे बहुमुखी सहायक बन गए हैं जो **सॉफ्टवेयर लिख सकते हैं, वैज्ञानिक अनुसंधान में सहायता कर सकते हैं, बड़े दस्तावेजों से अंतर्दृष्टि निकाल सकते हैं और संरचित मार्गदर्शन दे सकते हैं।**
- Today's **multi-modal AI systems** interpret **images, analyse audio, generate video**, and combine these seamlessly.
आज के **मल्टी-मोडल AI सिस्टम चित्रों की व्याख्या, ऑडियो विश्लेषण, वीडियो निर्माण और इनका संयोजन कर सकते हैं।**
- **Language, reasoning, and creativity**, once associated with humans, now appear in machines.
भाषा, तर्क और रचनात्मकता, जो पहले मनुष्यों से जुड़ी थीं, अब मशीनों में दिखाई दे रही हैं।

Scaling a neuron एक न्यूरॉन का विस्तार

- The core idea behind these AI systems is not new.
इन AI प्रणालियों के पीछे की मूल अवधारणा नई नहीं है।
- **Artificial neural networks** have existed since the **late 20th century**, with roots going back even further.
कृत्रिम न्यूरल नेटवर्क 20वीं सदी के उत्तरार्ध से मौजूद हैं, जिनकी जड़ें और भी पुरानी हैं।
- In **1943, Warren McCulloch and Walter Pitts** proposed a simple mathematical model of a neuron.
1943 में वॉरेन मैककुलोच और वाल्टर पिट्स ने एक न्यूरॉन का सरल गणितीय मॉडल प्रस्तावित किया।
- The **McCulloch–Pitts neuron** takes numerical inputs, multiplies them by adjustable weights, sums them, and applies a **non-linear function** to produce output.
मैककुलोच-पिट्स न्यूरॉन संख्यात्मक इनपुट लेता है, उन्हें समायोज्य वज़न से गुणा करता है, जोड़ता है और गैर-रैखिक फलन लागू कर आउटपुट देता है।
- Individually, such units are extremely simple.
व्यक्तिगत रूप से ये इकाइयाँ अत्यंत सरल होती हैं।
- The **universal approximation theorem** shows that networks of enough such units can approximate virtually any function.
यूनिवर्सल एप्रॉक्सिमेशन प्रमेय दर्शाता है कि पर्याप्त इकाइयों वाले नेटवर्क लगभग किसी भी फलन का अनुमान लगा सकते हैं।
- With sufficient scale, they can process complex patterns.
पर्याप्त विस्तार के साथ ये जटिल पैटर्न संसाधित कर सकते हैं।
- For a long time, hardware and data were limiting factors.
लंबे समय तक हार्डवेयर और डेटा सीमित कारक थे।
- What changed in the past **15 years** was the availability of enormous **computational power and data**.
पिछले **15 वर्षों** में विशाल **कंप्यूटेशनल शक्ति और डेटा** की उपलब्धता ने बदलाव लाया।



- **Graphics Processing Units (GPUs)** enabled training of networks with millions and billions of parameters.
ग्राफिक्स प्रोसेसिंग यूनिट्स (GPUs) ने लाखों और अरबों पैरामीटर वाले नेटवर्क को प्रशिक्षित करना संभव बनाया।
- **Convolutional neural networks** proved effective for **image recognition**.
कन्वोल्यूशनल न्यूरल नेटवर्क चित्र पहचान में प्रभावी सिद्ध हुए।
- **Recurrent neural networks** handled sequences such as **speech and text**.
रिकरेंट न्यूरल नेटवर्क ने भाषण और पाठ जैसे अनुक्रमों को संभाला।
- The breakthrough came with the **transformer architecture**, introducing **attention mechanisms**.
मुख्य सफलता ट्रांसफॉर्मर आर्किटेक्चर से आई, जिसने अटेंशन मैकेनिज्म प्रस्तुत किया।
- **GPT (Generative Pre-trained Transformer)** builds on this architecture.
GPT (जनरेटिव प्री-ट्रेड ट्रांसफॉर्मर) इसी आर्किटेक्चर पर आधारित है।
- It is trained on vast text collections to **predict the next word in a sequence**.
इसे विशाल पाठ संग्रह पर **अगले शब्द की भविष्यवाणी** करने के लिए प्रशिक्षित किया जाता है।
- At enormous scale, it captures **grammar, facts, stylistic patterns, conceptual relationships, and fragments of reasoning**.
विशाल स्तर पर यह **व्याकरण, तथ्य, शैलीगत पैटर्न, वैचारिक संबंध और तर्क के अंश** सीख लेता है।
- **Intelligence**, in this framework, emerges from the **statistical regularities** underlying the text.
इस ढाँचे में **बुद्धिमत्ता** पाठ में निहित **सांख्यिकीय नियमितताओं** से उभरती है।

