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OPEC+ grouping expected to open taps more despite price slump

After surprising markets with a sharp supply increase, OPEC+ is expected to ramp up production by larger quantum; some countries have increased output more than agreed, and risked Saudi Arabia's ire; past internal disputes; pressure from the White House threatens a drive-down of prices.

NEWS ANALYSIS

Agence France-Presse
LONDON

Doubtful path: Observers are sceptical, given concerns about global demand due to trade war that Trump has unleashed. AFP

Despite oil trading low at $60, OPEC+ this week is expected to continue to further open the taps.

This follows pressure from U.S. President Donald Trump and group leader Saudi Arabia's quest to penalise allies that breach the cartel's quotas.

In past months, Saudi Arabia, Russia and six other OPEC+ members have surprised markets by announcing a sharp increase in oil production despite the low prices.

Numbering a total of 22 countries, most of which are highly dependent on oil revenues, the group has long been exploiting supply scarcity to boost prices, holding millions of barrels in reserve.

This week the cartel will hold two meetings -- one online on Wednesday with all OPEC+ members to discuss the group's common strategy, and one on Sunday with just the eight member states, known as the "V8", that have made the largest cuts recently.

"What's most interesting is the V8 decision" in Sunday's meeting regarding production for July, UBS analyst Giovanni Staunovo told AFP.

Analysts expect the V8 to up production by 411,000 barrels a day for July -- the same as in May and June -- whereas the initial plan called for an increase of 137,000 barrels.

This could further weigh down prices already slumping to lows last seen during the pandemic, which hit global demand.

Internal disagreements

The Organization of the Petroleum Exporting Countries and their allies -- collectively known as OPEC+ -- have justified their change in strategy by citing "current healthy market fundamentals, as reflected in the low oil inventories".

Observers, however, are sceptical, given concerns about global demand due to the trade war that Mr. Trump has unleashed.

> It is absolutely impossible to interpret the change in position of the eight OPEC+ countries without referring to the pressure from Donald Trump
>
> **FRANCIS PERRIN**
> senior research fellow, Institute for International and Strategic Relations

Since late 2022, the cartel had slashed production, with Riyadh, Moscow and the six other OPEC+ members withholding 2.2 million barrels per day.

At the start of the year, the group said it would reintroduce some of the oil kept under ground, but it has significantly accelerated the pace.

With this, OPEC leader Saudi Arabia effectively puts pressure on members that have failed to cut back their production as agreed, reducing their profits.

Behind the quota violations, there are "people who make investments and want to monetise the benefit", said Lawrence Haar, an associate professor at the University of Brighton, told AFP.

For Kazakhstan, the main offender within the group, the increase in recent production is linked to the Tengiz project, whose main operator is the American group Chevron, according to Francis Perrin, a senior research fellow at the Institute for International and Strategic Relations (IRIS). Other countries, such as Iraq or the United Arab Emirates, have also increased output more than agreed, but Riyadh targets especially Astana. "Kazakhstan continues to overproduce massively above its OPEC+ quota, and Saudi cannot walk back on its threats of punishing the cheaters without losing credibility, so it leaves Saudi with no choice," DNB Carnegie analysts said.

Pressure from Trump

Beyond these internal disputes, "it is absolutely impossible to interpret the change in position of the eight OPEC+ countries without referring to the pressure from Donald Trump", according to Mr.Perrin.

The U.S. leader -- aiming to drive down prices to combat inflation being stoked domestically -- said in late January that he would ask Saudi Arabia and other OPEC nations "to bring down the cost of oil".

During Mr. Trump's recent diplomatic tour of Gulf countries, "none of that has been mentioned", suggesting that "he seems to be happy with the actions" of OPEC+, said Carole Nakhle, an economist at the Surrey Energy Economics Centre.

Eye on talks

OPEC+ is also no doubt keeping an eye on the outcome of discussions between Tehran and Washington on the Islamic republic's nuclear programme. If a deal on that were reached -- and sanctions lifted -- OPEC member Iran's oil would also come onto the global market. Excessively low oil prices do present a challenge for Saudi Arabia, the world's largest oil exporter, to finance its ambitious plan aimed at diversifying the economy.

"The Saudi Arabian economy depends on oil," Mr. Nakhle stressed.

ABSTRACT

ISTOCKPHOTO

Scientists finally solve the 160-year-old problem of Mendel's peas

In 1900, 16 years after Mendel's death, three scientists realised that Mendel had answered the question of whether some traits of the parents are passed on to their offspring more frequently than others

Arun Panchapakesan

Feng, C., Chen, B., Hofer, J. et al, 'Genomic and genetic insights into Mendel's pea genes', *Nature* (2025). doi.org/10.1038/s41586-025-08891-6

In 1856, an Austrian monk named Gregor Johann Mendel began experimenting on pea plants to understand how traits are passed on from parent to offspring. He worked diligently for eight years, experimenting on more than 10,000 plants, before presenting his results in a meeting of the Brunn Natural History Society in 1865.

His work was published the following year in a small journal of the society called *Proceedings of the Natural History Society of Brno*. His findings received very little attention at the time. Mendel died in 1884, unaware that his work would go on to become the foundation of the field of genetics.

Crossing plants

In 1900, 16 years after Mendel's death, three scientists – Hugo de Vries, Carl Correns, and Erich von Tschermak – independently rediscovered his work. They realised that Mendel had answered the question of whether some traits of the parents are passed on to their offspring more frequently than others.

Mendel had studied the inheritance patterns of seven traits in pea plants, each with two clearly distinguishable forms. For example, one of the traits he examined was seed shape, where the seeds were either round or wrinkled. Mendel observed that when he crossed plants with opposing traits, one form would consistently dominate the other. That is, crossing plants with round seeds and those with wrinkled seeds always produced first-generation offspring with round seeds.

