DAILY CURRENT AFFAIRS

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The Hindu Analysis June 23rd,2025

Topics Covered

- U.S. attacks Iran, strikes three nuclear sites
- Lessons from Operation Sindoor's global outreach
- Compensating theft
- India trails in critical tech, particularly semiconductor tech
- Fighting antimicrobial resistance with insect based livestock feed
- Stealth frigate INS Tamal to be commissioned on July 1

U.S. attacks Iran, strikes three nuclear sites

Syllabus:

GS Paper 2: International Relations

U.S. attacks Iran, strikes three nuclear sites

Attacks crossed a 'big red line', says Iran Minister while asserting the country's right to self-defence

No immediate signs of radioactive contamination following the strikes, says UN nuclear watchdog

There will be 'either peace or tragedy for Iran', says Trump acting without congressional nod

Associated Press
DUBAI

Prompting fears of a wider regional conflict, the United States inserted itself into Israel's war against Iran early on Sunday by dropping 30,000-pound bombs on a uranium enrichment site buried under a mountain, a risky gambit that aimed at destroying the Islamic Republic's nuclear programme after months of failed diplomacy.

The U.S. also fired dozens of missiles, and President Donald Trump said that the combination of strikes "completely and fully obliterated" three nuclear sites. However, U.S. defence officials said an assessment of the damage was ongoing.

The Atomic Energy Organization of Iran confirmed that attacks took place on the Fordow and Natanz enrichment facilities as well as its Isfahan nuclear site, but it insisted that its nuclear programme will not be stopped. Both Iran and the UN nuclear watchdog said there were no immediate signs of radioactive contamination following the strikes.

U.S. Defence Secretary Pete Hegseth said the country does not "seek war" and that the operation would not be "open-ended", though Mr. Trump earlier warned there would be additional strikes if Tehran retaliated. "There will either be peace or there will be tragedy for Iran," said Mr. Trump, who acted without congressional authorisation. Vice-President J.D. Vance, however, said the strikes have given Tehran the possibility of returning to negotiate with Washington.

Hours later, Iranian Foreign Minister Abbas Araghchi said the attacks have crossed a 'big red line' adding that the time for diplomacy had passed and that his country had the right to defend itself. Mr. Araghchi said he would be flying to Moscow to coordinate positions with its ally, Russia. "The warmongering and lawless administration in Washington is solely and fully responsible for the dangerous consequences and far-reaching implications of its act of aggression," he told presspersons in Turkiye.

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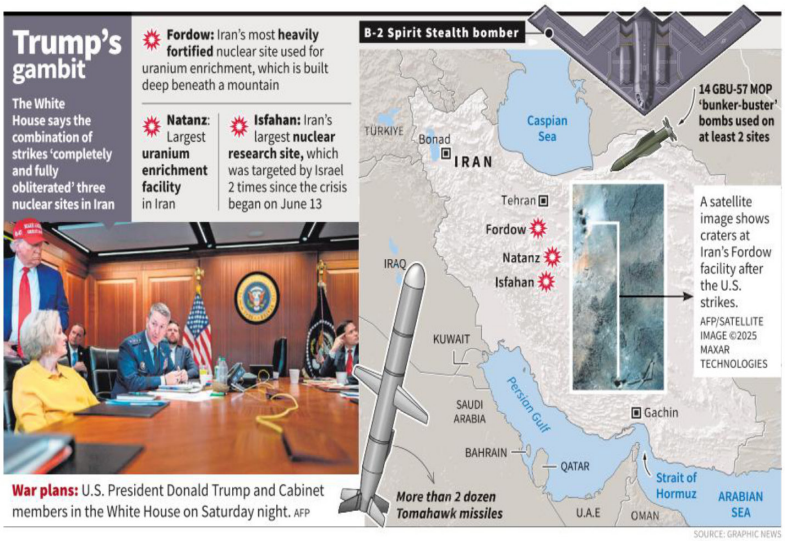

Iranian parliament votes to close Strait of Hormuz

T.C.A. Sharad Raghavan
NEW DELHI

Iran's parliament, the Majlis, has reportedly approved the closure of the Strait of Hormuz in response to the attacks by the U.S. on Iranian nuclear facilities, the country's state-owned media *PressTV* reported on Sunday.

The Strait of Hormuz connects the Persian Gulf with the Gulf of Oman and the Arabian Sea, and is one of the world's most important oil trade routes.

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PM calls for 'immediate de-escalation' of conflict

Kallol Bhattacherjee
NEW DELHI

Prime Minister Narendra Modi spoke with the President of Iran, Masoud Pezeshkian, and called for "immediate de-escalation" on Sunday, hours after the U.S. struck three prominent nuclear sites in Iran. The conversation between the two leaders is significant as it came ahead of an emergency meeting of the Board of Governors of the International Atomic Energy Agency (IAEA) in Vienna, where the U.S. attack on Iran will be the main subject of attention.

