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Making waves in the orange economy

Vallari Sanzgiri

At the inaugural World Audio Visual & Entertainment Summit (Waves), cine stars Shah Rukh Khan, Rajinikanth, Mohanlal, et al, created a lot of buzz, as expected.

But the non-glamorous show stealers at the summit, which saw rousing words on the orange economy by Prime Minister Narendra Modi, were creators such as Akash Jadhav and Mayo Murasaki, who demonstrated how platforms like YouTube have made it possible for anybody to become a star.

Indeed, YouTube CEO Neal Mohan, who dubbed India as the 'Creator Nation' of the world, stated that Indian content racked up 45 billion hours of watch-time outside the



Game changer: Non-glamorous show stealers demonstrated how platforms like YouTube can make anyone a star. PTI

country, and the platform had paid ₹21,000 crore to Indian creators, artists and media companies in the last three years.

He announced an over ₹850-crore investment towards building up the orange economy further.

At the event, business-line caught up with Akash

Jadhav, who, along with his brother Santosh, runs Indian Farmer, an agricultural channel with a huge following, to gauge the impact of the content economy, brand play, monetisation, and AI.

Reaping a rich harvest
Jadhav describes how the

two brothers from rural Maharashtra started out in 2018 with a vision to "make farming more sustainable, profitable, and residue-free". "My primary motivation is to get clean food on my table," he says.

Today, across platforms (YouTube, Facebook and Instagram), Indian Farmer has a following of around 10 million farmers from around the world; only 15-20 per cent is from India, even though the content is in Hindi. Over time, they realised that brand collaborations gave the best returns, despite their lack of affiliation with any agency.

Jadhav estimates that about 80 per cent of their revenue comes from collaborations with agricultural brands, manufacturing brands, companies working on digital farming, irri-

gation, and, at times, even the government.

"At Indian Farmer, we created a proper commercial deck with fixed pricing, clear deliverables, and workflows. This helped us build structure and credibility with brands," he says. The rest of the revenue comes from ads like YouTube AdSense and Facebook monetisation.

Risky Business

Jadhav, however, foresees a dip in this form of revenue since Facebook has paused monetisation.

"Our Facebook page was 'demonetised' over two years ago and, despite multiple attempts, we've received no resolution from Meta. The bulk of our ad revenue now comes from YouTube, and that has not been much. Struc-

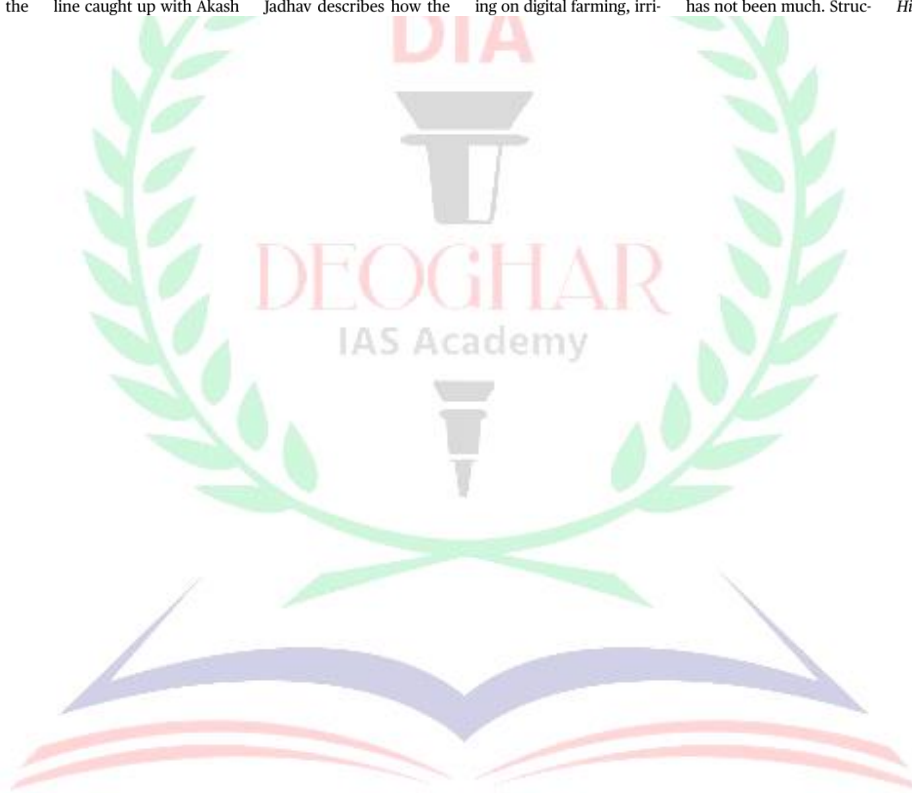
tured agri courses were a turning point. A reel may go viral, but a paid course builds depth and predictable revenue," says Jadhav, adding that the use of AI by platforms like Meta has done little to help his business.

He also warns that content creation is a risky business. "You can lose your business overnight.

Currently, I am treating this as a full-time platform. But people should remember that anything can happen. Monetisation also doesn't begin with followers but clarity on value.

The real shift for content creators as viable business folk will happen when they start thinking like entrepreneurs, building systems around content."

(The writer is with *The Hindu Businessline*)



India has ambitious expansion plans in the port sector globally

These expansion efforts will be undertaken through Indian Ports Global Ltd (IPGL), a joint venture company formed by Jawaharlal Nehru Port Trust (JNPT) and Kandla Port Trust (KPT); the State-run firm is likely to be positioned as a domestic terminal operator, too, as per government officials

NEWS ANALYSIS

Abhishek Law

India is eyeing a strategic expansion of its port infrastructure and management capacities on a global scale. Post its fruitful engagement at Chabahar port in Iran, and other ports in its immediate neighbourhood, the country is scouting for opportunities in African nations for port and/or berth operations.

According to officials of the Ministry of Ports, Shipping and Waterways (MoPSW), these expansion efforts will be undertaken through Indian Ports Global Ltd (IPGL), a joint venture company formed by Jawaharlal Nehru Port Trust (JNPT) and Kandla Port Trust (KPT).

The Shipping Ministry has assigned IPGL to equip and operate container/multi-purpose terminals at Chabahar port and the company is reportedly looking for a project manager to be "stationed in Tehran".

Tapping Tanzania

Sources said that India and Tanzania have signed multiple memorandums of understanding (MoUs) related to maritime and port infrastructure development, including industrial parks, port operations, and maritime cooperation.