On the artificial and biological कृत्रिम और जैविक के बीच

- As these systems grow, they are beginning to rival the **human brain** in sheer numbers.
जैसे-जैसे ये प्रणालियाँ बढ़ रही हैं, वे संख्या के मामले में **मानव मस्तिष्क** की बराबरी करने लगी हैं।
- **GPT-3** contained **175 billion parameters**, while newer models are estimated to reach **trillions**, approaching the roughly **100 trillion synapses** in the human brain.
GPT-3 में **175 अरब पैरामीटर** थे, जबकि नए मॉडल **ट्रिलियन** तक पहुँचने का अनुमान है, जो मानव मस्तिष्क के लगभग **100 ट्रिलियन सिनैप्स** के करीब है।
- Despite this convergence in scale, **AI and biological intelligence** operate on fundamentally different principles.
इस पैमाने की समानता के बावजूद **AI और जैविक बुद्धिमत्ता** मूल रूप से अलग सिद्धांतों पर काम करते हैं।
- To take advantage of modern computing hardware, models such as **GPT-3** process information in a strictly **feed-forward** manner.
आधुनिक कंप्यूटिंग हार्डवेयर का लाभ लेने के लिए **GPT-3** जैसे मॉडल जानकारी को सख्ती से **फीड-फॉरवर्ड** तरीके से संसाधित करते हैं।
- Input flows through stacked layers and produces an output without revisiting earlier computations in the same pass.
इनपुट परतों से होकर गुजरता है और उसी प्रक्रिया में पहले की गणनाओं पर लौटे बिना आउटपुट देता है।
- This design enables efficient training across **thousands of GPUs** and allows rapid scaling.
यह डिजाइन **हजारों GPUs** पर कुशल प्रशिक्षण और तेज़ विस्तार को संभव बनाता है।
- The **human brain** operates differently.
मानव मस्तिष्क अलग तरीके से कार्य करता है।
- Constrained by **biology and metabolism**, it cannot rely on brute-force parallel computation.
जीवविज्ञान और मेटाबोलिज्म की सीमाओं के कारण यह अत्यधिक समानांतर गणना पर निर्भर नहीं हो सकता।
- Instead, it is built around dense **feedback loops**.
इसके बजाय यह घने **फीडबैक लूप्स** पर आधारित है।
- Signals in the **cortex** flow forward, backward, and laterally.
कोर्टेक्स में संकेत आगे, पीछे और पार्श्व दिशा में प्रवाहित होते हैं।
- Perception is an ongoing dialogue between incoming information and **prior knowledge**.
अनुभूति आने वाली जानकारी और **पूर्व ज्ञान** के बीच सतत संवाद है।
- When reading "Harry" in a wizard story, one thinks of **Harry Potter**, but in a royal context, of **Prince Harry**.
जादूगरों की कहानी में "Harry" पढ़ने पर **Harry Potter** याद आता है, जबकि शाही संदर्भ में **Prince Harry**।



- **Context shapes perception** almost immediately.
संदर्भ अनुभूति को आकार देता है।
- The brain constantly **predicts and updates** based on incoming signals.
मस्तिष्क लगातार **पूर्वानुमान और अद्यतन** करता रहता है।
- When searching for a friend in a crowd, the brain enhances relevant features and suppresses irrelevant details.
भीड़ में मित्र को खोजते समय मस्तिष्क प्रासंगिक विशेषताओं को बढ़ाता और अप्रासंगिक को दबाता है।
- **Neuromodulatory systems** enable selective attention by adjusting **synaptic input-output gains**.
न्यूरोमॉड्युलेटरी सिस्टम सिनैप्टिक इनपुट-आउटपुट गेन को समायोजित कर चयनात्मक ध्यान सक्षम करते हैं।
- **Acetylcholine** tracks uncertainty of cues and adjusts reliance accordingly.
एसिटाइलकोलाइन संकेतों की अनिश्चितता को ट्रैक कर निर्भरता समायोजित करता है।
- **Norepinephrine** signals abrupt context change and reduces feedback strength.
नॉरएपिनेफ्रिन संदर्भ में अचानक बदलाव का संकेत देता है और फीडबैक शक्ति कम करता है।
- **Dopamine** conveys reward prediction errors and modulates **synaptic plasticity**.
डोपामिन पुरस्कार-पूर्वानुमान त्रुटि का संकेत देता है और **सिनैप्टिक प्लास्टिसिटी** को नियंत्रित करता है।
- At the cellular level, the brain uses **event-driven signalling**.
कोशिकीय स्तर पर मस्तिष्क **इवेंट-ड्रिवन सिग्नलिंग** का उपयोग करता है।
- Neurons communicate using brief **electrical spikes**.
न्यूरोन्स छोटे **विद्युत स्पाइक्स** से संचार करते हैं।
- If a neuron does not spike, it consumes minimal **energy**.
यदि न्यूरोन स्पाइक नहीं करता, तो वह न्यूनतम **ऊर्जा** खर्च करता है।
- Only a small fraction of neurons are active at any moment, ensuring **energy efficiency**.
किसी भी समय केवल थोड़े न्यूरोन्स सक्रिय होते हैं, जिससे **ऊर्जा दक्षता** बनी रहती है।
- **Memory and computation** are co-located at **synapses**.
स्मृति और गणना सिनैप्स पर सह-स्थित होती हैं।
- The same structures that transmit signals also store past interactions.
जो संरचनाएँ संकेत भेजती हैं, वही पिछले अनुभव भी संग्रहित करती हैं।
- Learning occurs locally at **individual connections**, not via a global optimisation signal.
सीखना **व्यक्तिगत कनेक्शनों** पर स्थानीय रूप से होता है, न कि पूरे मस्तिष्क में वैश्विक अनुकूलन संकेत से।

Mirroring the brain मस्तिष्क का प्रतिबिंब

- This feedback-rich and chemically regulated architecture allows the brain to perform perception and reasoning using roughly **20 watts** of power.
यह फीडबैक-समृद्ध और रासायनिक रूप से नियंत्रित संरचना मस्तिष्क को लगभग **20 वाट** ऊर्जा में अनुभूति और तर्क करने में सक्षम बनाती है।
- This is roughly what a couple of **LED bulbs** consume.
यह लगभग दो **LED बल्बों** के बराबर ऊर्जा है।
- Large **AI systems**, in contrast, activate vast numerical matrices for every input and rely on **high-precision digital arithmetic**.
इसके विपरीत बड़े **AI सिस्टम** हर इनपुट पर विशाल संख्यात्मक मैट्रिक्स सक्रिय करते हैं और **उच्च-सटीक डिजिटल अंकगणित** पर निर्भर रहते हैं।
- Training and operating them requires **data centres consuming megawatts of electricity**.
इनके प्रशिक्षण और संचालन के लिए **मेगावाट बिजली खपत करने वाले डेटा सेंटर** की आवश्यकता होती है।
- They are also far more **data-intensive**.
वे बहुत अधिक **डेटा-आधारित** भी हैं।
- Modern **LLMs** are trained on **trillions of words**, whereas humans encounter only a fraction over a lifetime.
आधुनिक **LLMs** को **ट्रिलियनों शब्दों** पर प्रशिक्षित किया जाता है, जबकि मनुष्य जीवनभर में इसका केवल एक छोटा हिस्सा देखते हैं।
- Yet humans develop flexible **understanding and generalisation**.
फिर भी मनुष्य लचीली **समझ और सामान्यीकरण** विकसित करते हैं।