FULL REPORT ON
» PAGE 13

Lessons from Operation Sindoor's global outreach

Syllabus:

GS-2: Role of diaspora, bilateral relations, India's foreign policy strategy.
GS-3: Role of security forces in counter-terrorism.
Essay Paper: Use points on "Power of soft diplomacy" and "Unity in foreign policy".

Lessons from Operation Sindoor's global outreach

The aftermath of the April 22 Pahalgam terror attack, and India's resolute response through "Operation Sindoor", presented a critical juncture for our nation's foreign policy. While the immediate military action was decisive, the subsequent diplomatic outreach was equally, if not more, vital in shaping global perceptions and consolidating international support. Leading one of the seven all-party parliamentary delegations to five countries in the Western Hemisphere – Guyana, Panama, Colombia, Brazil and the United States – offered me a unique vantage point to reflect on the lessons learned from this intensive period of public diplomacy.

Shashi Tharoor

is the fourth-term Lok Sabha Member of Parliament (Congress) for Thiruvananthapuram, a former Minister of State for External Affairs and the award-winning author of 27 books, including 'Pax Indica: India and the World of the 21st Century' and most recently, 'Our Living Constitution'

Unity behind a strong voice

One of the most striking takeaways is the power of national unity in projecting a strong foreign policy voice. The very composition of our delegations, featuring Members of Parliament (MPs) from diverse political parties, different States and varied faiths, was a potent message in itself. It underscored that when it comes to national security and confronting terrorism, India speaks with one voice. This transcended domestic political differences, imbuing our message with greater credibility and gravitas in the eyes of our international interlocutors. Whether engaging with the President of Guyana or the U.S. Vice-President, the collective resolve of India, represented by its varied political spectrum, resonated deeply.

Our primary objective was to provide clarity on "Operation Sindoor" – its rationale, the targeted nature of India's initial strikes against terrorist infrastructure, its calibrated and measured nature, and its avoidance of any harm to civilians and even to Pakistani military facilities. We meticulously explained that India's actions were a legitimate exercise of self-defence, a necessary response to persistent cross-border terrorism. The success of this narrative was evident in the shift witnessed in several capitals. For instance, Colombia's retraction of its initial statement expressing condolences for supposed civilian casualties in Pakistan and its subsequent reaffirmation of support for India's sovereign right to self-defence was a significant diplomatic victory, directly attributable to our detailed and persuasive engagements. This demonstrated that facts, patiently and persistently presented, can overcome initial misunderstandings or even deliberate misinformation.

A parallel, and equally crucial, aspect of our outreach was to underscore Pakistan's continued links to terrorism. We consistently highlighted the severity of the threat emanating from across our borders, aiming to build global consensus on holding perpetrators accountable. The engagements in Washington DC were particularly illuminating in this regard. Even as a Pakistani delegation was simultaneously present, we found U.S. representatives, including those who met the Pakistani officials, echoing our concerns and urging decisive action against terror groups such as the Lashkar-e-Taiba and Jaish-e-Mohammed. This confirmed that our arguments, grounded in verifiable facts and consistent advocacy, were cutting through the noise and reinforcing the legitimacy of India's position.

The intensive period of public diplomacy affirmed that India, when united, can project its voice with clarity and conviction on international platforms

Beyond the immediate crisis management, the tour served as a powerful reminder of the enduring relevance of soft power diplomacy. The very name "Operation Sindoor" proved evocative, its cultural resonance helping to explain the depth of the outrage and the resolve it represented. From the widespread embrace of yoga to the global appeal of Bollywood, India's traditions offer a unique pathway to connecting with diverse audiences. It is a compelling reminder that our cultural heritage is not merely for domestic consumption; it is a powerful tool in our diplomatic toolkit, capable of evoking interest and fostering understanding far beyond geopolitical considerations.

The 'T's' and Indian strategy

Tradition is one of the three "T's" that I believe should drive India's future global strategy: tech, trade, and tradition all go together in promoting the new India to the world. While India's prowess in IT services is well-established, the next frontier lies in technological products and innovation in the age of Artificial Intelligence. Our diplomatic efforts must actively promote Indian technological breakthroughs and foster collaborative innovation with international partners. This is not just about economic growth; it is about showcasing India as a source of solutions and ingenuity, a nation that contributes meaningfully to global progress. Similarly, trade remains vital to our economic development and global standing. In an increasingly competitive world, particularly in comparison to China, India must proactively expand its trade volumes and diversify its trade basket.

Diplomatic outreach must therefore seamlessly blend security concerns with economic opportunities, creating mutually beneficial partnerships. One of my key messages was that India is focused on its growth and development and considers terrorism and war an avoidable distraction; all we want from Pakistan is to be left alone to serve our people. But if they hit us, we will hit back: we are determined to make them pay a price for each assault. Equally, if they desist, we have no desire for conflict. Peace is what allows us to prosper.