Vast as sea: Shipping Ministry is eyeing container/ multi-purpose terminals at Chabahar port. AFP

A key agreement is between Jawaharlal Nehru Port Authority (JNPA) and the Tanzania Investment Centre for establishing an industrial park in Tanzania. Cochin Shipyard Ltd and Marine Services Co Ltd – a Tanzanian company operating ferries, cargo ships and tankers – have signed an MoU for cooperation in maritime industry.

"Tanzania is definitely on the radar, and with JNPA constructing an industrial park or SEZ in that country, we will look at expanding our scope of operations there," the ministry official, who declined to be named, told BusinessLine.

India's largest integrated transport utility, Adani Ports and Special Economic Zone Ltd (APSEZ), currently has a significant presence in Tanzania, especially at Dar



India and Tanzania have signed memoranda of understanding related to maritime and port infrastructure development, including industrial parks,

es Salaam port, where it manages container terminal 2 (CT2) under a 30-year concession. Adani Ports also has a joint venture – named East Africa Gateway Limited (EAGL) – with AD Ports Group and East Harbour Terminals Limited (EHTL), which acquired a 95 per cent stake in Tanzania International Container Terminal Services (TICTS).

India, through IPGL, operates the Shahid Beheshti

terminal at Chabahar Port, a gateway for trade with Afghanistan and Central Asia, and vital to India's participation in the International North-South Transport Corridor (INSTC).

Container handling at Chabahar is expected to reach 100,000 TEUs (full capacity) by FY26 and plans are afoot for Indian shipping liners to launch operations there. In FY25, the port's container traffic is expected to reach 75,000 TEUs.

By end-January, it had touched 64,245 TEUs, compared with just 9,126 TEUs in FY23, India's shipping ministry data shows. Chabahar port remains in an "investment mode", a source said. "Operations are commercially viable, but it will take some more time to be profitable as ge-

opolitical turmoil continues," the source added. A second berth also planned.

India is reportedly exploring ₹4,000-crore capex-led expansion of operations at Chabahar port. With orders for nearly five mobile harbour cranes, India eyes a five-fold capacity expansion to 500,000 TEUs over a 10-year period, shipping ministry officials said, adding that talks were underway.

Neighbourhood plans

Vying with China for a presence at ports in its immediate neighbourhood, India seeks to promote its strategic and commercial interests along trade routes between the Asia-Pacific region, Europe and Africa.

In Myanmar, IPGL has assumed control of operations at Sittwe port, which is an integral component of the Kaladan multimodal transit transport project linking Bangladesh, Thailand, and Kolkata. The enhanced connectivity through Myanmar is expected to help India establish a seamless trade corridor to Southeast Asia and strengthen regional economic partnerships.

In Sri Lanka, the development and operation of Kankesanthurai port by IPGL not only boosts bilateral trade but also revives maritime passenger connectivity, with a regular ferry service planned between Nagapattinam (India)

and Kankesanthurai (Sri Lanka).

APSEZ announced commencement of operations at Colombo West International Terminal (CWIT) in Colombo port. The \$800-million, fully automated deepwater terminal can handle 3.2 million TEUs annually, elevating the port's status as a key transshipment hub in South Asia.

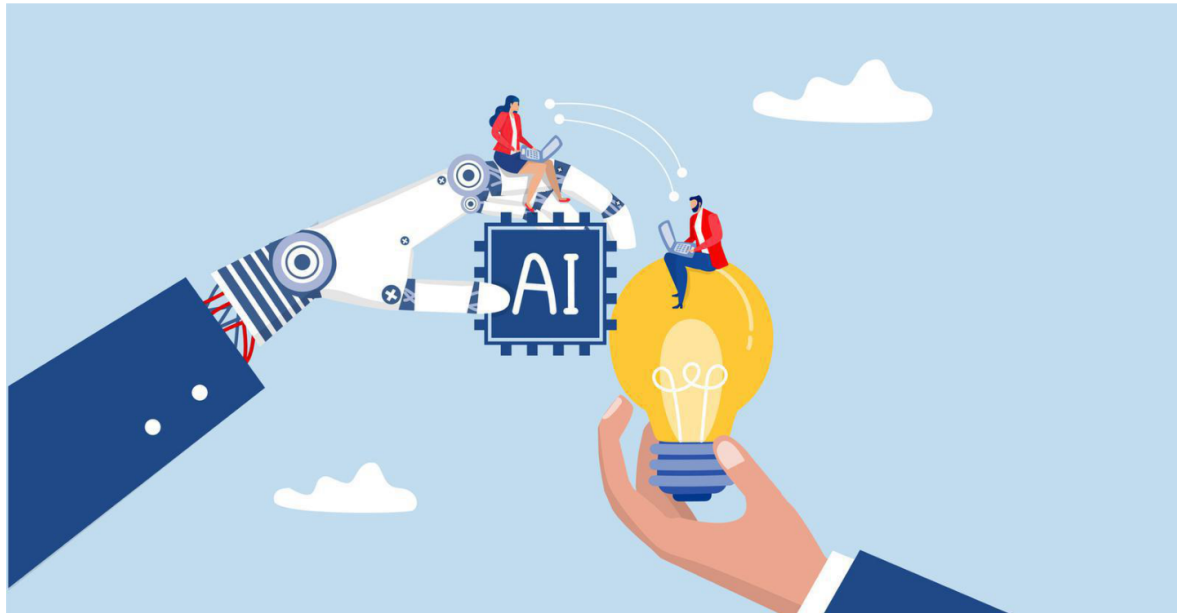
Repositioning IPGL

Interestingly, India's Shipping Ministry plans to propel IPGL into the commercial spotlight. The State-run firm – currently limited to strategic outposts like Chabahar and Sittwe – is likely to be positioned as a domestic terminal operator, too, with high-value oil handling facilities.

At the centre of these plans is Bharat Global Ports, a newly formed State-owned consortium that is being pitched as an "end-to-end port infrastructure solutions provider", including terminal operations, financing, logistics, and connectivity.

IPGL will be the operations arm of this entity. "If IPGL gets into domestic berth ops, it will improve the international image of the entity," an official explained, as queries arise as to why a State-backed entity does not have presence in its own country.

(The writer is with The Hindu BusinessLine)



GETTY IMAGES

From pyramids to hourglasses: how AI can change Indian workplaces

McKinsey estimates that Artificial Intelligence could pump trillions into the global economy, with firms seeing productivity rise by up to 25% when they embrace it. That's the lure that AI promises — efficiency and flexibility

Venkat Ram Reddy Ganuthula
Krishna Kumar Balaraman

Artificial Intelligence (AI) has outgrown its role as a mere task automator — it's now reshaping how Indian companies are built and run. The old pyramid model, with its top tier of bosses, a thick layer of middle managers, and broad base of workers, is giving way to something new — an hourglass. In this setup, AI shrinks the middle by taking over coordination and decision-making, letting leaders at the top focus on strategy while the bottom diversifies into a mix of people and smart tools.

