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GS Paper II – Polity

Date: 19.07.26

Panels examining Bill for removal of Ministers and VBSA Bill defer meeting

The Hindu Bureau
NEW DELHI

The Joint Parliamentary Committee examining the Viksit Bharat Shiksha Adhishthan (VBSA) Bill on Saturday cancelled its July 20 meeting where the Bill's draft report was to be adopted. This came a day after the Committee examining the Constitution (130th Amendment) Bill to remove Prime Minister, Chief Ministers, and Ministers if they are detained in prison for 30 days in serious criminal offences deferred its meeting.

Opposition leaders – Congress general secretary Jairam Ramesh and Trinamool leader Sagarika Ghose – called the development, which comes just ahead of the Monsoon Session of Parliament, a “big victory” for the Opposi-

Opposition leaders call the development just ahead of the Monsoon Session, a ‘big victory’

tion. In a social media statement, Mr. Ramesh said, “The shadow of the embarrassment that the [Narendra] Modi government had to endure in the Lok Sabha on April 17, 2026, still lingers.”

On April 17, the government's effort to pass Bills related to delimitation of Lok Sabha constituencies was defeated in the Lower House. On Saturday, Mr. Ramesh referred to the defeat of the delimitation-related Bills as a “humiliation suffered by the Modi government” that had cast a “long shadow that persists in spite of the Union Home

Minister's bluff, brag, and bluster”.

While the Committee examining the Constitution Amendment Bill on Friday said it had deferred its meeting so as to make room for more consultations, the panel on the VBSA Bill, which intends to overhaul the country's higher education regulatory framework, on Saturday said it had deferred its meeting until further notice.

The panel on the Constitution Amendment Bill, headed by BJP MP Aparajita Sarangi, in its draft report, recommended replacing “removal” of Ministers with “suspension”. The Committee on the VBSA Bill, headed by BJP MP D. Purandeswari, in its report, revealed that the Centre had agreed to changes proposed by its

NDA-allied governments in Andhra Pradesh and Meghalaya over concerns of over-centralisation, as reported by *The Hindu*.

The Trinamool is learnt to have submitted a formal dissent note to the committee on the VBSA Bill, in which it has called the legislation a “constitutional Trojan Horse” being presented as a standards-setting framework for higher education. The party's note further expounds that the proposed VBSA architecture exceeds Parliament's constitutional role, weakens cooperative federalism, affects academic freedom and institutional autonomy, and proposes reform without a financing framework – issues that were reportedly raised by Congress leader Digvijay Singh, who is also on the panel.



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GS Paper II – Governance



Hunger stir against Ken-Betwa Link Project enters 15th day

An indefinite hunger strike against the Ken-Betwa Link Project and other irrigation schemes in Madhya Pradesh's Bundelkhand region entered its 15th day on Saturday, with protesters alleging inadequate rehabilitation and grievances related to displacement. The protest, mainly by tribal women, is being held on the banks of the Barana river near Kupa village. Protesters have also launched 'jal satyagraha', 'chita satyagraha' and a symbolic 'faansi satyagraha'. PTI

GS Paper II – Governance

'Felt I would be heard': a month on, real test begins for first women's police station

Shrimansi Kaushik
NEW DELHI

For Laxmi Singh, Station House Officer (SHO) of Delhi's first women's police station at Sabzi Mandi, law takes its own course but what law enforcers can ensure is timely action and quicker justice. "The aim of a dedicated police station is to ensure a focused and specialised approach to crimes against women. We understand the urgency with which women approach us," she said, adding that women officers bring greater sensitivity to such cases.

A month since its inauguration on June 19, the police station at Sabzi Mandi in north Delhi is preparing to file its maiden chargesheet in a case involving charges of rape and under

the Protection of Children from Sexual Offences (POCSO) Act.

Officials said they have largely received complaints related to marital disputes, domestic violence and dowry in the first month. So far they have registered nine FIRs - two each under POCSO and for rape and molestation, and three related to dowry. Cases earlier handled by the Crime Against Women (CAW) cell at Sabzi Mandi have also been transferred to the station.

While complainants have welcomed the dedicated facility, many are waiting to see whether their complaints translate into timely action.

"I am satisfied with the way the police handled my case," said Priyanka (name changed), who ap-



Since its inauguration on June 19, the women's police station in Sabzi Mandi has so far received 154 complaints, of which 23 have been disposed of. SUSHIL KUMAR VERMA

proached the station with a marital dispute. "They give time to your concerns. I chose the women's police station over a regular one because I felt I would be heard," she said, adding that counselling helped

her move towards reconciliation. Explaining the difference between the women's police station and a CAW cell, the SHO said the latter primarily handles dowry-related cases. "But

here, women can choose to register complaints instead of local police stations. Unlike regular stations where women personnel are saddled with multiple duties, officers here focus solely on women-related com-

plaints," she said.

Since its launch, the station has received 154 complaints, of which 23 have been disposed of until July 15. It has also taken over 298 complaints from the CAW cell, with 47 disposed of so far. Around 25 complaints were addressed during a Jan Sunwai meeting held last week.