The tour also brought to the fore the importance of proactive and consistent public diplomacy. Every country we went to welcomed our visit and urged India to send its MPs more often. In addition to public representatives, lawmakers and government leaders, we spoke extensively with think-tankers, influential policy-shapers and national media. The media coverage we garnered, and the quality of the dialogue with foreign policy experts, demonstrated the appetite for India's perspective. This underscores the critical need for intensive engagement with western and mainstream media. A narrative vacuum is easily filled by misinformation, and our consistent presence in global media landscapes is essential to counter false narratives and ensure our story is told accurately and persuasively. This is something we could do better.

Furthermore, the visits to countries such as Panama and Guyana, both current non-permanent members of the UN Security Council (UNSC), alongside Colombia, which anticipates a UNSC tenure in 2026, highlighted the strategic imperative of nurturing relationships with a broad spectrum of nations. Panama's explicit support for India's candidature for a permanent seat on the UNSC, articulated by Foreign Minister Javier Martínez Acha, is a testament to the value of direct engagement and the cultivation of long-term diplomatic ties. These are the partners who can amplify India's voice on crucial global platforms.

Guiding principles

Looking ahead, several actionable recommendations emerge from this experience. We must continue to elevate diplomatic outreach in South and Central America, including reciprocal VVIP visits and augmenting the diplomatic strength of our Missions with greater language proficiency. At the multilateral level, the External Affairs Minister should consider engaging with the UN Secretary-General and UN General Assembly President to specifically address the terrorism issue, ensuring comprehensive briefings to UN representatives and engaging directly even with the sceptics among the UN press corps. Strengthening ties with Brazil, particularly through the Prime Minister's participation in the upcoming BRICS summit and a state visit, remains a high priority given President Luiz Inácio Lula da Silva's emphasis on the importance he attaches to his relationship with India. And, crucially, India must ramp up its engagements in Guyana to safeguard India's strategic interests in its newly discovered oil resources and burgeoning infrastructure sector

Prime Minister Narendra Modi's energy, dynamism and willingness to engage remains a prime asset for India on the global stage, but deserves greater backing. The diplomatic outreach following "Operation Sindoor" was a moment of national resolve and effective communication. It affirmed that India, when united, can project its voice with clarity and conviction on international platforms. The lessons learned – the power of unity, the efficacy of clear communication, the strategic value of soft power, and the imperative of sustained public diplomacy – will undoubtedly serve as guiding principles as India navigates an increasingly complex international landscape, leveraging its three Ts and always striving for a more just, secure, and prosperous world.

Key points from article

- After a terrorist attack in Pahalgam (J&K), India responded with **Operation Sindoor**—a calibrated strike on terror infrastructure.
- Alongside military action, India launched a **diplomatic campaign** with all-party delegations visiting countries like the USA, Brazil, Panama, etc.
- Objective: Explain India's position, defend the strike as self-defence, and expose Pakistan's terror links.
- Shashi Tharoor led one such delegation and shares insights on how unity and strategic communication helped.

1. Unified Political Messaging = Strong Diplomacy MPs from all political backgrounds presented a united front.

Foreign counterparts saw this as a **national stand, not political posturing.**

Such unity gives credibility to India's stance internationally. This is often referred to as **Bipartisan Foreign Policy Support.**

2. Narrative Building & Public Diplomacy Explained that India's actions were targeted, avoided civilian casualties, and focused on terror camps only.

Result: Some countries (like Colombia) **changed their initial statements** and supported India.

Narrative-building is key in diplomacy. International support depends not just on facts but **how they're presented.**

3. Soft Power as a Diplomatic Tool The operation's name "Sindoor" had **emotional & cultural resonance.** Bollywood, Yoga, Ayurveda, etc. help build goodwill and emotional connect.

- **Three T's Strategy:**
  - **Tech** – Indian innovation in AI, digital diplomacy
  - **Trade** – Expand and diversify exports
  - **Tradition** – Leverage culture, heritage

4. Engagement with Smaller Countries = Big Impact Countries like Panama, Guyana, Colombia, even though small, hold **UNSC seats** and influence.

Panama supports India's **UNSC permanent seat** bid.

Lesson: Small states matter. Diplomacy is not only about the big powers.

5. Need for Active Global Media Presence Western media can distort narratives if India is not proactive.

Engaging think tanks, journalists, and policy influencers is **as important as engaging leaders.**

Practice Question:

"India's soft power and consistent diplomatic engagement are as important as its military might." Discuss with reference to Operation Sindoor. *(150 words)*

Compensating theft

Syllabus:

GS-3: Role of AI, IPR issues, future of jobs, tech regulation.
GS-2: Government policy and regulation.
GS-4: Ethics in emerging tech.