Interestingly, when two such first-generation plants were crossed, the wrinkled form reappeared, though at a much lower frequency. Mendel found that the ratio of round to wrinkled seeds in this second generation was consistently around 3:1. For reasons unknown at the time, the round form appeared to "dominate" the wrinkled form, and this same pattern held true for all seven traits he studied, the remaining six being: seed colour (yellow or green), flower colour (purple or white), pod shape (inflated or constricted), pod colour (green or yellow), flower position (along the stem or at the end), and plant height (tall or short).

Predictability of inheritance

Mendel's observations became the basis for understanding how traits are inherited through discrete units of heredity, which we now call genes.

Scientists later realised that for each trait, an organism carries two versions of a gene, one inherited from each parent. These versions, known as alleles, can differ in their effect on the offspring's appearance. In many cases, one allele masks the effect of the other, explaining why only one form of the trait appeared in first-generation plants.

This work provided the first clear evidence that inheritance follows predictable patterns – an insight that eventually led to the development of the chromosome theory of inheritance, the identification of genes as specific units on chromosomes, and paved the way for the emergence of modern genetics.

However, the original question of what genetic differences gave rise to the two forms of each of the seven traits Mendel studied remained unanswered for a long time. Although efforts to identify the genetic locations involved had begun to make progress by 1917, it took the scientific community another 108 years to fully understand why Mendel observed what he did.

Mountain of information

A paper published in *Nature* on April 23, has now identified the genetic factors responsible for the final three traits, that had remained unresolved, while also uncovering additional alleles involved in the four traits that were previously characterised.

The team achieved this by selecting more than 697 well-characterised variants of the pea plant and sequencing the total DNA content of all these plants using a technique called next-generation sequencing. This resulted in almost 60 terabases of DNA sequence information. That's the equivalent of nearly 14 billion pages of text, or a stack of A4 sheets stretching 700 km into the sky.

The answer to the problem of Mendel's traits was buried within this colossal mountain of information.

Opening new doors

The authors of the study analysed this data to create a comprehensive map so that they could begin searching for patterns. This revealed several interesting findings.

First, while it is well accepted that the genus Pisum, to which the pea plant belongs, has four species, genetically they appear to form eight groups. The four species are spread across these groups due to multiple crosses and admixtures between them, revealing that the plants have a more complex population structure than previously recognised.

Second, while four of Mendel's seven traits – viz. seed shape, seed colour, plant height, and flower colour – were well characterised, the team identified additional allelic variants that contribute to the observed traits. For instance, the team found a new variant that, when present in white-flowered plants, causes them to produce purple flowers again, showing that the genetic picture is more complex than Mendel originally observed.

Third, they identified genes that are involved in the remaining three traits – pod colour, pod shape, and flower position – that remained uncharacterised until now. Specifically, they found that a deletion of a segment of DNA present before a gene called ChlG disrupts the synthesis of chlorophyll, the pigment that gives plants their green colour, resulting in the yellow pods. Changes near the MYB gene and changes in the CLE-peptide-encoding genes together resulted in the constricted pod trait. And a small deletion in the DNA containing the CIK-like-coreceptor-kinase gene, along with the presence of another DNA segment called a modifier locus, was associated with the flowers appearing at the end of the stem.

Finally, the map that the team generated shows multiple other genome-wide interactions that Mendel did not study, including 72 agriculturally relevant traits such as the architectures of the seed, pod, flower, leaf, root and plant.

While closing the doors on this 160-year-old scientific mystery, the scientists involved in the study have paved the way to something greater. The depth of genetic information they had uncovered holds enormous promise for future research, with a lot of implications for increasing crop yield, enhancing disease resistance, and improving environmental adaptations.

It is incredible to think that all of this owes its origin to a 19th century monk, who, while tending to his garden, chose to ask why.

Arun Panchapakesan is an assistant professor at the Y.R. Gaitonde Centre for AIDS Research and Education, Chennai.

Why are 'sugar boards' necessary in schools?

How do 'sugar boards' teach children about the health risks associated with high sugar consumption? Has the National Commission for Protection of Child Rights stepped in? Is Type-2 diabetes prevalent in children in India? Has the Food Standards and Safety Authority of India formulated a High Fat, Salt and Sodium definition?

EXPLAINER

Maitri Porecha

The story so far:

In order to check the sugar intake of school-going children, the Central Board of Secondary Education (CBSE) has instructed over 24,000 affiliated schools across India to establish 'sugar boards', where information is displayed for educating students about the risks of excessive sugar intake.

What are 'sugar boards'?

Two years ago, food influencer Revant Himatsingka appealed to schools through a video to start a 'sugar board' campaign, which involves a visual representation of the quantity of sugar contained in a bottle of aerated drink or packaged fruit juice. "Children need to learn in fun and interesting ways the perils of consuming excess sugar. So, in Do It Yourself (DIY) workshops with school children, we ask the students to stick, say for instance bottles of aerated drinks, or packaged juices, [on a paper/white board] and adjacent to that stick the quantity of sugar in a packet and number of teaspoons of sugar that go into the product," Mr. Himatsingka told *The Hindu*. For example, a 300 ml bottle of a popular aerated drink contains eight teaspoons of sugar, with one teaspoon of sugar being nearly four grams. Similarly, a popular brand of a 125 ml packaged mango drink contains five teaspoons of sugar.

'Sugar boards' provide essential information, including recommended sugar intake, the sugar content in commonly consumed foods (such as junk food and cold drinks), health risks associated with high sugar consumption and healthier dietary alternatives.

The CBSE has stated that schools may submit a brief report and photos of the activity on 'sugar boards' till July 15. Mr. Himatsingka said that while many schools have already included 'sugar boards' in their activities, CBSE's directive will create awareness in nearly two crore students and their families.