- Researchers are increasingly borrowing insights from **biology**.
शोधकर्ता बढ़ते हुए **जीवविज्ञान** से अंतर्दृष्टि ले रहे हैं।
- **GPT-4** introduced **mixture-of-experts architecture** activating only specialised portions of a network for a task.
GPT-4 ने **मिश्रण-विशेषज्ञ आर्किटेक्चर** प्रस्तुत किया, जो कार्य के अनुसार नेटवर्क के विशेष भाग सक्रिय करता है।
- This resembles the brain's **modularity and selective recruitment**.
यह मस्तिष्क की **मॉड्युलैरिटी और चयनात्मक सक्रियता** जैसा है।
- Newer models adjust **computational effort** based on task difficulty.
नए मॉडल कार्य की कठिनाई के अनुसार **कंप्यूटेशनल प्रयास** समायोजित करते हैं।
- Recent hardware developments include **neuromorphic chips** using spike-like operations to reduce energy use.
हाल के हार्डवेयर विकास में **न्यूरमॉर्फिक चिप्स** शामिल हैं जो स्पाइक-जैसे ऑपरेशन से ऊर्जा उपयोग कम करते हैं।
- Researchers are exploring richer **training methods** beyond next-word prediction.
शोधकर्ता केवल अगले शब्द की भविष्यवाणी से आगे बढ़कर अधिक समृद्ध **प्रशिक्षण विधियाँ** खोज रहे हैं।
- These advances remain **approximations**.
ये प्रगति अभी भी केवल **अनुमानित** हैं।
- Neural networks implement sparsity through **engineered routing** rather than metabolic constraint.
न्यूरल नेटवर्क विरलता को **इंजीनियर किए गए रूटिंग** से लागू करते हैं, न कि जैविक सीमाओं से।
- They approximate feedback using **attention mechanisms and deep layering**.
वे फीडबैक का अनुमान **अटेंशन मैकेनिज्म और गहरी परतों** से लगाते हैं।
- True **recurrence** is difficult to train and parallelise at scale.
वास्तविक **रिकरेंस** को बड़े पैमाने पर प्रशिक्षित और समानांतर करना कठिन है।
- Most **LLMs** rely primarily on deep **feed-forward structures**.
अधिकांश **LLMs** मुख्य रूप से गहरे **फीड-फॉरवर्ड ढाँचे** पर निर्भर करते हैं।
- Biological neurons are far more **complex** than artificial ones.
जैविक न्यूरॉन्स कृत्रिम न्यूरॉन्स से कहीं अधिक **जटिल** होते हैं।
- A single cortical neuron contains branching **dendrites** performing nonlinear computations.
एक कॉर्टिकल न्यूरॉन में शाखित **डेंड्राइट्स** होते हैं जो गैर-रैखिक गणनाएँ करते हैं।
- Deep networks collectively approximate processing that fewer biological neurons perform individually.
गहरे नेटवर्क सामूहिक रूप से उस प्रसंस्करण का अनुमान लगाते हैं जो कम जैविक न्यूरॉन्स अकेले करते हैं।
- Artificial neurons are **simplified mathematical constructs**.
कृत्रिम न्यूरॉन्स **सरल गणितीय संरचनाएँ** हैं।
- Biological neurons are **biochemical systems** in a changing chemical environment.
जैविक न्यूरॉन्स बदलते रासायनिक वातावरण में **जैव-रासायनिक प्रणाली** हैं।
- Where this leads remains **uncertain**.
यह कहाँ ले जाएगा, यह अभी **अनिश्चित** है।
- Machines are not bound by **evolutionary and size constraints**.
मशीनें **विकासवादी और आकार संबंधी सीमाओं** से बंधी नहीं हैं।
- AI may eventually **bridge or surpass** the brain in computational and energy efficiency.
AI अंततः कंप्यूटेशनल और ऊर्जा दक्षता में मस्तिष्क को **पार कर सकता है**।
- It is also possible machines will **diverge further** from biological intelligence.
यह भी संभव है कि मशीनें जैविक बुद्धिमत्ता से और **अलग हो जाएँ**।
- Intelligent behaviour need not be implemented in **brain-like circuits**.
बुद्धिमान व्यवहार का कार्यान्वयन **मस्तिष्क-जैसे सर्किट** में होना आवश्यक नहीं है।
- A **pacemaker** supports heart function without resembling cardiac tissue.
एक **पेसमेकर** हृदय ऊतक जैसा दिखे बिना हृदय का कार्य समर्थन करता है।
- Similarly, AI may **mimic, extend, or augment human cognition** without replicating biology.
इसी प्रकार AI जैविक संरचना की नकल किए बिना **मानव संज्ञान की नकल, विस्तार या वृद्धि** कर सकता है।
- In the end, it is **intelligence itself**, not resemblance to the brain, that matters.
अंततः महत्वपूर्ण **बुद्धिमत्ता स्वयं** है, न कि मस्तिष्क से उसकी समानता।



Questions and Answers to the February 20

edition of the daily quiz: 1. Name the paper published by Google researchers in 2017 that introduced the Transformer architecture. **Ans: 'Attention Is All You Need'**

2. Name the specialised processing units within NVIDIA GPUs. **Ans: Tensor Cores**

3. Copilot grounds its LLM responses in real-time web data by using this proprietary orchestrator that connects to the Bing search index. **Ans: Prometheus**

4. Name the Israeli-Canadian scientist who co-invented AlexNet. **Ans: Ilya Sutskever**

5. Expand RNN and LSTM. **Ans: Recurrent Neural Networks and Long Short-Term Memory networks**

6. Define 'hallucination'. **Ans: The term for an error when a LLM asserts a fabricated or nonsensical piece of information as a fact**

Visual: Name this young IITM alumnus. **Ans:**

Aravind Srinivas

Early Birds: Piyali Tuli| Tom Alan Faith| Neil Lall| Arjun Debnath| Jasvir Kaur Chahal

23F. QUIZ

Paper Name 'Attention Is All You Need' (2017)

- 'Attention Is All You Need' is a 2017 research paper by Google Brain researchers that introduced the Transformer architecture, a deep learning model for natural language processing
 - It replaced recurrent and convolutional networks with a self attention mechanism, enabling parallel computation, better long range dependency capture, and improved efficiency.
 - The paper revolutionised machine translation and later powered models like BERT and GPT, becoming foundational for artificial intelligence research worldwide today.