When asked why many complaints have not resulted in FIRs, Ms. Singh said a large number of those are still under preliminary inquiry. "Most cases require counselling, but we are not fully equipped with trained counsellors. We rely on experience, but expert support is needed," she said.

The station currently coordinates with the Delhi Commission for Women for counselling, but officers said additional support

may be required given the volume of cases.

The station has a sanctioned strength of 57 personnel, but currently has about 35 to 40 staff members. "All women-related cases from the North district are being transferred here. We may need more staff to handle each case effectively," an Assistant Sub-Inspector said.

Officers said transferring all women-related cases to the police station has both its advantages and drawbacks. "It reduces the scope for local goons to exploit their familiarity and connections in the area to influence investigations, making the process more transparent. However, since we are not always familiar with the localities, we often have to rely on the local police for assis-

tance," an officer said.

Some complainants, however, flagged delays and coordination issues.

'Coordination issues'

Shalu (name changed), from Burari, said she was called to the station by an investigating officer who did not turn up. "I have been waiting for over an hour. I could have been informed," she told *The Hindu*. She was later attended to by another officer.

Another complainant said, "I want a separation from my husband, but I am still being advised reconciliation."

The SHO acknowledged that there is "scope for improvement". But she is hopeful of overcoming the challenges sooner than later and fulfilling public expectations.



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GS Paper II – Governance

Kerala records 2,914 State school dropouts in 2024-25

Migrant workers' children account for 36.72% of the dropouts; they discontinued studies to return to their native States or as their parents moved elsewhere for work, says Education Minister

R.K. Roshni

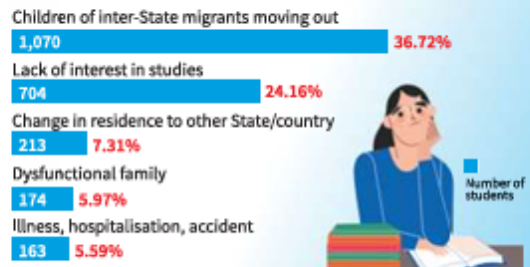
THIRUVANANTHAPURAM

As many as 2,914 students dropped out of schools that follow the State government syllabus in the 2024-25 academic year in Kerala. Of them, 36.72% (1,070 students) were children of migrant workers.

These students formed the biggest group of dropouts from State schools. A majority of them were from States such as Assam, West Bengal, Bihar, Uttar Pradesh, Tamil Nadu, and Odisha.

They discontinued studies either because they, along with their parents, had returned to their native States or their parents had shifted to another location for work, Minister for General Education N. Samsudheen said in a writ-

Reasons for dropping out



ten reply in the Assembly recently.

Key reasons

Of the total inter-State migrant children who dropped out, 36.5% (390 children) were from Ernakulam. Malappuram followed with 169 children dropping out, while Idukki recorded 127 dropouts.

Additionally, 29 students were children of

workers from other countries. They returned to their home countries and discontinued their education in Kerala. Of them, 27 were from Nepal and two from Bangladesh.

Another major reason for dropping out from schools was a "lack of interest in studies", according to the Minister's reply. A total of 704 students in the State dropped out ow-

ing to this reason.

Of them, 42.19% (297 students) were from Wayanad district. Palakkad recorded 92 such students, followed by Thrissur with 60 and Kannur with 55, who also discontinued their education midway owing to lack of interest.

As many as 213 students left studies because they moved to other States or countries, while 174 had dysfunctional family backgrounds. Persistent illness, hospitalisations, and accidents were responsible for 163 students discontinuing studies. As many as 103 students left to prioritise religious education.

Some of the other factors for students dropping out include "negative attitude" of parents to education (78 students), and poor financial condition of family (43 students).

GS Paper II – Polity

'Delimitation Bill a matter of national concern'

The Constitution (131st Amendment) Bill is not a Congress or an INDIA bloc issue alone; it concerns India's constitutional framework, says the party's general secretary; citing exam paper leaks, ethanol blending issues, and the Ram Temple donation theft, the leader says people are losing faith in BJP

INTERVIEW

K.C. Venugopal

Sandeep Phukan

Ahead of the Monsoon Session of Parliament, Congress general secretary (organisation) K.C. Venugopal speaks to *The Hindu* on the BJP's push for the Constitution (131st Amendment) Bill on delimitation, the changing Opposition numbers, repeated examination paper leaks, and concerns among vehicle owners over ethanol blended petrol among others. Edited excerpts:

The Opposition benches will look different this Monsoon Session, with 20 Trinamool MPs and six Shiv Sena (UBT) MPs now sitting with the NDA, and the DMK forming a separate bloc. Does this alter the Opposition's numbers and morale?

Not at all. The seating arrangement may have changed, but that is not going to change the character of Parliament or the Opposition's resolve.