GETTY IMAGES

Why are 'sugar boards' necessary?

The National Commission for Protection of Child Rights (NCPCR) has pushed for the introduction of a 'sugar board' in all schools, not only in those which are CBSE affiliated, but also in schools which are affiliated to various State boards. In a letter written to CBSE by NCPCR in March earlier this year, the child rights body emphasised, "Over the past decade, there has been a significant increase in Type 2 Diabetes among children, a condition primarily seen in adults. This alarming trend is attributable to high sugar intake... easy availability of sugary snacks, beverages and processed foods within school environments," the letter states.

While population-based data on Type-2 diabetes among children and adolescents are unavailable from India, it is estimated that the incidence of Type 2 Diabetes in the group is 397 per lakh population, next only to China which has 734 estimated cases per lakh. Speaking with *The Hindu*, Dr. Divya Gupta, gynaecologist and a member of NCPCR, said, "Studies indicate that sugar constitutes 13% of daily calorie intake for children aged 4 to 10 years and 15% of those aged 11 to 18 years —substantially exceeding the recommended limit of 5%."

What is India's regulatory stand?

Official sources said that the Food Standards and Safety Authority of India (FSSAI) had convened a scientific panel of experts in April and May earlier this year, to decide on a High Fat, Salt and Sugar (HFSS) definition pertaining only to school meals. However, the FSSAI has still not set HFSS standards or finalised the 'health-star rating system', for front-of-pack labelling regulations. "In the meeting, we could not arrive at definition for HFSS for what comprises a school meal. Discussions are underway and it was decided that the HFSS definition for what comprises school meals cannot be different from that of packaged food. So a holistic HFSS definition should be formulated," an official said.

Currently, FSSAI has regulation for brands making food claims. For instance, a low sugar claim can only be made if a product contains not more than five gm sugar per 100 gm. "While there are regulations in place for making claims on packaged food, FSSAI has not fixed cut-offs for High Fat, Salt, Sugar consumption for the Indian population," the official said. India currently relies on World Health Organization (WHO) cut-offs for ideal HFSS intake. For instance, WHO guidelines restrict daily sugar intake in adults and children to 25 grams (six teaspoons). However, experts argue that the Indian cut-off should be lower, and should be derived from indigenous data, as the genetic make-up of Indians make them more prone to heart attacks. "We need epidemiological data, through a country wide study which monitors dietary intake, along with variables like data on Body Mass Index, insulin resistance, lipid profile, biochemical parameters and so on," said an expert closely working with FSSAI on the issue.

What next?

Dr. Gupta said that the child rights body is working on gradually introducing directives for foods high in salt and trans-fats as well.

"NCPCR is also gathering data on children suffering from diabetes from government hospitals. We will be talking to parents during parent teacher meetings about the importance of healthy eating. We have had stakeholder meetings with paediatric doctors who will be roped in to go to schools for workshops and so on. Introducing 'sugar boards' is just the beginning," Dr. Gupta said.

THE GIST

- The NCPCR has pushed for the introduction of a 'sugar board' in all schools, not only in those which are CBSE affiliated, but also in schools which are affiliated to various State boards.
- 'Sugar boards' provide essential information, including recommended sugar intake, the sugar content in commonly consumed foods, health risks associated with high sugar consumption and healthier dietary alternatives.
- WHO guidelines restrict daily sugar intake in adults and children to 25 grams (six teaspoons).

Arms deals: India moves away from Russia; Pakistan from the U.S.

India has increased its dependency on Western countries, while Pakistan has relied extensively on China

DATA POINT

Nitika Francis
Vignesh Radhakrishnan

While India effectively utilised many of its indigenous defence systems during Operation Sindoor, it also relied on weapons built in collaboration with Israel, such as the SkyStriker drone, and those imported from Russia, such as the Pechora and OSA-AK missiles. Pakistan used Chinese-origin PL-15 missiles and Turkish-origin Unmanned Aerial Vehicles.

An analysis of arms transfer data from the Stockholm International Peace Research Institute shows that over the past decade, there has been a significant shift in the sourcing of weapons for both India and Pakistan. India has gradually reduced its dependence on Russia and has increasingly turned to Western countries such as France, the U.S., and the U.K. A significant portion of its arms imports also comes from Israel. The data reflect the quantity of weapons imported, without accounting for their firepower or operational role.

Chart 1A shows the country-wise share of India's defence imports. Staring from the 1960s, India began to consistently source more than 33% of its weapons from Russia (formerly the Soviet Union). This dependence peaked in the 1990s, when Russia accounted for an overwhelming 96.5% of India's imports. From then, Russia's share steadily dropped, falling to a still substantial 75% in the 2020s. This drop was offset by increased imports from other countries: in the 2020s, France accounted for over 9%, the U.K. for 5.5%, Israel for nearly 5%, and the U.S. for close to 3% of India's weapons imports.

In contrast, Pakistan has historically sourced the majority of its weapons from both China and the U.S. over several decades. However, in the 2020s, China has emerged as Pakistan's dominant arms supplier. **Chart 1B** illustrates the country-wise share of Pakistan's defence imports. In the 2020s, nearly 95% of Pakistan's arms imports came from China, marking a sharp rise from 41% in the 2010s and just 19% in the 2000s. Meanwhile, the U.S.'s share declined from nearly 67% in the 2000s to 38% in the 2010s to merely 0.85% in the 2020s.

Apart from overall arms procurement, specific weapons and aircraft were also points of discussion during the recent conflict. The Indian Air Force played a crucial role in "delivering precision strikes against terror infrastructure across Pakistan". Additionally, the IAF's control of the airspace proved "pivotal in protecting Indian airspace during retaliatory drone and UAV attacks".

Charts 2A and 2B present the same data as Chart 1A and 1B, but focus exclusively on weapons related to air power. India's dependence on countries apart from Russia is even more evident in this regard. In the 2020s, India has procured more than 55% of its weapons related to air power from France, the U.K., and Israel.