Compensating theft

News publishers must have legal protection from AI systems

Large language artificial intelligence models are fuelled by content on the Internet, and much of this content comprises news reports gathered, curated and published by media professionals and organisations with decades of experience. As creative industries reckon with their labour getting diffused into unaccountable clusters of graphics processing units that reproduce styles and spit out human-level artwork in mere seconds, the news industry has reason to fear the compounding of permissionless innovation into an existentially threatening heist of several lifetimes of work. Previous waves of digitisation peeled away captive audiences from print and broadcast media by replacing these with a web-charged attention economy, and Big Tech platforms further squeezed news media's place in these rapid transformations by often short-changing the very sources of information that their businesses relied on to be useful to the public. In a landscape where even precarious business models in the Internet age are threatened by a reluctance to pay for news and declining public trust in professional news-gathering, AI may very well be a body blow. It is clear: AI firms, with their billions in market capitalisation, must not be permitted to just take what they want from the Internet, synthesise these inputs into monetised insights, and pretend that the whole process is a form of victimless, innovative progress. Publishers have a clear right to decide who gets to hoover up their entire corpuses, and to ensure that their businesses benefit from the AI wave. To this end, the Department for Promotion of Industry and Internal Trade's committee on copyright and AI is a welcome step.

This is not a decelerationist, or "decel" demand, as those who advocate for rapid AI development might be quick to say. The news industry has fought as search giants and social media companies profited enormously on the back of its content and set the terms for how the financial benefits flowed back to it. That cannot be permitted to happen – as social media platforms turn more and more into video-focused walled gardens, discouraging even a step outside their apps. For the news organisations, the avenues to earn are shrinking. As AI-generated overviews of news content with source links are reduced to a footnote, it is time for compensation to be negotiated at the time of publishers' content being scraped from their websites in the first place. AI firms may claim "fair use" in model training, but there is nothing fair – morally or legally – about accessing and disseminating troves of news without taking the creators and processors into confidence. News publishers and policymakers must now fight for their share in the AI era.

Key points from article

- AI systems use news content to train and generate outputs—but often without compensating or crediting the original publishers.
- AI models (like ChatGPT, Bard, etc.) learn from news articles written by journalists.
- But many of these models **don't pay** or even **credit** the publishers.
- The concern is: *"Are news companies being exploited for AI profits?"*

1. The Danger to News Industry

- AI can generate news-like summaries, but without humans involved.
- This reduces website traffic, revenue, and relevance of journalism.
- This is a classic case of **IPR (Intellectual Property Rights)** vs. **Open Internet Models.**

2. "Fair Use" vs. "Free Exploitation" AI companies claim they use data under "fair use". But journalists argue this is theft unless compensated.
Legal Relevance: Fair Use is meant for education, parody, etc., **not mass scraping for profit.**
3. Policy & Governance Response A government committee (DPIIT) is working on rules for copyright & AI.
News agencies want laws that protect their content from being used freely.
Ethical Dimension:
AI must be **accountable**. Innovation should not mean ignoring consent and compensation.
4. Economic & Social Impact
AI threatens already weak business models of journalism.
If newsrooms die, **truth, accountability, and public trust** suffer.

India trails in critical tech, particularly semiconductor tech

Syllabus:

GS Paper 3- Science and Technology

India trails in critical tech, particularly semiconductor tech

The U.S. and China lead across five critical tech sectors: semiconductors, AI, biotechnology, space and quantum

DATA POINT

The Hindu Data Team

A new global index has been launched to assess how 25 countries perform across five technology sectors: AI, biotechnology, semiconductors, space, and quantum. India lags significantly behind the top three – U.S., China, and Europe – across most technology sectors.

Developed using public and commercial data, the Critical and Emerging Technologies Index allows policymakers to explore each country's relative strengths and weaknesses across these sectors.

To reflect strategic importance, the sectors were assigned default weights: semiconductors (35%), AI (25%), biotechnology (20%), space (15%), and quantum (5%). These were based on six criteria, such as geopolitical relevance and dual-use potential. **Chart 1** shows the overall index scores of all the countries. India with a score of 15.2 is below France and above Russia, Canada and Australia.

The U.S. leads in all five sectors, powered by deep investments, a strong research workforce, and a decentralised innovation ecosystem spanning government, academia, and industry. Its dominance is most pronounced in AI, semiconductors, and space.

China is closing the gap, especially in biotechnology and quantum. China is backed by centralised planning, scale, and state-led investments. It still lags in semiconductors and advanced AI due to dependence on foreign tools and weaker private research.

Europe ranks third overall, showing strength in biotech and quantum but falling behind in semiconductors and space.

U.S. partnerships with Europe, Japan, and South Korea enhance its position, particularly in quantum and chips. However, no country has full control over the semiconductor supply chain. While the U.S. holds a clear lead in AI, China's advantage in data and talent, along with model breakthroughs, signals a tightening race.

Chart 1 also shows the individual scores of each country in these sectors. The AI analysis is based on eight pillars, with the highest weight given to funding and talent. Technical factors such as algorithms, computing power, and data also play a key role, while regulation and global influence are included with lower weight. The U.S. leads this by a huge margin, followed by China and Europe.

The biotechnology analysis is based on nine pillars, with the highest weight given to human capital, funding, and core capabilities such as pharmaceutical production, genetic engineering, and vaccine research.

The semiconductor analysis uses eight pillars, with the highest weight given to chip design, funding, talent, and manufacturing. Other factors such as equipment, materials, and regulations are weighted lower as they play supporting roles. Taiwan, Japan and South Korea rank higher than Europe in this indicator.