This is not merely about numbers. The BJP is trying very hard to secure a two-thirds majority to push through constitutional amendments, particularly on delimitation. Delimitation is not a Congress issue or an INDIA bloc issue alone; it is a national issue because it concerns India's democratic and constitutional framework. The Government appears to be trying to divide Opposition parties to facilitate its agenda. In West Bengal, even the Opposition has been handpicked by the BJP. The same MPs who opposed the delimitation Bill have now crossed over.

The Constitution (131st Amendment) Bill is expected to be one of the most contentious pieces of legislation. Has the INDIA bloc evolved a common



SUSHIL KUMAR VERMA

strategy on the Bill?

The INDIA bloc, along with several Opposition parties outside the alliance, believes this is a matter of national concern. We fundamentally oppose any attempt to alter the constitutional balance in a manner that undermines federalism and democratic representation.

The people are losing faith in the BJP and its leadership. That is why they [the BJP] want to win elections through other means like delimitation, SIR and by splitting parties.

If the Government

includes the clause of a 50% increase in seats for all States, will the Opposition agree?

Our first demand is that the Government convene an all-party meeting and explain its intentions. We made the same demand when the Bill was introduced earlier. The Congress president has also conveyed this in writing. Individual consultations cannot substitute for a formal discussion with all Opposition parties.

We want to see the Bill before deciding our parliamentary strategy. In principle, however, we oppose

any attempt to give the executive sweeping powers over delimitation through a constitutional amendment. Even if the Government were to include such an assurance, that alone would not address our concerns.

Parties like the DMK could be important. Are you in touch with them?

We believe this issue transcends party politics and will unite those committed to protecting democracy. Whatever political differences may exist, the DMK has consistently placed Tamil Nadu's interests above all else. The State's interests are paramount for the party. Therefore, I do not think the DMK will support this Bill.

What are the other issues on which the Opposition intends to corner the Government?

The repeated paper leaks in various examinations will be a major issue. Stu-

dents and parents across the country have lost faith in the examination system. There is no accountability, and the Education Minister has failed to provide credible answers. We will continue to demand his resignation.

We will also raise the theft of donations at the Ram Temple in Ayodhya. The BJP came to power invoking the Ram Janmabhoomi movement. This is not merely a financial issue; it concerns the faith of millions. The Prime Minister, under whose watch the trust functions, has not uttered a word.

Then there is the issue of ethanol-blended fuel. Many middle-class vehicle owners are worried about the impact of higher ethanol blending on their vehicles, and the government has not adequately addressed these concerns. Then there is also inflation, unemployment, and large-scale layoffs following changes in labour codes. *Read full interview at newsth.live/KCVenugopal*



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GS Paper II – Polity

Article 370 wins top honour; Mammooty bags best male actor award for fourth time

The Hindu Bureau
NEW DELHI

Bollywood film *Article 370*, based on the events surrounding the abrogation of Article 370 of the Constitution in 2019, was named the best feature film of 2024 at the 72nd National Film Awards on Saturday.

Malayalam superstar Mammooty won his fourth National Film Award for best male actor with his performance in *Bramayugam*, sharing the honour with Kartik Aaryan, who was recognised for *Chandu Champion*. Mammooty had previously won the best actor award for *Oru Vadakkkan Veeragatha* and *Mathilukal* (1989), *Ponthan Mada* and *Vidheyam* (1994), and *Dr. Ambedkar* (1999).

Yami Gautam was named best female actor for her performance in *Article 370*.

Rajkumar Periasamy won the best director award for *Amaran*, a Tamil biography war movie starring Sivakarthikeyan and Sai Pallavi that chronicles the life of Major Mukund Varadarajan, an officer of the Indian Army, who was posthumously awarded the Ashoka Chakra. Music



composer G.V. Prakash Kumar won the best music director award for his background score in *Amaran* while Randeep Hooda won the best debutant director award for *Swatantrya Veer Savarkar*. The biographical drama chronicles the life of Hindutva ideologue Vinayak Damodar Savarkar, tracing his early revolutionary activities and the torture he endured in the Cellular Jail, Andaman Islands.

The acclaimed Tamil slice-of-life drama *Meiyazhagan* received a special mention for its sound mixing. Directed by C. Prem Kumar, the film stars Karthi and Arvind Swamy in the lead roles *Pushpa 2*,

starring Allu Arjun, won two awards as Deepali Noor and Sheetal Sharma received the best costume design award, while director Sukumar was honoured with the best screenplay award. Tamil actor Dhanush received a special mention for his performance in *Captain Miller*, which was named the best feature film promoting national, social, and environmental values.

Regional honours

Satirical drama *Feminichi Fathima* was named the best Malayalam film. The movie critiques the patriarchal and religious constraints imposed on women. *Mithya* won the

award for best Kannada film, while *Raayan*, directed by Dhanush, was named the best Tamil film.

Telugu movie *Kalki 2898 AD* bagged the trophy for the best popular film.

"Around 400 feature films in 34 languages, including Scheduled and non-Scheduled languages, were considered. It was a huge task because many young filmmakers came up with different experiments and fresh visions. It was quite hectic, but I believe we have done justice," Jayaraj, noted filmmaker and chairperson of the feature film jury, said while announcing the awards.