Tensor Cores (Specialised Processing Units in NVIDIA GPUs)

- Tensor Cores are specialised hardware units inside NVIDIA GPUs designed to accelerate matrix multiplications and mixed precision calculations essential for artificial intelligence and deep learning.
- First introduced in 2017 with the Volta architecture, they significantly boost training and inference speed for neural networks. Modern generations support FP16, BF16, TF32 and FP8 precision, enabling faster generative AI and scientific computing.
- They are widely used in supercomputing, autonomous systems, and large language model training today.

Prometheus (Proprietary Orchestrator Used in Copilot)

- Prometheus is Microsoft's proprietary orchestration system that integrates large language models with the Bing search index to deliver grounded, real time responses in Copilot.
- Introduced in 2023, it enables the model to retrieve current web data, rank relevant sources, and generate answers with updated information.
- It combines search results, contextual ranking, and AI reasoning to reduce hallucinations and improve accuracy. This architecture strengthened enterprise grade AI deployment globally.

Ilya Sutskever (Co-inventor of AlexNet)

- Ilya Sutskever is an Israeli-Canadian computer scientist known for co-inventing AlexNet in 2012 with Alex Krizhevsky and Geoffrey Hinton, marking a breakthrough in deep learning and computer vision.
- AlexNet dramatically improved image recognition accuracy in the ImageNet competition using deep convolutional neural networks and GPU computing.
- Sutskever later contributed to major advances in artificial intelligence, including sequence learning and large language models, playing a key role in modern generative AI research and development globally today.

Recurrent Neural Networks (RNN)

- Recurrent Neural Networks are a class of artificial neural networks designed to process sequential data by maintaining a hidden state that carries information from previous time steps.
- Introduced in the 1980s and refined in the 1990s, RNNs are widely used for speech recognition, language modelling, and time series forecasting.
- They enable contextual understanding but face vanishing gradient problems in long sequences. They laid the foundation for advanced sequence models in artificial intelligence research.



Long Short-Term Memory (LSTM) Networks

- Long Short-Term Memory networks are a specialised type of Recurrent Neural Network developed in 1997 by Hochreiter and Schmidhuber to overcome vanishing gradient limitations
- . LSTMs use memory cells and gating mechanisms namely input, forget, and output gates to retain long term dependencies effectively.
- They significantly improved performance in speech processing, handwriting recognition, and machine translation. LSTMs remain relevant in sequence modelling despite the rise of Transformer architectures.

Hallucination (in Large Language Models)

- Hallucination in artificial intelligence refers to a situation where a large language model generates incorrect, fabricated, or nonsensical information but presents it confidently as factual.
- This occurs due to probabilistic text prediction, imperfect training data, or lack of real time verification. Hallucinations may include false citations, invented facts, or logical inconsistencies.
- Recent AI research focuses on grounding, retrieval augmentation, and alignment techniques to reduce hallucination and improve reliability in critical domains like healthcare, governa

PATRIOTIC IAS



Behind scenes, quiet threshold moments at AI Impact Summit



Step forward: India must take the summit to cities where access does not exist. SHASHI SHEKHAR KASHYAP

OPINION

GS III S&T
Shubho Sengupta

If global tech summits were theatre, the AI Impact Summit would qualify as a full-scale opening night — bright lights, big promises, a distinguished audience, and... er, just the faintest hint that something backstage may have required a touch of improvisation.

While the spotlights tracked Ministers, bureaucrats, investors, and marquee names, something quieter and far more stirring was unfolding in the wings. Founders from towns better known for railway junctions than research labs, engineers who had coded more often under tube lights than studio lights and small teams with improbable ideas suddenly found themselves presenting to the world. For them, this was not merely a summit — it was a threshold moment. Here's a list of the interesting AI startups I came across; I have also thrown in a few that my friends and circles on X found interesting.

Agriculture Agrograde

AI-powered optical sorting and grading machines for fruits and vegetables (such as potatoes and onions) that analyse size, colour, shape, and defects in real time to reduce post-harvest losses and improve marketability.

Global potential: Scalable to smallholder farmers in developing countries facing high produce wastage; proven in 12-plus Indian States with partnerships such as Bosch and Nvidia; suitable for export-oriented agricultural markets in Africa and Southeast Asia.

Hanunnotech

AI- and IoT-driven analytics for dairy, agriculture, and animal husbandry, including wearable sensors such as the 'Cow Necklace' for monitoring vital signs, predicting yield, and managing heat stress.

Global potential: Supports food security in dairy-dependent regions like South Asia and Africa; low-power machine learning enables affordable deployment for small farmers globally.

Aalgorix

Precision agriculture AI for yield optimisation, crop monitoring, and resource management.

Global potential: Improves productivity for small farmers in climate-vulnerable regions such as South Asia and sub-Saharan Africa.

- For them, this was not merely a summit — it was a **threshold moment**. उनके लिए यह केवल एक समिट नहीं था — यह एक **निर्णायक मोड़** था।
- Here's a list of the interesting **AI startups** I came across; I have also thrown in a few that my friends and circles on **X** found interesting. यहाँ कुछ रोचक **AI स्टार्टअप्स** की सूची है जिनसे मेरा सामना हुआ; साथ ही कुछ ऐसे भी जो **X** पर मेरे दोस्तों और नेटवर्क को दिलचस्प लगे।

Agriculture कृषि

Health BigOHealth

AI-powered health monitoring wearables and platforms for real-time patient data analysis and preventive care.

Global potential: Affordable remote monitoring suited to bridging rural and urban healthcare gaps in developing countries; integrates with telemedicine ecosystems.

A I V E d a

AI platform integrating Vedic wellness principles with modern health insights to provide personalised recommendations and holistic care.

Global potential: Appeals to expanding wellness markets across Asia and diaspora populations; blends traditional knowledge with scalable technology.

Eka Care

Digital health platform with AI tools such as EkaScribe for automating prescriptions, patient histories, and records, enabling rural doctors to serve more patients efficiently.

Global potential: Keyboard-free AI scribes can transform primary care in resource-limited health systems, similar to those in India, Africa, and Southeast Asia.