Pakistan's dependence on China is also even more pronounced in this regard. Over the past three decades, between 50% and 85% of Pakistan's air-related imports have come from China.

While the U.S.'s share in Pakistan's arms imports has significantly declined and its share in India's imports is only gradually rising, the superpower continues to dominate global arms exports overall **(Chart 3)**. In the 2020s, more than 65% of the world's arms exports originated from the U.S. Russia's share has dwindled to 5% in the 2020s, which coincides with its invasion of Ukraine.

Interestingly, China accounts for less than 2% of total exports worldwide in the 2020s. A significant portion of its limited exports (33%) is directed to Pakistan **(Chart 4)**.

Chart 1A: The country-wise share of India's defence imports across decades

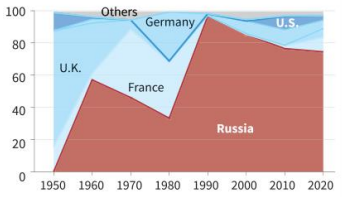


Chart 1B: The country-wise share of Pakistan's defence imports across decades

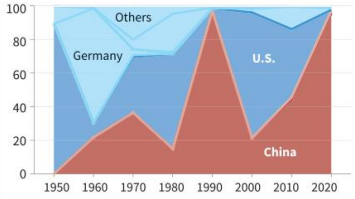


Chart 2A: The country-wise share of India's defence imports exclusively on weapons related to air power

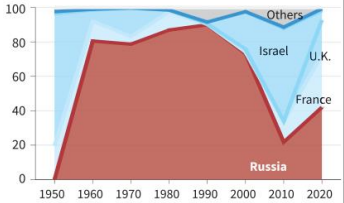


Chart 2B: The country-wise share of Pakistan's defence imports exclusively on weapons related to air power

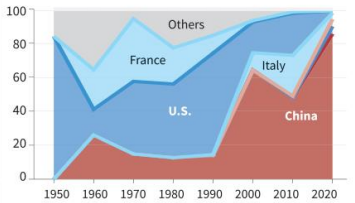


Chart 3: Country-wise share of global arms exports across decades

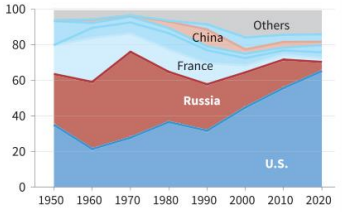
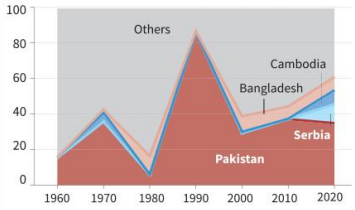


Chart 4: Country-wise share of China's arms exports across decades



Greater share

States deserve a bigger share of central taxes in post-GST era

Prime Minister Narendra Modi's exhortation to the Chief Ministers gathered at the 10th Governing Council Meeting of NITI Aayog over the weekend, in New Delhi, that the Centre and States should come together as "Team India" to propel the country forward, is a good sentiment; but, it belies reality. The Centre-States relationship right now is a one-way street, with the Centre resorting to the stick, and, occasionally, to the carrot method, to make the States comply with its wishes. The States are finding it increasingly difficult to voice their often genuine and serious grievances at the national level since federal bodies such as the NITI Aayog Governing Council or the Goods and Services Tax (GST) Council do not meet often. Meeting once a year is not nearly enough for the Governing Council of a body whose very first objective is to develop a "shared vision of national development priorities". The GST Council, too, has not met in more than five months, when regulations say it should meet at least once a quarter. So, when the States do get a chance to speak at the national level, as they did on Saturday, most have no choice but to focus on their individual problems or achievements rather than on a collaborative 'Team India' approach. There were, however, some notable deviations where Chief Ministers looked beyond their States' borders in an attempt to drive national growth. One was Andhra Pradesh Chief Minister N. Chandrababu Naidu's proposal for the creation of three sub-groups of States to focus attention on the issues of GDP growth and investments, leveraging India's demographic bounty, and using technology to drive governance. Sub-groups are a good way for the Centre to bring States on board, if it finds a body comprising all States to be too unwieldy.

The most notable pan-India suggestion was probably Tamil Nadu Chief Minister M.K. Stalin's call for the Centre to share 50% of its tax revenue with the States, up from the current formula of 41%. This is an issue that certainly requires more discussion. The implicit condition behind the Centre providing States compensation for any losses arising out of GST for five years was that the States would use this time to bolster their own tax revenues. While progress on this has been patchy – with some States doing far better than others – it has nevertheless been significant. The States' combined own tax revenues as a percentage of Gross State Domestic Product (GSDP) grew from 6.6% in 2017-18 to 7.2% in 2024-25. On the other hand, GST has failed to live up to its potential, with net revenues only recently surpassing pre-GST indirect tax levels. Since GST subsumed many of the States' levies, it seems only fair that the Centre seriously consider their demand for a bigger share in central taxes.

An operation that was also about a self-reliant India

Sanjiv Puri

is President, Confederation of Indian Industry (CII)

Chandrajit Banerjee

is Director General, Confederation of Indian Industry (CII)

Operation Sindoor has been a validation of a decade-long focus to ensure India's economic and technological resilience

Over the past decade, India has undergone a profound transformation across economic, technological, and strategic domains. Prime Minister Narendra Modi's leadership has been central to this evolution, underpinned by his belief that India must not only be a major economic player but also a strategic and technological power in the 21st century. Under his leadership, India has emerged as a globally engaged strong self-reliant and resilient nation.