Mammooty, in a Facebook post, congratulated the co-winners and thanked the *Bramayugam* director for giving him the character of Kodumon Potty. "Heartfelt congratulations to Dhanush, Vaikom Vijayalakshmi, Shehnad Jalal, Rajkumar Periyasamy, Team Feminichi Fathima, Team Bhadra Kali Natakam, and all the winners of the coveted National Awards. Truly well deserved! Thanks Team #Bramayugam and Rahul Sasidharan, for entrusting me with Kodumon Potty," he said.

'Opposition's resolve in Parliament won't change'

Sandeep Phukan
NEW DELHI

The INDIA bloc and several other Opposition parties will oppose any attempt to alter constitutional balance and undermine federalism, Congress general secretary K.C. Venugopal has said. Speaking to *The Hindu* ahead of the Monsoon Session of Parliament where the Bill on delimitation is expected to be introduced again, Mr. Venugopal said a change in the seating arrangement amid the BJP's push for a two-thirds majority is not going to change the character of Parliament or the Opposition's resolve.

He said the Opposition's first demand is that the Central government convene an all-party meeting and explain its intentions. He also said the people are losing faith in the BJP and its leadership.

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GS Paper III – Environment

'Coastal lions mainly depend on wild prey, not domestic animals'

Abhinav Deshpande

AHMEDABAD

Asiatic lions living along Gujarat's coast depend mainly on wild prey rather than livestock, challenging the long-held belief that lions outside the Gir Protected Area survive largely on domestic animals, according to a study published in the peer-reviewed journal, *Conservation*.

The study found that wild prey accounted for 64% of the lions' diet and nearly 70% of the biomass consumed, while livestock contributed 31% of the diet and 30% of the biomass.

Researchers analysed 160 lion scat samples collected during March and April 2024 from the coastal districts of Junagadh, Gir Somnath, Amreli, Bhavnagar and Porbandar.

"Our study found that wild prey accounted for 64% of the lions' diet, while domestic animals contributed 31%. In terms of biomass consumed, wild prey contributed 70%, compared to 30% from livestock," said Mohan Ram, Conservator of Forests, Junagadh Circle, and one of the study's authors.

Among the prey species, blue bull (nilgai) was the largest contributor, accounting for 51% of the biomass consumed by lions. Wild pigs were the second most important wild prey, while cattle formed the largest domestic prey component.

The study, titled '*Dietary Pattern of Asiatic Lions in the Coastal Ecosystem of Saurashtra, Guja-*



The researchers said the findings contradicted their original hypothesis. SPECIAL ARRANGEMENT

rat, India', was authored by Mr. Ram, Aradhana Sahu, Nityanand Srivastava, Kritagnya Vadar, Rohit Chaudhary and Lahar Jhala. The researchers said the findings contradicted their original hypothesis that lions living in human-dominated coastal landscapes would depend more heavily on livestock because of limited wild prey availability.

Instead, the study concluded that healthy populations of nilgai and wild pigs along Gujarat's coastline enable lions to sustain themselves largely on natural prey, reducing pressure on livestock.

Habitat to over 100 lions

The study also noted that Gujarat's coastal ecosystem supports three satellite lion populations along the southwestern, southeastern, and Bhavnagar coasts. According to estimates cited in the paper, these habitats support more than 100 Asiatic lions.

According to the 2025 lion population estimation, Gujarat is home to 891 Asiatic lions.

GS Paper III – Environment

Unwanted guests turn sweet hosts for Assam butterflies

Rahul Karmakar
GUWAHATI

Butterflies have revealed that some invasive plant species, disliked by conservationists and farmers, and avoided by herbivores, serve an ecological purpose.

Bishal Basumatary, a research scholar at Bodoland University, set out to document the butterflies and their nectar sources in Raimona National Park. The university is on the outskirts of Kokrajhar, the administrative headquarters of the Bodoland Territorial Region, about 220 km west of Guwahati.

The research was conducted under the supervision of Kushal Choudhury, an associate professor at the university's Department of Zoology, between 2022 and 2025.

Their study document-

ed 220 species of butterflies, 56 species of larval host plants, and 41 species of nectar plants in the 422 sq. km national park that forms a large transboundary conservation landscape with Bhutan's Phibsoo Wildlife Sanctuary.

"One of the most significant findings is that *Lantana camara*, *Chromolaena odorata*, and *Ziziphus mauritiana*, which are generally regarded as invasive exotic species and are often excluded from forest management practices, serve as major nectar sources for a large number of butterfly species in the park," Mr. Choudhury said. *Lantana camara* and *Chromolaena odorata* are recognised among the world's most aggressive invasive plant species and regarded as ecologically undesirable because of their negative impacts on native



Plot twist: *Lantana camara* and a few other plant species are often excluded from forest management practices but they also function as host plants. SPECIAL ARRANGEMENT

vegetation and ecosystem functioning.