For India, this shift is a double-edged sword, brimming with potential yet fraught with hurdles. Getting it right could propel Indian businesses onto the global stage while getting it wrong could leave them trailing.

The hourglass model

Imagine a company where top executives plan for the future without worrying about the nitty-gritties of the everyday workspace because AI now handles schedules, tracks performance, and crunches data for decisions. The middle level, once crowded with managers, thins out as AI steps in, cutting the need for human oversight. At the base, frontline workers, specialists, and AI systems team up using real-time insights to get the job done more efficiently. It's a sleeker and quicker way to work, and is powered by AI's ability to sync operations, adapt on the fly, and pair human ingenuity with machine precision. McKinsey estimates that AI could pump trillions into the global economy, with firms seeing productivity rise by up to 25% when they embrace it. Small and Medium-sized Enterprises (SMEs), India's economic

spine, stand to gain big from that 25% productivity lift. That's the lure that AI promises — efficiency and flexibility.

In European countries as well as the U.S., the hourglass model is taking hold fast. A Gartner report forecasts that by 2026, one in five companies there will use AI to slash over half their middle managers, saving costs while boosting output. High wages — around \$35 an hour in the U.S. versus \$1-\$2 in India, according to the International Labour Organization — make automation a smart bet. Big players use AI to monitor workers or streamline onboarding, pushing for flatter, tech-savvy setups.

Is India adapting?

India's path is its own. Cities like Bengaluru and Hyderabad pulse with AI innovation, yet India ranks 72nd on the International Monetary Fund's AI Preparedness Index with a score of 0.49, far behind the U.S. (0.77) or Singapore (0.80). The lag stems from uneven infrastructure — rural areas lack the connectivity urban hubs enjoy — and a cultural lean towards hierarchy that's hard to shake.

Indian firms aren't diving fully into the hourglass; they're testing it with a hybrid spin. E-commerce leaders like Flipkart and Reliance Jio use AI to predict buying trends or iron out delivery kinks, but they keep layers of managers to tackle India's diverse, multilingual markets. Lower labour costs ease the pressure to cut middle roles, and our respect for authority slows the shift to flatter organisational structures. A report by World Business Culture highlights how Indian businesses echo our society's top-down ways, making big change a tough sell. This hybrid tack isn't a retreat — it's a strategic play, blending AI's perks with what already works.

The perks of such blending are real and enticing. Efficiency tops the list. A Surat textile maker could use AI to forecast fabric demand, slashing waste and boosting profits. Innovation follows close behind. AI tools speed up coding for tech firms, freeing staff to come up with new solutions. The NNG Group found that generative AI boosts task performance by 66%, a hint of what it could do for the Indian IT sector. Flexibility's another win — pharmaceutical companies leaned on AI during the pandemic to navigate supply chain chaos, showing its value in difficult times. Add in better customer and employee experiences — banks roll out 24/7 chatbots, payroll automation frees up staff duties — and you've got a compelling case. Additionally, it also brings in an array of new roles, such as AI experts and data ethicists, with demand set to hit 1.25 million by 2027, per Deloitte and Nasscom.

Myriad challenges

But the road's not all rosy. Jobs hang in the balance, especially for middle managers and the less skilled. Pew Research pegs 19% of U.S. workers with high exposure to AI, and globally, up to 800 million jobs could shift by 2030. In India, where steady work props up millions, this could widen gaps — non-graduates and older workers would face the brunt. While LinkedIn states 94% of Indian firms plan to reskill their workers, it's going to be a tall order.

Ethics throw up another snag. AI can stumble with bad data, a worry in our diverse nation — think skewed loan calls or hiring picks. Another worry is transparency; 79% of Indians dislike their data being sold off, as per ISACA. While the Digital Personal Data Protection Act, 2023 aims to curb this, it's still finding its feet.

Infrastructure's a sticking point too. With 65% of Indians in rural areas and many offline, AI's reach is cramped. Moreover, bringing in AI infrastructure isn't cheap, and not every firm will be able to afford it. Culture adds a twist. Our love for hierarchy, especially in family businesses, jars with the hourglass push. Flattening things risks pushback from workers and bosses wedded to the old ways. It's not just technology — it's people as well.

What should be done?

Start with reskilling — train staff in AI basics, data skills, and problem-solving; Skill India's digital courses are a launchpad. Next, adopt a hybrid model — use AI for analytics or customer chats, and keep humans for the big decisions. Then, lay down ethical guidelines — set rules for fair, open AI, with checks to dodge bias and build trust, as per the OECD guidelines. Team up with Western firms for know-how, tailoring it to India's needs, like affordable tech for SMEs. Additionally, know that AI is a journey, and not a fix; track cyber risks and regulatory shifts to keep ahead.

India's hourglass won't ape the West — it'll be our own blend, fusing AI's power with our economic and cultural roots. By doing so, we could lead in AI-driven business. A Centre for Economic Policy Research study flags a 0.5-0.6% productivity bump from AI in Japan — India could see the same. It's about time we start syncing tech with human grit and India's unique rhythm. For our firms, this should not be just a trend — it's a chance to rethink work, value, and how 1.4 billion of us shape the future.

Venkat Ram Reddy Ganuthula and Krishna Kumar Balaraman are faculty at IIT Jodhpur. The views expressed are personal.

Can New Caledonia gain independence from France?

Why was the 1998 Nouméa Accord significant? Why did recent high-stakes talks break down?

Franciszek Snarski

The story so far:

A high-stakes attempt by French Overseas Minister Manuel Valls to broker a new political accord for New Caledonia collapsed on May 8, plunging the French Pacific territory into profound uncertainty.

What is its current status?

For decades, New Caledonia, a French island territory of approximately 2,71,400 people in the southwest Pacific Ocean, has been on a complex journey regarding its status. The 1998 Nouméa Accord, born from a history of colonial tensions and a near civil war in the 1980s, explicitly recognised the "trauma" inflicted upon the indigenous Kanak people. It also led to three referendums on independence, in 1988, 2020 and 2021, of New Caledonia from France. While all three rejected independence, the final vote was

boycotted by pro-independence parties and its legitimacy has been contested.

Why is independence still a demand?

New Caledonia's modern history began with its seizure by France as a penal colony in 1853. Despite attempts to ease colonial rule, such as granting French citizenship to all inhabitants in 1957, deep divisions persisted, culminating in the 1984-1988 conflict. The Kanak and Socialist National Liberation Front (FLNKS) emerged during this period as a powerful political force, advocating for complete independence.