Carenow Healthcare

AI-driven patient triage, care coordination, and monitoring systems that streamline hospital and clinic workflows.

Global potential: Reduces overload in public health systems; scalable for emerging markets with high patient volumes and limited staff.

If India is serious about turning moments like this into a movement, the next step is obvious: take the summit off the usual circuit and into cities where ambition already exists but access does not.

And if the occasional flourish of chaos accompanies the expansion, well... that may simply be proof that something genuinely alive is happening.

(Shubho Sengupta is a digital marketer with an analogue past)

23F. Behind scenes, quiet threshold moments at AI Impact Summit

AI इम्पैक्ट समिट में परदे के पीछे, शांत लेकिन निर्णायक क्षण

• If global tech summits were theatre, the **AI Impact Summit** would qualify as a full-scale opening night — bright lights, big promises, a distinguished audience, and... er, just the faintest hint that something backstage may have required a touch of improvisation.

अगर वैश्विक टेक समिट एक रंगमंच होते, तो **AI इम्पैक्ट समिट** पूरी तरह एक भव्य उद्घाटन रात्रि के रूप में योग्य ठहरता — तेज़ रोशनी, बड़े वादे, विशिष्ट दर्शक, और... शायद यह हल्का सा संकेत कि परदे के पीछे कुछ चीज़ों में थोड़ी improvisation की ज़रूरत पड़ी होगी।

• While the spotlights tracked **Ministers, bureaucrats, investors, and marquee names**, something quieter and far more stirring was unfolding in the wings.

जब स्पॉटलाइट **मंत्रियों, नौकरशाहों, निवेशकों** और **प्रसिद्ध नामों** पर थी, तब परदे के पीछे कुछ अधिक शांत लेकिन कहीं ज़्यादा प्रेरक घटित हो रहा था।

• Founders from towns better known for **railway junctions** than **research labs**, engineers who had coded more often under **tube lights** than **studio lights** and small teams with improbable ideas suddenly found themselves presenting to the world.

ऐसे कस्बों के संस्थापक, जो **रिसर्च लैब्स** से अधिक **रेलवे जंक्शनों** के लिए जाने जाते हैं, वे इंजीनियर जिन्होंने **स्टूडियो लाइट्स** से ज़्यादा **ट्यूबलाइट** में कोडिंग की थी, और असंभव-सी लगने वाली सोच वाली छोटी टीमों अचानक खुद को दुनिया के सामने प्रस्तुत करते हुए पा रहे थीं।



Agrograde एग्रोग्रेड

- AI-powered **optical sorting and grading machines** for fruits and vegetables (such as potatoes and onions) that analyse **size, colour, shape, and defects** in real time to reduce post-harvest losses and improve marketability.
फलों और सब्जियों (जैसे आलू और प्याज़) के लिए AI-संचालित **ऑप्टिकल सॉर्टिंग और ग्रेडिंग मशीनें**, जो **आकार, रंग, आकृति और दोषों** का वास्तविक समय में विश्लेषण कर कटाई के बाद होने वाले नुकसान को कम करती हैं और बाज़ार क्षमता बढ़ाती हैं।
- **Global potential:** Scalable to **smallholder farmers** in developing countries facing high produce wastage; proven in **12-plus Indian States** with partnerships such as **Bosch** and **Nvidia**; suitable for export-oriented agricultural markets in **Africa** and **Southeast Asia**.
वैश्विक क्षमता: विकासशील देशों के **छोटे किसानों** के लिए उपयुक्त, जहाँ उत्पादन की बर्बादी अधिक होती है; **12 से अधिक भारतीय राज्यों** में **Bosch** और **Nvidia** जैसी साझेदारियों के साथ प्रमाणित; **अफ्रीका** और **दक्षिण-पूर्व एशिया** के निर्यात-उन्मुख कृषि बाज़ारों के लिए उपयुक्त।

Hanunotech हनुनोटेक

- AI- and **IoT-driven analytics** for dairy, agriculture, and **animal husbandry**, including wearable sensors such as the '**Cow Necklace**' for monitoring vital signs, predicting yield, and managing heat stress.
डेयरी, कृषि और **पशुपालन** के लिए AI और **IoT-आधारित एनालिटिक्स**, जिसमें '**काउ नेकलेस**' जैसे वियरेबल सेंसर शामिल हैं, जो जीवन संकेतों की निगरानी, उत्पादन पूर्वानुमान और हीट स्ट्रेस प्रबंधन में मदद करते हैं।
- **Global potential:** Supports **food security** in dairy-dependent regions like **South Asia** and **Africa**; low-power machine learning enables **affordable deployment** for small farmers globally.
वैश्विक क्षमता: **दक्षिण एशिया** और **अफ्रीका** जैसे डेयरी-निर्भर क्षेत्रों में **खाद्य सुरक्षा** को समर्थन; कम ऊर्जा वाले मशीन लर्निंग से दुनिया भर के छोटे किसानों के लिए **किफ़ायती उपयोग** संभव।

Aalgorix आल्गोरिक्स

- **Precision agriculture AI** for yield optimisation, crop monitoring, and **resource management**.
उत्पादन अनुकूलन, फसल निगरानी और **संसाधन प्रबंधन** के लिए **प्रिसीजन एग्रीकल्चर AI**।
- **Global potential:** Improves productivity for small farmers in **climate-vulnerable regions** such as **South Asia** and **sub-Saharan Africa**.
वैश्विक क्षमता: **दक्षिण एशिया** और **सब-सहारा अफ्रीका** जैसे **जलवायु-संवेदनशील क्षेत्रों** में छोटे किसानों की उत्पादकता बढ़ाता है।

Health स्वास्थ्य

BigOHealth बिगओहेल्थ

- AI-powered **health monitoring wearables** and platforms for real-time patient data analysis and **preventive care**.
रीयल-टाइम रोगी डेटा विश्लेषण और **निवारक देखभाल** के लिए AI-संचालित **हेल्थ मॉनिटरिंग वियरेबल्स** और प्लेटफ़ॉर्म।
- **Global potential:** **Affordable remote monitoring** suited to bridging rural and urban healthcare gaps in developing countries; integrates with **telemedicine ecosystems**.
वैश्विक क्षमता: विकासशील देशों में ग्रामीण और शहरी स्वास्थ्य अंतर को पाटने के लिए **किफ़ायती रिमोट मॉनिटरिंग**; **टेलीमेडिसिन सिस्टम** से एकीकरण।