Abundant nectar

Larval host plants serve as the food source for butterfly larvae during their developmental stages, whereas nectar plants provide nectar, the principal nutritional resource for adult butterflies. The study revealed that some invasive plant

species provide abundant nectar supply for adult butterflies, particularly during periods when native wildflowers are scarce in the park. Their prolonged flowering period and high nectar availability were also found to have helped sustain butterfly populations during seasons of limited floral resources.

The researchers ob-

served that *Lantana camara* attracted exceptionally large numbers of butterflies. "The species produces flower clusters that change colour as the flowers age, resulting in multi-coloured inflorescences that serve as highly conspicuous visual cues for foraging butterflies. Coupled with its continuous nectar production, this characteristic likely contributes to its high attractiveness and frequent visitation by diverse butterfly species," they noted.

The study showed *Lantana camara* alone attracted more than 30 butterfly species between April and October, while *Chromolaena odorata* supported 24 butterfly species from December to February.

In addition to serving as nectar sources, several invasive plant species were also found to function as

larval host plants, highlighting their multifaceted ecological importance. These include *Ricinus communis*, *Senna alata*, *Portulaca oleracea*, *Sida rhombifolia*, *Cleome rutidosperma*, *Gomphocarpus physocarpus*, *Ageratum conyzoides*, *Chromolaena odorata*, *Tridax procumbens*, *Mikania micrantha*, *Mesosphaerum suaveolens*, *Spermacoce latifolia*, *Cyanthillium cinereum*, *Heliotropium indicum*, *Persicaria*

hydropiper, *Persicaria sagittata*, *Sida acuta*, *Leucas aspera*, and *Urena lobata*.

The researchers recommended maintaining small, carefully managed patches of *Lantana camara*, *Chromolaena odorata*, and *Ziziphus mauritiana* in suitable areas of protected landscapes to provide a continuous nectar supply for butterflies.

GS Paper III – Environment

Power grids face unexpected slow-burn threat from solar storms

Yasudevan Mukunth

As countries electrify more of their economies and increasingly interconnect their power grids, understanding space weather has become crucial. One particularly adverse form of space weather is a geomagnetic storm: temporary disturbances in earth's magnetic field caused by charged particles from the sun. These storms produce beautiful aurorae but also induce strong yet short-

lived currents in the grid.

However, a new study in *Space Weather* has reported that these storms can also stress power grids in a hitherto unexpected way and that existing tools may not fully capture the effects. The findings are centred on a geomagnetic storm in June 2015 that the U.S. Space Weather Prediction Centre had rated G4, or 'severe', and which produced a strange effect in New Zealand.

Instead of intensely

spiking the strength of currents in the South Island power grid, the storm ramped up geomagnetically induced currents over 90 minutes. The currents amounted to only 20 amperes but the duration was interesting, per the study. When such a current flows through a transformer for long periods, it can saturate the magnetic cores, leaving them to overheat and suffer more wear.

The study data came from multiple datasets plus

measurements provided by Transpower New Zealand.

The researchers – from the University of Gothenburg, Sweden – traced the cause to a possible "mid-latitude ionospheric current wedge". That is, the storm had appeared to divert a part of the electric current that encircles earth in space, called the ring current, into the ionosphere.

Aside from the unusually prolonged current, the

authors also wrote that the extant ways to track the effects of geomagnetic storms didn't properly capture the diversion. Scientists conventionally use the rate of change of earth's horizontal magnetic field, denoted 'H', to understand the extent of the geomagnetically induced current. But during the June 2015 event, 'H' did not sufficiently correlate with the grid currents. The wedge also distorted some of the parameters com-

monly used to assess geomagnetic storms.

The authors also found that the risk of these unusual events depends on how well the local ground conducts electricity and the layout of power lines.

They concluded that experts need to update their understanding of the ways in which adverse space weather could be dangerous and suggested that protective measures could not afford to focus on spiking currents alone.



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GS Paper III – Science & Technology

Non-animal testing is key to next phase of pharma growth

Animal studies continue to play an important role and cannot be entirely replaced at present; however, advances in non-animal testing models are enabling a more scientific approach that can reduce dependence on lab animals

N.K. Ganguly

For every medicine that reaches a pharmacy shelf, many others do not – not necessarily because the science was flawed but because testing models do not always predict how those medicines will behave in the human body. This long-standing challenge is at the heart of global drug development. But for India, which supplies affordable medicines to more than 200 countries, it also presents an opportunity.

As the sector matures, future growth must be anchored in creating value through original drug discovery, complex biologics, and stronger domestic innovation. Central to this transition will be India's ability to adopt and scale non-animal testing models (NAMs).

Only 10-14% of drug candidates worldwide entering phase I clinical trials ultimately receive regulatory approval. One significant reason is animal testing, which often struggles to accurately predict how a compound will behave in humans.

The consequence is not only high attrition and rising costs but also delays in bringing effective treatments to patients.