The 1998 Nouméa Accord was a landmark compromise. It established a unique *sui generis* status for New Caledonia within the French Republic. It granted the territory significant autonomy, including its own Congress with law-making powers, and incorporated "New Caledonian citizenship" which restricted voting rights

to long-term residents, a key provision for Kanak political representation.

However, due to the FLNKS boycott of the last independence referendum, over COVID-19 and customary mourning periods, the final solution to New Caledonia remained uncertain.

Why did recent talks fail?

The period following the contested 2021 referendum was marked by heightened tension, which exploded in May 2024 over a French proposal to "unfreeze" the electoral roll (to change rules which restrict voting rights to only long-term residents). The ensuing riots, the worst in decades, resulted in 14 deaths, and hundreds injured. In this volatile context, the French government, through Mr. Valls, intensified efforts to find a "third way" – a new institutional status that could offer a form of sovereignty without complete traditional independence.

Mr. Valls's mission aimed to facilitate

dialogue between FLNKS and loyalist factions towards such a consensual outcome. The concept of "sovereignty in partnership" became central. This envisioned New Caledonia gaining enhanced international recognition and control over most aspects of governance such as the judiciary, but with an immediate, negotiated delegation of the exercise of these powers back to France.

However, this path was abruptly blocked on May 8. During the negotiations, the proposal was decisively rejected by headline loyalist factions in the island. They deemed the "sovereignty in partnership" model as tantamount to disguised independence. Instead, these loyalist groups proposed a form of partition, with the pro-independence North and Loyalty Islands provinces having an association status, while the wealthier, loyalist-majority South Province would remain fully French. This solution was found unacceptable to both the French state, which upholds New Caledonia's indivisibility, and the independents who called this "paramount to apartheid".

The failure of the talks has significantly amplified the obstacles. The immediate challenge is the upcoming provincial elections, due by November 2025, which will now proceed without a prior political agreement on the territory's future.

Franciszek Snarski is an intern at The Hindu.

THE GIST

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What is a Presidential reference?

What does Article 143 of the Constitution state? Do other nations also have provisions wherein the government can raise legal questions with their respective judiciaries? What has President Droupadi Murmu raised with the Supreme Court? Should the top court answer these questions compulsorily?

EXPLAINER

Rangarajan. R

The story so far:

President Droupadi Murmu, has made a reference to the Supreme Court, under Article 143 of the Constitution, on certain questions of law and has sought its opinion on those questions.

What is the historical context?

The advisory jurisdiction of the Supreme Court under Article 143 is a relic of the Government of India Act, 1935. It vested the Governor-General with discretionary power to refer any question of law of public importance to the federal court for its opinion.

A similar provision is available in the Canadian constitution. This mechanism allows the Supreme Court of Canada to offer opinions on legal questions referred to it by the federal or provincial governments. The U.S. Supreme Court on the other hand has consistently declined to provide any advisory opinion to the executive as it would violate the strict separation of powers envisaged in its constitution.

What are the provisions?

As per Article 143, the President may refer any question of law or fact of public importance to the Supreme Court for its opinion. The President makes such a reference based on the advice of the Union Council of Ministers. Article 145 of the Constitution provides that any such reference shall be heard by a bench of minimum five judges.

The Supreme Court may provide its opinion after such hearing as it thinks fit. The opinion is legally not binding on the President, and does not hold a precedential value for the courts to follow in subsequent cases.

However, it carries a strong persuasive value and is usually followed by the executive and the courts.



Pointed questions: President Droupadi Murmu during the swearing-in ceremony of Justice Bhushan Ramkrishna Gavai at the Rashtrapati Bhavan in New Delhi, on May 14, 2021.

What were past instances?

There have been around fifteen references made since 1950 before the current reference. Some of the landmark opinions from such references is summarised here.

The first reference was made in the Delhi Laws Act case (1951) which laid down the contours of 'delegated legislation', through which the legislature could delegate legislative powers to the executive for effective implementation of any law. The reference in the Kerala Education Bill (1958) resulted in the court laying down the principle of harmonious construction between Fundamental Rights and Directive Principles of State Policy as well as interpretation of protection given to minority educational institutions under Article 30. In the *Berubari* case (1960), the court opined

that ceding or acquisition of territory by India would need a constitutional amendment under Article 368. In the *Keshav Singh* case (1965), the court interpreted the powers and privileges of the legislature. In the Presidential poll case (1974), the court opined that Presidential elections should be held notwithstanding vacancies in the electoral college due to dissolution of State assemblies.

The opinion provided in the Special Courts Bill (1978) was significant on many counts. It provided that the court may decline to answer a reference; that the questions referred must be specific and not vague; and that the court, while answering a reference, should not encroach upon the functions and privileges of Parliament. The Third Judges case reference (1998) laid down detailed

guidelines for the collegium system with respect to the appointment of judges to the higher judiciary.

It is not obligatory for the Supreme Court to render its opinion. However, out of the references made till date, the court has declined to provide its opinion for only one reference in 1993 with respect to the *Ram Janmabhoomi* case.

What is the current reference?

The current reference is a result of a recent Supreme Court judgment that had specified timelines for Governors and the President to act on Bills passed by State legislatures. The court had also held that decisions by Governors and the President on such Bills are subject to judicial review. The present reference has raised 14 questions, primarily surrounding the interpretation of Articles 200 and 201, for the court's opinion. The government has raised questions regarding the authority of the courts to prescribe timelines when they are not specified in the Constitution. It has questioned whether the actions of Governors and the President can be made justiciable at a stage prior to the enactment of a Bill into a law. The reference also seeks opinion on the extent of powers that can be exercised by the Supreme Court under Article 142.

Political differences between the Union government and Opposition-ruled State governments have been the principal reason for this conflict. The Supreme Court had adopted the timelines prescribed for the President in the Office Memorandum of the Home Ministry while passing its judgment. In the Cauvery dispute reference (1992), the court had opined that it cannot sit on appeal over prior judgments in its advisory capacity. However, an authoritative opinion on this reference will hopefully settle the issues surrounding these constitutional provisions that are crucial for the smooth functioning of our democracy and federalism.

Rangarajan R is a former IAS officer and author of 'Courseware on Polity Simplified'. Views expressed are personal.

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A caste census is not a silver bullet for social justice

Census data have long been the backbone of public policymaking in India, offering critical insights into sectors such as health, education, employment and housing. In this context, the Narendra Modi government's recent announcement to include caste enumeration in the upcoming national Census has drawn considerable attention. For many, it represents a long-overdue move toward collecting substantive statistical data that are necessary to better address the needs of the Other Backward Classes (OBCs). However, the disproportionate emphasis placed on the caste census raises concerns about the intent and the commitment of the ruling dispensation. It suggests that the formulation of welfare policies for marginalised communities has been unjustifiably deferred under the pretext of awaiting more precise data.