Path to industrial resurgence, innovation

When "Make in India" was launched in 2014, it signalled a paradigm shift. India no longer aspired to remain a passive participant in the global manufacturing value chain. Instead, it set its sights on becoming a manufacturing powerhouse. The policy ushered in major reforms that were aimed at improving ease of doing business, streamlining approvals, and encouraging both domestic and foreign direct investments. Sectors such as electronics, defence and automobiles saw renewed interest, with production-linked incentive (PLI) schemes further amplifying India's attractiveness as a manufacturing hub.

In 2020, the Atmanirbhar Bharat Abhiyan (Self-Reliant India Mission) reinforced this momentum. It was a fervent call for action to not only make India self-reliant but also become a global lighthouse in state-of the-art manufacturing, with modern and efficient value chains while integrating globally powered by its own strengths. This would also reduce India's dependence on imports in key strategic areas. It focused sharply on bolstering capacities in defence manufacturing, electronics, semiconductors, pharmaceuticals and critical minerals. These are not just economic sectors; they are also key enablers of strategic importance and national security.

Parallel to its industrial resurgence, India has also emerged as a global innovation leader. Today, it is the world's third-largest start-up ecosystem. From fintech to agritech, health tech to edtech, Indian startups are not only solving local challenges but also competing globally. Importantly, the start-up ecosystem is beginning to make strategic contributions in defence tech, cybersecurity, Artificial Intelligence (AI) and space technology.

India's economic transformation is bolstered by global engagements and strategic partnerships. Collaborations such as the U.S.-India Transforming the Relationship Utilizing Strategic Technology (TRUST) initiative and the India-France road map advance cooperation in AI, quantum, and defence tech.

A focus on 'Made in India'

Operation Sindoor was a moment of reckoning for Made in India. The operation showcased India's ability to strike with precision and confidence using indigenous defence technologies. The operation not only neutralised threats across the border but also symbolised India's gradual transition from a dependent arms importer to a producer of world-class defence equipment. India's defence exports climbed up to ₹23,622 crore in FY25, reaching out to close to 80 countries, and is expected to touch ₹50,000 crore by 2029. The private sector's contribution to these exports is ₹15,233 crore.

We understand that much of the equipment used in Operation Sindoor was developed under the Make in India and Atmanirbhar Bharat initiatives. This operation was, therefore, a validation of a decade-long focus on economic and technological resilience, under the Prime Minister.

In today's world, national power is increasingly defined by technological leadership. Nations that do not control future-critical technologies such as AI, quantum computing, biotechnology, and space systems risk long-term strategic vulnerability. India has rightly recognised this and is actively investing in these domains. Government initiatives such as the National Quantum Mission and the India Semiconductor Mission are positioning the country as a hub for advanced research and technology development. The Indian Space Research Organisation's achievements, including the Chandrayaan and Gaganyaan missions, reflect the maturity of India's space capabilities. However, technology leadership cannot rest solely on government initiatives. It must be a national enterprise involving industry, academia, and startups.

Indian industry remains committed to stepping up its efforts and actively collaborating with the government in this journey toward global excellence. Given the recent events, it would be important to strengthen industry's resolve to explore newer horizons to contribute even more meaningfully to building a secure and resilient tomorrow and reinforce India's position as a leader in frontier technology.

Industry is helping build hi-tech capabilities across a wide range of critical sectors such as semiconductors, clean tech, next-gen mobility, defence and electronics. Industry has significantly contributed to India's space success by providing critical components and supporting satellite and launch vehicle development. It is helping enhance India's defence capabilities by developing advanced technologies, supporting indigenous manufacturing, and collaborating on joint ventures for systems such as missiles, drones, and combat platforms.

Indian industry is playing a key role in building India's AI capabilities through investments, innovation, and collaboration. It supports initiatives such as Bhashini for AI-driven real time language translation in 22 languages and partners in FutureSkills Prime to train professionals, ensuring a skilled workforce for AI-driven growth.

Going forward, the private sector must ramp up its investments in research and development (R&D). It must also be more aggressive in forging overseas technology partnerships and joint ventures to leapfrog India's technological capabilities.

Collaborations between industry, academia and public research institutions are critical and industry should take a lead in catalysing these. Through these collaborations, not only should it contribute to R&D and innovation, but it must also contribute toward generating a steady pipeline of industry ready and trained engineers, scientists and skilled technicians who can drive innovation and manufacturing.

A lead role for India

India today stands at a defining juncture. With economic resilience, manufacturing strength, innovation-led growth, and a global outlook, India is no longer catching up – it is shaping the future. The Prime Minister's leadership has laid a robust foundation and this purposeful journey to Viksit Bharat will call for substantial industry action. As the Prime Minister has said "Self-reliance has not only become India's policy, but it has also become our passion." The Confederation of Indian Industry would indeed like to fuel this passion and see India rise to higher orbits in the future.

India must now aim to lead the next wave of global innovation. It must embed technological ambition into its industrial, academic and strategic fabric. The vision is clear: a strong, secure, self-reliant, and globally respected India.

The dawn of autonomous satellites and the legal vacuum above us

AI hallucinations are becoming an important source of misinformation on the ground, and they pose a similar threat in space. A satellite hallucinating, misclassifying a harmless commercial satellite as hostile, and responding with defensive actions is entirely uncharted territory

Shrawani Shagun
Leo Pauly

AI is transforming satellites from passive observers into active, thinking machines. IMAGE CREATED WITH CHATGPT

When the Soviet Union launched the Sputnik satellite in 1957, it started the Space Age as the beeping metal sphere transmitted radio signals. Since then, satellites have grown in complexity, but their core functions have remained surprisingly static. Most still function as passive tools: capturing images, relaying communications, beaming GPS coordinates to the earth, and so on.

But a quiet revolution is now underway above us. Satellites are becoming smarter, powered by artificial intelligence (AI), and autonomous.