NAM is emerging as a complement to this system. NAMs include organoids, organ-on-chip platforms, advanced computational models, and artificial intelligence-enabled approaches designed to generate insights

Animals of medicine

Only 10-14% of drug candidates entering phase I trials ultimately receive regulatory approval

■ High failure rates in global drug development often stem from the poor predictive accuracy of animal models

■ Transitioning to non-animal models is essential for India to move from generic manufacturing towards discovering original drugs

■ Technologies like organoids and artificial intelligence can improve predictive accuracy while significantly shortening drug development timelines

■ India must establish a national framework and clear regulations to effectively integrate these innovative testing methods

■ Implementing these models in generic and biosimilar testing offers an immediate way to enhance domestic pharmaceutical efficiency

■ Adopting advanced testing technologies will position India as a competitive leader in the evolving global medical landscape



Hit or miss: Animal testing often struggles to accurately predict how a compound will behave in humans. PUBLIC DOMAIN

grounded in human biology. Increasingly, these tools are demonstrating the ability to improve predictive accuracy, shorten drug development timelines, and support more informed decision-making.

India's engagement with NAMs has evolved steadily over the years. Greater emphasis on laboratory animal ethics and institutional oversight encouraged researchers to explore alternative approaches. This led to the adoption of a range of platforms, including *Caenorhabditis elegans*, *Drosophila melanogaster*, zebrafish, yeast-based models, and *ex-vivo* tissue studies. More recently, 3D organoids and human-relevant cellular models have expanded the scientific toolkit available for research.

The U.S., the European Union, the U.K., and Japan

have already established national centres, dedicated funding streams, and validation programmes for NAMs. For India, engaging early with this shift will be critical to remain competitive and to play a role in shaping emerging global standards.

India's existing strengths include a robust generics industry, growing biosimilars capability, and a well-established contract research ecosystem. However, moving from scale to innovation will require a decisive shift in how we approach drug development. Integrating NAMs into research and development pipelines can enable more reliable science and faster development cycles. In this sense, NAMs can enable India's ambition to become a hub for drug discovery and innovation.

Incorporating NAMs in-

to quality testing of generics and biosimilar development could enhance efficiency without disrupting existing systems. In areas such as pyrogen and endotoxin testing, validated non-animal alternatives are already available and can be adopted at scale. For more complex therapies, NAMs can complement conventional approaches.

NAMs' relevance extends beyond pharmaceuticals. In the cosmetics and personal care sectors, virtual skin models and computational testing platforms have demonstrated an ability to generate robust safety data without relying exclusively on animal studies.

While India possesses significant scientific capabilities and research infrastructure relevant to NAMs, much of this capacity re-

mains underutilised and is not formally integrated into regulatory pathways. Progress remains constrained by limited regulatory clarity and the absence of a unified national strategy. Addressing these gaps will require aligning existing strengths with a clear and shared direction that recognises NAMs as a strategic priority.

A national framework to adopt NAMs would provide that direction. A central coordinating mechanism can help align stakeholders, prioritise investments, and ensure India moves in step with global developments. The regulatory system already permits the use of NAMs in areas such as proof-of-concept studies, target identification, drug screening, and aspects of toxicology. As a next step, clear guidance on the use and acceptance of NAMs-generated data will give industry confidence and accelerate adoption.

The broader implication is not limited to improving efficiency in drug development. It is about positioning India as an active participant in defining the future of medical science. While animal studies continue to play an important role and cannot be entirely replaced at present, advances in NAMs are enabling a more balanced and scientifically informed approach that can progressively reduce dependence on laboratory animals.

(N.K. Ganguly is former director-general, Indian Council of Medical Research)



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GS Paper III – Science & Technology

Knowledge work in the age of agentic AI



John Xavier

In the middle of a technological shift, people tend to get stuck in tunnel vision – heads down, focused on whatever's directly in front of them. It helps, every so often, to step back and get a broader read on the lay of the land.

In 1969, the management thinker Peter Drucker, in *The Age of Discontinuity*, argued that the coming wave of technology would break apart the work structures everyone assumed were permanent. Two years later, Intel released the 4004 – the first commercially available microprocessor, a full central processing unit shrunk on to a single programmable chip. Before it, computing power lived in the back

rooms of large corporations and research labs. After it, computing got small enough to put on a desk, and eventually in a pocket.

Semiconductors did their part. So did software and together they built the scaffolding for what we came to call the knowledge economy. Manual, repetitive industrial labour gave way to work that ran on judgment and information. A new class of worker emerged, one who owned the means of production in their own head.

The numbers back up how big that shift was. Global GDP grew from roughly \$1.3 trillion in 1960 to about \$33.5 trillion by 2000, then nearly doubled again to around \$66.8 trillion within another decade, as trade barriers fell and emerging markets came online. Knowledge work didn't just survive that expansion – it drove it. Now we're in the middle



Agentic AI systems can pursue goals, sequence decisions, operate over stretches of time without a human checking. FILE PHOTO

of another discontinuity, and once again it's easy to miss while everyone's arguing about the latest model release.