The merit of caste census

Proponents of a caste census argue that it will provide empirical grounding to assess the socio-economic status of various caste groups, particularly the OBCs. They believe that this data will enable more targeted affirmative action and help the state legitimise welfare programmes in the eyes of the judiciary, which has sometimes questioned the reliability of surveys and commission reports. Additionally, disaggregated data within the OBC category could help identify intra-group socio-economic inequalities, thereby informing new policies for the Extremely Backward Classes (EBCs) within the OBCs.

While these arguments are not without merit, they risk overstating what a caste census can achieve on its own. Caste enumeration should certainly be a regular institutional practice in a diverse society such as India. But to elevate the Census data as a precondition for social and economic justice or as the central document for policymaking is a flawed and potentially dangerous misreading of its purpose.

The Registrar General of India's role is to collect and present neutral, factual data and not



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to direct the government to design social welfare policies. Elevating the Census into a tool for political reform burdens the institution beyond its mandate and risks politicising its work. It is vital to maintain the objectivity of Census operations, especially in a polarised political environment. Importantly, it is the responsibility of the ruling political elites to have public policies for the welfare of vulnerable social groups, based on the available sources of information and empirical evidence.

Empirical evidence

More crucially, policies for social justice have historically not waited for perfect data. Landmark initiatives such as reservations, land reforms, and the implementation of the Mandal Commission's recommendations were driven not by statistical revelations but by political struggle, mass mobilisation, and the moral commitment of the ruling political class. Public policy in India is often shaped more by electoral strategies, ideological inclinations, and public pressure than by spreadsheets or survey graphs. For example, the Modi government's decision to implement the reservation policy for the Economically Weaker Sections (EWS) was not based on any substantive statistical data or commission report. Instead it only shows that the ruling dispensation has an authoritative power to execute such policy.

Moreover, extensive data about caste-based inequality already exists. Since Independence, Scheduled Castes (SCs) and Scheduled Tribes (STs) have been part of the decennial Census. But Census and complementary national surveys (such as the National Sample Survey Organization/Office, National Family Health Survey) continue to highlight their persistent educational, economic, and social disadvantages. The National Crime Records Bureau has documented a consistent rise in crimes against these communities – from sexual violence to atrocities under the SC/ST (Prevention of Atrocities) Act.

Likewise, the Bihar Caste Survey and the earlier Socio-Economic and Caste Census (SECC) have laid bare the deep economic vulnerabilities and heterogeneity within the OBC category. These reports show that a vast majority of OBCs remain stuck in informal, insecure, low-income employment, with little to no social security or opportunity for mobility.

Despite this abundance of data, the central government has yet to implement bold or transformative policy reforms. For OBCs in particular, there remains a conspicuous policy vacuum at the national level. Importantly, multiple academic researches and reports have demonstrated that in influential sectors of private economy (corporates, the IT industry, and media houses) the representation of SCs/STs and OBCs is marginal. However, no substantial measures have been taken to increase their representation in such institutions of power and privileges. Also, they lack participation in state-run institutions especially in higher education, the judiciary and the top bureaucracy.

Social justice needs robust political will

Available empirical evidence using various surveys, reports and research highlights a fundamental truth – that data does not necessarily drive public policy. Instead, it is the intent of the governing class and people's democratic pressure that crafts public policy. A caste census may help sharpen the diagnosis, but it cannot administer the cure. Data is only the map; it cannot chart the journey by itself. If India is to move toward a more just and inclusive future, the focus must remain on the moral and political imagination of its ruling class. Without political will, empirical evidence remains inert. The real test of the current national government lies not in collecting information on caste-based socio-economic stratification, but in executing effective policy measures, with courage and commitment, for the welfare of the worst-off social groups.



Tough timing

ISRO needs more resources to support India's military needs

In contemporary spaceflight, cost, reliability and time form a tense triangle. Whether more money can ensure more reliability is tricky to answer, more so following the failure of ISRO's PSLV-C61 mission to launch the EOS-09 earth-observation satellite into a sun-synchronous polar orbit. EOS-09 was designed to produce high-quality radar images for civilian applications such as land-use mapping and hydrology studies and for defence surveillance, even if inclement weather prevailed over the areas of interest thanks to a synthetic aperture radar and a C-band data-link. Against the backdrop of tensions with Pakistan, such all-weather data would also have informed tactical decisions. The Department of Space had also invited several Members of Parliament to the launch event, which would have been unusual for a strictly civilian earth-observation satellite. ISRO chairman V. Narayanan later said that his team noted a glitch in the vehicle's third stage minutes after liftoff that prevented the satellite from reaching its intended altitude. While the cause is yet to be ascertained, the failure is a reminder that a "textbook" launch of a rocket even as well-understood as the PSLV is not a given.

India is just embarking on its ambitious Space-Based Surveillance-3 programme to launch 52 surveillance satellites; 31 are to be built in the private sector, which still needs ISRO's guidance. Focus on the programme also comes against the backdrop of Operation Sindoor, which revealed at least one gap in the country's space-based military surveillance capabilities when it depended on a foreign commercial operator for more frequent data. Small margins of error in a rocket components' operations separate success from failure, and thus cost from reliability. Time, however, is a separate matter: the pressing need for surveillance capabilities, if not improving the understanding of climate change and disaster risk over India, means that developers lack the luxury of time while also coming under greater pressure to deliver across both civilian and military domains. The PSLV-C61 failure follows the failure in January to place the NVS-02 navigation satellite into its designated orbit. Between an increasingly crowded launch manifest, research and development, data acquisition and processing pipelines, limited access to manufacturing capacity, and the human spaceflight programme, it will not be remiss to increase the resources available to ISRO if only to ensure its ability to meet India's military needs while carrying on with other enterprises, all of which are becoming time-sensitive in a highly competitive global industry.



Operation Sindoor — a doubtful deterrent

The “new normal” in India’s fight against terrorism, which Prime Minister Narendra Modi is seeking to establish after the horrific terror attack at Pahalgam on April 22, 2025, is neither based on complete information nor a rigorous security review of Operation Sindoor. Unlike Pakistan, India is a constitutional democracy, where major policies related to national security which impact the lives of millions of citizens need to be debated and discussed in Parliament. The political consensus *vis-à-vis* combating terrorism within India cannot be misused to truncate democratic processes or muzzle discussions on the fitness and the efficacy of anti-terror policies.

Retaliation as deterrent?