The space analysis is based on 10 pillars, with the highest weight given to funding, talent, and defence assets. Key operational areas such as launch capability, navigation, and telecom are weighted slightly lower, while global influence and regulation receive the least weight. Russia is placed third in this indicator, and India seventh.

The quantum analysis uses eight pillars, with the highest weight given to funding, talent, and core technologies. Policy, global influence, and security are weighted lower.

CHART 1: The chart assesses the national power of countries across key technology sectors such as Artificial Intelligence (AI), Biotechnology, Semiconductors, Space, and Quantum

	AI	Biotechnology	Semiconductors	Space	Quantum	Total
United States	27.7	17.2	26.4	13.8	4.2	84.3
China	14.5	16.8	22.1	8.4	3.8	65.6
Europe	11.6	11.6	8.3	6	3.6	41
Japan	3.3	4.7	10.5	3.3	2	23.8
South Korea	3.5	3.4	9.4	2.5	1.2	20
United Kingdom	4.7	4.6	3.8	3.7	2.4	19.1
Germany	4.7	4.3	3.8	3.6	2.2	18.6
Taiwan	2	1.7	10.1	1.6	0.6	16
France	4.6	3	1.9	3.8	2	15.3
INDIA	3.9	4	2.4	3.6	1.3	15.2
Russia	2	2.7	1.1	6.3	1.2	13.4
Canada	3.5	3.6	1.5	1.9	2.1	12.6
Australia	2.8	3.8	1.2	2.7	1.1	11.6
Italy	2.8	2.6	1.8	3.2	0.9	11.4
Netherlands	2.6	2.3	2.2	2.6	1.5	11.1
Spain	2.6	2.9	1.5	2.3	0.9	10.2
Singapore	2.8	1.7	2.6	1.1	0.8	9
Brazil	1.8	3.2	1.7	1.5	0.2	8.4
Israel	2.1	2	1	2.2	1	8.2
U.A.E	2.2	1.4	1	0.9	0.4	5.8
New Zealand	1.7	1.9	0	1.5	0.2	5.3
Turkey	1.7	1.8	0.1	1.6	0.2	5.3
Saudi Arabia	2.2	1.2	0.1	1.2	0.2	4.9
Iran	1.1	1.2	0.4	1.7	0.3	4.6
Ukraine	0.9	1.1	0	0.8	0	2.8
North Korea	0	0	0	0.8	0	0.8

Key points from article

- A new **Global Tech Index** developed from public and commercial data evaluates 25 countries on their capabilities in five strategic technology sectors:
- **Semiconductors (35%)**
- **Artificial Intelligence – AI (25%)**
- **Biotechnology (20%)**
- **Space Technology (15%)**
- **Quantum Technology (5%)**
- The **United States** leads across all five domains, followed by **China** and **Europe**. **India**, while an emerging tech power, ranks significantly lower — positioned just above Russia, Canada, and Australia — with an **overall score of 15.2.**

Top 3 Global Tech Powers

1. United States America's leadership is driven by **deep private and public investments**, a **vibrant R&D ecosystem**, and strong coordination between **government, industry, and academia.** The U.S. holds a dominant position particularly in **AI, semiconductors, and space technology.**

2. China China shows impressive growth, especially in **biotechnology and quantum technologies**, supported by **centralised planning** and massive **state-led investments**. However, it still **lags in advanced AI and semiconductor manufacturing**, being dependent on foreign technologies.

3. Europe (EU) Europe ranks third, thanks to its strength in **biotech and quantum research**, but struggles with **chip manufacturing and space technology infrastructure.**

Where Does India Stand?

India scores **15.2** in the index — ahead of countries like Russia, Canada, and Australia — but **significantly behind the top three.**

While India has made **considerable strides in space and biotech**, it remains **critically underdeveloped in semiconductors and quantum tech.**

Each sector was assigned a weight based on its **strategic and geopolitical importance:**

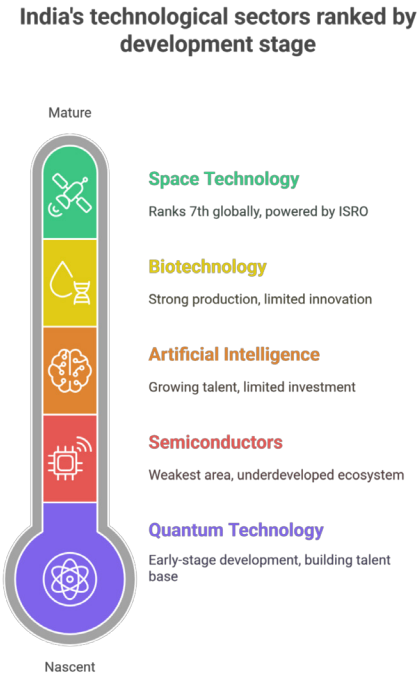
Semiconductors – 35% (due to their role in defence, computing, and AI)

AI – 25% (central to automation, data governance, and global influence)

Biotech – 20% (health security and dual-use in pharma & bio-defense)

Space – 15% (key for navigation, defense, and satellite infrastructure)

Quantum – 5% (emerging, but potentially transformative in security & communication)



What India Needs to Do?