A I V E d a AI वेदा

- AI platform integrating **Vedic wellness principles** with modern health insights to provide **personalised recommendations** and holistic care.
वैदिक वेलनेस सिद्धांतों को आधुनिक स्वास्थ्य ज्ञान के साथ जोड़ने वाला AI प्लेटफॉर्म, जो **व्यक्तिगत सुझाव** और समग्र देखभाल प्रदान करता है।
- **Global potential:** Appeals to expanding **wellness markets** across Asia and diaspora populations; blends **traditional knowledge** with scalable technology.
वैश्विक क्षमता: एशिया और प्रवासी समुदायों में बढ़ते **वेलनेस बाज़ारों** के लिए आकर्षक; **पारंपरिक ज्ञान** को स्केलेबल तकनीक से जोड़ता है।

Eka Care एका केयर

- Digital health platform with AI tools such as **EkaScribe** for automating prescriptions, patient histories, and records, enabling rural doctors to serve more patients **efficiently**.
EkaScribe जैसे AI टूल्स वाला डिजिटल हेल्थ प्लेटफॉर्म, जो प्रिस्क्रिप्शन, रोगी इतिहास और रिकॉर्ड को स्वचालित कर ग्रामीण डॉक्टरों को अधिक रोगियों की **कुशलता से** सेवा करने में सक्षम बनाता है।
- **Global potential:** Keyboard-free AI scribes can transform **primary care** in resource-limited health systems, similar to those in **India, Africa, and Southeast Asia**.
वैश्विक क्षमता: कीबोर्ड-रहित AI स्क्राइब **प्राथमिक स्वास्थ्य सेवाओं** को बदल सकते हैं, विशेषकर **भारत, अफ्रीका और दक्षिण-पूर्व एशिया** जैसे संसाधन-सीमित क्षेत्रों में।

Carenow Healthcare केयरनाउ हेल्थकेयर

- AI-driven **patient triage**, care coordination, and monitoring systems that streamline hospital and clinic **workflows**.
AI-संचालित **रोगी प्राथमिकता निर्धारण**, देखभाल समन्वय और निगरानी प्रणालियाँ, जो अस्पताल और क्लिनिक के **वर्कफ्लो** को सरल बनाती हैं।
- **Global potential:** Reduces overload in **public health systems**; scalable for emerging markets with high patient volumes and limited staff.
वैश्विक क्षमता: सार्वजनिक स्वास्थ्य प्रणालियों पर बोझ कम करता है; अधिक रोगी संख्या और सीमित स्टाफ वाले उभरते बाज़ारों के लिए उपयुक्त।
- If India is serious about turning moments like this into a **movement**, the next step is obvious: take the summit off the usual circuit and into cities where **ambition** already exists but **access** does not.
यदि भारत ऐसे क्षणों को एक **आंदोलन** में बदलने को लेकर गंभीर है, तो अगला कदम स्पष्ट है: समिट को पारंपरिक स्थानों से हटाकर उन शहरों तक ले जाना, जहाँ **महत्वाकांक्षा** तो है लेकिन **पहुंच** नहीं।
- And if the occasional **flourish of chaos** accompanies the expansion, well... that may simply be proof that something **genuinely alive** is happening.
और यदि इस विस्तार के साथ कभी-कभार **अराजकता की झलक** भी दिखाई दे, तो शायद यही इस बात का प्रमाण है कि कुछ **वास्तव में जीवंत** घटित हो रहा है।



In manifesto, scientists oppose 'militarisation' of research into quantum science

GS III: S&T
Vasudevan Mukunth
A group of quantum researchers has issued a manifesto urging colleagues to resist what it calls the "militarisation" of quantum science.
The authors, who describe themselves as "Quantum Scientists for Disarmament", say they oppose military uses of quantum research, reject military funding for academic work, and want universities to disclose which quantum projects take defence money.
The manifesto, uploaded to the arXiv repository on the web on January 13, frames its call as a response to wider trends in rearmament and the spread of dual-use technologies, i.e. those that claim

civilian value while also serving defence goals. The group proposes four immediate steps: to speak as a collective against military use, to force an ethics debate inside the field, to create a forum for concerned researchers, and to establish a public database listing defence-funded projects at public universities.
"We still believe that war must be utterly rejected as a means of settling international disputes, and that peace can only be guaranteed by diplomacy, international treaties, and cooperation, rather than by mutual assured destruction," the manifesto says.
"As scientists working in a non-neutral research field, we can raise our voices toward that aim."
The researchers argue

that quantum physics is no longer just basic science and that its military applications have become evident.
These include quantum communications, space and drone sensing, high-precision timing for navigation, and surveillance.
"Strategic competition" The manifesto says that NATO, for example, has located its quantum physics work inside its broader "emerging and disruptive technologies" agenda and released a public quantum strategy summary in 2024 that described research in this field as an element of strategic competition.
European institutions have also described quantum physics as relevant to defence projects, with the



A quantum computer can solve complex problems that would take billions of years for today's computers to solve. REUTERS

European Commission describing quantum sensors as offering performance improvements for military operations.
The manifesto also says India's National Quantum Mission works in "strong collaboration" with the public and private defence sectors. Late last month, India's Chief of Defence

can hide it behind funding structures and partnership vehicles.
This is why they say they've called for a public database, to force agencies and institutions to be clear about who funds what, and to reduce the room for any actors to deny their involvement after a technology finds its way into a military application.
Military patronage has a long history in physics, a field in which it has often shaped research agendas without always dictating the day-to-day contents of experiments.
Quantum physics itself grew out of attempts in the early 20th century to explain atoms and light, work associated with figures such as Max Planck, Albert Einstein, Niels Bohr, Werner Heisenberg, and Erwin Schrödinger.
But the second half of the century pushed quantum ideas into devices like atomic clocks, masers and lasers, and semiconductor physics, all of which states treated as strategic technologies.
Accounts of the development of quantum electronics and universities' incentives and organisational structures during the Cold War have paved the way for debates about whether such patronage only accelerated research or also changed its direction, and about how much agency scientists have retained inside these funding systems.
The Defense Advanced Research Projects Agency (DARPA) at the U.S. Department

of Defence is also famed for directly funding quantum information science for decades.
Today, however, quantum physics, cyber security, advanced artificial intelligence, and space systems are all capabilities that governments want to control, scale, and weaponise, often with the anxiety that their rivals might do so first.
The manifesto acknowledges that the greater threat isn't every piece of quantum research leading to a weapon but that defence-linked funding can reshape the whole ecosystem in the military establishment's favour. This is mainly because its funding is stable, which is attractive for students and universities.