In his recent address to the nation, Mr. Modi stated that the surgical strikes following the terror attacks at Uri (September 2016), the air strikes after the February 2019 attack at Pulwama, and the recent offensive under Operation Sindoor “define” India’s policy against terrorism. Had the Indian strikes across the Line of Control (LoC) in 2016 and 2019 been effective as deterrents, the Pahalgam attack should not have occurred in the first place.

Can the retaliatory cross border strikes and calibrated military escalation attempted under Operation Sindoor serve as an effective deterrent? It remains doubtful due to several reasons.

First, investigations by the National Investigation Agency (NIA) have not yet been able to capture the perpetrators of the Pahalgam terror attack. This is crucial not only in order to secure justice for the innocent victims, but also to prevent them from attempting another attack. Second, Mr. Modi has claimed that over a 100 deadly terrorists were eliminated in India’s strikes on their hideouts and training facilities, which includes Bahawalpur and Muridke, located deep inside Pakistan’s territory. Yet, the government to date has not been able to confirm the identities of the neutralised terrorists beyond five high value terrorists.

In contrast, nine out of the 10 terrorists involved in the Mumbai terror attacks of November 2008 were gunned down by the Mumbai police and National Security Guard (NSG) commandos. Ajmal Kasab was arrested, interrogated, tried and sentenced to death by India’s judicial system. True, the Mumbai attack was a fidayeen suicide mission. But, importantly, the investigations uncovered the terror plot hatched by the Lashkar-e-Taiba, thoroughly



Prasenjit Bose

is an economist and activist

exposed the role played by Pakistan’s Inter-Services Intelligence (ISI) and eventually caught up with international terrorists such as David Headley and Tahawwur Rana; Rana was finally extradited to India from the United States in April. India was also successful in diplomatically isolating Pakistan after 26/11.

Ironically, the Prime Minister’s references to “nuclear blackmail” in his recent address and his warning call to Pakistan to dismantle its “terror infrastructure” for its own survival, expose the limits of this doctrine.

The security calculus

That the military establishment of Pakistan is hand in glove with terrorist organisations operating on both its eastern and western borders has been established and documented over the decades. It was vividly exposed by Indian investigations after the Mumbai terror attacks. The takeover of Osama bin Laden by the U.S. military in May 2011 from Pakistan’s Abbottabad was another clear pointer.

The fact remains that the military superpowers such as the U.S., China and Russia – now joined by wannabe power Türkiye – continue to supply military hardware, advanced technologies, finance and offer diplomatic assistance to the Pakistan military, being perfectly aware of their sinister end-uses. Unless this reservoir of material, strategic and diplomatic support for Pakistan’s military-terrorism complex, dries up, effective deterrence cannot be achieved.

A realistic cost-benefit analysis of Operation Sindoor should objectively assess the damage inflicted on the Indian side not only in terms of military lives and hardware but also in terms of civilian lives lost in Pakistani shelling across the LoC in Jammu and Kashmir. Obfuscation of such human casualties and operational losses does little to enhance India’s credibility in the global arena.

Notwithstanding the Prime Minister’s rhetoric on “Made in India” weapons being tested and proven in Operation Sindoor – establishing India’s superiority in “new age warfare” – the crucial weapons systems used by India during the conflict are its expensive procurements from French, Russian and Israeli suppliers. Pakistan’s arms inventory includes procurements from China, Russia, the U.S. and Türkiye. These foreign suppliers of high-tech arms are the only winners in such “new age warfare”, with no clear victor or the vanquished among the parties in actual conflict.

The alacrity with which the U.S. intervened to

terminate Operation Sindoor and sought to impose a ceasefire serves as a reality check for India’s security and foreign policy establishment. The near-simultaneous nuclear weaponisation of both India and Pakistan from the late 1990s has created a durable ground for international intervention in any conflict between the nuclear-armed neighbours, weakening the edifice of the Simla Agreement, signed after India’s decisive victory in the 1971 Bangladesh war.

Earlier, it was only Pakistan which wanted to internationalise its territorial conflict with India over Kashmir, while India consistently resisted any departure from the bipartite framework. With India’s increasing acceptance of U.S. mediation over time – evident from the recent ceasefire with Pakistan – another nail has been driven into the coffin of the Simla Agreement.

Strategic reset required

There is a plausible case for India to explore pathways of engaging with Pakistan in the context of changes in the geopolitical landscape and global power dynamics in the past five decades. Terrorism motivated by religious bigotry, with or without state sponsorship, has, indeed, emerged as a complex strategic threat for nation-states across the world.

However, the new anti-terror doctrine articulated by Mr. Modi falls short on retrospective insight, being premised on the same tried-and-failed formula of the war on terror by the U.S. and Israel. With its nuclear trigger as existing leverage, the Pakistan military shall now have an additional trigger to start a new cycle of terror and conflict with India.

Rather, priority must be accorded to the NIA investigation and bringing the perpetrators of the Pahalgam terror attack to justice. This is vital for the credibility of India’s anti-terror stance. Diplomatic efforts should be renewed to persuade the U.S., China and Russia to stop arming and financing the military-terrorist complex in Pakistan.

India needs to work together with all international stakeholders to restore civilian rule and democracy in Pakistan, which alone can defuse religious extremism and dismantle its terrorist infrastructure.

This is not an easily attainable objective, but is certainly a more practicable and realistic one, compared to dystopian military non-solutions. An informed parliamentary debate on Operation Sindoor and the Prime Minister’s new anti-terror doctrine is essential before it actually becomes the “new normal”.

India’s new anti-terror doctrine must be subject to parliamentary scrutiny



WHAT IS IT?

PSLV: centre of attention

Vasudevan Mukunth

At 5.59 am on May 18, the Indian Space Research Organisation (ISRO) launched a PSLV rocket in its XL configuration. It was carrying a satellite called EOS-09, which it planned to deposit into a sun-synchronous polar orbit (SSPO) around the earth. The mission was designated C61. But a few minutes after liftoff, the rocket suffered a problem in its third stage and the PSLV-C61 mission ended in a failure.

PSLV stands for 'Polar Satellite Launch Vehicle.' It was originally built to launch satellites into SSPOs. It's a four-stage rocket. Each stage is defined by a set of engines that often fire together. Once they are done, the rocket jettisons that stage so that the remaining stages have less mass to lift.

PSLV's first stage engine burns hydroxyl-terminated polybutadiene-bound (HTPB) propellant to generate a peak thrust of 4.8 MN. (In its XL configuration, six strap-on boosters augment the first stage.)