To rise in global tech rankings, India must:

- **Accelerate semiconductor design, fabrication, and material supply chains**
- **Increase investment in AI research and computing infrastructure**
- **Strengthen biotechnology R&D, focusing on core innovation over production**
- **Leverage ISRO's experience to commercialize and privatize space technology**
- **Build academic and industrial capacity in quantum computing and communication**

Fighting antimicrobial resistance with insect based livestock feed

Syllabus:

GS-2 (Governance & Health): AMR and India's National Action Plan on AMR, Food safety regulations in animal husbandry

GS-3 (Agriculture, Environment, Science & Tech): Sustainable agriculture, Biotechnology in feed systems, Climate-smart farming techniques

Fighting antimicrobial resistance with insect-based livestock feed

Studies show that the use of insect-based feed can be more cost-effective because it provides better digestible proteins than fish- or soy-based feeds. It is also attractive because of its lower cost and the ease with which it can be made a sustainable activity. In other words, such feed has a better benefit-to-cost ratio in terms of production cost

Irfan Shakeer
Iswarya Lakshmi

Traditional livestock production systems have severe environmental consequences, including high greenhouse gas emissions, extensive land and water use, and risk of fostering antimicrobial resistance (AMR). Together with the steadily rising demand for nutrition, global and regional food systems have been exploring alternative ways to sustainably maintain their supply chains. Insect-based feed has emerged as one promising candidate.

The Indian Council of Agriculture (ICAR) and its affiliated centres have already been strengthening the adoption of insect-based feeds in the country. In March 2023, the ICAR-Central Institute of Brackishwater Aquaculture (CIBA) signed an MoU with Ultra Nutri India, Pvt. Ltd. to explore the possibility of using insect-based feed in aquaculture. The aim was to use black soldier fly (*Hermetia illucens*) larvae as an ingredient in aqua-feed to improve growth and immunity.

In June 2024, CIBA and Loopworm, a Bengaluru-based manufacturer of insect-based proteins and fats, inked another MoU to evaluate the use of insect-based feed products in shrimp and Asian seabass. In January 2025, the ICAR-Central Marine Fisheries Research Institute confirmed a formal MoU with Coimbatore-based Bhairav Renderers.

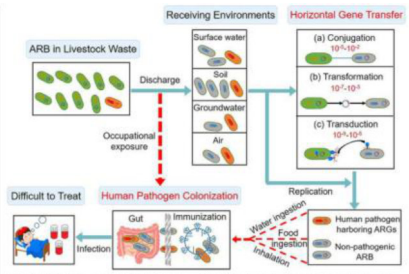
AMR and livestock production

Animal husbandry accounts for more than half of all antibiotic use around the world and is expected to increase to 200,000 tonnes by 2030, up 53% from 2013. Over the last 70 years, antimicrobial compounds have been becoming embedded in livestock feed. They are used to treat diseases as well as to boost growth, in turn raising productivity.

The excessive or inappropriate use of antibiotics in this regard can lead to AMR, which endangers public health. Traces of antibiotics left behind in the intestinal environments of livestock impose selective pressure for bacteria in the gut to acquire and maintain antibiotic resistance genes. These genes replicate when they are expelled into the surrounding environment, such as soil or water, increasing the possibility of human exposure, especially for those who work in agriculture.

It has been projected that the number of deaths worldwide from antibiotic-resistant infections will increase from 700,000 a year in 2014 to 10 million by 2050.The increasing demand for proteins of animal origin has in turn increased the costs of production and has encouraged farming practices to intensify. Ultimately, farmers are forced to use non-essential antibiotics to boost growth. The use of such antibiotics remains mostly unregulated in many countries, especially in LMICs.

The type and frequency of antibiotic-based animal feed consumption differs across continents and depends highly on socioeconomic conditions, regional demand and production, farming systems, and the national legislative framework. Some common antibiotics in use as feedstock in LMICs are chloramphenicol, tylosin, and TCN (a powdered mixture of oxytetracycline, chloramphenicol, and neomycin); developed countries have banned their use. In humans, over-exposure to these drugs can eventually increase the risk of kidney disease, cancers, and aplastic anaemia.



Bacteria containing antibiotic resistance genes are discharged through drainage, treated wastewater, and solid waste from livestock farms into various receiving environments. NPJ CLEAN WATER 3, 4 (2020)

Animal husbandry accounts for more than half of all antibiotic use around the world and is expected to increase to 200,000 tonnes by 2030, up 53% from 2013. TIM BRUNAUER/GIZ (CC BY-SA)

These realities prompted researchers to explore the use of insect-based feed to keep AMR at bay. As of today, 40 countries have accepted and issued regulations to use insect-based feed for animals. Examples of such insects include black soldier flies, house flies (*Musca domestica*), compost worm (*Perionyx excavatus*), grasshoppers (*Locusta*), small mealworms (*Alphitobius*), house crickets (*Acheta localus*), tropical crickets (*Gryllodes sigillatus*), and Jamaican field crickets (*Gryllus assimilis*).