Now, say an autonomous satellite operated by a private company malfunctions in orbit. The AI system onboard mistakenly interprets a routine atmospheric anomaly as a collision threat and initiates an unplanned evasive manoeuvre. In doing so, it crosses dangerously close to a military reconnaissance satellite belonging to a rival nation. A crash is narrowly averted, but not before that nation lodges a diplomatic protest and alleges hostile intent. The satellite's AI system was developed in one country, launched by another, operated from a third, and registered by a fourth. Who is liable? Who is accountable?

Understanding autonomous satellites

AI is transforming satellites from passive observers into active, thinking machines. Thanks to recent breakthroughs – from large AI models powering popular applications like ChatGPT to smaller, energy-efficient systems capable of running on smartphones – engineers are now able to fit satellites with onboard AI. This onboard intelligence is technically called satellite edge computing and allows satellites to analyse their environment, make decisions, and act autonomously like self-driving cars on the ground.

These AI-powered satellites are emerging from prestigious national labs and startup garages alike and possess game-changing applications:

* Automated space operations: Independent manoeuvring in space to perform tasks like docking, inspections, in-orbit refuelling, and debris removal
* Self-diagnosis and repair: Monitoring their own health, identifying faults, and executing repairs without human intervention
* Route planning: Optimising orbital trajectories to avoid hazards and obstacles or to save fuel
* Targeted geospatial intelligence: Detecting disasters and other events of interest in real-time from orbit and coordinating with other satellites intelligently to prioritise areas of interest
* Combat support: Providing real-time threat identification and potentially enabling autonomous target tracking and engagement, directly from orbit

Smarter sats, smarter risks

This autonomy is not without consequence.

AI hallucinations are becoming an important source of misinformation on the ground, and they pose a similar threat in the space domain. A satellite hallucinating, misclassifying a harmless commercial satellite as hostile, and responding with defensive actions is currently entirely uncharted territory. Misjudgments like this could escalate tensions between nations and even trigger a geopolitical crisis.

As satellites become more intelligent and autonomous, the stakes rise concomitantly. Intelligence brings not just power but also responsibility in technological design and legal, ethical, and geopolitical oversight.

In particular, AI's ability to confer autonomy to satellites exposes gaps in the Outer Space Treaty (OST) of 1967 and the Convention for International Liability for Damage Caused by Space Objects of 1972. The OST's assignment of state responsibility for space activities (Article VI), liability for damage (VII), and the Liability Convention's liability provisions assume a human is in control – but AI autonomy challenges this.

For example, the "authorisation and continuing supervision" concept in the OST is rendered ambiguous, and the Liability Convention's definitions struggle with AI-caused incidents.

The core legal dilemma is fault attribution: who is liable when an AI's decision causes a collision – the launching state, the operator, the developer, or the AI? This human-AI gap, coupled with transnational space ventures, entangles accountability in jurisdictional and contractual complexities.

Further, AI's dual-use capabilities (i.e., civilian + military) create misinterpretation risks in geopolitically sensitive contexts. Addressing these shortcomings requires adapting legal principles, developing new governance frameworks, and in all a multifaceted approach that adapts existing legal frameworks as well as develops new governance mechanisms.

Legal and technical solutions

Space safety amid AI developments demands synchronised legal and technical evolution. A first step is categorising satellite autonomy levels, similar to autonomous vehicle regulations, with stricter rules for more autonomous systems. Enshrining meaningful human control in space law is crucial, as the 2024 IISL Working Group's Final Report on Legal Aspects of AI in Space emphasised.

Global certification frameworks, such as those under the United Nations Committee on the Peaceful Uses of Outer Space or the International Standards Organisations, could test how satellite AI handles collisions or sensor faults; subject it to adversarial (but controlled) tests with unexpected data; and log key decisions like manoeuvres for later review.

Since they manage high-risk, cross-border operations, the aviation and maritime sectors offer useful templates. The 1996 International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances (a.k.a. HNS) and the 1999 Convention for the Unification of Certain Rules for International Carriage by Air use strict liability and pooled insurance to simplify compensation. These models could inform space law, where a single AI malfunction may affect multiple actors.

Ethical, geopolitical imperatives

AI in space raises critical ethical and geopolitical concerns as well. The potential for AI-driven autonomous weapons is a topic of ongoing discussions within the Convention on Certain Conventional Weapons and its Group of Governmental Experts on Lethal Autonomous Weapons Systems. It raises critical concerns about the lack of human control and the risk of escalation, concerns that are equally applicable to the development of autonomous weapons in space. Thus, international safeguards to prevent an arms race in that domain are necessary.

Ethical data governance is also vital thanks to the vast amount of data AI satellites collect and the attendant privacy and misuse risks. Since autonomy can also inadvertently escalate tensions,

The core legal dilemma is fault attribution. Who is liable when an AI's decision causes a collision? This human-AI gap, coupled with transnational space ventures, entangles accountability in jurisdictional and contractual complexities

international cooperation is as crucial as legal and technical development.

Shared orbits, shared responsibilities

The rise of AI-powered satellites marks a defining moment in humanity's use of outer space. But with thousands of autonomous systems projected to operate in low-earth orbit by 2030, the probability of collisions, interference or geopolitical misinterpretation is rising. Autonomy offers speed and efficiency but also introduces instability without legal clarity.

History shows that every technological leap demands corresponding legal innovation. Railways required tort law. Automobiles brought about road safety legislation. The digital revolution led to cybersecurity and data protection regimes. Space autonomy now demands a regulatory architecture that balances innovation with precaution and sovereignty with shared stewardship.

We are entering an era where the orbits above us are not just physical domains but algorithmically governed decision spaces. The central challenge is not merely our ability to build intelligent autonomous satellites but our capacity to develop equally intelligent laws and policies to govern their use, demanding urgent international collaboration to ensure legal frameworks keep pace with technological advancements in space.