Agentic AI systems can pursue goals, sequence decisions, and operate over stretches of time without a human checking in at every step – work that, until recently, only people could do. These systems can move through enormous volumes of information fast enough that the old premise of the knowledge eco-

nomy no longer holds the way it used to.

So the real question is what happens to the knowledge worker once knowledge itself stops being scarce.

Drucker warned about something that reads as almost prophetic now: the knowledge worker's biggest risk wasn't ignorance, it was becoming a prisoner of their own speciality – brilliant in a narrow lane, lost outside it. The knowledge economy rewarded

that narrowness because depth was what execution required.

The agentic economy may reward the opposite. When an agent can already execute a well-scoped task inside a domain, the human's value shifts toward defining the task well and checking the output – catching what's wrong before it ships. And people are still hesitant to take AI output at face value; a lack of trust in reliability remains one of the biggest reasons people won't treat an AI-generated answer as final.

That means the next class of essential workers won't be defined just by the depth of their speciality, but by how well they can set context across domains, get a grasp of the technology, the people involved, the institutional politics, and the ethics at stake to know which question is even worth handing to an agent

in the first place.

That's an uncomfortable finding for anyone who has spent a career building a narrow technical edge. But it fits Drucker's deeper point about discontinuities: they don't shrink the need for human judgment. They move it somewhere else.

The agentic economy won't mean fewer decisions. It'll mean more of them than any person or organisation has had to navigate before.

The knowledge workers who come out ahead won't be the ones who know the most. They'll be the ones with the judgment to ask the right question, the skepticism to distrust a suspiciously confident answer, and the nerve to stop an agent mid-task when something looks off.

We may need a new name for that kind of worker. But we're going to need them more than ever.



Question Corner

Changing chemistry

Why does our body scent change distinctly as we age?

– Mahua Ray

The distinct scent often associated with ageing is primarily caused by a compound called 2-nonenal. Around 40 years old, our bodies' natural antioxidant defenses start to weaken, allowing certain fats on the skin to break down. For instance, when omega-7 unsaturated fatty acids like palmitoleic acid are exposed to oxygen, they oxidise and produce 2-nonenal.

The body odour caused by sweat and bacteria can be easily washed away but 2-nonenal is an

unsaturated aldehyde and repels water. So standard soaps and water often can't remove it, allowing the scent to persist even in individuals with excellent hygiene. In Japan, products containing persimmon extract (which in turn contain tannins) are known to be chemically effective at neutralising the 2-nonenal odour. Second, since the scent is a result of oxidation, a diet rich in antioxidants can help mitigate oxidative stress on the skin. Staying well-hydrated also helps flush toxins out.

Readers may send their questions / answers to science@thehindu.co.in



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GS Paper III – Science & Technology

What goals does Semicon 2.0 aim to achieve?

What are the key focus areas of Semicon 2.0? How is it different from the first phase? Why is India focusing on semiconductor manufacturing? What incentives does the Mobile Phone Manufacturing Scheme offer?

Aroon Deep

The story so far:

In July 15, the Union Cabinet cleared the second phase of the India Semiconductor Mission (ISM), and the Mobile Phone Manufacturing Scheme (MPMS), with a ₹1.27 lakh crore and ₹62,500 crore outlay, respectively. The programmes are aimed at encouraging the next cohort of semiconductor fabrication, assembly, and packaging facilities in India, as well as following through on encouraging more phone assembly and component manufacturing in the country. The government expects the scheme to draw ₹4 lakh crore in investment, ₹2 lakh crore in production, and ₹1 lakh crore in exports over its tenure of five years.

How is this different from the first phase?

ISM's first phase was approved in December 2021 with an outlay of ₹76,000 crore. Following an amendment in 2022, the programme was empowered to provide for up to 50% capital subsidy for big-ticket projects, such as Micron's memory chip packaging facility in Sanand, Gujarat. The funds were also directed to the Electronics Component Manufacturing Scheme, which was designed to incentivise additional

The government has insisted that building domestic capacities is essential even if it takes decades to reach the level of countries, such as the Netherlands and Taiwan, whose companies are critical in chipmaking

manufacturing of smaller electronics components.

The Gazette notification laying out the precise details of the second phase is set to be published by next month. In the meantime, Information Technology Minister Ashwini Vaishnaw and Ministry of Electronics and Information Technology (MeitY) Additional Secretary Amitesh Kumar Sinha have offered a few details of the expanded scope of the programme.

The main change is that the ISM programme will now cover a larger part of the electronics manufacturing ecosystem, including areas that were partially addressed in the previous phase. These include encouraging chip design talent, capital machinery (the large equipment used in chip-making facilities), chemicals and gases that are of semiconductor-grade purity, and research and development efforts.

The newer scheme will also trim capital subsidies to 30-40%, Mr. Sinha said, as the semiconductor industry is likely to get more attractive in India even with less incentives. The government is also less likely to offer land support, as State governments have shown increasing enthusiasm for hosting such projects by providing land at token prices and offering their own incentives on top of those provided by the Union government.