23F. In manifesto, scientists oppose 'militarisation' of research into quantum science

घोषणापत्र में वैज्ञानिकों ने क्वांटम विज्ञान अनुसंधान के 'सैन्यीकरण' का विरोध किया

- A group of quantum researchers has issued a manifesto urging colleagues to resist what it calls the "militarisation" of quantum science.
क्वांटम शोधकर्ताओं के एक समूह ने एक घोषणापत्र जारी किया है, जिसमें साथियों से क्वांटम विज्ञान के "सैन्यीकरण" का विरोध करने का आग्रह किया गया है।
- The authors, who describe themselves as "Quantum Scientists for Disarmament", say they oppose military uses of quantum research, reject military funding for academic work, and want universities to disclose which quantum projects take defence money.
लेखक, जो स्वयं को "निरस्त्रीकरण के लिए क्वांटम वैज्ञानिक" बताते हैं, कहते हैं कि वे क्वांटम अनुसंधान के सैन्य उपयोग का विरोध करते हैं, अकादमिक कार्य के लिए सैन्य वित्तपोषण को अस्वीकार करते हैं, और चाहते हैं कि विश्वविद्यालय यह सार्वजनिक करें कि कौन-से क्वांटम प्रोजेक्ट रक्षा धन लेते हैं।
- The manifesto, uploaded to the arXiv repository on the web on January 13, frames its call as a response to wider trends in rearmament and the spread of dual-use technologies, i.e. those that claim civilian value while also serving defence goals.
यह घोषणापत्र 13 जनवरी को वेब पर arXiv रिपॉजिटरी में अपलोड किया गया, और इसे पुनःशस्त्रीकरण की व्यापक प्रवृत्तियों तथा दोहरे-उपयोग वाली प्रौद्योगिकियों के प्रसार के प्रति एक प्रतिक्रिया के रूप में प्रस्तुत किया गया है, यानी ऐसी तकनीकें जिनका नागरिक मूल्य भी बताया जाता है और जो रक्षा उद्देश्यों की भी सेवा करती हैं।
- The group proposes four immediate steps: to speak as a collective against military use, to force an ethics debate inside the field, to create a forum for concerned researchers, and to establish a public database listing defence-funded projects at public universities.
समूह ने चार तात्कालिक कदम प्रस्तावित किए हैं: सैन्य उपयोग के खिलाफ सामूहिक रूप से बोलना, क्षेत्र के भीतर नैतिक बहस को मजबूर करना, चिंतित शोधकर्ताओं के लिए एक मंच बनाना, और सार्वजनिक विश्वविद्यालयों में रक्षा-वित्तपोषित परियोजनाओं की सूची वाला सार्वजनिक डेटाबेस स्थापित करना।
- "We still believe that war must be utterly rejected as a means of settling international disputes, and that peace can only be guaranteed by diplomacy, international treaties, and cooperation, rather than by mutual assured destruction," the manifesto says.
"हम अब भी मानते हैं कि अंतरराष्ट्रीय विवादों को सुलझाने के साधन के रूप में युद्ध को पूरी तरह अस्वीकार किया जाना चाहिए, और शांति केवल कूटनीति, अंतरराष्ट्रीय संधियों और सहयोग से ही सुनिश्चित की जा सकती है, न कि परस्पर सुनिश्चित विनाश से," घोषणापत्र में कहा गया है।
- "As scientists working in a non-neutral research field, we can raise our voices toward that aim."
"एक गैर-तटस्थ अनुसंधान क्षेत्र में काम करने वाले वैज्ञानिकों के रूप में, हम उस उद्देश्य की ओर अपनी आवाज़ उठा सकते हैं।"
- The researchers argue that quantum physics is no longer just basic science and that its military applications have become evident.



शोधकर्ताओं का तर्क है कि **क्वांटम भौतिकी** अब केवल **मूल विज्ञान** नहीं रही है और इसके **सैन्य अनुप्रयोग** स्पष्ट हो चुके हैं।

- These include **quantum communications, space and drone sensing, high-precision timing for navigation, and surveillance.**
इनमें **क्वांटम संचार, अंतरिक्ष और ड्रोन संवेदन, नेविगेशन के लिए उच्च-सटीक समय निर्धारण, और निगरानी** शामिल हैं।

‘Strategic competition’ ‘रणनीतिक प्रतिस्पर्धा’