The second stage is powered by a Vikas engine,



The PSLV-C57 mission lifts off on September 2, 2023, carrying the Aditya-L1 spacecraft. PTI

which uses unsymmetrical dimethylhydrazine as fuel and nitrogen tetroxide as oxidiser to develop a thrust of 0.8 MN. The third stage is back to using HTPB as fuel whereas the fourth burns a combination of monomethylhydrazine and mixed oxides of nitrogen in two engines.

After the failure of PSLV-C61 became clear, ISRO chairman V. Narayanan said the chamber pressure in the casing that contained the third-stage motor fell during the flight, leading to the unfortunate outcome. ISRO will assess the reasons for the loss of pressure in the coming days and subsequently reattempt the mission to launch (another copy of) EOS-09.

For feedback and suggestions

for 'Science', please write to

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with the subject 'Daily page'

Our bodies perform a kind of mRNA editing, and we don't know why

Researchers from China recently reported that it's hard to make sense of the widespread persistence of A-to-I mRNA editing in animals; now a study into a particular fungus appears to show that editing is delayed in certain stages of growth to suit the conditions and begins when it is necessary to promote development in the next stage

D.P. Kasbekar

The noted geneticist and evolutionary biologist Theodosius Dobzhansky (1900-1975) published an essay in 1973 in the journal *American Biology Teacher*, titled 'Nothing in biology makes sense except in the light of evolution.' The title became wildly popular in scientific circles. It was even engraved in the Jordan Hall of Science at the University of Notre Dame in the US.

Recently, an article in the *Journal of Molecular Evolution* by Qihua Xie and Yuange Duan from China Agricultural University, Beijing, posited that even in evolution's light, it is not easy to make sense of the widespread persistence of A-to-I RNA editing in animals and fungi.

A-to-I RNA editing had not yet been discovered in Dobzhansky's time.

Cooking a protein

The DNA is basically a book of recipes. Each recipe tells the cells in our bodies how to make specific proteins by combining 20 ingredients, called amino acids, in different ways.

Sometimes a recipe is for a single protein; sometimes it's for multiple. Either way, each recipe is called a gene. The recipes are written in the gene's own language, which uses an alphabet consisting of four 'letters': A, T, G, and C. For example, the ingredient alanine can be written as GCA, glycine can be written as GGT, and so on.

A cell transcribes the recipe to make a protein from a gene in the DNA to an mRNA. Then the cell moves the mRNA from the nucleus to the ribosome, where the mRNA is "read" to make the protein.

Sometimes, after the cell copies a recipe to the mRNA, it switches particular letters in it – specifically, the 'A' in the mRNA language above (standing for adenosine) to 'I' (inosine). This conversion is called A-to-I mRNA editing. Proteins in the cell called ADAR are responsible for it.

And when a ribosome reads from this mRNA to make the protein, it reads inosine as though it was guanine. Thus, A-to-I mRNA editing results in a protein with an amino acid coded by, say, AXX to be manufactured as the protein with the amino acid encoded by GXX instead. This can be dangerous.

Why so complicated?

Some letters in the recipe tell a ribosome where the recipe ends. They're called stop codons. Two examples are UAG and UGA. When the ADAR proteins act on either of them, the ribosome reads them as UGG instead, which is the instruction



The DNA is basically a book of recipes. Each recipe tells the cells in our bodies how to make specific proteins by combining 20 ingredients, called amino acids, in different ways. Representative illustration. GETTY IMAGES/ISTOCKPHOTO

to insert the amino acid tryptophan. So instead of stopping at that point, the protein under construction receives tryptophan, and the ribosome continues until it hits the next stop codon.

The funky part is that while we know ADAR-mediated A-to-I mRNA editing exists, we have no idea why.

For example, if the goal was for a cell to instruct a ribosome to see UGG instead of UAG, it would have been simpler for the DNA to say UGG to begin with. But the ADAR-mediated way is for some unknown reason more complicated: the DNA says UAG, followed by the ADAR proteins intervening to change it to UGG later.

Making sense

In a January 2024 study, researchers from the Northwest A&F University in Yangling, China, posed this question to a fungus called *Fusarium graminearum*, which infects wheat and barley crops. But instead of finding another reminder of the mystery, they found a glimpse of a clue.

When *F. graminearum* grows on an infected plant, i.e. in its vegetative growth stage, its cells don't do any A-to-I mRNA editing. But when the fungus enters its sexual stage, more than 26,000 sites transcribed from its DNA into mRNA undergo A-to-I mRNA editing.

Why?

If the goal was for a cell to instruct a ribosome to see UGG instead of UAG, it would have been simpler to say UGG to begin with. But the ADAR way is for some unknown reason more complicated

The team focused on 71 *F. graminearum* genes whose coding sequence was interrupted by a UAG stop codon that the ADAR proteins had scrambled. Since the pre-scrambled mRNA version of all these genes contained a premature stop codon, the team called the genes PSC.

When they deleted any one of the PSC genes from the genome, *F. graminearum* wasn't affected in its vegetative growth stage. But when they started deleting PSC genes in its sexual stage, there were observable effects.

This proved A-to-I mRNA editing was essential for the proper function of the PSC genes during sexual development. They also found that the unedited version of two genes (*PSC69* and *PSC64*) helped the fungus resist environmental stresses during the vegetative growth stage. This meant that mutating the A to a G in the DNA would be disadvantageous

during asexual growth. These findings together explained why evolution didn't replace the A in the DNA sequence of these two genes with a G at the beginning of their lives.

Never so easy

Of the 71 genes the team examined, only two seemed to benefit from A-to-I mRNA editing. But what about the other 26,000 sites in the fungus's genome? It's possible that over time, the genes that benefit from A-to-I mRNA editing will increase and mRNA editing by ADARs will become an essential component of the gene-expression pathway. At that point, it's conceivable that more G-to-A mutations will begin to accumulate in the genome, sheltered by the ADAR-based editing machinery.

King Alfonso X (1221-1284) of Spain reputedly grumbled, "If the Lord Almighty had consulted me before embarking upon his creation, I should have recommended something simpler."

The Beijing researchers seem to have shared this lament but were more prosaic in their articulation. Explaining the net benefit of A-to-I mRNA editing "is far more difficult than revealing its function," they wrote in their paper.