What have been the outcomes of phase 1?

Of the 12 manufacturing and packaging units approved in phase 1, with a total committed investment of ₹1.64 lakh crore, most are semiconductor packaging units. Nine such units are spread across Gujarat, Uttar Pradesh, Punjab, Assam, Odisha, and Andhra Pradesh. In addition, there is a silicon fabrication unit, and one gallium-nitride Micro LED display fabrication unit. The Tata Electronics fab is set to start commercial production in 2028.

The scheme included a design-linked incentive programme, under which 24 projects have been approved. The government has also obtained licences for expensive semiconductor design software and provided them free of cost

to universities and startups. The Semiconductor Lab, Mohali, which is being revamped, is being positioned as a facility to help "tape out" chips designed by students and researchers.

Why is India focusing on semiconductor manufacturing?

From the COVID-19 era supply chain disruptions to export controls initiated by the U.S. during the trade war with China, there has been a growing sense that India needs to integrate more tightly with global electronics value chains. The government has insisted that building domestic capacities is essential even if it takes decades to reach the level of countries, such as the Netherlands and Taiwan, whose companies are critical in chipmaking.

How sophisticated are the chips targeted in the current facilities?

While the most powerful phones use "frontier" grade chips, with a process node of 7 nanometres or even less, the Union government has targeted 28nm chips (which are made in what are called "legacy" process nodes). There is a massive market for these chips, Mr. Vaishnaw reasoned, as everyday electronics, where size and computing power are not constraints, require such components too.

As ISM 2.0 progresses, the government hopes that the ecosystem will progress to frontier nodes, especially by improving the level of domestically owned intellectual property and research for such chips. While semiconductor designers are aplenty in India, most work for either foreign firms or on their behalf, leaving royalties and expertise outside the domestic industry.

Why is MPMS being notified?

While a growing share of iPhone sales around the world come from handsets assembled in India, most components remain imported, and there are barely any Indian-designed handsets in the market. The MPMS aims to incentivise both the expansion of domestic phone assembly as a way to grow the ancillary market, and to incentivise domestic design and research and development. To that end, the scheme provides for incentives ranging from 2.25% to 5%, depending on the level of local design involved in the handsets.



Union IT Minister Ashwini Vaishnaw showcases 'Made in India' semiconductor chips while speaking during a Cabinet briefing in New Delhi. PTI



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GS Paper III – Science & Technology

India's first privately made orbital rocket Vikram-1 places payloads into orbit

Hemanth C.S.
SRIHARIKOTA

India achieved a major milestone in its space journey on Saturday as the country's first privately developed orbital rocket, Vikram-1, successfully placed multiple technology demonstration payloads and postcards – including from Prime Minister Narendra Modi – into a low earth orbit.

Dubbed 'Mission Aagamam' (meaning arrival), the launch marked India's entry into an elite group of nations, becoming only the third country in the world to achieve the feat through a privately developed launch vehicle. The mission was a "grand success", said private space launch company Skyroot Aerospace, which developed the rocket.

Vikram-1 lifted off from the Satish Dhawan Space Centre in Sriharikota at 12.05 p.m. Earlier, the launch was temporarily put on hold from its original time of 11.30 a.m.

'Defining moment'

Pawan Kumar Chandana, co-founder and CEO of Skyroot Aerospace, said that during the flight, Vikram-1 completed every principal mission milestone, validating the performance of its propulsion, avionics and guidance, navigation, and control systems under true operational conditions.

Private entry

The 'Mission Aagamam' makes India the third country in the world to attain private orbital launch capacity

- 1 Developed by Skyroot Aerospace, Vikram-1 is a **multi-stage orbital launch vehicle** built with an all-carbon composite structure
- 2 It is powered by **in-house developed propulsion systems**, including 3D printed engines
- 3 It is designed to carry **small satellites** weighing up to 350 kg to low earth orbit

PAYLOADS

- Embraze by CosmoServe Space
- Solaris Satellite by Grihaa Space
- Scope Satellite by Skyroot Aerospace

CONFIGURATION

Three solid stages and a liquid orbital adjustment module

- uD3PP and mD3RN by Germany's Dcubed
- Cosmic Bloom by Cosmos Diamonds
- Micro Art Tribute by Ajay Kumar Mattewada

New player: Vikram-1 Test Flight-1 lifts off from the Satish Dhawan Space Centre in Sriharikota on Saturday. PTI



Following the successful launch, Mr. Modi had a phone conversation with the team of Skyroot Aerospace. Speaking to Mr. Chandana, the Prime Minister said that the launch is a defining moment in India's space journey.

"The growing participation of our private sector is opening new frontiers and accelerating innovation. This achievement will encourage countless youngsters to dream bigger and innovate fearlessly," the

Prime Minister said.

The launch comes 46 years after India launched its first experimental satellite launch vehicle, SLV-3. On July 18, 1980, India became the sixth member of an exclusive club of space-faring nations when the SLV-3 was successfully launched from the same venue as Vikram-1.

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