- The manifesto says that **NATO**, for example, has located its quantum physics work inside its broader “**emerging and disruptive technologies**” agenda and released a **public quantum strategy summary** in 2024 that described research in this field as an element of **strategic competition.**
घोषणापत्र में कहा गया है कि उदाहरण के लिए **नाटो** ने अपने क्वांटम भौतिकी कार्य को अपनी व्यापक “**उभरती और विघटनकारी प्रौद्योगिकियों**” की एजेंडा के भीतर रखा है और **2024** में एक **सार्वजनिक क्वांटम रणनीति सारांश** जारी किया, जिसमें इस क्षेत्र के अनुसंधान को **रणनीतिक प्रतिस्पर्धा** का एक तत्व बताया गया।
- **European institutions** have also described quantum physics as relevant to **defence projects**, with the **European Commission** describing **quantum sensors** as offering **performance improvements** for military operations.
यूरोपीय संस्थानों ने भी क्वांटम भौतिकी को **रक्षा परियोजनाओं** से संबंधित बताया है, और **यूरोपीय आयोग** ने **क्वांटम सेंसरों** को सैन्य अभियानों के लिए **प्रदर्शन में सुधार** प्रदान करने वाला बताया है।
- The manifesto also says **India’s National Quantum Mission** works in “**strong collaboration**” with the public and private defence sectors.
घोषणापत्र में यह भी कहा गया है कि **भारत का राष्ट्रीय क्वांटम मिशन** सार्वजनिक और निजी रक्षा क्षेत्रों के साथ “**मजबूत सहयोग**” में काम करता है।
- Late last month, **India’s Chief of Defence Staff** released a “**Military Quantum Mission Policy Framework**” to guide how the armed forces plan to integrate **quantum technologies.**
पिछले महीने के अंत में, **भारत के चीफ ऑफ डिफेंस स्टाफ** ने “**मिलिट्री क्वांटम मिशन पॉलिसी फ्रेमवर्क**” जारी किया, ताकि सशस्त्र बलों द्वारा **क्वांटम तकनीकों** के एकीकरण का मार्गदर्शन किया जा सके।
- Researchers don’t always see the **defence implications** of a project at the outset.
शोधकर्ता हमेशा किसी परियोजना के **रक्षा संबंधी निहितार्थों** को शुरुआत में नहीं देख पाते।
- Even when partial information exists, institutions can hide it behind **funding structures and partnership vehicles.**
आंशिक जानकारी होने पर भी, संस्थान उसे **वित्तपोषण संरचनाओं** और **साझेदारी तंत्रों** के पीछे छिपा सकते हैं।
- This is why they say they’ve called for a **public database**, to force agencies and institutions to be clear about **who funds what**, and to reduce the room for any actors to deny their involvement after a technology finds its way into a **military application.**
इसीलिए वे कहते हैं कि उन्होंने **सार्वजनिक डेटाबेस** की मांग की है, ताकि एजेंसियों और संस्थानों को यह स्पष्ट करना पड़े कि **कौन किसे वित्तपोषित करता है**, और किसी तकनीक के **सैन्य उपयोग** में पहुँचने के बाद किसी भी पक्ष के लिए अपनी भूमिका से इनकार करने की गुंजाइश कम हो।
- **Military patronage** has a long history in **physics**, a field in which it has often shaped **research agendas** without always dictating the day-to-day contents of experiments.
भौतिकी में **सैन्य संरक्षण** का एक लंबा इतिहास है, एक ऐसा क्षेत्र जहाँ इसने अक्सर **अनुसंधान एजेंडों** को आकार दिया है, भले ही हमेशा प्रयोगों की दैनिक सामग्री तय न की हो।
- **Quantum physics** itself grew out of attempts in the **early 20th century** to explain **atoms and light**, work associated with figures such as **Max Planck, Albert Einstein, Niels Bohr, Werner Heisenberg, and Erwin Schrödinger.**
क्वांटम भौतिकी स्वयं **20वीं सदी की शुरुआत** में **परमाणुओं और प्रकाश** को समझने के प्रयासों से विकसित हुई, जो **मैक्स प्लैंक, अल्बर्ट आइंस्टीन, नील्स बोहर, वर्नर हाइजेनबर्ग और एर्विन श्रॉडिंगर** जैसी हस्तियों से जुड़ा है।
- But the **second half of the century** pushed quantum ideas into devices like **atomic clocks, masers and lasers, and semiconductor physics**, all of which states treated as **strategic**



technologies.

लेकिन सदी के दूसरे भाग में क्वांटम विचारों को परमाणु घड़ियों, मेज़र और लेज़र, तथा अर्धचालक भौतिकी जैसे उपकरणों में लागू किया गया, जिन्हें राज्यों ने रणनीतिक प्रौद्योगिकियाँ माना।

- Accounts of the development of **quantum electronics** and universities' incentives and organisational structures during the **Cold War** have paved the way for debates about whether such patronage only **accelerated research** or also **changed its direction**, and about how much **agency scientists** have retained inside these funding systems.

क्वांटम इलेक्ट्रॉनिक्स के विकास तथा शीत युद्ध के दौरान विश्वविद्यालयों की प्रोत्साहन और संगठनात्मक संरचनाओं के विवरण ने इस बहस को जन्म दिया है कि क्या ऐसे संरक्षण ने केवल अनुसंधान को तेज़ किया या उसकी दिशा भी बदली, और इन वित्तपोषण प्रणालियों के भीतर वैज्ञानिकों ने कितनी स्वायत्तता बनाए रखी।

- The **Defense Advanced Research Projects Agency (DARPA)** at the **U.S. Department of Defence** is also famed for directly funding **quantum information science** for decades.

अमेरिकी रक्षा विभाग की डिफेंस एडवांस्ड रिसर्च प्रोजेक्ट्स एजेंसी (DARPA) भी दशकों से क्वांटम सूचना विज्ञान को सीधे वित्तपोषित करने के लिए प्रसिद्ध है।

- Today, however, **quantum physics**, **cyber security**, **advanced artificial intelligence**, and **space systems** are all capabilities that governments want to **control, scale, and weaponise**, often with the anxiety that their rivals might do so first.

आज, हालांकि, क्वांटम भौतिकी, साइबर सुरक्षा, उन्नत कृत्रिम बुद्धिमत्ता, और अंतरिक्ष प्रणालियाँ ऐसी क्षमताएँ हैं जिन्हें सरकारें नियंत्रित, विस्तारित और हथियारबंद करना चाहती हैं, अक्सर इस चिंता के साथ कि उनके प्रतिद्वंद्वी ऐसा पहले न कर दें।

- The manifesto acknowledges that the greater threat isn't every piece of quantum research leading to a weapon but that **defence-linked funding** can **reshape the whole ecosystem** in the military establishment's favour.

घोषणापत्र स्वीकार करता है कि बड़ा खतरा यह नहीं है कि क्वांटम अनुसंधान का हर हिस्सा हथियार बने, बल्कि यह है कि **रक्षा-संबंधित वित्तपोषण पूरे पारिस्थितिकी तंत्र को सैन्य प्रतिष्ठान के पक्ष में पुनःआकार दे सकता है।**

- This is mainly because its funding is **stable**, which is attractive for **students and universities**.

यह मुख्यतः इसलिए है क्योंकि इसका वित्तपोषण स्थिर होता है, जो छात्रों और विश्वविद्यालयों के लिए आकर्षक है।