(D.P. Kasbekar is a retired scientist. kasbekardp@yahoo.co.in)

THE GIST

When *F. graminearum* grows on an infected plant in its vegetative growth stage, its cells don't do any mRNA editing. But when the fungus enters its sexual stage, more than 26,000 sites transcribed from its DNA into mRNA undergo A-to-I mRNA editing

Seventy-one *F. graminearum* genes' coding sequences were interrupted by a stop codon, called PSC. When a PSC gene was deleted during vegetative growth, it was not affected, but when the researchers deleted PSC genes in the sexual stage, there were observable effects

It is possible that over time genes that benefit from A-to-I mRNA editing will increase and mRNA editing by ADARs will become essential. At that point, it's conceivable that more G-to-A mutations will begin to accumulate in the genome

Saroj Ghose, father of India's science museum movement, passes away

Shiv Sahay Singh

KOLKATA

Saroj Ghose, the founding Director-General of the National Council of Science Museums (NCSM) and the father of India's science museum movement, passed away at 89.

"Dr. Ghose breathed his last on 17th May 2025 at 11:35 a.m. Pacific Time in Seattle, U.S., at the age of 89. As per his wishes, his mortal remains are being donated to Washington University for scientific research," the NCSM said in a press release on Sunday.

Ghose served as the Director-General of the NCSM from 1979 to 1997. A Harvard alumnus, he received the Padma Shri in 1989 and the Padma Bhushan in 2007. He also served as President of the International Council of Museums (ICOM), Paris.



Saroj Ghose

He is fondly remembered as the architect of India's network of science centres and museums.

"He envisioned and executed the development of a decentralised model of science museums across India, making science accessible, interactive, and inspiring to millions," the press statement added.

Ghose continued to lend his expertise after his retirement, and some of his contributions after he

served as the NCSM's Director-General were the Town Hall Museum, Kolkata; the Parliament Museum, New Delhi; and the Rashtrapati Bhavan Museum, New Delhi.

"In his passing, India has lost a visionary who laid the foundations for a scientific temper in society through informal education. NCSM pays heartfelt tribute to his legacy and remains committed to furthering his mission of democratizing science for all," the NCSM said.

Headquartered at Kolkata, the NCSM was formed in 1978 as an autonomous society under the Union Ministry of Culture, and administers 26 science centres and museums across the north, south, east, northeast, and west zones, including seven centres at the national level.

Constitution is supreme, not judiciary or executive, says Chief Justice B.R. Gavai

The Hindu Bureau

MUMBAI

Chief Justice of India B.R. Gavai on Sunday said it was the Constitution that was supreme and not the judiciary or the executive. The Constitution's pillars must work together, he added.

He said this at a felicitation programme organised by the Bar Council of Maharashtra and Goa in Mumbai.

The CJI expressed his displeasure at the absence of the Chief Secretary of Maharashtra, the Director-General of Police, and the Mumbai Police Commissioner from the event.

"Judiciary, legislature, and executive are the three pillars of democracy and they are equal. Every organ of the Constitution must reciprocate and show respect to other institutions. When a person from Maharashtra becomes the Chief Justice of India and visits Maharashtra for the



Chief Justice B.R. Gavai

first time, if the Chief Secretary of Maharashtra, the Director-General of Police or the Mumbai Police Commissioner do not feel it appropriate to be present, then they need to reflect on that. Protocols are not something new, it is a question of the respect one constitutional body gives to another," the Chief Justice said in his speech.

"It is a question of respect by the other organs of the institution to the judiciary. When the head of a constitutional institution visits the State for the first time, the way they are

treated should be reconsidered. Had it been any one of us in such a situation (meaning if judges broke the protocol), discussions about Article 142 would have taken place. These may seem like small things, but the public must be made aware of them," he said.

Article 142 of the Constitution empowers the Supreme Court to pass "any decree or order necessary for doing complete justice in any case or matter pending before it" within the country.

After the release of a book chronicling 50 remarkable judgments pronounced by him, Chief Justice Gavai headed to Babasaheb Ambedkar's memorial, Chaitya Bhoomi, where Maharashtra Chief Secretary Sujata Saurnik, DGP Rashmi Shukla, and Mumbai Police Commissioner Deven Bharti were present after learning about the CJI's remarks.

Karnataka set to hand over kumki elephants to A.P. to help tackle human-wildlife conflict

The Hindu Bureau
BENGALURU

Karnataka will hand over kumki elephants to Andhra Pradesh on May 21 to tackle man-elephant conflict along the Karnataka-Andhra Pradesh boundary.

Karnataka Forest and Environment Minister Eshwar Khandre on Sunday said that the trained elephants would be handed over by Karnataka Chief Minister Siddaramaiah and Deputy Chief Minister D.K. Shivakumar to Andhra Pradesh Deputy Chief Minister Pawan Kalyan at an official ceremony at the Vidhana Soudha here.



Task-ready: Tamed elephants at the Sakrebailu elephant camp near Shivamogga. SPECIAL ARRANGEMENT

Mr. Khandre, in a statement, said the handing over of the elephants was part of an agreement on the exchange of best practices between Karnataka, Andhra Pradesh, Telanga-

na, and Kerala.

The agreement was formulated between the States during an international conference on elephant-human conflict in Bengaluru in 2024.



AIWC to manage T.N. endangered species conservation fund

Geetha Srimathi

CHENNAI

After the Tamil Nadu Forest Department's plan to safeguard endangered wildlife hit a roadblock, it has been decided that the fund would be rerouted through the Advanced Institute of Wildlife Conservation (AIWC).

Announced in 2024 with an initial corpus of ₹50 crore, the Tamil Nadu Endangered Species Conservation Fund was initially set to be managed by the State Forest Development Agency (SFDA). However, concerns have emerged after it was found that the SFDA, a body responsible for promoting forestry development, has been largely defunct and inactive for some time.

In a government order issued in November 2024, the SFDA was designated as the managing agency for the fund, which was to be initially overseen by the Mudumalai Tiger Reserve Foundation. The corpus of ₹50 crore was to be held by the Tamil Nadu Power Finance Corporation or the Tamil Nadu Transport Development Finance Corporation until further arrangements were made, according to the Government Order.

However, after scrutiny, Supriya Sahu, Additional Chief Secretary to the Departments of Environment, Climate Change, and Forests, acknowledged that the agency's inability to operate effectively would hinder the fund's intended goals.



Key goals of the fund include surveying, assessing, and mapping threatened species.

She said that upon realising the SFDA's dysfunctional status, there were initial plans to create a new society or trust to manage the fund. However, this process was expected to take at least six months, which would delay the fund's deployment.

To address this, the Forest Department has now decided to transfer the responsibility of managing the fund to the AIWC in Vandalur, an institution known for its research and initiatives in wildlife conservation, which has been recently registered as a society.

The key objectives of the fund include surveying, assessing, and mapping threatened species across the State, enhancing conservation efforts both inside and outside protected areas, and building partnerships for the long-term protection of vulnerable species.

Soon, the AIWC is expected to invite grant proposals for research on endangered species in the State, including Salim Ali's fruit bat and Malabar civet.