(Shrawani Shagun is pursuing a PhD at National Law University, Delhi, focusing on environmental sustainability and space governance. Leo Pauly is the founder and CEO, Plasma Orbital. shrawani.shagun@gmail.com, leopauly@ieee.org)

YouTube channels irked as news agency demands licence fee for content

Content creators face copyright complaints from ANI for using footage without licence, prompting protests from channels; the move violates creative expression, says a prominent YouTube channel

The Hindu Bureau
NEW DELHI

YouTube channels in India complained over the last week that the news agency Asian News International (ANI) was "threatening" to issue copyright complaints against them for using footage published by them without licensing arrangements. ANI and other news agencies do news reporting, photography, and videography, and syndicate their content to others for a fee.

The agency had demanded that YouTubers who used its footage without paying a licence fee pay damages and licence fees for the use of its content.

To drop the demand, the news agency has reportedly sought upwards of ₹48 lakh plus GST for an annual licence, a demand that YouTubers such as Mohak Mangal contested.

"[T]his action violates creative expression and sets a wrong precedent," Mr. Mangal said in a letter to Minister of Information and Broadcasting Ashwini Vaishnaw.

YouTube allows copyright holders to seize the proceeds of videos under copyright dispute or allows them to send complaints that lead to "strikes", three of which within 90 days can result in the shutdown of a YouTube channel, putting pressure on them to reach negotiated settlements with copyright holders.

Reels gone awry

A news agency and YouTube content creators are on a collision course

Asian News International's case

- YouTubers using its footage without paying a licence fee
- They should pay ₹48 lakh plus GST for an annual licence

Content creators' stance

- Action violates creative expression and sets a wrong precedent
- Footage used is often very brief and amounts to 'fair use'
- Fair use refers to the use of copyrighted materials in a way that does not amount to an actionable infringement in the copyright framework

> It's not up to YouTube to decide who 'owns the rights' to content, which is why we give copyright holders tools to make copyright claims and uploaders tools to dispute claims that are made incorrectly
> YOUTUBE SPOKESPERSON

'Fair use'

YouTubers such as Mr. Mangal, whose video on his experience receiving such a demand got four million views in two days, said that the footage his channel used was very brief and amounted to "fair use".

Fair use refers to the use of copyrighted materials in a way that does not amount to an actionable infringement in the copyright framework.

India's fair use or fair dealing framework exempts personal use, criticism or review, reproduction in a court case, and "the reporting of current events and current affairs, including the reporting of a lecture delivered in public". These exemptions are laid out under Section 52 of the Copyright Act, 1952.

'Balancing the rights'

"We work hard to balance the rights of copyright holders with the creative pursuits of the YouTube community," a YouTube spokesperson said. "It's not up to YouTube to decide who 'owns the rights' to content, which is why we give copyright holders tools to make copyright claims and uploaders tools to dispute claims that are made incorrectly."

Operation Sindoor a reflection of India's values and sentiments: Modi

The Hindu Bureau
NEW DELHI

Prime Minister Narendra Modi stated on Monday in a public gathering at Dahod, Gujarat that Operation Sindoor was not just a military action but a reflection of India's values and emotions.

Emphasising that India's cultural values demand action against injustice, he questioned whether the nation could remain silent after the terrorist attack in Pahalgam.

He said that terrorists had no idea of the consequences of their actions, recalling the brutality of killing a father in front of his children. He stated that such images still ignite anger across the nation, as 140 crore Indians were challenged by terrorism.

Mr. Modi said that he fulfilled his responsibility as the nation's leader, giving full freedom to India's armed forces, who then executed an operation unseen in decades.

Grand show: Prime Minister Narendra Modi waving to the people gathered in Ahmedabad on Monday. VIJAY SONEJI

He stated that nine major terror hubs across the border were identified and destroyed in 22 minutes, and stated that Pakistan's military attempted retaliation but was decisively defeated by Indian forces.

Mr. Modi said that he has deep respect for the valour of India's armed forces, saluting their courage and dedication.

Mr. Modi laid the foundation stone and inaugurated multiple development projects worth over ₹24,000 crore in Dahod. Addressing the gathering, he said that May 26 holds special significance as it marks the day he first took the oath as Prime Minister in 2014.

Mr. Modi inaugurated the Locomotive Manufacturing plant of the Indian Railways in Dahod. This plant will produce electric locomotives of 9000 HP for domestic purposes and for export.

Among other development projects inaugurated by Mr. Modi are rail projects and various projects of the Government of Gujarat. He also flagged off a Vande Bharat Express between Veraval and Ahmedabad and an express train between Valsad and Dahod stations.

Mr. Modi announced that Gujarat had achieved 100% electrification of its railway network.

SC Collegium recommends new CJs for 5 High Courts

The Hindu Bureau
NEW DELHI

The Supreme Court Collegium on Monday recommended the names of five judges as Chief Justices of the High Courts of Madhya Pradesh, Karnataka, Gauhati, Patna and Jharkhand.

Justice Sanjeev Sachdeva, presently a judge in the Madhya Pradesh High Court, has been recommended as the court's Chief Justice.

Justice Vibhu Bakhru, the senior-most puisne judge of the Delhi High Court, has been recommended as the Chief Justice of the Karnataka High Court. If the government approves, the Gauhati High Court will get a new Chief Justice in Patna High Court judge Justice Ashutosh Kumar.

Justice Vipul Manubhai Pancholi, serving in the Patna High Court, has been proposed for the Chief Justiceship of the High Court.

Himachal Pradesh High Court judge Justice Tarlok Singh Chauhan has been suggested for the Chief Justiceship of the Jharkhand High Court.