Pros of insect-based livestock feed

Insects are nutritious and are healthy additions to human and animal diet. They are good sources of fats, proteins, fibres, and micronutrients like zinc, calcium, and iron. In their natural habitat, both aquatic and terrestrial animals eat insects.

Insect-based feed has the potential to become a climate-smart alternative to conventional feed because of its ability to shrink the environmental footprint of livestock farming

Rearing insects emits less greenhouse gases than rearing other sources of animal protein.

In most cases, insects are raised on organic waste because they can quickly transform low-grade waste into high-grade crude proteins, fats, and energy. For example, to generate the same quantity of proteins, crickets consume 12-times less feed than cattle. Rearing insects also requires fewer resources, especially land and water, compared to other livestock production enterprises.

Insect-based livestock feed is also an attractive option because of its lower overall cost and the ease with which producing it can be made a sustainable activity. In other words, such feed has a better benefit-to-cost ratio in terms of production cost.

In fact, some studies have shown that the use of insect-based feed can be even more cost-effective because it provides better digestible proteins than fishmeal- or soybean-based feeds. For example, per one estimate, one kilogram of fish meal can be replaced with 0.76 g of crickets (75% crude proteins), 0.81 g of termites or silkworms (70%), 0.85 g of black soldier flies (66%), 0.91 g of locusts or yellow mealworms (60%), and 950 g of mopane worms (56%). Similarly, one kilogram of soybean meal (49% crude proteins) can be replaced with 0.74 g, 0.79 g, 0.83 g, 0.89 g, and 930 g of the same insect species, respectively.

The U.N. Food and Agriculture Organisation has estimated that food production will have to be increased by 70% by 2050 to meet the world's demand. Unregulated use of non-essential antibiotics increases the risk of antibiotic-resistant genes in livestock farms.

Research has outlined the potential for insect-based feed to become a climate-smart alternative to conventional feed because of its ability to shrink the environmental footprint of livestock farming. At the macroscopic level, the ICAR is still streamlining research and collaboration on insect-based feeds; all the same, efforts should be made at the system's periphery to raise awareness.

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THE GIST

Traditional livestock production systems have severe environmental consequence. Global food systems have been exploring ways to sustainably maintain supply chains. Insect-based feed has emerged as one promising candidate

Traces of antibiotics in the livestock intestines impose selective pressure on bacteria to acquire antibiotic resistance genes. These genes increase the possibility of human exposure when expelled

Insects are nutritious and are healthy additions to human and animal diets. They are good sources of fats, proteins, fibres, and micronutrients like zinc, calcium, and iron. Both aquatic and terrestrial animals eat insects. Also, rearing insects emits fewer greenhouse gases

Key points from article

What Is the News About?

- Livestock farming is a **major consumer of antibiotics**, contributing heavily to **antimicrobial resistance (AMR).**
- A **sustainable and low-cost solution** is emerging: using **insect-based feed instead** of traditional fishmeal or soybean feed.
- This switch can **reduce antibiotic use**, lower costs, reduce environmental damage, and still maintain protein-rich nutrition for animals.

What is Antimicrobial Resistance (AMR)?

AMR happens when bacteria evolve to **resist the effects of antibiotics.**

Overuse of antibiotics in livestock creates **resistant bacteria**, which can spread to humans through:

Soil, water, and food

Direct contact with farm animals

WHO warns AMR could cause **10 million deaths annually by 2050** (from 700,000 in 2014).

AMR is both a **public health** crisis and an **agricultural practice failure.**

What is Insect-Based Feed?

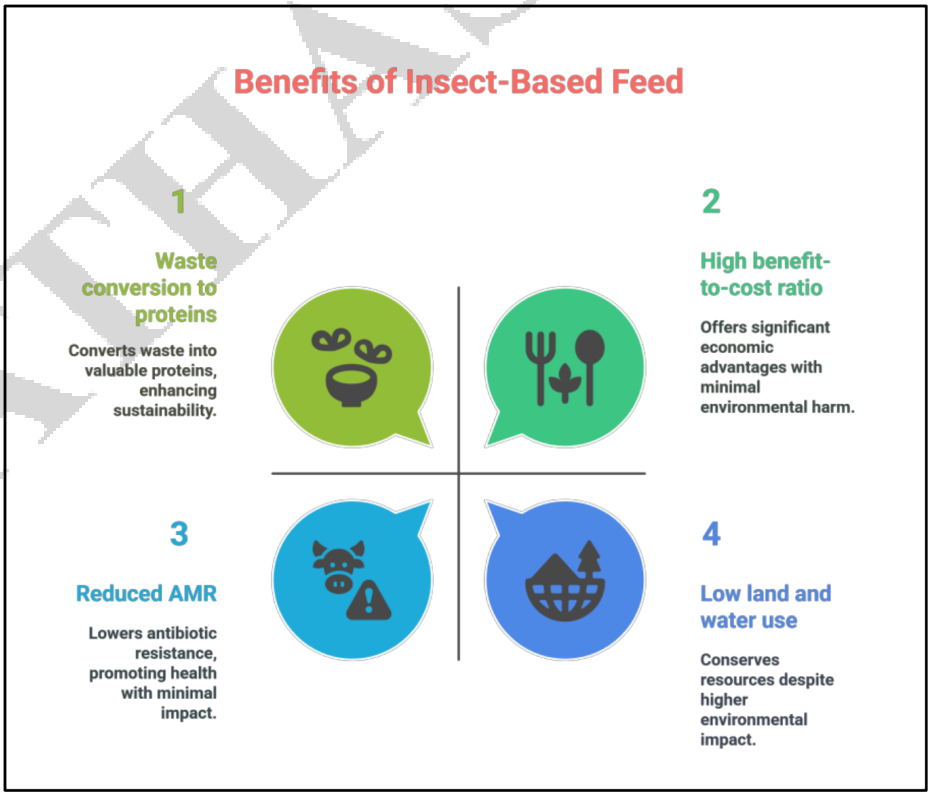
Protein-rich feed made from insects like:

- **Black soldier fly**, house fly, crickets, grasshoppers, mealworms, etc.

Can replace traditional feeds like **soybean meal** and **fish meal.**

Example: Crickets (75% protein) can replace fishmeal more efficiently than soy.

- Crickets need 12x less feed than cattle to produce the same protein output.



A **climate-smart agriculture** practice aligning with SDGs (Goal 2: Zero Hunger, Goal 12: Responsible Consumption)

India's Steps Towards Adoption

- **ICAR-CIBA + Ultra Nutri (2023):** Using black soldier fly in aquaculture.
- **CIBA + Loopworm (2024):** Insect feed trial for shrimp & seabass.
- **CMFRI + Bhairav Renderers (2025):** Exploring large-scale insect feed.

Why Livestock Feed Needs Reform

Problem	Consequence
Rampant antibiotic use	AMR crisis, resistant bacteria spread
Environmental strain	GHG emissions, deforestation for soy cultivation
Cost inflation	Soy and fishmeal prices rising, affecting farmers

40+ countries have legalized **insect-based feeds.** LMICs (Low and Middle-Income Countries) still use banned antibiotics like **TCN, chloramphenicol,** and **tylosin.**
Developed countries have stricter feed regulations — India is moving slowly but steadily.
Ethical, Ecological & Economic Value

- Reduces cruelty from overreliance on fish/cattle-based feeds.
- Tackles waste management (insects consume bio-waste).
- Supports **One Health Approach** — connecting animal, human, and ecosystem health.

Stealth frigate INS Tamal to be commissioned on July 1

Syllabus:

GS Paper 3: Science and Technology, Defence

Stealth frigate *INS Tamal* to be commissioned on July 1

This will be the last warship of Indian Navy to have been built outside India; it has 26% indigenous components, including the BrahMos long-range cruise missile, and cutting-edge technologies

Saurabh Trivedi
NEW DELHI

The Indian Navy is all set to commission its latest stealth multi-role frigate, *INS Tamal*, at Kaliningrad in Russia on July 1. This will be the last warship of the Navy to have been built outside India and the eighth in the series of Krivak-class frigates inducted from Russia over the past two decades.

The ceremony will be presided over by Western Naval Commander Vice-Admiral Sanjay J. Singh in the presence of several high-ranking Indian and Russian government and defence officials.

INS Tamal has been built at Yantar Shipyard in Kaliningrad, Russia, and is the last warship to be inducted from a foreign source, in line with the Government of India's impetus on the "Atmanirbhar Bharat" and "Make in India" initiatives.

India, as part of the broader contract for Tushil class, is also building two similar frigates, called the Triput class, at Goa Shipyard Ltd. with transfer of technology and design assistance from the Russian side. By the conclusion of this series of ships, the Navy will be operating 10 ships with similar capabilities and commonality in equipment, weapon, and sensor fit over four different classes.

A class apart: *INS Tushil*, the seventh in the series of Krivak-class stealth frigates, seen during a maritime exercise near the Gulf of Guinea on January 21, 2025. ANI

Packed with features

The 125-metre-long, 3,900-tonne warship features an impressive blend of Indian and Russian cutting-edge technologies and best practices in warship construction. The ship's new design provides it with enhanced stealth features and greater stability characteristics. The number of Made-in-India systems have more than doubled to 33.

The ship has 26% indigenous components, including the BrahMos long-range cruise missile for targeting both at sea and land. It has significant arsenal upgrades compared with its predecessors.

The crew, comprising over 250 personnel, have undergone rigorous ashore as well as afloat training in extremely challenging winter conditions of St. Petersburg and Kaliningrad in Russia.

INS Tamal has successively completed extensive sea trials undertaken over three months, proving its systems, weapons and sensors.

Upon commissioning, *INS Tamal* will join the Western Fleet, the "Sword Arm" of the Indian Navy.