Bharat Forecast System set to give sharper rain alerts

Jacob Koshy
NEW DELHI

The India Meteorological Department (IMD) on Monday adopted the Bharat Forecast System (BFS), which promises more fine-tuned and accurate rain forecasts down to the panchayat level. The improvements will largely be visible in the "short- and medium-term" forecasts (three- and seven-day lead time) issued by the IMD but not in the long-range forecasts, usually given a month in advance.

The BFS, developed by the Indian Institute of Tropical Meteorology (IITM), has been tested since 2002 and has shown "notable improvements" in giving advance warning of heavy rainfall events, M. Ravichandran, Secretary, Ministry of Earth Sciences, said. The improvement in the forecasts is due to the IITM significantly improving the existing weather forecast models as well as harnessing more powerful computing capabilities. For analysis, the current weather forecast models cut up the globe into gridded squares of 12-km sides; the newer BFS model breaks it down into 6-km sides – leading to a four-fold improvement.

"India is the only country that will now provide operational weather forecasts at a 6 km by 6 km resolution," said M. Mohapatra, Director-General, IMD.

However, the new system would not yet be able to significantly improve forecasts of phenomena like sudden, severe thunderstorms. "We have different models for that. We are in the process of installing 34 Doppler Weather Radars, in the coming year," Mr. Mohapatra added.

"Until now we have been able to give block-level forecasts five days ahead; now we can give up to the level of a panchayat, or a few villages," the IMD official said.

Another major change, said Mr. Ravichandran, was using a new 'grid structure'.

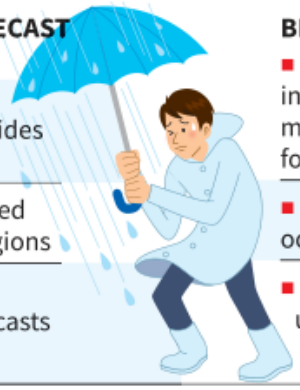
"The new grid-structure called the triangular-cubic octahedralgenerates more grids, and therefore higher resolution, over the tropical regions than the poles. As weather here is more volatile, this is more important for our forecast purposes," he said.

Precision technology

The BFS developed by the Indian Institute of Tropical Meteorology, aims at improving weather forecast models

EXISTING FORECAST MODELS

- Use square grids of 12-km sides to map a region
- Use equal-sized grids to map regions
- Able to give block-level forecasts 5 days ahead



BFS MODEL

- Breaks down a region into 6-km sides for mapping, leading to a four-fold improvement
- Uses a triangular-cubic octahedral structure
- Able to give forecasts up to the level of panchayats

Bangladesh Army at odds with govt. on Myanmar corridor

Armed forces will not compromise on issues related to the corridor, national security, and national sovereignty, says Army spokesperson

Kallol Bhattacherjee
NEW DELHI

The armed forces of Bangladesh will not be party to decisions that may harm the country's national security, a spokesperson of the Bangladesh Army said on Monday.

Speaking at a press briefing in Dhaka, Lt. Col. Shafiqul Islam hinted at divergence with the interim government's initiatives to start a humanitarian corridor to Myanmar's Rakhine province, home to the persecuted Rohingya Muslims, and said that the Army will "not compromise" on the matter.

"The army will not compromise on issues related to the corridor, national security, and national sovereignty. After August 5, 2024, the army has coordinated with everyone for the sake of the country," said Lt. Col. Islam, expressing opposition to the Muhammad Yunus-led interim government's proposed idea to create a "humanitarian corridor" to the conflict-torn Rakhine province of Myanmar. The press briefing came days after the Army chief, General Waker-Uz-Zaman, in a meeting with Commanding Officers on May 21, demanded that elections in Bangladesh be held in December this year.

Reflecting on General Zaman's speech, Lt. Col. Islam warned against mob violence in Bangladesh. "Stern action will be taken if anyone tries to organise mobs," he said.

Security risks

General Zaman had expressed opposition to the creation of the so-called "humanitarian corridor" that was being planned to connect Chittagong with the Rakhine province of Myanmar amidst apprehension that the corridor might turn into a security challenge as it would entail partnering with non-state actors such as the Arakan Army in a region that is noted for arms and drugs smuggling.

General Zaman had said that the interim government had taken crucial decisions without consulting the armed forces of Bangladesh.

The National Security Adviser to the interim government, Khalilur Rahman, on May 21 had said that the interim government was "not under pressure" from the U.S. or China for the creation of the corridor but has discussed it with the United Nations.

"The UN Secretary-General inquired about Bangladesh's ability to provide aid to Rakhine. Bangladesh has informed the Arakan Army, through the UN, that aid distribution must be impartial and not used for military purposes," Mr. Rahman had said during a press conference at the Foreign Service Academy in Dhaka.

Apart from the armed forces, the idea of the corridor with Rakhine has evoked strong criticism from multiple stakeholders, including political parties. "Since all other aid delivery avenues are unviable due to conflict, Bangladesh turned out to be the only feasible option," Mr. Rahman had said.

'Not acceptable'

General Zaman had indicated strong disagreement with the interim government in this regard and said that the corridor is "completely unacceptable".

In the backdrop of his remarks on the corridor, the Army Chief received support from Bangladesh Nationalist Party that also backed General Zaman's call for election by December. "He has spoken in support of democracy in Bangladesh," said BNP's standing committee member Amir Khosru Mahmud Chaudhury at an event in Dhaka on Monday.

'No compromise'

Key points made by Bangladesh Army spokesperson Lt. Col. Shafiqul Islam on Monday

> After August 5, the Army has coordinated with everyone for the sake of the country

> Stern action will be taken if anyone attempts to organise mobs

Lt. Col. Shafiqul Islam

- Army chief General Waker-Uz-Zaman had earlier said that the interim government had taken crucial decisions without consulting the armed forces of Bangladesh

Apart from the armed forces, the idea of the corridor with Rakhine has evoked strong criticism from multiple stakeholders, including parties

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